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The Effect of Manufacturing Sector Employment on Regional Service Sector Employment*

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The output of one industry can influence other industries beyond its immediate supply chains. When regional employment expands, local demand for goods and services rises, stimulating additional production and job creation. Because services are locally oriented, growth in manufacturing employment can boost regional service employment. This study empirically analyzes data at the si and gun levels using the Survey on Establishments' Labor Conditions from the Korean Statistical Information Service. Based on 2017-2022 data under the 10th Korean Standard Industrial Classification, the results indicate that each new manufacturing job generates about 0.9 additional service jobs within the same region.

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1. INTRODUCTION

The production of one industry affects the production of other industries. For example, production in the automobile industry increases the output of backward industries that supply essential raw materials, components, and services for automobile manufacturing, while also boosting the production of forward industries that use automobile industry outputs as inputs to produce goods or services. By examining the linkages with backward and forward industries, it is possible to quantify how production in the automobile industry influences the production, value added, and employment of other connected industries, as well as how increased employment leads to a rise in household income.

The production of one industry also affects the production of other industries that are not directly connected through backward or forward linkages. When new jobs are created and employment increases in a regional economy, the demand for local goods and services rises, leading to higher production and employment in local industries. If automobile production expands and creates new jobs, employment growth increases the household income of workers in the automobile industry, and this higher purchasing power results in greater household consumption. The increase in household consumption, in turn, leads to higher production and employment in industries not linked backward or forward to the automobile industry.

The effects of an industry's production on the production and employment of industries connected through backward and forward linkages can be identified through input-output analysis. However, to measure the effects on the production and employment of industries not connected through such linkages — those that change as a result of increased household income and consumption — additional analysis is required. To assess the employment effects, both the industries connected through backward and forward linkages and those that are not must be considered. Yet, while the former are frequently analyzed using the well-established input-output framework, the latter have rarely been studied due to the absence of a standardized analytical method. This study proposes a method to measure the employment effects on industries not connected through backward or forward linkages and analyzes how regional manufacturing production affects service sector employment in the same region, using industry-level employment data at the municipal (si-gun-gu) and medium industry category level provided by the Survey on Establishments' Labor Conditions from the Korean Statistical Information Service (KOSIS).

This paper is structured as follows. Chapter 2 defines the regional employment multiplier and discusses ways it can be utilized in policy applications. It also explains why the analysis focuses on service sector employment when measuring regional employment multipliers, examines the determinants of the multiplier, and develops a model for empirical analysis. Chapter 3 introduces the data and discusses the identification strategy of the model. It points out that employment in the manufacturing sector — the explanatory variable — may remain endogenous even after differencing, and develops potential instrumental variables. The chapter then presents the estimation results, conducts further analyses based on the main findings, and derives the economic implications. In particular, it additionally estimates the effect of increased production in high-tech industries on regional service sector employment. Chapter 4 summarizes the main findings of the study and presents the conclusion.

2. REGIONAL EMPLOYMENT MULTIPLIERS

2.1. Definition of the Regional Employment Multiplier

To gain a comprehensive understanding of the employment effects within a region, it is necessary to consider not only the employment effects on backward and forward industries identifiable through regional input-output analysis, but also the employment effects on other local industries resulting from increased consumption.[1] An increase in household income raises consumption of goods and services, thereby influencing the production and employment of the industries that produce those goods and services.

Among goods and services, services in particular are likely to have a strong local impact on the regional economy. This is because services often lack physical form or are difficult to store, and consumption typically occurs only when consumers are present at the place where the service is provided. In contrast, goods can be produced in other regions and easily transported to the area where consumers are located, making it unnecessary for production and consumption to occur in the same region. Therefore, an increase in household income within a region may have little effect on the production of goods in that region.

In summary, job creation in a region leads to an increase in household income, which in turn affects the production and employment of the service sector in the regional economy. From this perspective, quantifying the impact of manufacturing employment growth in a region on service sector employment within the same region can provide important implications for regional economic policy.

If the impact of employment growth in one industry on regional employment is defined as the “regional employment multiplier,” then measuring this multiplier is essential for formulating regional economic policy. Since it allows for the measurement of employment changes not only in backward and forward industries but also in other industries within the region, it can serve as an important indicator for evaluating the effectiveness of regional economic policies. For example, it can be used as supporting evidence when providing tax-based incentives to attract new firms at

[1] Analysis based on input-output tables continues to be widely used. For instance, the study by Lee and Ishiro (2025) is a recent example.

the provincial (si-do) or municipal (si-gun-gu) level.

