Asian Journal of Innovation and Policy (2023) 12.3:323-344
DOI: https://doi.org/10.7545/ajip.2023.12.3.323

Mitigating the Shocks: Exploring the Role of Economic Structure in the Regional Employment Resilience

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Abstract This study investigates the resilient structural characteristics of a region by assessing the impact of the financial crisis. Utilizing panel data at the prefecture level for metropolitan cities across pre-shock (2006-2008), shock (2009), and post-shock (2010-2019) periods, we calculated an employment resilience index by combining the resistance and recovery indices. The panel logit regression measures the influences of the region's industrial structure and external economic factors in response to the global financial crisis. The results revealed that the diversity index of industries contributed to the post-shock recovery bounce-back. Additionally, the presence of large firms and industrial clusters within the region positively contributed to economic resilience. The specialization and the proportion of manufacturing industries showed negative effects, suggesting that regions overly reliant on manufacturing-centered specialization might be vulnerable to external shocks. Furthermore, excessive capital outflows for market expansion were found to have a detrimental impact on regional economic recovery.

Keywords Regional resilience, industry diversity, employment recovery, regional specialization

I. Introduction

While the spread of NIDL(new international division of labor) has opened the chances of Korean economy growth, it has also adds uncertainty on the global economy (MacKinnon et al. 2019; Yoon, 2006). From the Korean financial crisis in the 1997, 1998 period (IMF crisis), the global financial crisis (sub-prime mortgage crisis) in 2008, to the onset of the COVID-19 pandemic in 2018, the Korea economy has constantly faced external shocks. Not just Academics researchers but also policymakers are increasingly concerned with how quickly

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Submitted, December 4, 2023; Accepted, December 25, 2023
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economy recovers from unpredictable exogenous shocks that have become a constant in the face of recurring economic uncertainty (Hong, 2017). At the regional level, various types of shocks including the closure of multinational companies' factories, the relocation of production facilities of major industries, and the deterioration of specialized industries due to the decline of core industries, exacerbates local employment. Moreover, with the prospect of stagnant growth prevailing, maintaining high-quality jobs in the region is evaluated as a critical policy means to improve the settlement conditions of younger workers and mitigate the long-term risk of regional decline (Kim et al., 2020).

The concept of resilience, from the perspective of the region's industry and employment, addresses the capacity to maintain the previous equilibrium in terms of income or productivity or the improved state after an impact by resisting the shock, restructuring resources and organizations in the system (Kim, 2013). While economic geographic research extends the resilience concept to local economies, there are still limitations to quantify the measurement index, obtain empirical data, define shocks (Hassink, 2010; Sunley et al., 2021; Simmie and Martin, 2010).

This paper aims to apply the concept of recovery resilience to the perspective of regional employment stability, exploring determining factors. To achieve this, each region's employment recovery resilience was measured and analyzed, considering three aspects: industrial structure, external economic structure, and population and social structure. We classified regions into 16 administrative units, considering the structural characteristics of industries and the availability of statistical data, and the temporal scope was set from 2006 to 2019 to reflect the impact of the 2008 global financial crisis on regional employment. Key variables included industrial diversity and specialization, the proportion of manufacturing, the proportion of national industrial complex factories, and outward foreign direct investment. Empirical analysis was conducted through panel logit analysis combining the flow of time and regions.

The paper is structured as follows. In Chapter 2, the concept of resilience and previous research are presented, and Chapter 3 provides detailed explanations of the analysis methods and data. In Chapter 4, the empirical analysis results of the data used for the analysis and determining factors are explained, and in the final Chapter 5, conclusions and policy implications are presented.

II. Literature Review

1. Resilience concept in the regional economy

Resilience, originates from the Latin word 'resilire,' meaning a return to the original state or form (Martin, 2012). Therefore, in the context of regional economics, resilience can be defined as the ability of a regional economy to maintain equilibrium in the face of external shocks (Kim, 2013). The term resilience gradually gained traction in the field of ecology in the 1960s (Holling, 1973) and later found application in psychology and organization science, drawing recent attention in regional analysis and economic geography. This increased interest stems from the observation that different regions react and recover at varying speeds when experiencing similar shocks and disturbances, such as natural disasters.

