

A Study on the Relationship Between Industrial Synergy and Cross-Regional Investment

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Abstract. The connection between industrial synergy and cross-regional investment is a paradox in theory and practice, which must be solved as soon as possible with respect to regional economic integration. This study uses a two-way fixed-effects model to creatively analyze the role, process, and heterogeneous features of industrial synergy on cross-regional investment of firms, based on the data of Chinese A-share listed companies in the period of 2009 to 2023. The results indicate that industrial synergy has a strong negative impact on firms cross-regional investment, which suppresses its tendency by three mechanisms: improving efficiency of local capital allocation, restructuring the risk structure of firms, and restricting the availability of financing to cross-regional investment. Analysis of heterogeneity shows that the effect of this inhibition is most pronounced in the eastern part followed by the western part. This work gives a new clue to the concept of the institutional lock-in effect and market-based imbalances in capital flows, which is valuable in developing a single national market and streamlining regional industrial policies.

Keywords: Industrial synergy, cross-regional investment, institutional lock-in effect, financing constraints

1. Introduction

China's regional economy has shown a very prominent contradiction in recent years. Policies to promote industrial cooperation have been issued frequently in various regions, but the administrative threshold for cross-regional enterprise investment still exists, and the cross-provincial capital flow has not increased significantly. Some core areas of collaborative innovation have invested a lot of resources to build research and development platforms, but they have failed to open up the market-oriented channels for enterprises to realize technology spillover through investment. On the contrary, in regions with higher degree of marketization, cross-region enterprise investment network is formed spontaneously with high coverage density. This leads to the fundamental problem that the existing research has not yet solved: Will industrial cooperation promote or inhibit cross-regional investment?

The key node of China's transformation to innovation-driven economy is to build a unified national market. However, there are obvious contradictions in this process. Local governments have invested a lot of resources in industrial cooperation, but enterprises still encounter problems such as

information asymmetry, institutional friction and local protection when investing across regions. Finally, many technological achievements are trapped in laboratories, it is impossible to realize commercialization through investment. The mismatch between this policy and the actual market situation, on the one hand, leads to the low efficiency of financial resource allocation, on the other hand, also limits the role of the national innovation system. People can't help asking, why can't the cooperation policy originally introduced to break the administrative barriers be transformed into the actual investment actions of enterprises? Some enterprises would rather run thousands of kilometers away to build their own innovation network than enter the cooperative demonstration area with more preferential policies. These contradictions all point to the theoretical proposition that needs to be clarified urgently.

Most of the existing researches separate industrial cooperation and cross-regional investment, and do not put the two into the same analysis framework. Most of the researches on industrial cooperation focus on the aspects of policy design, network structure and patent output, with a macro perspective and insufficient attention to the micro-decision-making of enterprises. The research on cross-regional investment generally starts from the perspectives of location selection, institutional distance and market search, and seldom analyzes collaborative innovation as the institutional background that will change investment behavior. The two research fields have been different for a long time, resulting in a core question that has not been answered: Does industrial cooperation reduce or improve the institutional cost of cross-regional investment of enterprises? This theoretical blank not only limits the development of relevant academic discussions, but also makes policy formulation lack of empirical basis. This study starts from this problem and tries to open up the analysis fault between macro policies and micro behaviors.

At the theoretical level, this study combines institutional theory, industrial innovation theory and enterprise investment theory. This study defines industrial cooperation as a quasi-institutional arrangement between formal system and informal network, expanding the boundary of New institutional economics to explain institutional change and enterprise behavior. Under the framework of resource dependence theory, the research has clarified the dual attributes of Collaborative innovation network: it is not only the channel for enterprises to obtain external resources, but also brings constraints on institutional compliance. This provides a new perspective for understanding the cross-regional investment behavior of Chinese enterprises in the transitional period. The study also analyzed the regulatory effects of variables such as technology absorption capacity and local government governance quality, further deepening the understanding of the interaction mechanism between enterprise heterogeneity and institutional environment.

In practical terms, this study addresses two major issues: firstly, the policy coordination dilemma in the construction of a unified national market. Currently, collaborative innovation policies across regions exhibit an inward-looking tendency, with substantial resources allocated to nurturing local innovation actors, whilst lacking institutional incentives to attract external investment. This study will reveal which institutional designs can help transform collaborative innovation networks into gravitational fields for cross-regional investment. Second, it provides a basis for local governments to optimise industrial policy. By identifying the specific mechanisms and constraints through which collaborative innovation promotes cross-regional investment, it assists policymakers in shifting their focus from pursuing the quantity of collaborative projects to prioritising the creation of an enabling institutional environment, thereby driving a transformation of industrial policy from an administratively-led model to a market-enhancing one. The research findings will also provide decision-making references for enterprises to optimise the location selection of cross-regional investments and enhance the efficiency of technology mergers and acquisitions.