Since the regional employment multiplier operates through entirely different channels from the employment effects identified in input-output analysis, its value can differ substantially from the employment inducement coefficients of backward and forward industries. For example, industries with high labor productivity per worker may have small employment inducement coefficients for linked industries, but if high productivity leads to higher income and consequently greater consumption, the regional employment multiplier may, in fact, be larger. As there is little existing research on how industry characteristics and technology relate to the regional employment multiplier, analyzing it offers significant value.

2.2. Spillover Channels of Regional Employment

The production of an industry affects the regional economy and society through various channels. For instance, for regional employment to increase, either the employment of local residents must expand or population inflows from other regions must occur. While domestic migration does not change the total national population, it can influence regional economies and societies by altering the distribution of the population across regions. An increase in the regional working-age population may generate various agglomeration effects, spillover effects from higher production and consumption influencing the output of other local industries, and network effects arising from greater cooperation and information exchange among economic agents. Since these effects can be either positive or negative in theory, the net impact of working-age population inflows should be estimated empirically.

When new technology firms become concentrated in a region — such as in a semiconductor cluster, advanced medical complex, or petrochemical industrial complex — and the working-age population flows into that area, economies of scale or scope may emerge, leading to productivity improvements beyond the mere increase in the number of firms, workers, or residents. The growth of technology industries and the inflow of skilled workers positively influence the development of social infrastructure and the expansion of service sectors such as education and healthcare, which can naturally spread or spill over to the growth of other industries. As the number of firms and workers increases, economic agents in the region exchange information and ideas more actively, expanding social networks and enhancing inter-firm cooperation, which in turn promotes innovation and productivity within local industries.

Negative effects may also arise simultaneously. Industrial clustering can lead to shortages in factor markets and intensified competition, resulting in higher factor prices such as wages, as well as increases in land values and rents. Rising regional production costs may translate into higher service prices, while the inflow of the working-age population can cause congestion in public services and infrastructure, as well as higher housing costs. Socially, these changes may exacerbate inequality and increase stress and psychological burdens, which can, in turn, hinder production. Such negative effects can offset the positive ones. Meanwhile, in regions that experience an outflow of the working-age population, local industries may decline, job opportunities may decrease, and rising unemployment and economic stagnation can lead to social instability, creating a vicious cycle.

2.3. Previous Literature

Since Moretti (2010), numerous studies have actively analyzed the channels through which manufacturing employment growth leads to regional employment expansion via increases in regional income.[2)] A closely related study by van Dijk (2016) conducts the same analysis using metropolitan statistical areas in the United States instead of city-level data and obtains qualitatively similar results. Moretti and Thulin (2013) estimate regional employment multipliers using data from the United States and Sweden, while Wang and Chanda (2018) apply the methodology of Moretti (2010) to Chinese data.

These studies also discuss the employment effects of high-tech industries within the manufacturing sector, and several others estimate differentiated effects according to the specific characteristics of manufacturing industries. Yi, Mueller, and Stegmaier (2024) examine how the impact of trade shocks on regional economies in Germany varies depending on industrial structure, analyzing their effects on manufacturing employment. They find that regions with a higher concentration of workers possessing industry-specific skills exhibit greater volatility in wage distribution and, consequently, experience larger employment effects. Fabra, Gutiérrez, Lacuesta, and Ramos (2024) analyze the impact of renewable energy projects on regional employment using data from Spain. They find that solar power projects have a larger employment multiplier effect than wind power projects, explaining that this is because the former are relatively more labor-intensive and therefore more effective in raising regional income.

Since regional income growth can occur independently of manufacturing employment increases, various studies examine how rising regional income affects regional employment expansion. Jofre-Monseny, Silva, and Vázquez-Grenno (2020) show that the expansion of public sector employment in Spain increases private sector employment in Spanish cities. They find that this employment growth occurs mainly because higher total regional wages raise demand for non-tradable goods and services.

Ku, Schönberg, and Schreiner (2020) evaluate how effectively region-based payroll tax reductions promote local employment in Norway. The Norwegian payroll tax system, which had applied differential rates across regions, is abolished abruptly due to EU regulations, creating exogenous variation in regional payroll tax rates faced by firms. Their analysis shows that regions experiencing payroll tax reductions see a

[2)] This paper closely follows the methodology of Moretti (2010) and applies it to Korean data.

significant increase in local employment.

Zou (2018) analyzes the impact of military base closures on regional economies by exploiting a 30% reduction in the number of stationed military personnel in the United States between 1988 and 2000. The results show that the reduction in military personnel significantly decreases civilian employment levels. Jofre-Monseny, Sánchez-Vidal, and Viladecans-Marsal (2018) demonstrate that when large manufacturing plants in Spain relocate overseas, the loss of one job within the plant leads to additional job losses in related local industries.

