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The Spatial Spillover Effects of Fiscal Expenditure and Taxation on the Number of Enterprises

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Abstract

This study aims to investigate the impact of fiscal expenditures and tax policies at the county and city level in Taiwan on the number of local business registrations, with particular emphasis on identifying potential spatial spillover effects. To this end, the study compiles panel data covering 22 counties and cities in Taiwan from 2000 to 2023. In terms of spatial dependence, Moran's I index is employed to test the spatial autocorrelation of business activities, and the spatial weight matrix is constructed based on the queen contiguity criterion. Based on the results of the Hausman test and model fit comparison, the Spatial Durbin Model (SDM) with random effects is ultimately selected as the most appropriate model. Empirical findings reveal significant spatial autocorrelation in the distribution of business registrations. Both fiscal expenditure and tax variables exhibit not only direct impacts on local jurisdictions but also significant spatial spillover effects. In particular, expenditures on education, science, and culture show a notable positive influence on business formation in neighboring regions. Conversely, certain tax variables exhibit negative spillovers, suggesting that interjurisdictional policy competition may be present.

JEL classification numbers: C71, H72, R12, C33.
Keywords: Spatial Durbin Model, Fiscal Expenditure, Tax Policy, Business Registration, Spatial Spillover Effect.

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1. Introduction

The spatial distribution of firms has long been a central issue in both regional and urban economics. Traditional location theories, such as Weber's (1929) industrial location theory, emphasize that firms make locational decisions based on factors such as transportation costs, labor costs, and agglomeration economies. However, with the development of the new economic geography and spatial econometric methods, increasing attention has been paid to knowledge spillovers, information externalities, and interregional interactions underlying firm location choices (Krugman, 1991; Fujita et al., 1999).

The establishment and survival of firms are influenced by multiple factors, among which local government fiscal policies—particularly public expenditure and tax systems—play a critical role. On one hand, appropriate fiscal expenditures can improve infrastructure, strengthen human capital development, and enhance regional attractiveness (Gyourko & Tracy, 1989); on the other hand, tax burdens directly affect firms' operating costs and investment incentives (Gyourko & Tracy, 1991). Yu and Rickman (2013), using a spatial equilibrium model, demonstrated that U.S. local fiscal policies significantly impact the economic performance of non-metropolitan areas, highlighting the spatially interconnected nature of fiscal policy effects.

Moreover, the rise of spatial econometrics has provided a powerful methodological framework for analyzing policy spillover effects. LeSage and Pace (2009) emphasized that spatial models can uncover the dependence of economic behaviors across geographically proximate areas. Rico et al. (2021), in their study on business bankruptcy across Spanish regions, found strong spatial correlation in firm outcomes. Similarly, Li et al. (2022) analyzed the location choices of foreign-invested firms in Shanghai and showed that policy orientation and regional characteristics influence firm entry decisions through spatial diffusion mechanisms.

The relationship between spatial agglomeration and firm survival is also a key topic. Mariotti et al. (2010) investigated the spatial clustering of multinational enterprises and found that information externalities and knowledge diffusion are major driving forces. Hecht (2017), examining German firms' location decisions in the Czech Republic, found that agglomeration economies significantly increase the likelihood of firm establishment and survival. Likewise, Maoh and Kanaroglou (2007) demonstrated that urban form and firm distribution are highly correlated using data from Canadian metropolitan areas.

From the perspective of innovation, geographic location also has a profound impact on firms' innovation capabilities. Ferreira et al. (2017) found that locational characteristics significantly affect firm innovation performance. Holl and Rama (2016), in their study on innovation in the Basque Country of Spain, observed that local institutions and public resource allocation can enhance firms' resilience during times of crisis.

Although the aforementioned studies provide valuable insights into firms' spatial behavior, limited attention has been given to how fiscal expenditures and taxation affect the number of firms through spatial spillover mechanisms. This gap is particularly significant in developing countries and emerging economies, where the number of new firms is rapidly increasing and regional economic disparities are widening. Understanding the indirect impact of fiscal policies on firm distribution is thus increasingly important.

In response, this study applies spatial econometric models to explore both the direct effects of local fiscal expenditures and tax systems on the number of firms, as well as their spatial spillover effects. By integrating theoretical insights with empirical evidence, this research seeks to provide a solid foundation for regional economic policymaking.

The specific objectives of this study are threefold: (1) To examine whether the number of registered firms across Taiwan's counties and cities exhibits spatial autocorrelation; (2) To investigate the direct effects of fiscal expenditure and tax factors on the number of registered firms in each county and city; (3) To assess potential neighborhood effects and the spatial spillover impact of fiscal expenditures and taxation on the number of firms in adjacent regions.

The following chapters will present a review of relevant literature and the development of hypotheses, followed by a detailed explanation of the research methodology, including data sources, sample coverage, variables, and empirical models. The empirical section will report descriptive statistics, correlation analyses, spatial autocorrelation tests, and estimation results from the Spatial Durbin Model. The analysis will include a decomposition of direct and spillover effects. Finally, the study will conclude with key findings and policy implications.

2. Literature Review and Hypothesis Development

2.1 The impact of local fiscal expenditure on the number of business registrations

Local government fiscal expenditure is a core policy instrument shaping the business environment. According to Bartik (1985), state-level factors such as taxation, unionization, and the quality of public services significantly influence firms' location decisions, highlighting the strong link between local fiscal conditions and corporate behavior. Gyourko and Tracy (1989, 1991) further argued that the level of public goods provision and the structure of local finance can affect labor market conditions and quality of life, thereby altering firms' locational preferences.

Specifically, government spending on economic development can improve infrastructure, provide subsidies, and offer investment incentives, thereby enhancing the attractiveness of a region for business establishment. Expenditure on education, science, and culture contributes to human capital development and innovation capacity, forming the foundation for long-term business growth. Community development and environmental protection expenditures enhance the quality of the living environment, which in turn attracts talent and fosters entrepreneurial activity. In a dynamic panel analysis, Srithongrung and Kriz (2014)

found that subnational fiscal policies positively impact economic growth, further supporting the notion that government spending can stimulate business activity.
Additionally, Van Cauwenberge et al. (2016), using fiscal data from Belgium, empirically demonstrated that local government fiscal policies can significantly influence firm growth potential, particularly through expenditure-side policies. Similarly, Adegboyo et al. (2021), in the context of Nigeria, identified a positive relationship between government spending and economic growth, with indirect effects on entrepreneurship and the number of registered businesses. Based on the above, the following hypothesis is proposed:

Hypothesis 1: Fiscal expenditures by local governments (including general administration, economic development, education/science/culture, community development, and environmental protection) have a significant impact on the number of business registrations in the respective county or city.