From a regional economic perspective, resilience can be defined as a disturbance factor that temporarily deviates from the growth path (steady-state) (Foster, 2007; Hill et al., 2008). Briguglio et al. (2009) introduced a resilience index for regional economies based on macroeconomic stability, micro-level market efficiency, good governance, and social development characteristics. Kahsai et al., (2015) suggested resilience factors like industrial diversity, the dynamics of business operations, human and social capital, and physical capital stock to construct resilience indices. Despite the advantage of reflecting the complex and unique characteristics of each region in resilience indicators, the application of the economic characteristics of a region to compose an index also has the limitation of difficulty in selecting a consistent single indicator.

The concept of resilience is differentiated from 'regional competitiveness'. Nam (2012) and Kim et al. (2010) have conducted notable studies delineating the concepts, measurement approaches, and determinants of regional competitiveness. Their works discern between broad and narrow perspectives of regional competitiveness, where the former pertains to the capacity to sustain or augment residents' income levels, and the latter aligns with regional productivity. It is crucial to underscore that regional resilience and competitiveness are discrete notions. The fundamental distinction lies in the requirement for elements such as shock and time in resilience measurement (Martin & Sunley, 2015). Resilience encompasses the capacity to adapt to shocks, rapidly recover, or progress toward a new form, thereby setting it apart from the concept of competitiveness.

2. Regional Industrial Structure and Resilience

Several economic researches have constantly focused on resilience concerning regional industrial structures. Notably, within studies examining the resilience of European regions during the 2009 financial crisis, Davies (2011) highlighted the vulnerability of regions with a substantial share of manufacturing and construction. Giannakis and Bruggeman (2017) analyzed resilience factors, distinguishing between pre-crisis (2002-2007) and post-crisis (2008-2013) periods, and concluded that regions specializing in manufacturing lowered resilience compared to those with a concentration in services. Similarly, Fingleton et al. (2012) also presented that regions with higher-than-average production and employment productivity recover more rapidly, emphasizing the diminished resilience of manufacturing-specialized regions, in contrast to regions where services sector predominates. Furthermore, Kim et al. (2016) suggested factors influencing resilience and growth across industries, advocating for a cautious approach toward excessive specialization in a specific industry while promoting diversity.

Empirical studies have suggested varying dimensions of regional vulnerability to external shocks. Martini (2020) posited that regions with elevated levels of external openness may be more susceptible to external shocks, thereby influencing their resilience. Hong (2012) advanced the classical argument concerning foreign direct investment, contending that corporate investment negatively affects regional employment. Kitsos and Bishop (2018) asserted that regions with higher unemployment rates demonstrate greater adaptability to shocks, whereas those with low unemployment rates exhibit lower resilience. Their argument emphasized the inverse relationship between high employment conditions, characterized by low labor productivity and a rigid structure, and the likelihood of substantial employment losses in response to economic shocks.

Despite the extensive body of research examining the nexus between industry structure and economic resilience, empirical study within the context of South Korea is few (Park & Woo, 2023). This study employs a dynamic regional categorization approach to elucidate determining factors. This involves assessing resistance levels at the time of the shock and re-evaluating employment growth rates, considering absolute recovery levels before and after the shock. This approach facilitates a nuanced comprehension of the variables influencing resilience, accounting for regional characteristics and temporal shifts. Moreover, this study utilizes determining factors considering industrial structure, external economic structure, and population-social structure, which is relatively explored.

Specifically, this study incorporates the national industrial complex variable in exploring the relationship between industrial agglomeration effects and resilience. Additionally, for the purpose of assessing the role of anchor companies in the region, this study employs the number of large firms as a variable. Moreover, while many studies examining the association between the degree of external openness and resilience rely on trade data, this study employs foreign direct investment (FDI) as a variable. It is motivated by the potential for overseas direct investment to induce a hollowing-out phenomenon, with potential negative ramifications for regional employment, as noted by Hong et al. (2016).

III. Methodology

1. Analysis Approach

As a metric of resilience of the regional economy, Martin (2012) examined the extent of labor force reduction and the speed of recovery, capturing how much the labor market is influenced and how quickly it returns to the previous state after a shock. Later, Martin & Sunley (2015) decomposed resilience index as resistance and recovery indices and presented four determining factors: industrial structure, finance, labor structure, and government role.