2.4. Baseline Model for Empirical Analysis

Employment growth in a specific region has various economic and social impacts on that region, including effects on local employment itself. Even from the perspective of employment alone, the creation of new jobs can generate additional employment through increased demand for local goods and services. However, these positive employment effects may be partially offset by general equilibrium effects such as rising regional wages and service prices. Therefore, since the net effect of regional industrial restructuring on local employment can be theoretically evaluated from multiple perspectives, it should be estimated empirically.

To measure the effect of employment changes in one industry on employment changes in other industries within the same region, this study employs the method of Moretti (2010). In this framework, each region of a country constitutes a competitive economy that uses labor to produce both nationally traded goods and locally traded services. The prices of nationally traded goods are uniform across regions, whereas the prices of locally traded services are determined within each region.

Regions should be defined at a geographic scale where commuting across boundaries is difficult, so that spillover effects into local service employment remain within the region and are not transmitted elsewhere. For instance, in Moretti's (2010) study, regions are defined as U.S. cities. Zou (2015) conducts the analysis at the U.S. county level, and Ku, Schönberg, and Schreiner (2020) define regions using Norway's commuting zones. The comparable regional units in Korea are si (cities) and gun (counties).[3)]

It is assumed that workers possess industry-specific skills, making occupational mobility across industries within a region relatively limited. Consequently, marginal productivity and wages may not fully equalize within a region, and wages can differ across industries. The regional labor supply curve is upward sloping, with its slope determined by workers' preferences for leisure and by the degree of labor mobility both

[3)] Districts (gu) areas, which comprise metropolitan cities in Korea, are characterized by frequent commuting enabled by an extensive metro system, allowing spillover effects to extend beyond individual gu boundaries. Therefore, using gu as the unit of analysis is likely to yield incorrect estimates of the spillover effects of local service-sector employment, compared with analyses that define regions more appropriately.

within and across regions. The easier it is for workers to move within or between regions, the higher the elasticity of labor supply; in the extreme case of perfect mobility, regional labor supply becomes infinitely elastic. The regional housing supply curve is also upward sloping, and its slope varies depending on geographical factors and land-use regulations.

Consider a case in which the labor demand of an industry producing a particular good in a region continues to increase. According to Greenstone and Moretti (2004), such an increase may stem from the attraction of new firms or a rise in product demand faced by existing firms. Policy initiatives to attract specific industries, as well as advances in technology or growing foreign demand for newly developed products, can also be contributing factors. For example, the widespread adoption of artificial intelligence has sharply increased demand for semiconductors, and advances in battery technology have driven rapid growth in the electric vehicle industry.

If the demand for a particular good rises, labor demand in the corresponding manufacturing sector increases, leading to higher production and employment. The expansion of regional manufacturing production and employment subsequently induces growth in production and employment in backward and forward industries within the region, while also affecting the production and employment of local service industries not directly linked to manufacturing. Meanwhile, such a shock may trigger general equilibrium effects on the regional price system. Specifically, if regional labor supply is not infinitely elastic, wages of local workers rise, and if housing supply is not infinitely elastic, housing costs also increase.

2.5. Determinants of the Regional Employment Multiplier

When local employment increases and wages rise, the purchasing power of local residents expands. This increase in purchasing power leads to greater local demand for services, resulting in employment growth in industries such as retail, food services, education, finance, healthcare, technical services, and staffing services. The newly created jobs are distributed between existing residents and new migrants, depending on the degree of interregional mobility. The magnitude of the local employment multiplier for the service sector is largely determined by three factors.

First, the local employment multiplier depends on consumers' preferences for services and the technologies used in the service industries; the more labor-intensive the technology required for a given service, the larger the multiplier. Second, it varies by the types of new jobs created in the local upstream and downstream industries — high-wage, skilled jobs tend to generate larger employment multipliers than low-wage, unskilled ones. Third, general equilibrium effects on wages and prices can partially or fully offset employment gains, and the extent of this offset depends on the elasticities of local labor and housing supply. If the local labor supply is inelastic, causing substantial increases in labor costs, or if the housing supply is inelastic, leading to large increases in housing costs, the local employment multiplier will decline sharply. Conversely, if labor or housing supply is highly elastic, cost increases remain limited, and the multiplier does not decrease significantly.