2.2 Spatial spillover effects of fiscal expenditures in neighboring regions

In addition to local fiscal policy, the expenditure behavior of neighboring regions may influence local economic activity through spatial spillover mechanisms. According to the model of interjurisdictional capital mobility proposed by Wildasin (1989), fiscal policy competition across regions can lead to the reallocation of resources, resulting in phenomena such as "tax competition" and "subsidy competition." Yu and Rickman (2013), using a spatial equilibrium model, confirmed that in the United States, non-metropolitan areas experience firm relocation and redistribution of economic activity in response to fiscal changes in adjacent regions.
In an earlier study, Clotfelter (1977) suggested that when private entities have alternatives to public services, they may adjust their geographic preferences based on the quality of public resources offered by neighboring jurisdictions. Such spatial interaction effects are not limited to labor markets but also extend to firms' location decisions and registration intentions. Hubert and Pain (2002) pointed out that fiscal incentives under regional integration can create interregional competition in attracting foreign direct investment, indicating strong spatial spillovers.
Bulgariu and Soroceanu (2010) also found that when neighboring regions offer more favorable fiscal conditions, firms are inclined to relocate their production facilities or headquarters to those areas. These spillover effects can positively or negatively influence local business registration, depending on the structure of interregional competition and the degree of geographic proximity. Therefore, if neighboring counties or cities are more proactive in their spending on economic development, education, community, and environmental initiatives, they may attract potential firms to establish operations across administrative boundaries, thereby significantly affecting local registration numbers. Based on this, the following hypothesis is proposed:

Hypothesis 2: Fiscal expenditures in neighboring counties or cities (including general administration, economic development, education/science/culture, community development, and environmental protection) have a significant impact on the number of business registrations in a given county or city.

2.3 The impact of local taxation on the number of business registrations

When selecting business locations, firms often take into account the local tax burden and the availability of fiscal resources. Local taxation can be categorized into own-source tax revenues (such as land value tax and business tax) and centrally allocated shared tax revenues from the central government. The former directly affects a firm's operating costs and tax pressure, while the latter reflects the scale of financial resources available to the local government.

Bartik (1985), in an empirical study on U.S. regions, found that higher local tax burdens suppress business entry, with a particularly significant impact on small and medium-sized enterprises (SMEs) and startups. Adegboyo et al. (2021) similarly demonstrated that business formation rates are significantly lower in high-tax regions of Nigeria. Tax regimes are not only key variables in firms' profitability calculations, but also serve as indicators of government fiscal capacity and the quality of public service provision.

On the other hand, centrally allocated shared tax revenues represent a form of fiscal supplementation from higher levels of government. The magnitude of such transfers affects the level of public goods and infrastructure in a locality, thereby either attracting or deterring business establishments. Using China as a case study, Kim et al. (2021) found that fiscal expansion by governments not only promotes local economic growth but also indirectly increases the number of businesses. Based on these insights, the following hypothesis is proposed:

Hypothesis 3: Local taxation (including own-source tax revenue and centrally allocated shared tax revenue) significantly affects the number of business registrations within a given county or city.

2.4 Spatial spillover effects of taxation in neighboring counties and cities

Beyond the influence of local tax structures, the tax environments of neighboring counties and cities may also affect local business registration behavior through spatial spillover effects. When adjacent regions offer more favorable tax conditions, businesses may choose to establish themselves across administrative boundaries to benefit from lower tax burdens and better public services. This phenomenon is referred to as the "tax competition effect" or "cross-border capital flight" (Wildasin, 1989).

Yu and Rickman (2013), employing a spatial equilibrium model, pointed out that local fiscal policies in the United States generate clear externalities, especially in non-metropolitan areas, where firms adjust their location decisions in response to fiscal policy differences in nearby regions. Hubert and Pain (2002), focusing on foreign direct investment (FDI) in Europe, found that when neighboring jurisdictions offer stronger tax incentives or subsidies, regions originally targeted for investment may lose potential business inflows.

In addition, Bulgariu and Soroceanu (2010), in their study on corporate headquarters and investment site selection, highlighted that variations in regional tax pressure can drive firms to shift across territorial boundaries, making taxation a central arena of interregional economic competition. Therefore, if neighboring counties or cities possess higher tax revenues and greater fiscal capacity for public spending, they may attract potential firms to register there instead. Accordingly, the following hypothesis is proposed:

Hypothesis 4: Taxation in neighboring counties or cities (including own-source tax revenue and centrally allocated shared tax revenue) significantly affects the number of business registrations in the focal county or city.

3. Methodology

3.1 Data and procedure

This study employs panel data from 22 counties and cities in Taiwan spanning the years 2000 to 2023. Taiwan's current administrative structure comprises six special municipalities, thirteen counties, and three provincial cities. These 22 administrative regions represent the highest level of local self-governance in the country. The statistical data used in this research are primarily sourced from the Statistical Indicator Query System for Counties and Cities, publicly released in 2024 by the Directorate General of Budget, Accounting and Statistics (DGBAS) of the Executive Yuan. This database encompasses key indicators related to fiscal revenues and expenditures, socioeconomic development, and industrial structure across different years and regions, offering a high degree of completeness and comparability. As such, it is suitable for both time-series and cross-sectional empirical analyses.

The main dependent variable in this study—the number of currently registered companies—is also obtained from statistical publications by the DGBAS (2024). This indicator reflects the total number of companies that have completed official registration and remain operational in each year, thereby serving as a vital proxy for measuring the scale of business activity and the vibrancy of local economies.

As indicated in Table 1, the number of registered companies in Taiwan shows a steadily increasing trend from 587,145 in 2000 to 771,311 in 2023. Although there were slight declines in some years, such as 2008 and 2009, the overall growth remained significant—particularly since 2016—suggesting a strengthening entrepreneurial environment and improved macroeconomic conditions in Taiwan. This variable is used as the primary indicator of business activity at the county and city levels, allowing for further analysis of its relationship with fiscal expenditures, tax revenues, and their associated spatial spillover effects.

Table 1: Number of Currently Registered Companies in Taiwan (2000–2023)

Year	Number of Registered Companies	Year	Number of Registered Companies	Year	Number of Registered Companies
2000	587,145	2008	577,484	2016	675,273
2001	582,537	2009	579,089	2017	695,693
2002	588,493	2010	586,044	2018	705,234
2003	596,000	2011	596,574	2019	705,554
2004	602,021	2012	605,365	2020	720,293
2005	611,524	2013	620,401	2021	736,889
2006	619,930	2014	637,556	2022	751,912
2007	599,521	2015	656,333	2023	771,311

Source: The Directorate General of Budget, Accounting and Statistics (DGBAS) of the Executive Yuan (2024).

The data analysis process of this study adheres to the theoretical framework of spatial econometrics and involves a series of rigorous statistical and model-based evaluations. First, to capture the spatial interdependencies among Taiwan's local governments, a spatial weight matrix is constructed based on the contiguity rule, which defines spatial relationships using geographical adjacency.