Following their work, this paper investigates the production structure, external economic structure, and population-social structure by combining diversity, specialization, and enterprise size. To identify determining factors based on regional resilience results, panel data, including 16 Metropolitan-level (NUTS-2) regions in South Korea[1], is constructed. The time period ranges from 2006 before the global financial crisis to 2019. This study focuses on the employment fluctuations during the periods of the global financial crisis in 2008. Figure 3-1 illustrates that South Korea's employment rate experienced negative growth during the 2009 financial crisis and, more recently, faced a similar decline during the COVID-19 pandemic.

[1] We excluded Sejong City considering a time-series discontinuity region since its establishment on July 1, 2012

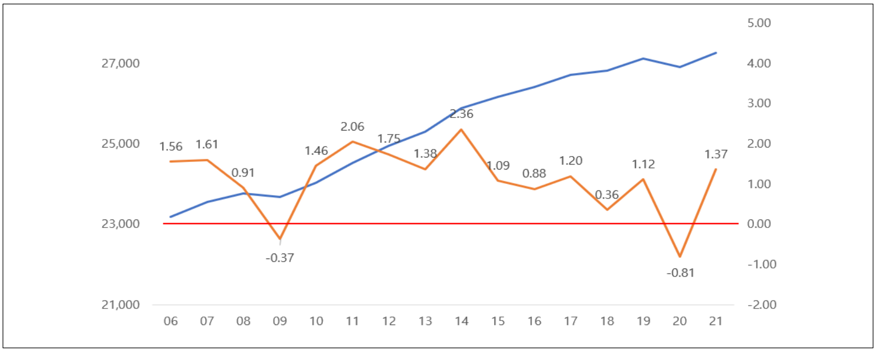

Figure 1. Number of Employmed (Blue) and Employment Growth rate (Orange)

We employed logistic regression analysis by categorizing regions into resilient group and non-resilient group. In Equation (1), $p(y = 1|x_1 \cdots x_i)$ denotes as the probability of resistance, x_i is determining factors to the resistance and β_i is estimated coefficient.

$$p = \frac{\exp\,[f(x_i, \beta_i)]}{1 + \exp\,[f(x_i, \beta_i)]} = \frac{\exp\,[\beta_0 + \sum f(x_i, \beta_i)]}{1 + \exp\,[\beta_0 + \sum f(x_i, \beta_i)]} \qquad (1)$$

As dependent variable is categorized, then, we log-transformed Equation (1) into Equation (2).

$$\ln(p) = ln\frac{\exp[f(x_i, \beta_i)]}{1 + \exp[f(x_i, \beta_i)]} = \ln\left[\frac{\mathrm{p}}{1 - p}\right] = \beta_0 + \sum \beta_i x_i \qquad (2)$$

In logistic regression, the coefficients might not be directly comparable or interpretable, so that odds-ratio is used as follows:

$$odds\ ratio = \frac{P_{H1}}{1 - P_{H1}} / \frac{P_{H0}}{1 - P_{H0}} \qquad (3)$$

The logistic regression combining the cross-sectional and time-series data allows for the repetitive examination of the same entities over time. This repetitive observation of identical entities enables the control of individual-specific effects. Consequently, it alleviates estimation bias and multicollinearity. The panel analysis also serves to enhance the precision of estimates and offers a solution to the challenges associated with multicollinearity by capturing individual characteristics across multiple time points. This study compares three models: the pooled logit model (Pooled OLS: POOL), the random effects logit model (Random Effect: RE), and the fixed effects logit model (Fixed Effect: FE).

2. Data and Variables

2.1 Dependent Variables

Martin (2012) explained the concept of resilience into four components: resistance, recovery, renewal, and re-orientation. Empirical research has utilized the concepts of resistance and recovery to explicate resilience. The elusive nature of renewal and re-orientation may be attributed to the pragmatic absence of quantitative metrics. In this study, we also applied the concepts of resistance and recovery as dependent variables to explore the determinants influencing resilience. In order to conduct panel logit analysis, we established a binary dependent variable based on resilience status. The determination of resilience status involved measuring resistance and recovery for each region from 2006 to 2019 using employment fluctuations. We divided this period into three stages: pre-crisis (06-08), crisis (09), and recovery (10-19). During the crisis, we measured resistance, while in the pre-crisis and recovery stages, we measured recovery. If there was resistance or recovery, resilience was considered present (1); if there was neither resistance nor recovery, resilience was considered absent (0). The calculation formula for resistance is presented below.

$$resistance = \frac{\triangle Y_{r(t,t+k)} - \triangle Y_{N(t,t+k)}}{\triangle Y_{N(t,t+k)}} \tag{4}$$