Employment growth in one industry affects not only local services but also local manufacturing, though for manufacturing industries that are not vertically linked, the direction of the effect is theoretically ambiguous. The employment effect on local goods-producing industries is largely determined by three factors. First, the most important factor is that rising overall labor costs in the region can negatively affect employment in other local manufacturing sectors. Since the prices of manufactured goods are determined in the national market, higher production costs weaken competitiveness, and in the long run, some of these industries may relocate to other regions. Second, although it is commonly assumed for analytical simplicity that goods are traded nationally, if an industry produces goods traded primarily within the region, local employment may increase. Third, when agglomeration economies are significant, greater local concentration of industries may be further reinforced.

Local governments allocate substantial public resources to promote regional economic development, and the economic impacts of such policies are typically assessed using regional multipliers derived from regional input-output tables. However, the baseline model discussed in this paper indicates that additional regional employment multipliers are needed beyond those obtained from input-output analysis. This is because input-output tables do not capture employment effects on industries other than those in forward and backward linkages, nor do they reflect potential employment losses in local manufacturing due to rising labor costs or employment gains driven by agglomeration economies.

Regional employment multipliers are closely related to national employment multipliers. The regional employment multiplier for the service sector represents an upper bound for the national service-sector employment multiplier, as labor supply is more elastic at the regional level due to the possibility of population mobility. Greater elasticity implies that substitution effects are less pronounced regionally than nationally. Conversely, the regional employment multiplier for the manufacturing sector represents a lower bound for the national manufacturing-sector employment multiplier, since goods are tradable and much of the additional regional demand is likely to increase employment in other regions. From this perspective, quantifying the impact of industrial employment growth within a region on local employment also provides valuable insights into its broader implications for national employment.

3. EMPIRICAL ANALYSIS

3.1. Data

For a precise analysis, the ideal dataset must satisfy several conditions. First, it should include regional information disaggregated down to the si-gun (city-county) level. While the si and do levels, such as metropolitan cities and provinces, may allow for measuring employment effects related to agglomeration, spillovers, and networks within the region, they are too broad to serve as practical policy units. Conversely, the eup-myeon-dong (town-township-neighborhood) level is too narrow for analysis, as employment effects are likely to extend beyond those administrative boundaries. Therefore, data at either the sido or eup-myeon-dong level are not suitable for this study.

Second, industry information must be classified at least at the minor or sub-minor level.[4] For example, the semiconductor manufacturing industry is categorized as follows: the major category "Manufacturing," the medium category "Electronic components, computer, visual, sound, and communication equipment manufacturing," the minor category "Electronic components manufacturing," and the sub-minor category "Semiconductor manufacturing." Similarly, the automobile manufacturing industry falls under the major category "Manufacturing," the medium category "Motor vehicles and trailers manufacturing," and the minor category "Motor vehicles manufacturing." If information at the minor or sub-minor level is unavailable, medium-level industry data may serve as a second-best option. However, when industries are grouped only at the major classification level, the instrumental variables introduced later cannot be applied, thereby reducing the reliability of the analysis.

Third, if individual-level or establishment-level data are available, it is possible to conduct analyses at the level of individual workers or firms. In the absence of such microdata, aggregated data can be used as a second-best option. Industry-level data classified at the minor group level by si or gun would be particularly useful for this purpose.

In addition to the three conditions above, sufficient time coverage and a representative sample are also required. However, in practice, no dataset satisfies all these conditions simultaneously. Therefore, this study employs the Survey on Establishments' Labor Conditions provided by the Korean Statistical Information Service (KOSIS). This dataset fully meets the first condition and partially satisfies the second and third conditions for an ideal dataset.

The Survey on Establishments' Labor Conditions is a processed statistic generated using raw data from Statistics Korea's Census on Establishments. It provides information that allows analysis of Korea's industrial structure at the si-gun-gu level. The survey offers statistical data on the number of establishments and employees

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[4] This study follows the 10th revision of the Korean Standard Industrial Classification (KSIC).

subject to the Labor Standards Act and serves as a population frame and sampling frame for various other statistical surveys. Because it is used as a sampling frame for other official surveys, the dataset is known for its high level of accuracy.

The Survey on Establishments' Labor Conditions provided by the Korean Statistical Information Service (KOSIS) reports the number of establishments and employees by industry at the si-gun-gu level, classified at the medium industry level. This study uses the number of employees to measure employment. The analysis employs six years of data, from 2017 to 2022, during which industries are classified according to the 10th Korean Standard Industrial Classification (KSIC). Districts (gu) within metropolitan cities and special cities are excluded from the analysis because employment effects in these areas are likely to extend beyond their administrative boundaries. Accordingly, this study uses si and gun within the nine provinces as the smallest regional units for analysis.