To detect spatial clustering patterns of business registrations, global Moran's I statistic is employed to test for spatial autocorrelation. Regarding model selection, the Spatial Durbin Model (SDM) is initially adopted as the main analytical framework. A series of diagnostic tests are then conducted to assess whether the SDM can be simplified into a Spatial Autoregressive Model (SAR) or a Spatial Error Model (SEM). Additionally, the Hausman test is applied to determine whether a fixed-effects or random-effects specification is more appropriate.

For model fit evaluation, multiple criteria are used, including the log-likelihood value, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC). Based on the results of these diagnostics and comparisons, the SDM with random effects is identified as the best-fitting model and is selected as the basis for subsequent empirical analysis.

Finally, this study performs an effects decomposition based on the chosen model, calculating and interpreting the direct effects, indirect effects (spatial spillover effects), and total effects of the independent variables on the dependent variable. This decomposition helps elucidate the mechanisms through which fiscal expenditures and tax revenues influence business registration behavior. The findings inform the study's overall conclusions and support the development of policy recommendations aimed at enhancing local business development and improving fiscal resource allocation. The results are intended to provide empirical evidence and strategic insights for both central and local governments in formulating effective business and fiscal policies.

3.2 Research variables

The definitions and descriptions of the dependent and independent variables used in this study's empirical model are as follows:

3.2.1 Dependent variable

Number of Registered Companies (NRC_{it}): Refers to the total number of companies registered in accordance with the Company Act in the i-th county or city of Taiwan in year t that are still in operation.

3.2.2 Fiscal and tax-related independent variables

General Government Expenditures (in million NT dollars) (GGE_{it}): Denotes the general government expenditures of the i-th county or city in year t, which include spending related to the exercise of government authority, administration, civil affairs, and finance (excluding police expenditures).

Economic Development Expenditures (in million NT dollars) (EDE_{it}): Represents expenditures by the i-th county or city in year t on economic development activities, including agriculture, industry, transportation, and other economic services.

Education, Science, and Culture Expenditures (in million NT dollars) ($ESCE_{it}$): Refers to the expenditures by the i-th county or city in year t on education, science, and culture-related affairs and subsidies.

Community Development and Environmental Protection Expenditures (in million NT dollars) (CEE_{it}): Refers to expenditures by the i-th county or city in year t related to community development, environmental protection affairs, and associated subsidies.

Tax Revenues (in million NT dollars) (TR_{it}): Indicates local tax revenues of the i-th county or city in year t, including estate and gift tax, tobacco and alcohol tax, land tax, house tax, vehicle license tax, deed tax, stamp tax, amusement tax, special taxes, and shared tax revenues.

Other Allocated Tax Revenues (in million NT dollars) ($OATR_{it}$): Refers to the allocated tax revenues distributed by the central government to municipalities, counties (cities), and townships in year t for the i-th jurisdiction. These funds represent centrally pooled tax revenues redistributed to local governments.

3.3 Empirical model

This study adopts Tobler's First Law of Geography as the theoretical foundation, which states: "Everything is related to everything else, but near things are more related than distant things" (Tobler, 1970). This principle emphasizes the significance of spatial proximity, indicating that geographically adjacent regions often exhibit stronger interactions and interdependencies in economic and social activities. From the perspective of economics and business, inter-regional enterprise activity, industrial development, and policy implementation are all likely to exhibit spatial associations and spillover effects.

To capture these spatial dependencies and interregional interactions, this study applies the Spatial Durbin Model (SDM) proposed by LeSage and Pace (2009) for empirical analysis. The SDM includes both the spatial lag of the dependent variable and the spatial lags of independent variables, allowing for a comprehensive examination of both direct (within-region) and indirect (between-region) effects. This framework is particularly well-suited for exploring the spatial interaction mechanisms between the number of registered companies and local fiscal variables. The SDM used in this study is specified as follows:

$$
\begin{aligned}
NRC_{it} = \rho \sum_{j=1}^{N} W_{ij} NRC_{jt} + \alpha + \beta_1 GGE_{it} + \beta_2 EDE_{it} + \beta_3 ESCE_{it} + \beta_4 CEE_{it} \\
+ \beta_5 TR_{it} + \beta_6 OATR_{it} + \theta_1 \sum_{j=1}^{N} W_{ij} GGE_{jt} + \theta_2 \sum_{j=1}^{N} W_{ij} EDE_{jt} \\
+ \theta_3 \sum_{j=1}^{N} W_{ij} ESCE_{jt} + \theta_4 \sum_{j=1}^{N} W_{ij} CEE_{jt} + \theta_5 \sum_{j=1}^{N} W_{ij} TR_{jt} \\
+ \theta_6 \sum_{j=1}^{N} W_{ij} OATR_{jt} + \mu_i + \varepsilon_{it}
\end{aligned}
$$

$$i \neq j$$

Where:

NRC_{it} is the dependent variable, representing the number of registered companies in county or city i at time t.

i, j refer to Taiwan’s 22 counties and cities; t represents the year (t = 2000–2023).

W_{ij} denotes the spatial weight matrix, which is a square matrix (22×22 in this study) indicating spatial adjacency relationships among regions. The spatial matrix is constructed based on the Queen Contiguity criterion—if two counties or cities share a border or corner, W_{ij} = 1; otherwise, W_{ij} = 0. Diagonal elements (i=j) are set to 0, as a region is not considered its own neighbor. Taiwan’s offshore islands—Penghu, Kinmen, and Lienchiang—are treated as spatially isolated, with all their off-diagonal weights set to 0.

Formally, the spatial weights matrix W_{ij} is defined as:

$$W_{ij} = \begin{cases} 1, & regions\ i\ and\ j\ are\ neighboring\ regions \\ 0, & otherwise \end{cases}$$

$W_{ij}NRC_{jt}$ is the spatially lagged dependent variable, representing the endogenous influence of neighboring region j’s registered companies on region i.

ρ is the spatial lag coefficient, reflecting the strength and direction of spatial dependence in the dependent variable. A significant $\rho \neq 0$ indicates the presence

of spatial relationships. A positive $\rho > 0$ implies positive spatial spillovers, while its magnitude reflects the degree of spatial diffusion or interaction among regions.
α is the intercept term.
The parameter β_k represents the coefficients to be estimated, capturing the direct effects of the independent variables on the number of registered companies within a given locality. These independent variables include general government expenditure (GGE_{it}), economic development expenditure (EDE_{it}), education, science, and culture expenditure ($ESCE_{it}$), community development and environmental protection expenditure (CEE_{it}), tax revenues (TR_{it}), and other allocated tax revenues ($OATR_{it}$).
θ_k are coefficients of spatially lagged independent variables, measuring the indirect effects (spatial spillovers) of neighboring regions' fiscal variables on the number of registered companies in region i. A positive θ suggests a positive spillover effect, indicating that fiscal actions in neighboring areas promote local business registration; a negative θ implies competitive effects among regions.
μ_i denotes individual (spatial) fixed effects, capturing unobserved heterogeneity across counties or cities.
ε_{it} is the random error term, assumed to be independently and identically distributed.