The variable ($\triangle Y$) represents proportional changes in employment, where $(t+k)$ denotes the shock period, (r) signifies the region, and (N) represents the entire nation. The resistance is concerned with comparing the relative magnitudes of employment changes in a specific region and nationwide. It will be positive if the change in employment in a region is greater than that of the nation during the shock, negative if it is less, and zero if they are exactly the same. This concept can also be interchangeably referred to as sensitivity. The measurement method for sensitivity is as follows.

$$Sensitivity = \frac{E_{r,t}}{E_{r,t-1}} / \frac{E_{n,t}}{E_{n,t-1}} \tag{5}$$

In equation (5), the variables "t" and "t-1" represent time after and before the occurrence of a shock, respectively. "$E_{r,t}$" denotes regional employment, and "$E_{n,t}$" represents national employment. The equation compares the employment change rates at the national and regional levels following a shock, with resistance being assessed based on positive and negative values. The sensitivity values greater than 1 indicate resistance, values less than 1 indicate non-resistance. The results of measuring resistance and sensitivity in 16 regions of South Korea following the 2009 financial crisis shock are presented in Table 3-1 and Fig -1.

[Table 3-1] The Resistance and Sensitivity of 16 regions

Regions	Resistance	Sensitivity
Seoul	- 1.85	0.985
Busan	- 1.85	0.985
Daegu	0.62	1.010
Incheon	1.48	1.019
Gwangju	1.85	1.022
Daejeon	0.44	1.008
Ulsan	- 0.96	0.994
Gyeonggi	0.02	1.004
Gangwon	0.87	1.012
Chungbuk	1.39	1.018
Chungnam	- 0.79	0.996
Jeonbuk	0.00	1.004
Jeonnam	0.76	1.011
Gyeongbuk	- 0.44	0.999
Gyeongnam	- 0.45	0.999
Jeju	0.00	1.004

Source: Authors' calculation by Economic Activity Survey (2009) from KOSIS.kr

Regions with a sensitivity greater than 1, indicating resilience, include Daegu (1.010), Incheon (1.019), Gwangju (1.008), Gyeonggi (1.004), Gangwon (1.012), Chungbuk (1.018), Jeonbuk (1.004), Jeonnam (1.011), and Jeju (1.004). On the other hand, regions lacking resilience are Seoul (0.985), Busan (0.985), Ulsan (0.994), Gyeongbuk (0.999), and Gyeongnam (0.999).

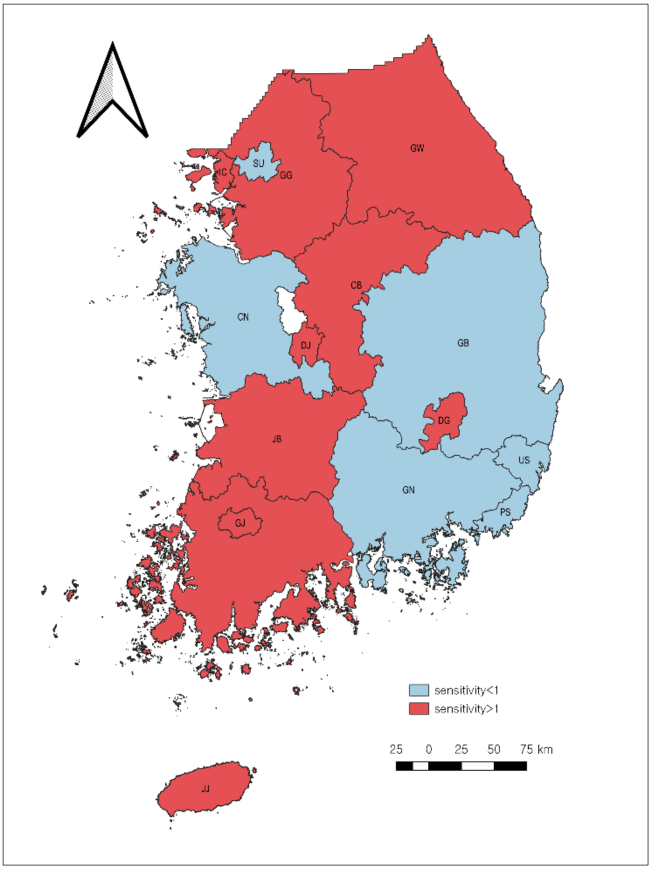

Figure 2. The Resistance and Sensitivity of 16 regions (mapping)