The variable used from the Survey on Establishments' Labor Conditions is the number of employees by year, industry, and region. Basic statistics in Table 1 summarize the nationwide number of employees by industry for each year. Overall, the number of employees shows an increasing trend across all surveyed industries for all years except 2020. Column (3), which reports total employment across all industries, shows a sharp decline in 2020 due to the COVID-19 crisis, followed by recovery. This pattern is also observed in Column (1) for manufacturing and Column (2) for services. Table 2 summarizes the annual growth rates of employees by industry at the si-gun level. As in Table 1, a decline in employment during the COVID-19 period in 2020 is evident.

Table 1 Number of Employees in Manufacturing and Service Industries (Nationwide)

(unit: persons)

Year	(1)	(2)	(3)
	Manufacturing	Services	All Industries
2017	2,736,929	5,560,751	9,072,817
2018	2,757,174	5,805,926	9,374,862
2019	2,774,575	6,130,259	9,746,277
2020	2,676,548	5,446,674	8,880,659
2021	2,739,958	5,867,013	9,450,555
2022	2,805,878	6,170,218	9,830,898

Note: Based on the Survey on Establishments' Labor Conditions.

Table 2 Employment Growth Rates in Manufacturing and Services (Si-Gun)

(unit: %)

Year	Observations	(1)	(2)	(3)	(4)
		Manufacturing		Services	
		Mean	Std. Dev.	Mean	Std. Dev.
2018	154	1.3	7.4	3.6	4.8
2019	154	2.6	7.6	8.1	5.1
2020	154	−5.9	6.9	−11.0	5.7
2021	154	1.1	7.3	5.1	7.3
2022	154	3.2	8.4	5.4	6.1

Note: Based on the Survey on Establishments' Labor Conditions.

3.2. Empirical Specifications and Identification Strategy

If ideal data were available, it would be possible to estimate the effect of employment growth in manufacturing at the minor or sub-minor industry level on employment growth in the service sector. However, since obtaining minor-level industry data at the si-gun level is difficult, this study estimates the impact of employment growth in the major industry category, manufacturing, on local service-sector employment growth using the following equation. The reason for not constructing the model with medium-level manufacturing data is that, as explained later, medium-level industry classification is essential for generating instrumental variables.

$$N_{ct}^{Service} = \alpha + \beta N_{ct}^{Manu} + \gamma_c + \gamma_t + u_{ct} \,. \quad (1)$$

$N_{ct}^{Service}$ denotes the natural logarithm of the number of employees in the service sector in region c and year t, while N_{ct}^{Manu} represents the natural logarithm of the number of employees in the manufacturing sector in region c and year t. The service sector includes the following major industries: wholesale and retail trade; transportation and storage; accommodation and food services; information and communications; financial and insurance activities; real estate; professional, scientific, and technical activities; business facilities management, business support, and rental services; education; health and social work; arts, sports, and leisure-related services; membership organizations; and repair and other personal services. The manufacturing sector consists of 25 medium-level industries, including electronic components, computers, visual, audio, and communication equipment manufacturing. In addition to N_{ct}^{Manu}, Equation (1) also includes region fixed effects and year dummies.

The regional employment multiplier can be obtained by estimating the coefficient on N_{ct}^{Manu}, β, in Equation (1). The parameter β represents the elasticity of regional service sector employment with respect to regional manufacturing employment, and it is interpreted as the percentage increase, β%, in service sector employment in a region when manufacturing employment in that region increases by 1%. The identification strategy for estimating the coefficient on $N_{ct}{}^{Manu}$ depends on the relationship between the model's error term u_{ct} and other variables in the model, such as $N_{ct}{}^{Manu}$, γ_c, and γ_t. The regional fixed effects γ_c capture unobserved, time-invariant characteristics specific to each region, which are likely to be correlated with $N_{ct}{}^{Manu}$. To address this issue, the model is differenced so that regional fixed effects are eliminated.

$$\Delta N_{ct}{}^{Service} = \delta_0 + \beta \Delta N_{ct}{}^{Manu} + \delta_t + \varepsilon_{ct} . \tag{2}$$

The variable $\Delta N_{ct}{}^{Service}$ represents the differenced log of service sector employment, which corresponds to the growth rate of service sector employment in region c between years $t-1$ and t. Similarly, $\Delta N_{ct}{}^{Manu}$ represents the growth rate of manufacturing employment in region c between years $t-1$ and t. Through the differencing process, regional fixed effects are eliminated, while year dummies remain in the model.