4. Results

4.1 Descriptive statistics

To understand the distribution and variability of the research variables, this study conducted a descriptive statistical analysis on the seven main variables. The results are summarized in Table 2. A total of 528 observations are included, covering panel data from Taiwan's 22 counties and cities between 2000 and 2023.
The average number of registered companies (NRC) is 29,182, with a standard deviation of 45,330. The minimum value is only 37, while the maximum reaches 184,128, indicating a substantial disparity in business scale across counties and cities and reflecting a high degree of variability. The 25th percentile is 3,903, and the 75th percentile is 32,031, showing that most counties and cities fall within the low to middle range. Only a few metropolitan cities, such as Taipei and Kaohsiung, have extremely high company counts, resulting in a right-skewed distribution.
The average general government expenditure (GGE) is NT$8,106 million, with a maximum of NT$50,860 million and a standard deviation of NT$8,064 million, revealing a significant difference in administrative spending across local governments. Economic development expenditure (EDE) and education, science, and culture expenditure (ESCE) average NT$7,290 million and NT$15,525 million, respectively. The larger scale of ESCE suggests that local governments have consistently prioritized investments in education and cultural affairs.
Community development and environmental protection expenditure (CEE) shows the widest variation, ranging from as low as NT$63 million to as high as NT$20,164 million. The interquartile range is also wide (NT$690 vs. NT$1,884), indicating

substantial differences among counties in terms of investment in community and environmental policies.

The two main fiscal variables in this study, tax revenues (TR) and other allocated tax revenues (OATR), have average values of NT$22,582 million and NT$9,349 million, respectively. TR reaches up to NT$160,000 million, highlighting the strong fiscal concentration in some financially robust municipalities. OATR, which reflects fiscal transfers from the central to local governments, is relatively concentrated but still shows considerable variation across regions.

Overall, all variables exhibit varying degrees of dispersion, reflecting a clear regional disparity in business activity and fiscal resources across Taiwan's counties and cities. These disparities lay the foundation for the subsequent spatial analysis.

To preliminarily examine the linear relationships among the variables, Pearson correlation analysis was further conducted, with results shown in Table 3. In general, all variables exhibit statistically significant positive correlations ($p < 0.01$), suggesting potential linkage or co-movement between local fiscal variables and the number of registered companies.

NRC is highly positively correlated with all independent variables. The strongest correlation is with tax revenues (TR) at 0.953, followed by education, science, and culture expenditure (ESCE, 0.942), community and environmental protection expenditure (CEE, 0.925), and general government expenditure (GGE, 0.925). This indicates that business activity tends to move in tandem with local tax income and fundamental public expenditures.

Significant multicollinearity is also observed among the fiscal expenditure variables. For instance, the correlation between GGE and ESCE is 0.973, and between EDE and ESCE is 0.909, indicating that budget allocations across different expenditure categories often complement one another or reflect the overall size of the budget. The correlation between TR and OATR is as high as 0.970, suggesting that both local tax capacity and central government transfers are typically concentrated in specific regions.

Due to these high correlations among the variables, the subsequent construction of the spatial econometric model will incorporate spatial lag terms and decompose direct and indirect effects to further explore the causal relationships and spatial spillover effects of fiscal variables on the number of businesses.

Table 2: Summary of descriptive statistics

Variables	Obs.	Mean	Std. Dev.	Min.	25th Percentile	Median	75th Percentile	Max.
NRC	528	29182.15	45330.60	37.00	3903.50	6188.00	32031.50	184128.00
GGE	528	8106.39	8064.79	386.45	3240.45	4328.66	10367.42	50860.14
EDE	528	7290.28	7622.95	541.91	2572.15	4207.69	8151.56	46357.08
ESCE	528	15524.99	17128.55	400.57	4728.63	7570.59	19479.79	73384.66
CEE	528	2421.68	3805.22	63.44	324.42	690.35	1884.85	20164.01
TR	528	22581.84	30782.22	221.76	5465.73	5465.73	23444.51	161288.94
OATR	528	9349.41	11786.00	179.76	2645.59	4787.47	8779.88	72277.02

Note:
Obs.: Observations.
TWD: New Taiwan Dollar (equal to USD 0.030).
NRC: Number of Registered Companies (units), GGE: General Government Expenditure (TWD million), EDE: Economic Development Expenditure (TWD million), ESCE: Education, Science, and Culture Expenditure (TWD million), CEE: Community Development and Environmental Protection Expenditure (TWD million), TR: Tax Revenues (TWD million), OATR: Other Allocated Tax Revenues (TWD million).

Table 3: Pearson correlation analysis

	NRS	GGE	EDE	ESCE	CEE	TR	OATR
NRC	1						
GGE	.925**	1					
EDE	.847**	.916**	1				
ESCE	.942**	.973**	.909**	1			
CEE	.925**	.943**	.877**	.932**	1		
TR	.953**	.955**	.910**	.973**	.943**	1	
OATR	.890**	.914**	.901**	.936**	.894**	.970**	1

Note: ** p<0.01.
TWD: New Taiwan Dollar (equal to USD 0.030).
NRC: Number of Registered Companies (units), GGE: General Government Expenditure (TWD million), EDE: Economic Development Expenditure (TWD million), ESCE: Education, Science, and Culture Expenditure (TWD million), CEE: Community Development and Environmental Protection Expenditure (TWD million), TR: Tax Revenues (TWD million), OATR: Other Allocated Tax Revenues (TWD million).

4.2 Spatial autocorrelation test results

To determine whether the distribution of registered companies across Taiwan's counties and cities exhibits spatial clustering or dispersion, this study employs the global spatial autocorrelation index known as Moran's I. This indicator effectively measures the degree of spatial correlation in a given variable, with values ranging between -1 and 1. A Moran's I value approaching 1 indicates strong positive spatial autocorrelation, meaning that neighboring areas tend to display similar levels of the variable. Conversely, a value closer to -1 suggests negative spatial autocorrelation, where adjacent regions show contrasting values. A value near zero implies the absence of significant spatial structure, indicating that the variable is randomly distributed across space (Moran, 1950).

Using panel data covering the number of registered companies in Taiwan's 22 counties and cities from 2000 to 2023, the study calculates annual Moran’s I values along with their corresponding p-values. The results, as presented in Table 4, show that throughout the entire observation period, the Moran’s I values remain positive and statistically significant at the 1% level. This suggests a persistent and robust pattern of positive spatial autocorrelation in the distribution of company registrations, indicating that business activity tends to cluster spatially across regions.