Recovery index is measured by comparing regional employment at a baseline time with subsequent periods. If regional employment increases than the baseline, recovery index is positive values, while if employment decreases, it goes to negative values. The equation (6) can be interpreted zero, assessing the presence or absence of resilience. In Table 3-2, the temporal changes in employment across 16 regions are presented at different time periods.

$$Recovery = \frac{E_{r,t+1} - E_{r,t}}{E_{r,t}} \quad (6)$$

The analysis is focuses on the year 2009 highlighting the impact of the global financial crisis on domestic regions. The period is divided into three stages: pre-shock, during the shock, and post-shock. The employment growth rates of each region are analyzed during these stages. In 2009, a year marked by economic downturn due to the financial crisis, the overall employment recorded an average decrease of 0.37%. In the mid-of global financial crisis, ten out of sixteen regions (Daegu, Incheon, Gwangju, Daejeon, Gyeonggi, Gangwon, Chungbuk, Jeonbuk, Jeonnam, Jeju) did not show decline, while six regions (Seoul, Busan, Ulsan, Chungnam, Gyeongbuk, Gyeongnam) did. Even in regions where employment did not decrease during the shock, the growth rates after shock showed a decrease compared to pre-shock levels for most regions. For example, Incheon decreased from 2.49% to 1.48%, Daejeon from 2.40% to 0.44%, Gyeonggi from 2.92% to 0.02%, indicating that the impact of the shock continued to influence these regions throughout 2009. We categorized each region into two groups based on resistance and recovery index. The first group is the 'High-Recovery Group,' characterized by a Sensitivity Index (SI) greater than 1 or a positive resistance index. The second group is the 'Low-Recovery Group,' characterized by an SI less than 1 or a negative resistance index.

[Table 3-2] The employment change rate before/after shock by regions (%)(2006-2019)

Regions	Pre-Shock (2006-2008) (A)	Shock (2009)	Post-shock (2010-2019) (B)	Diff. shock (%p) (B-A)
Seoul	0.79	-1.85	0.21	-0.58
Busan	-0.14	-1.85	0.52	0.66
Daegu	-0.67	0.62	0.66	1.33
Incheon	2.49	1.48	1.98	-0.51
Gwangju	1.54	1.85	1.26	-0.28
Daejeon	2.40	0.44	1.17	-1.23
Ulsan	2.51	-0.96	1.07	-1.44
Gyeonggi	2.92	0.02	2.54	-0.38
Gangwon	0.64	0.87	1.57	0.93
Chungbuk	1.78	1.39	1.91	0.13
Chungnam	2.05	-0.79	1.80	-0.25
Jeonbuk	0.81	0.00	0.98	0.17
Jeonnam	-0.43	0.76	0.43	0.86
Gyeongbuk	0.12	-0.44	0.55	0.43
Gyeongnam	1.71	-0.45	1.22	-0.49
Jeju	0.59	0.00	2.85	2.27
Average	1.36	-0.37	1.36	0.00

Source: Authors' calculation

2.2 Independent variables

a) Industrial Structure Variables

This study employs industrial diversity, specialization, the proportion of manufacturing, the number of large enterprises, and the proportion of factories within the national industrial complex in order to represent the industrial structure. According to the previous studies, the diversification in the region tends to have a positive impact on resilience against the shocks, comparing to regions with higher concentration of a single industry. The equation of the industrial diversity (ENTROPY) is expressed as follows.

$$DIV = -\sum \left[\frac{b_{ri}}{b_r}\right] * ln \left[\frac{b_{ri}}{b_r}\right] \tag{7}$$

The *DIV* index was calculated using the number of establishments from the nationwide establishment survey conducted by Statistics Korea, where diversity represents the diversification index of region *r*, and *n* denotes the total number of industries. b_{ri} represents the number of establishments in a specific industry in region r, b_r is the total number of firms in all industries in region r. The higher value of this index indicates greater diversity, while a lower value suggests reduced diversity. If the index value is zero, it implies that the region has only one industry.