The tendency for manufacturing employment in a given region to increase may not be exogenously determined but rather stem from the region's inherent characteristics. For instance, a region with a high employment growth rate in the automobile manufacturing industry may possess attributes that favor the expansion of that industry. In such cases, one might incorrectly infer that the growth of manufacturing employment led to the growth of service sector employment. To address this issue of endogeneity, instrumental variables are employed to identify the local employment effect in Equation (2).

To isolate exogenous variation in labor demand, the instrumental variable is constructed as the weighted average of national employment growth rates across sub-industries within the manufacturing sector.[5] The weights are based on each region's employment share within the corresponding manufacturing sub-industry. Since the instrument uses national rather than regional employment growth rates, it is uncorrelated with region-specific shocks. At the same time, because regional manufacturing employment is concentrated differently across sub-industries, national growth in those sub-industries generates exogenous variation that is strongly correlated with regional manufacturing employment growth, ensuring the relevance of the instrument. The instrumental variable for region c and year t is constructed as follows:

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[5] For more detailed discussions, see Goldsmith-Pinkham, Sorkin, and Swift (2020).

$$\sum_j w_{jc} \Delta N_{jt}{}^{Manu}, \tag{3}$$

where w_{jc} denotes the share of employment in manufacturing sub-industry j within total manufacturing employment in region c at the base year $t-1$, and $\Delta N_{jt}{}^{Manu}$ is the national employment growth rate in manufacturing sub-industry j between years $t-1$ and t.

For example, suppose there are two regions in which manufacturing employment at the broad industry level accounts for the same share of total employment in 2021, but the composition across medium-level manufacturing industries differs. If employment in a particular medium-level manufacturing industry increases nationwide, the region employing a larger share of its workforce in that specific industry will experience an exogenous increase in overall manufacturing labor demand. While nationwide changes in manufacturing employment are correlated with total manufacturing employment at the regional level, the variation originating from nationwide employment growth in each medium-level manufacturing industry is uncorrelated with unobserved local factors. Therefore, this variable serves as a valid instrumental variable.

3.3. Estimation Results of Regional Employment Multipliers in Manufacturing

The estimation results of Equation (2) are presented in Table 3. Columns (1) and (2) show the results estimated using the ordinary least squares (OLS) method without addressing endogeneity, in order to provide a baseline comparison. Columns (3) and (4) present the estimates obtained using the instrumental variable constructed in Equation (3) to address the endogeneity issue.

Because the data used in the estimation are aggregated at the si-gun (city-county) level, the number of employees in each si-gun is used as a weight. This weighting ensures that regions with more employment contribute more significantly to the estimation results. Although the same si-gun is observed over multiple years, the amount of additional information does not increase proportionally with the number of years observed. Therefore, standard errors are clustered at the si-gun level.

Table 3 presents the estimation results of the impact of manufacturing employment growth on service sector employment growth within regions. Columns (1) and (2) report the results estimated by ordinary least squares (OLS). The elasticity in Column (1), which does not control for year effects, is 0.620. This implies that a 10% increase in manufacturing employment in a region leads to a 6.2% increase in service sector employment within the same region. The elasticity controlling for year-specific business cycle effects is 0.168 in Column (2).

Table 3 The Effect of Manufacturing Employment on Local Service Employment

Explanatory Variable	(1)	(2)	(3)	(4)
	OLS	OLS	IV 2nd Stage	IV 2nd Stage
$\Delta N_{ct}{}^{Manu}$	0.620*** (0.104)	0.168*** (0.038)	2.588*** (0.301)	0.637*** (0.196)
Year Dummy		Yes		Yes
Observations	770	770	770	770
			IV 1st Stage	IV 1st Stage
Instrument			1.180*** (0.126)	3.718*** (1.146)
Year Dummy				Yes
F-Statistic			87.63	38.72

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
Source: Author's estimation based on the Survey on Establishments' Labor Conditions (2017-2022).

Columns (3) and (4) present the estimation results using the instrumental variable (IV) approach to address endogeneity, showing larger estimates than those in Columns (1) and (2). When year effects are not controlled, the elasticity is 2.588, while it is 0.637 when year effects are included. In both IV specifications, the first-stage F-statistics indicate that weak instrument issues are unlikely.