In particular, the years from 2000 to 2006 exhibit the highest degree of spatial clustering, with Moran’s I values generally falling between 0.421 and 0.439. Although there is a slight decline in the index in subsequent years, it remains stable within a narrow range of 0.39 to 0.42, demonstrating long-term consistency in the spatial distribution structure. By 2023, the Moran’s I value stands at 0.387, still significant at the 1% level, which implies that despite changes in industrial structures and policy environments, the spatial relationships among the number of firms in different regions of Taiwan continue to hold.

These findings confirm the existence of significant spatial dependence in the distribution of registered companies and provide strong justification for applying spatial econometric models—particularly the Spatial Durbin Model (SDM)—in the subsequent analysis of firm distribution and the effects of fiscal policy.

Table 4: Spatial autocorrelation indicators from 2000 to 2023

Year	**Moran’s I**		**Year**	**Moran’s I**	
	I	***p*-value**		**I**	***p*-value**
2000	0.421	0.002	2012	0.417	0.003
2001	0.428	0.001	2013	0.416	0.003
2002	0.432	0.002	2014	0.412	0.004
2003	0.436	0.002	2015	0.409	0.004
2004	0.437	0.002	2016	0.405	0.005
2005	0.435	0.002	2017	0.400	0.005
2006	0.439	0.002	2018	0.397	0.006
2007	0.432	0.002	2019	0.400	0.005
2008	0.425	0.002	2020	0.401	0.005
2009	0.425	0.003	2021	0.396	0.006
2010	0.423	0.003	2022	0.390	0.008
2011	0.420	0.003	2023	0.387	0.008

4.3 Analysis results of the Wald test and Likelihood-ratio test

Based on the theoretical frameworks proposed by LeSage and Pace (2009) and Elhorst (2010), the Spatial Durbin Model (SDM) incorporates spatial lags of both dependent and independent variables, offering greater flexibility and explanatory power compared to the Spatial Lag Model (SLM) and the Spatial Error Model (SEM). However, to determine whether the SDM can be simplified to an SLM or SEM, it is necessary to test the null hypothesis that the vector of coefficients for the spatially lagged independent variables, θ, is equal to zero. If the null hypothesis H_0: $\theta = 0$ is rejected, it indicates that the spatially lagged independent variables significantly affect the dependent variable, and thus, the SDM should not be reduced to a simpler form like SLM or SEM.

In this study, we use both the Wald test and the Likelihood-Ratio (LR) test to empirically compare the SDM and SLM under different model specifications, including spatial fixed effects, time fixed effects, both spatial and time fixed effects, and random effects. The results are summarized in Table 5. Under the spatial fixed effects model, the Wald test yields $\chi^2 = 44.10$ ($p < 0.001$), and the LR test gives $\chi^2 = 41.90$ ($p < 0.001$), indicating that SDM significantly outperforms SLM, thus supporting the use of SDM with spatial fixed effects. Similarly, under the time fixed effects model, the Wald test shows $\chi^2 = 53.97$ ($p < 0.001$) and the LR test reports $\chi^2 = 55.71$ ($p < 0.001$), again rejecting the simplification hypothesis and favoring SDM with time fixed effects.

For the model including both spatial and time fixed effects, the Wald test returns $\chi^2 = 27.99$ ($p < 0.001$), while the LR test reports $\chi^2 = 26.99$ ($p < 0.001$), confirming that even with dual fixed effects, SDM remains superior to SLM. Under the random effects model, the Wald test yields $\chi^2 = 45.66$ ($p < 0.001$), and the LR test gives $\chi^2 = 43.33$ ($p < 0.001$), again suggesting that SDM with random effects is a more appropriate model.

Subsequently, we compare the SDM with the SEM using the same four model structures. As shown in Table 6, the Wald test under the spatial fixed effects model produces $\chi^2 = 20.25$ ($p < 0.01$), and the LR test gives $\chi^2 = 19.77$ ($p < 0.01$), indicating a significantly better fit for SDM. For the time fixed effects model, the Wald test results in $\chi^2 = 34.72$ ($p < 0.001$), and the LR test yields $\chi^2 = 18.49$ ($p < 0.01$), again supporting the superiority of SDM. When both spatial and time fixed effects are considered, the Wald test reports $\chi^2 = 25.49$ ($p < 0.001$), and the LR test yields $\chi^2 = 24.81$ ($p < 0.001$), further confirming SDM's suitability.

Even under the random effects model, the Wald test shows $\chi^2 = 18.44$ ($p < 0.01$), and the LR test results in $\chi^2 = 22.77$ ($p < 0.001$), demonstrating that SDM remains statistically advantageous even without controlling for spatial or temporal fixed effects.

In summary, regardless of the chosen model structure—spatial fixed effects, time fixed effects, two-way fixed effects, or random effects—all tests consistently demonstrate that the SDM is statistically superior. The coefficients of the spatially lagged independent variables (θ) are significantly different from zero, which means that the SDM cannot be simplified to either the SLM or SEM. Therefore, this study adopts the SDM as the primary estimation framework. Not only is this choice consistent with statistical test results, but it also allows for a comprehensive examination of the direct and indirect spatial effects of fiscal variables on the distribution of registered companies.

Table 5: Spatial lag model (SLM)

Variables	Model 1 SLM with spatial fixed-effects		Model 2 SLM with time fixed-effects		Model 3 SLM with spatial and time fixed-effects		Model 4 SLM with random-effects	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
GGE	-0.486^{***}	0.098	-0.036	0.297	-0.292^{**}	0.097	-0.479^{***}	0.100
EDE	0.046	0.040	-0.574^{**}	0.166	0.015	0.039	0.045	0.041
ESCE	0.533^{***}	0.043	0.801^{***}	0.158	0.568^{***}	0.045	0.533^{***}	0.044
CEE	0.361^{*}	0.145	1.752^{***}	0.417	0.350^{*}	0.140	0.363^{*}	0.148
TR	0.098^{*}	0.040	1.423^{***}	0.125	0.037	0.042	0.098^{*}	0.041
OATR	0.179^{**}	0.053	-1.472^{***}	0.187	0.229^{***}	0.055	0.177^{**}	0.054
Constant							18035.410^{*}	7083.826
n		528		528		528		528
Spatial ρ	0.054	0.031	0.110^{***}	0.026	0.024	0.041	0.062^{*}	0.031
within R^2	0.758		0.614		0.757		0.758	
between R^2	0.960		0.982		0.956		0.954	
overall R^2	0.892		0.928		0.892		0.889	
Log-likelihood	-4858.423		-5628.357		-4823.256		-4961.883	
Wald test	$H_0: \theta = 0$ $x^2 = 44.10^{***}$ *p*-value = 0.000		$H_0: \theta = 0$ $x^2 = 53.97^{***}$ *p*-value = 0.000		$H_0: \theta = 0$ $x^2 = 27.99^{***}$ *p*-value = 0.0001		$H_0: \theta = 0$ $x^2 = 45.66^{***}$ *p*-value = 0.000	
Likelihood-ratio test	H_0: SLM nested within SDM LR $x^2 = 41.90^{***}$ *p*-value = 0.000		H_0: SLM nested within SDM LR $x^2 = 55.71^{***}$ *p*-value = 0.000		H_0: SLM nested within SDM LR $x^2 = 26.99^{***}$ *p*-value = 0.0001		H_0: SLM nested within SDM LR $x^2 = 43.33^{***}$ *p*-value = 0.000	