The impact of specialization on resilience derived from previous studies do not all lead to the same conclusion. The typical assumption is made that concentrated economies lead to production and employment growth, fostering regional development. However, given the unforeseeable nature of economic shocks, this assumption may not always be supported. The specialization index utilized the location quotient (LQ) is as follows.

$$LQ_{ri} = \frac{b_{ri}/b_r}{b_{Ni}/b_N} \tag{8}$$

We utilized the number of firms from the nationwide enterprise survey of South Korea. b_{Ni} represents the number of firms in industry (i) at the national level, and b_N represents the total number of firms across all industries nationwide. If the value is greater than 1, it can be inferred that the specific industry in that region is specialized. While the Local Quotient (LQ) index of an individual industry allows for an assessment of the degree of specialization of that particular industry in a specific region, directly comparing the degree of specialization of that industry with the overall industrial specialization across different regions is challenging issue. Therefore, equation (8) is transformed to compare the specialization indices between regions (Tan, J., Hu, X., Hassink, R., & Ni, J., 2020).

$$LQ_r = \sum LQ_r{}^2 \tag{9}$$

The manufacturing sector's share refers to the proportion of manufacturing output in the Gross Regional Domestic Product (GRDP) of each region. While the manufacturing sector typically leads economic growth, previous studies argue that an excessively high share of manufacturing or the formation of concentrated economies may cause economic stagnation or negative impacts on resilience, leading to 'lock-in' (Martini, 2020).

The count of large enterprises is defined as businesses with more than 300 employees. Critical studies argue that large enterprises, particularly when compared to small and medium-sized enterprises, may have less resilient structures and struggle to respond quickly to crises, potentially hindering regional economic resilience (Kitsos & Bishop, 2018). However, their role as focal points in regional industries through vertical networks remains valuable in the recovery process.

The proportion of factories within national industrial complexes is measured as the ratio of the number of factories located in national industrial complexes to the total number of factories in the region. This measure is used to assess the positive impact on economic growth, given that economies of scale and active knowledge transfer are expected to occur within industrial clusters.

b) Population-Social Structure

From the perspective of population-social structure, we utilized three variables as control variables - population net migration, unemployment rate, and per capita personal income. Population net migration serves as a derivative variable influencing population growth, providing insights into the impact of increased regional economic size or resilience through enhanced consumer power.

The unemployment rate, as an indicator of employment status, allows us to signify the relationship between resilience and the level of unemployment. Per capita personal income, calculated as the total disposable income of households and non-profit organizations serving households divided by a region's population, represents an indicative measure of purchasing power that non-profit organizations and households can discretely dispose of. It serves as a variable that allows us to understand the impact of economic shocks on high-income or low-income individuals.

From the perspective of the external economic structure, prominent economic factors include trade and Foreign Direct Investment (FDI). However, considering the impact of overseas relocation of key local companies on the regional economy, we selected the amount of overseas investment by region and purpose as a variable. To analyze the influence of the outflow of foreign investment on resilience, we utilized data from the Korea Exchange Bank, focusing on overseas direct investment for market expansion and low-wage utilization.

The ten independent variables utilized in this paper are defined as presented in Table 3-3 below.

[Table 3-3] The definitions and sources of independent variables

Category	Independent Variables	Definition	Source
Industrial Structure	Diversity	ENTROPY Index	Economic Activity Survey
	Specialization	Location Quotient	Economic Activity Survey
	Share of Manufacturing	Percentage of manufacturing production in GRDP	Economic Activity Survey
	Number of Large Firms	Number of enterprises with more than 300 employees	Economic Activity Survey
	The proportion of factories within national industrial complexes	Proportion of factories located in national industrial complexes among all factories in the region	Korea Industrial Complex Corporation
External Economic structure	Market Expansion OFDI	OFDI for market expansion	Korea Trade-Investment Promotion Agency
	Low-Wage seeking OFDI	OFDI for utilizing low-wage labor	Korea Trade-Investment Promotion Agency
Population-social structure	Net Migration Population	Population outflows from inflows in each year	Statistics Korea's Domestic Migration Statistics.
	Unemployment Rate	Unemployment rate	Economic Activity Survey
	Per Capita Personal Income	Per capita disposable income	Economic Activity Survey

IV. Estimation Results

1. Goodness-of-fit test

Based on the results of the VIF (variance inflation factor) of the ten variables, the count of large corporations had the highest value at 5.78. The average VIF of all variables was 2.60, indicating the absence of multi-collinearity issue among the variables. The variables found consistently significant were diversity index, locational coefficient, count of large corporations, foreign direct investment for market exploration, net migration, unemployment rate, and per capita personal income. It is found that majority of variables are estimated to have consistent signs. It is particularly noteworthy in that both the Pooled OLS (POOL) and Random Effects (RE) models show the same significance and signs of the variable coefficients. It suggests that, compared to the Fixed Effects model that considers individual characteristics, the Pooled OLS and Random Effects models, which do not account for such characteristics, yield more efficient estimators. This observation is further supported by the results of the Hausman test.