The results in Column (4) are the most reliable, as they control for business cycle fluctuations and mitigate endogeneity concerns. The estimate in Column (4) indicates that a 10% increase in manufacturing employment within a region leads to a 6.4% increase in service sector employment in the same region. Additional calculations show that, on average during the analysis period, the number of service sector employees in a region is 1.389 times the number of manufacturing employees. Combining this information with the estimated elasticity allows us to compute how much service sector employment increases when manufacturing employment rises. Specifically, when manufacturing employment in a region increases by one worker, service sector employment in that region increases by approximately 0.885 (=0.637×1.389) workers. This result can be interpreted as suggesting that when one manufacturing job is created in a region, about 0.89 additional jobs are generated in local industries not directly linked through input-output relationships.

It should be noted that the estimated multiplier reflects the composition of manufacturing industries during the sample period and may therefore vary depending on the timeframe of the data used. However, this does not imply that cyclical effects are ignored or that the estimates lack statistical rigor. The first-differenced equation includes year dummy variables to control for business cycle fluctuations, and the statistical precision of the estimates is ensured by the sufficient number of regions in a given year, rather than relying on asymptotic time-series theory. Thus, the estimated multiplier represents a precise measure for this period, while controlling for the business cycle.

3.4. Comparison with Previous Studies

The results in Table 3 are comparable to those of Moretti (2010), who used U.S. data. Using census data from 1980, 1990, and 2000, Moretti estimated a local long-run employment multiplier through an instrumental variable approach, finding an elasticity of 0.33. This implies that a 10% increase in manufacturing employment in a region leads to a 3.3% increase in service sector employment within the same region. At that time, there were approximately five service sector jobs for every manufacturing job in the United States. Combining this ratio with the estimated elasticity indicates that an additional manufacturing job in a region generated about 1.59 new service sector jobs.

Although it is difficult to empirically analyze why the local employment multiplier in the United States is larger than in Korea due to data limitations, one possible explanation, as discussed earlier, is the difference in the ease of interregional mobility. Because U.S. cities are geographically distant from one another, commuting across regions is relatively difficult, and manufacturing workers are more likely to reside in the same region where they work. Consequently, the impact of manufacturing employment on local service sector employment may appear relatively stronger in the United States.

In general, the elasticity of local labor supply may also contribute to cross-country differences in the local employment multiplier. Moretti and Thulin (2013), in their comparison of U.S. and Swedish multipliers, suggest that differences in the ease of interregional relocation and in labor market institutions, such as public subsidies for the unemployed, can lead to variation in local labor supply.[6] They show that the average multiplier for Sweden is smaller than that for the United States, partly because Swedish workers are less likely to relocate, a pattern reinforced by the country's generous welfare system.

Korea exhibits relatively high interregional migration, particularly among younger and college-educated workers, which may increase the responsiveness of local labor supply and thus potentially lead to a larger local employment multiplier than that estimated for Sweden. On the other hand, commuting is generally easier in Korea than in the United States due to shorter average distances and more developed transportation networks. This may contribute to a smaller multiplier than that of the United States, as

[6] Of course, differences in industrial composition, including the relative shares of high-skill versus low-skill occupations or high-technology versus low-technology industries, may also influence the extent to which manufacturing employment growth translates into local service sector employment. High-skill occupations and high-technology industries typically provide higher incomes, which can, in turn, lead to a larger local employment multiplier.

improved commuting options reduce the need for workers to relocate.

The value of the local employment multiplier is known to vary depending on the characteristics of the industry under analysis. Studies such as Moretti (2010) and Moretti and Thulin (2013) find that among industry-specific local multipliers, high-tech industries — such as machinery and computer equipment, electrical machinery, and professional instruments — exhibit the largest effects. High-tech industries tend to provide skilled jobs, and industries offering skilled employment generally have higher local employment multipliers than those providing unskilled jobs. This is because skilled jobs generate higher income. Consequently, when one skilled job is added in the manufacturing sector, approximately 2.52 local service jobs are created, although the estimate is not statistically significant. For unskilled jobs, the corresponding figure is 1.04. These findings are consistent with the prediction that skilled jobs, which pay higher wages, create greater demand for local goods and services.

3.5. Robustness

To verify the robustness of the results obtained in Section 3, Table 4 estimates the local employment multiplier for all non-manufacturing industries instead of only for the service sector. The non-manufacturing industries include not only services but also agriculture, forestry, and fisheries; mining; electricity, gas, steam, and air conditioning supply; water supply, sewerage, waste management, and remediation activities; and construction.