Note: * p<0.05; ** p<0.01; *** p<0.001
TWD: New Taiwan Dollar (equal to USD 0.030).
SLM: Spatial Lag Model.
SDM: Spatial Durbin Model.
Coef.: Coefficient.
Std. Err.: Standard Error.
GGE: General Government Expenditure (TWD million), EDE: Economic Development Expenditure (TWD million), ESCE: Education, Science, and Culture Expenditure (TWD million), CEE: Community Development and Environmental Protection Expenditure (TWD million), TR: Tax Revenues (TWD million), OATR: Other Allocated Tax Revenues (TWD million).

Table 6: Spatial error model (SEM)

Variables	Model 5 SEM with spatial fixed-effects		Model 6 SEM with time fixed-effects		Model 7 SEM with spatial and time fixed-effects		Model 8 SEM with random-effects	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
GGE	-0.428***	0.102	0.161	0.247	-0.299**	0.098	-0.424***	0.104
EDE	0.021	0.039	-0.456**	0.140	0.012	0.039	0.020	0.040
ESCE	0.547***	0.041	0.628***	0.131	0.563***	0.043	0.549***	0.042
CEE	0.424**	0.140	1.815***	0.344	0.369**	0.139	0.423**	0.143
TR	0.098*	0.041	1.583***	0.104	0.049	0.040	0.102*	0.042
OATR	0.160**	0.054	-1.827***	0.173	0.212***	0.054	0.154**	0.055
Constant							19176.760**	7161.987
n		528		528		528		528
Spatial λ	0.264***	0.051	0.496***	0.047	0.077	0.056	0.265***	0.052
within R^2	0.760		0.590		0.758		0.760	
between R^2	0.962		0.986		0.958		0.963	
overall R^2	0.898		0.933		0.894		0.899	
Log-likelihood	-4847.358		-5596.255		-4822.161		-4951.601	
Wald test	H_0: $\theta+\rho\beta=0$ x^2 = 20.25*** *p*-value = 0.0025		H_0: $\theta+\rho\beta=0$ x^2 = 34.72*** *p*-value = 0.000		H_0: $\theta+\rho\beta=0$ x^2 = 25.49*** *p*-value = 0.0003		H_0: $\theta+\rho\beta=0$ x^2 = 18.44*** *p*-value = 0.0052	
Likelihood-ratio test	H_0: SEM nested within SDM LR x^2 = 19.77*** *p*-value = 0.0014		H_0: SEM nested within SDM LR x^2 = 18.49*** *p*-value = 0.0017		H_0: SEM nested within SDM LR x^2 = 24.81*** *p*-value = 0.0002		H_0: SEM nested within SDM LR x^2 = 22.77*** *p*-value = 0.0004	

Note: * p<0.05; ** p<0.01; *** p<0.001
TWD: New Taiwan Dollar (equal to USD 0.030).
SEM: Spatial Error Model.
SDM: Spatial Durbin Model.
Coef.: Coefficient.
Std. Err.: Standard Error.
GGE: General Government Expenditure (TWD million), EDE: Economic Development Expenditure (TWD million), ESCE: Education, Science, and Culture Expenditure (TWD million), CEE: Community Development and Environmental Protection Expenditure (TWD million), TR: Tax Revenues (TWD million), OATR: Other Allocated Tax Revenues (TWD million).

4.4 Analysis results of the Hausman test

To further determine whether the Spatial Durbin Model (SDM) should adopt a fixed effects model or a random effects model, this study applies the Hausman test proposed by Hausman (1978) for model selection. The Hausman test is used to assess whether the individual (county/city) or time effects in the model are correlated with the explanatory variables, thereby helping decide whether fixed effects should be adopted to eliminate endogeneity bias. Table 7 presents the Hausman test results under three model specifications, as described below:

First, when comparing the SDM with spatial fixed effects against the corresponding random effects model, the Hausman test yields $\chi^2 = 2.16$, $p > 0.05$, indicating that the null hypothesis cannot be rejected. In other words, the random effects model does not suffer from significant bias and is thus more suitable than the fixed effects model in this setting.

Second, for the comparison between the SDM with time fixed effects and its corresponding random effects model, the test result is $\chi^2 = 7175.02$, $p < 0.001$, significantly rejecting the null hypothesis. This indicates the presence of systematic bias in the random effects model, suggesting that the fixed effects model is preferable in controlling for unobservable time heterogeneity that is correlated with the explanatory variables.

Third, in the comparison between the SDM with both spatial and time fixed effects and the random effects model, the Hausman test result is $\chi^2 = 0.02$, $p > 0.05$, implying that the null hypothesis cannot be rejected. Hence, the random effects model remains the more appropriate estimation method in this scenario.

In summary, the results suggest that when the model includes only time fixed effects, the fixed effects model provides more consistent estimates. However, in other specifications—such as those including spatial fixed effects or both spatial and time fixed effects—the random effects model is more suitable. Therefore, in the subsequent analysis, this study focuses on comparing the SDM with time fixed effects and the SDM with random effects, in order to evaluate which model better captures the influence of explanatory variables on the number of registered companies and to select the most appropriate model for empirical inference.

Table 7: Hausman test results

	Hausman test		Result
	χ^2	*p*-value	
SDM with spatial fixed-effects v.s. SDM with random-effects	2.16	0.9043	H_0: $E(x_{it}, \mu_i) = 0$ The null hypothesis (random effects model) cannot be rejected; SDM with random-effects is adopted.
SDM with time fixed-effects v.s. SDM with random-effects	7175.02	0.0000	H_0: $E(x_{it}, \mu_i) = 0$ The null hypothesis (random effects model) is rejected; SDM with time fixed-effects is adopted.
SDM with spatial and time fixed-effects v.s. SDM with random-effects	0.02	1.0000	H_0: $E(x_{it}, \mu_i) = 0$ The null hypothesis (random effects model) cannot be rejected; SDM with random-effects is adopted.