2. Logit Model Estimation Results

The goodness-of-fit for the overall model, as indicated by the LR chi-square statistic ($chi^2(10)$) in Table 4-1, yields 45.60 with a significance level below 1%, signifying the validity of models.

[Table 4-1] The logit estimation result

Variables		Coefficient	Std. err.	P>|z|
Industrial Structure	Diversity	27.9948***	9.194912	0.002
	Specialization	- 0.0062**	0.002793	0.025
	Share of Manufacturing	- 0.0258*	0.014065	0.067
	Number of Large Firms	0.007401*	0.004306	0.085
	The proportion of factories within national industrial complexes	0.059141**	0.023342	0.011

External Economic structure	Market Expansion OFDI	-	0.000274*	0.000143	0.055
	Low-Wage seeking OFDI		0.000664	0.000415	0.110
Population-social structure	Net Migration Population		0.000056***	0.000019	0.003
	Unemployment Rate	-	0.749923**	0.314273	0.017
	Per Capita Personal Income	-	0.000281***	0.000107	0.009
	constant	-	53.5736***	18.70146	0.004

Number of obs. = 224
Log pseudo-likelihood = -92.272952
LR chi2(11) = 45.60 Prob. > chi2 = 0.0000

Source: Authors' calculation

The estimation shows that 8 variables - diversity index, specialization index, share of manufacturing, number of large companies, proportion of national industrial complex factories, foreign direct investment for market exploration, net migration, unemployment rate, and per capita income – are significant. First, as previous studies supported, industrial diversity played a positive role in resilience by disperse the risks. Although there are arguments that the role of large firms has diminished or their influence has decreased in traditional industries, it was confirmed that they still play a positive role in resilience. National industrial complexes are also expected to contribute to resilience by reducing costs through agglomerated economies, knowledge sharing, and networking effects. The positive net migration implies that more incoming migrants than outgoing ones, involving that population inflow can strengthen regional capabilities and enhance consumption, potentially serving as a positive factor to overcome economic crises (Hong, 2017).

While the specialization is presumed to be beneficial for growth from the perspective of efficiency, it may lead to stagnation and pose a negative effect on resilience due to excessive concentration in specific industries. The manufacturing concentration was estimated to have a negative impact on resilience, due to its failure to quickly change its structure in response to economic crises. Foreign direct investment (FDI) for overseas market entry, rather than having a positive impact on resilience through enhancing corporate capabilities and increasing exports, demonstrated negative effect, contributing less to resilience. Unemployment rate was found to have a negative impact on resilience as it tends to work inversely with recovery. Thus, the higher unemployment rates indicated a negative influence on resilience. Per capita income played a negative role in resilience as regions with higher income are more likely to be consumption-oriented, making them susceptible to economic shocks.

Next, we turn the estimated coefficient in the Ordinary Least Squares (OLS) to model to the marginal effects and odds ratios for the interpretation in the logistic model, indicating the probability of selection compared to the reference type. If the odds ratio is greater than 1, the variable is considered to have a positive impact, while if it is less than 1, it is deemed to have a negative (-) impact. The farther away the odds ratio is from 1, the greater the influence.

The variables exceeding 1 - diversity, the proportion of national industrial complex factories, the number of large enterprises, and net migration population - are identified as having the greatest impact. Among variables with values less than 1, the unemployment rate, the proportion of manufacturing, specialization, market-expanding foreign direct investment, and per capita personal income are considered to have significant negative (-) impacts.

The results of the odds ratio calculations are presented in [Table 4-2].