The results in Table 4 show that the estimated elasticity is similar to that in Table 3, but its magnitude is relatively smaller. The result in Column (4) indicates that a 10% increase in manufacturing employment within a region leads to a 5.1% increase in non-manufacturing employment in the same region. Separate calculations reveal that, on average, the number of non-manufacturing employees in a region is 1.554 times the number of manufacturing employees. Combining this ratio with the estimated elasticity implies that when manufacturing employment in a region increases by one

Table 4 Impact of Manufacturing Employment on Regional Non-Manufacturing Employment

Explanatory Variable	(1)	(2)	(3)	(4)
	OLS	OLS	IV	IV
ΔN_{ct}^{Manu}	0.633*** (0.107)	0.186*** (0.042)	2.570*** (0.301)	0.512*** (0.184)
Year Dummy		Yes		Yes
Observations	770	770	770	770

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
Source: Author's estimation based on the Survey on Establishments' Labor Conditions (2017-2022).

worker, non-manufacturing employment in that region rises by 0.796 (= 0.512×1.554) workers.

The smaller increase in non-manufacturing employment compared to service employment suggests that some employment crowding-out effects may occur in non-manufacturing, non-service sectors. The non-manufacturing category includes several sectors that differ substantially from service industries in how their employment responds to local demand shocks. Many sectors in this group have the character of public or quasi-public services, where employment is relatively rigid and does not expand proportionally with local economic activity. Moreover, primary industries such as agriculture, forestry, and fisheries also tend to exhibit limited responsiveness to local demand because their production and employment levels are largely determined by technological and resource-based constraints. Workers in these industries may move into service occupations when local service demand rises. As a result, the non-manufacturing employment response to manufacturing growth is weaker than the corresponding service-sector response.

Table 5 presents several robustness checks for the results reported in Column (4) of Table 3. Column (1) limits the analysis to Gyeonggi-do and Gyeongsangnam-do, while Column (2) focuses on regions outside these two provinces. Because Gyeonggi-do and Gyeongsangnam-do are expected to have higher population mobility than other regions, the effect on local service employment may be smaller. This is reflected in Column (1) showing a smaller estimate than Column (2).

Columns (3) and (4) show the effect of manufacturing employment growth on local service employment one year and two years later, respectively, allowing us to assess whether these effects are short-lived or persistent. The one-year lag effect is larger than the result in Column (4) of Table 3, whereas the two-year lag effect is smaller and not statistically significant, indicating that the effect becomes stronger after one year and begins to decline in the second year.

Column (5) examines whether the results in Table 3 are influenced by the effects of COVID-19. To investigate this, Column (5) presents the analysis excluding the

Table 5 The Effect of Manufacturing Employment on Local Service Employment

Explanatory Variable	(1)	(2)	(3)	(4)	(5)
	IV Gyeonggi + Gyeongnam	IV excluding Gyeonggi and Gyeongnam	IV Effect one year Later	IV Effect two years Later	IV Pre-COVID- 19 Years
$\Delta N_{ct}{}^{Manu}$	0.462* (0.268)	0.597*** (0.186)	1.010** (0.402)	0.588 (0.358)	0.900* (0.501)
Year Dummy	Yes	Yes	Yes	Yes	Yes
Observations	245	525	616	462	308

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
Source: Author's estimation based on the Survey on Establishments' Labor Conditions (2017-2022).

COVID-19 period (using data up to 2019), which shows a larger effect of manufacturing employment growth on local service employment.

4. CONCLUSION

The production of an industry affects not only its backward and forward linked industries but also other industries within the region that are not directly connected through input-output relationships. When new jobs are created and employment increases in a region, demand for local goods and services rises, leading to higher regional production and the creation of additional jobs. Services are particularly localized and thus have a stronger potential to influence the regional economy. Therefore, when manufacturing employment increases, the household income of manufacturing workers rises, boosting household consumption based on greater purchasing power, which in turn can lead to increased employment in local service industries.

The regional employment multiplier captures these broader employment effects and serves as an important indicator for assessing the effectiveness of regional economic policies. Empirical analysis of Korean regional data from 2017 to 2022 shows that the creation of one manufacturing job in a region leads to the creation of approximately 0.9 additional jobs in local service industries that are not directly linked through production chains.

These findings have several important policy implications for Korea. First, regional industrial policies that support manufacturing can have broader employment effects by stimulating local service sectors. Existing evidence suggests that the effects of manufacturing employment extend beyond direct supply chain links, particularly by boosting local consumption and service-sector jobs. Second, from the perspective of local governments, such policies can serve as a tool to promote employment within the region. It is also important not to evaluate industries solely based on their backward and forward linkages; rather, local governments should attract industries that can increase regional income. Third, from the perspective of the central government, fostering high-value-added industries can help promote sustainable regional growth and reduce economic disparities between regions. These policies may also serve as national-level strategies to counter regional decline.

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