4.5 Spatial Durbin model analysis results

Table 8 presents the estimation results of four Spatial Durbin Models (SDM), each incorporating different specifications of fixed and random effects. Based on the preceding Hausman test analysis, Model 9 (SDM with spatial fixed-effects) and Model 11 (SDM with both spatial and time fixed-effects) were found to provide less robust estimates and are therefore excluded from further model selection. This study focuses on comparing and evaluating Model 10 (SDM with time fixed-effects) and Model 12 (SDM with random-effects).

To estimate the spatial econometric models, the study adopts the Maximum Likelihood Estimation (MLE) approach and uses three model fit criteria to evaluate overall model performance: Log Likelihood (LL), Akaike Information Criterion (AIC), and Schwarz Bayesian Information Criterion (SBC or BIC). Theoretically, the optimal model should exhibit the highest log-likelihood value or the lowest AIC and BIC values, indicating a favorable balance between data fit and model complexity.

The comparison results show that Model 12 (SDM with random-effects) outperforms Model 10 across all three criteria. It achieves a higher log-likelihood value and lower AIC and BIC scores, demonstrating superior explanatory and predictive capabilities. Based on this analysis, Model 12 is selected as the preferred model for subsequent empirical interpretation.

Moreover, in Model 12, the spatial lag coefficient is positive and statistically significant, indicating a strong positive spatial autocorrelation in the number of registered companies across geographic space. In other words, an increase in enterprise density in neighboring counties and cities promotes business establishment in the local region, highlighting the complementary and interconnected nature of enterprise activities across space. This finding aligns with Tobler's First Law of Geography, which states that "everything is related to everything else, but near things are more related than distant things."

In summary, Model 12 (SDM with random-effects) not only performs best in terms of statistical fit but also effectively reveals the spatial interaction patterns of company registrations across Taiwan's counties and cities. Therefore, it serves as the empirical foundation for the subsequent marginal effects decomposition and policy recommendations.

Table 8: Spatial Durbin model analysis results

Variables	Model 9 SDM with spatial fixed-effects		Model 10 SDM with time fixed-effects		Model 11 SDM with spatial and time fixed-effects		Model 12 SDM with random-effects	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
GGE	-0.436***	0.106	0.163	0.317	-0.397***	0.102	-0.431***	0.108
EDE	0.014	0.039	-0.697	0.165	0.009	0.038	0.013	0.040
ESCE	0.602***	0.044	0.988	0.163	0.632***	0.046	0.604***	0.045
CEE	0.362*	0.141	1.302	0.440	0.333*	0.137	0.369*	0.143
TR	0.089	0.047	1.448	0.133	0.060	0.046	0.095*	0.047
OATR	0.138*	0.063	-1.679	0.208	0.156*	0.063	0.126*	0.064
W×GGE	-0.333	0.194	-0.423	0.530	-0.097	0.204	-0.291	0.197
W×EDE	0.103	0.057	-0.271	0.255	0.103	0.059	0.101	0.058
W×ESCE	0.089	0.079	0.532	0.297	0.310**	0.092	0.069	0.081
W×CEE	-0.213	0.171	-2.132	0.661	-0.042	0.176	-0.212	0.175
W×TR	0.065	0.082	-0.404	0.232	-0.089	0.090	0.046	0.083
W×OATR	-0.304**	0.096	0.421	0.317	-0.211	0.109	-0.288	0.097
Constant							15313.780	6596.721
n		528		528		528		528
Spatial ρ	0.202***	0.055	0.375***	0.057	0.039	0.063	0.230***	0.055
within R^2	0.774		0.627		0.765		0.774	
between R^2	0.969		0.979		0.954		0.943	
overall R^2	0.903		0.923		0.894		0.888	
Log-likelihood	-4837.473		-5600.500		-4809.759		-4940.217	
AIC	9698.946		11209		9643.518		9908.434	
BIC	9750.175		11226.08		9694.747		9968.201	

Note: * p<0.05; ** p<0.01; *** p<0.001
TWD: New Taiwan Dollar (equal to USD 0.030).
SDM: Spatial Durbin Model.
Coef.: Coefficient.
Std. Err.: Standard Error.
GGE: General Government Expenditure (TWD million), EDE: Economic Development Expenditure (TWD million), ESCE: Education, Science, and Culture Expenditure (TWD million), CEE: Community Development and Environmental Protection Expenditure (TWD million), TR: Tax Revenues (TWD million), OATR: Other Allocated Tax Revenues (TWD million).

4.6 Decomposition results of the SDM with random effects

LeSage and Pace (2009) emphasized that in the Spatial Durbin Model (SDM), which includes both spatial lags of the dependent and independent variables, interpreting coefficient estimates alone does not accurately reflect the actual marginal effects of each variable. This misinterpretation arises due to feedback effects inherent in spatial models—where the influence of an independent variable on the dependent variable in both the local and neighboring regions loops back, creating discrepancies between the estimated coefficients and the true effects (LeSage & Pace, 2009).

To address this, the estimated effects in the SDM must be decomposed into three parts: direct effects, indirect effects (i.e., spatial spillover effects), and total effects. Following the methodology proposed by Elhorst (2010), this study performs effect decomposition based on the SDM with random effects, and the results are shown in Table 9.

The results reveal that General Government Expenditure (GGE) has a significantly negative direct effect (-0.449, $p<0.001$) and indirect effect (-0.428, $p<0.05$), resulting in a highly significant total effect of -0.877 ($p<0.001$). This suggests that increases in administrative expenditures not only reduce the number of firms locally but also exert negative spillover effects on neighboring regions. Such outcomes may be linked to inefficient resource allocation or excessive administrative overhead.

Education, Science, and Culture Expenditure (ESCE) demonstrates the strongest positive impact. Both its direct effect (0.620) and indirect effect (0.229) are highly significant, yielding a total effect of 0.848 ($p<0.001$). This indicates that such spending promotes firm establishment locally and in surrounding areas, contributing to regional entrepreneurship and talent attraction, and reflecting a clear positive spatial spillover effect.

Community Development and Environmental Protection Expenditure (CEE) shows a positive direct effect (0.357, $p<0.05$), but its indirect effect is insignificant and even negative (-0.143). This suggests a localized positive impact on firm numbers without significant spillovers to nearby regions.

Tax Revenue (TR) exhibits a positive direct effect (0.097, $p<0.05$) and total effect (0.173, $p<0.05$). While the indirect effect is not statistically significant, it remains positive in direction, implying that regions with higher tax revenue tend to support more active business environments.

Conversely, Other Allocated Tax Revenue (OATR), representing fiscal transfers from the central government, shows a significantly negative indirect effect (-0.288, $p<0.01$). This may indicate a "substitution effect" or "dependency effect," where such transfers create competition for resources or crowding-out effects in neighboring areas, thus reducing firm numbers in those adjacent regions.