[Table 4-2] Odds-ratio

Variables		Odds ratio	Std. err.	P>|z|
Industrial Structure	Diversity	1.44e+12***	1.32e+13	0.002
	Specialization	0.9937706**	0.0027751	0.025
	Share of Manufacturing	0.9745243*	0.0137067	0.067
	Number of Large Firms	1.007429*	0.0043354	0.085
	The proportion of factories within national industrial complexes	1.060925**	0.0247636	0.011
External Economic structure	Market Expansion OFDI	0.9997258*	0.0001427	0.055
	Low-Wage seeking OFDI	1.000664	0.0004151	0.110
Population-social structure	Net Migration Population	1.000664***	0.000185	0.003
	Unemployment Rate	0.4724028**	0.1484636	0.017
	Per Capita Personal Income	0.9997196***	0.0001071	0.009
	Cons	224	224	182

Source: Authors' calculation

V. Conclusion

1. Summary and Policy Implications

Over the past several decades, the regional economy of South Korea achieved rapid economic growth. The recent environment signals a slowdown in this economic growth, coupled with unforeseeable external shocks including economic crises, climatic changes, wars, and the pandemic, leading to a shift in the perspective on regional economic outlook (Byun, 2015). The importance of recovery from continuous shocks has drawn attention over high-speed growth from researchers and policy-makers as well. Against this backdrop, this paper explores the economic resilience of each region, focusing on determining the key factors from the perspectives of industrial structure and external environmental structure. The main findings can be summarized as follows.

Industrial Diversity vs. Specialization

Despite ongoing debates, this study supports that industrial diversity has a positive impact on regional resilience. Conversely, regional industrial specialization demonstrates a negative influence. Reflecting on South Korea's recent economic history, the concentration of specific industries for so called ‘compressed growth’ contributed significantly to rapid growth but hindered the formation of diverse industrial structures. Consequently, when absorbing and overcoming unpredictable shocks today, industrial concentration proves counterproductive. Moreover, specialized industrial structures, prone to path dependency, may lead to neglecting investments in new areas or industries with higher added value (Han, 2022).

Manufacturing Sector Impact

The higher the proportion of the manufacturing sector in the region, the less resilient, it may affect regional economic recovery. This result derived from that the manufacturing sector, due to its failures in rapid transitions in industrial structures and restructuring employment in the external shocks, is likely to play a counterproductive and time-consuming role.

Role of Anchor firm, National Industrial Complexes and FDI Imbalance

Anchor firms, characterized by large scale and central positioning in regional industrial networks, play a significant role in generating production and employment, contributing positively to resilience. National industrial complexes are relatively larger in scale and predominantly host key industries that supported Korea’s past economic growth. This characteristic, along with the concentration of clusters, is analyzed as contributing positively to regional employment and resilience. The imbalance derived from excessive outward FDI than inward is suggested to have a more significant negative impact on regional economic resilience than the positive functions of net FDI, emphasizing potential counterproductive effects.

Based on the empirical research findings, the need for improving the industrial structure in South Korea becomes more apparent. However, it is emphasized that sacrificing specialization or the manufacturing sector seems not a policy measure for enhancing resilience. Rather, the crucial issue lies in determining the sequencing and degree of combination when pursuing industrial policies. To achieve this, a well-coordinated governance system involving regional governments, industries, research sectors, and continuous efforts to foster a culture of industrial innovation are deemed essential.

2. Limitations and Future studies

Research on regional resilience has a strong background in Europe, where it has been initiated and actively developed. While the domestic research in South Korea case has only few cases, this paper holds significance in applying the resilience concept to the Korean regional context, empirically analyzing factors closely. Methodologically, it contributes to future resilience research by considering both regional and temporal aspects.

Nevertheless, this study has its limitations. Firstly, this study concerns employment as an index of resilience concept, which still limited in quantifying and analyzing various factors influencing regional economy. Consequently, the analysis had to proceed with a constrained understanding of resilience. Secondly, the exclusion of Sejong Special Autonomous City from the analysis due to temporal discontinuity is also a limitation. Additionally, due to the limitations in the completeness of statistical data, the analysis was conducted at the metropolitan level, necessitating further examination at the municipal level.

Despite these challenges, the study provides a basis for evaluating the impact of economic shocks on regional employment recovery, revealing factors in industrial structure. As regional economies advance and respond to economic crises, the enhancement of regional industrial capabilities is critical. However, addressing the increasing disparities in industrial capabilities among regions, marked by differences in population, capital, and knowledge, requires policies that focus not just on pursuing superficial growth rates but on strategically adopting diversified or specialized industrial policies to efficiently cope with external shocks. To overcome the issue of disparate resilience indices, it is proposed that government, industry, and academia collaborate to establish tailored indicators at the national or regional level for future research endeavors.

Acknowledgment

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2022S1 A5A8052970).

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