In summary, the SDM decomposition results highlight that how local governments allocate fiscal resources not only affects economic activity within their jurisdictions but also influences firm establishment in surrounding counties through spatial mechanisms. In particular, education and cultural expenditures yield strong positive spillover effects, while general administrative spending and central government transfers may lead to negative competitive or dependency outcomes. These findings offer critical implications for regional development policy and further support the necessity of incorporating spatial analysis in this research.

Table 9: Direct, indirect, and total effects of SDM with random-effects

Variables	Direct Effect		Indirect Effect		Total Effect	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
GGE	-0.449***	0.108	-0.428*	0.187	-0.877***	0.193
EDE	0.017	0.040	0.117	0.062	0.133	0.080
ESCE	0.620***	0.044	0.229**	0.077	0.848***	0.099
CEE	0.357*	0.141	-0.143	0.180	0.215	0.238
TR	0.097*	0.043	0.076	0.078	0.173*	0.075
OATR	0.114	0.062	-0.288**	0.096	-0.174	0.107

Note: * $p<0.05$; ** $p<0.01$; *** $p<0.001$
TWD: New Taiwan Dollar (equal to USD 0.030).
Coef.: Coefficient.
Std. Err.: Standard Error.
GGE: General Government Expenditure (TWD million), EDE: Economic Development Expenditure (TWD million), ESCE: Education, Science, and Culture Expenditure (TWD million), CEE: Community Development and Environmental Protection Expenditure (TWD million), TR: Tax Revenues (TWD million), OATR: Other Allocated Tax Revenues (TWD million).

5. Conclusion and Suggestions

5.1 Conclusion

This study employs panel data from Taiwan’s 22 counties and cities spanning the years 2000 to 2023 to empirically investigate the effects of local fiscal expenditure and taxation on the number of registered companies, using the Spatial Durbin Model (SDM) as the primary analytical framework. Furthermore, the study examines the spatial spillover effects of these fiscal variables. Through a series of model constructions, hypothesis tests, and model fit comparisons, the results indicate that the spatial distribution of company registrations exhibits significant spatial autocorrelation. This finding aligns with Tobler’s First Law of Geography (1970), suggesting that economic activities in neighboring areas are closely related. Additionally, the significant coefficients of the spatial lag terms confirm the presence of diffusion and interaction effects among adjacent regions in terms of business registration activity.

Regarding fiscal expenditures, the results reveal that general government expenditure, economic development expenditure, education, science and culture expenditure, and community development and environmental protection expenditure all generally have positive impacts on local business establishment. This suggests that local government investments can improve the business environment, enhance public infrastructure, and foster human capital, thereby encouraging firms to register and operate locally. On the other hand, the effects of taxation are more complex. The influence of local tax revenue and other allocated tax revenue (intergovernmental transfers) varies across models, reflecting the possibility that the impact of tax policies on firm behavior is moderated by local industrial structures and economic conditions.

More importantly, the findings indicate that fiscal expenditures and tax revenues from neighboring counties and cities also exhibit significant spatial spillover effects on local business registrations. Some spatial lag variables show positive effects, suggesting complementary or synergistic effects in policy spending across neighboring jurisdictions. However, other coefficients are negative, reflecting potential competition for resources and firms between regions. These results suggest that without coordinated regional policy frameworks, local policies may inadvertently lead to uneven spatial development and interregional rivalry.

In terms of model selection, after a comprehensive comparison using the Hausman test, Wald test, Likelihood Ratio test, and model fit criteria (Log Likelihood, AIC, and BIC), the SDM with random-effects (Model 12) was identified as the most appropriate specification. This model not only demonstrates strong statistical robustness and significance but also provides deeper insights into the spatial interaction mechanisms between business activities and local fiscal policies. The spatial lag coefficient is significant and negative, indicating a clear substitution or crowding-out effect among neighboring areas in terms of firm distribution. This highlights the competitive nature of firm location decisions under interregional interaction dynamics.

In summary, this study confirms that local government fiscal expenditures and taxation policies have both direct effects on firm establishment within a jurisdiction and indirect effects on neighboring areas through spatial spillovers. These findings underscore the empirical value of spatial economics in policy research and provide evidence-based recommendations for regional development planning. The results call for greater intergovernmental coordination and integrated fiscal planning to address the growing spatial interdependence of business activity across jurisdictions.

5.2 Policy suggestions

Through spatial econometric analysis, this study finds that local government fiscal expenditures and taxation policies not only have direct effects on the number of business registrations within a jurisdiction, but also indirectly influence enterprise activity in neighboring counties and cities through spatial spillover effects. Based on these empirical results, several concrete policy recommendations are proposed for improving Taiwan’s current local fiscal system and business support strategies, with the aim of informing future policy design.

First, it is recommended that local governments actively strengthen fiscal expenditure categories that are favorable to businesses—particularly those shown in this study to have significantly positive effects on business registrations, such as economic development spending and education and cultural expenditures. These investments not only improve the business environment and enhance local talent attraction and entrepreneurial incentives but also strengthen the long-term operational conditions for enterprises. The central government may also consider incorporating performance-based principles into the intergovernmental fiscal allocation system, encouraging local governments to channel resources toward projects that directly stimulate local economic activity, thereby improving overall policy effectiveness.

Second, the presence of spatial spillover effects implies that enterprise activity across regions is interdependent. Proactive actions in one region may generate either positive or negative crowding effects on neighboring areas. Therefore, it is advisable to establish more institutionalized cross-jurisdictional collaboration platforms to coordinate regional industrial planning and the sharing of public resources. For instance, when developing inter-county industrial parks, transportation infrastructure, or entrepreneurial resource hubs, a joint planning and co-management model should be adopted to prevent redundant investments and avoid unhealthy policy competition among local governments.

Third, adjustments to tax policies must carefully balance fiscal stability and business competitiveness. While this study shows that both tax revenue and intergovernmental transfers exert certain levels of influence, their effects vary across regions and are conditioned by structural differences. Local governments are advised to avoid relying solely on tax increases for revenue generation. Instead, they should focus on designing tax incentives and enhancing transparency to reduce uncertainty for businesses regarding tax policy changes. Additionally, the central government could introduce enterprise-supportive adjustment mechanisms within the tax allocation system to help resource-constrained regions attract and retain businesses through rational and incentivized policy design.

Finally, policy planning should more broadly incorporate spatial analytical tools and Geographic Information Systems (GIS) to enhance simulation and evaluation capabilities related to inter-county policy impacts. When promoting regional development policies, local revitalization programs, or industrial cluster strategies, the central government should utilize spatial econometric findings to identify key nodal regions and strategic locations, thereby maximizing the spatial effectiveness of policy resources and promoting more balanced regional development.

In conclusion, the empirical findings of this study highlight the close relationship between local fiscal policies and the spatial behavior of businesses. Policymakers are thus reminded to consider both "local autonomy" and "regional integration" in order to build a resilient and synergistic regional economic system—one that can effectively respond to the increasing spatial interactivity of modern enterprise activities.

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