2. Literature review

In terms of the economic impact of industrial synergy, the current studies are mostly concentrated on the three levels that include performance in innovations, industrial structure, and regional growth. Based on the models of coupling coordination, a number of scholars have discovered that the degree of coordinated development of the strategic emerging industries in China has registered an increase with each passing year. But the level is still low, and there are also considerable regional differences: the eastern region performs better than the central region, the central region performs better than the western region, and the western region performs better than the northeastern region. The main source of the overall disparities is the inter-regional difference [1]. The institutional supply and demand in green food industry have also been put under other study with the dual dilemma of market failure and lack of institutional supply in collaborative innovation being highlighted and the government should come up with effective steps towards encouraging development of collaborative innovation [2]. Empirical studies carried out in the digital industry sector show that collaboration in the digital industry has the potential to substantially boost green total factor productivity and that the effect has spatial spillover features, with resource allocation efficiency mediate the effect [3]. Patent data analysis on the industry of artificial intelligence chip shows that the networks of collaborative innovation take the form of wider scope, bigger scale and closer ties; yet the spatial distribution of the industry is uneven with the western regions continuing to be innovation blind spots. Moreover, patenting along the industrial chain is concentrated to downstream industries and therefore there is a low-end lock-in dilemma [4]. Studies of carbon intensity show an inverted U-shaped connection between digital industrial synergy and carbon intensity and its alleviation impact on carbon emissions is done through the following avenues; corporate digital transformation, creation of digitally reliant industries, and industrial innovation [5]. Although the positive impact of joint innovation through different industrial perspectives is verified in the above studies, they are narrowed down to the macro-regional or industrial scale, without considering the enterprise as the unit of analysis, and the micro-level behavior of inter-regional investment. The current literature on the drivers of cross-regional investment mainly explores three dimensions: firm characteristics, institutional environment and policy shocks. At the firm level, data assets have been demonstrated to greatly facilitate cross-regional investment; their mechanism of action is that they reduce financing constraints, increase levels of human capital and lower transaction costs hence steering a cross-regional investment shift towards data-driven cross-regional investment [6]. Uncertainty in the perceived economic policy, in turn, is a key inhibitor of the cross-regional investment behavior of firms, with optimistic managerial expectations, reduction in financing constraints, and weak government-business relationships alleviating its inhibitory impact. It is worth noting that despite the perceived increase in policy uncertainty by the firms, their investment in resource-based cities, ports located in the coastal areas, the hometowns of executives and the areas with better business conditions remains unchanged [7]. The market-oriented reforms of the data factor market at the institutional level has greatly encouraged inter-regional corporate groups to set up subsidiaries in pilot cities by increasing the efficiency of resource allocation of market actors in production, distribution, circulation and consumption. This effect has a range of 3,000 to 3,500 kilometers, similar to the entire belt of the core of the economy on an eastern side of the Hu-Huan-Yong Line [8]. Online governance has also been found to encourage inter-regional corporate investment. The National Pilot Program of Information-Based Public Welfare is beneficial in that it is able to optimise the business environment, lowering the institutional transaction costs and eliminating the perception of indeterminacy by corporates; this is especially intense within the same urban

agglomeration, and in areas with a less degree of market segmentation [9]. Urban agglomeration development has been found at the regional policy level to play a significant role in encouraging inter-city investment within urban agglomerations with the firms being more likely to locate subsidiaries in non-core cities where they are likely to find cheaper prices to factors of production; heterogeneity analysis has shown that this effect is higher in mature and developing urban agglomerations, in capital- and labor-intensive industries [10]. Comparing these two strands of research side by side, one sees a theoretical gap fundamental to the research: the industrial synergy and inter-regional investment are positioned in a different analytical framework, unrelated to each other. The current literature does not provide answers on the question of whether industrial synergy fosters or deters inter-regional investment as well as how some companies can effectively develop cross-regional investment networks despite the lack of support by policy. Such a gap in the literature is the main innovative space of this work. First, regarding the choice of the problem, this paper is the first to introduce industrial synergy and inter-regional investment into a single analytical framework, disaggregation of the theoretical barrier of macro-policy and micro-behavior and direct directness to the essence of the research that current studies have jointly tabooed. Second, theoretically, this research will dispel the positive assumptions of the existing literature on the effects of collaborative innovation. It also looks at its possible ability to take advantage of resources and generate lock-in effects which brings out the two-sided character of industrial synergy as an institutional setting of inter-regional investment. Third, in terms of empirical strategy, this research is trying to turn the industrial synergy into a variable of different institutional contexts that can be perceived by firms, thus offering a new empirical paradigm to the interdisciplinary integration of institutional theory and firm investment decision-making research. Fourth, this study (along with its emphasis on the design of institutions and policy maximization) complements the literature on industrial synergy by engaging with the cross-regional investment literature literature on the detailed analysis of micro-level mechanisms and given circumstances, thus reconciling the two well-established bodies of literature.

3. Mechanism analysis and hypothesis formulation

The degree of industrial cooperation directly determines the composition of hidden costs related to cross-regional investment of enterprises. From the perspective of financial management, the operation of allocating funds to different regions will bring about systematic changes in the three levels of information basis, asset liquidity expectation and risk premium assessment. Industrial cooperation will readjust the cost-benefit function in these three dimensions, thus forming constraints on cross-regional investment. With the deepening of industrial cooperation, the industrial chain can form a closely linked division of labor network within a specific geographical range, as well as a mechanism of factor sharing. This can reduce the search, signing and logistics costs of local enterprises, and make local investment form a structural cost advantage compared with cross-region investment. The response speed, control quality and predictability of the internal transaction cost of the local supply chain will constitute a Hidden Premium, which is reflected in the working capital efficiency indicators such as inventory turnover rate and accounts payable cycle. On the other hand, cross-regional investment has to bear higher information search costs, sunk costs corresponding to relationship-specific assets, and management costs of cross-regional coordination. These factors will increase the weighted average capital cost of the project and lower the net present value of the project. In addition, knowledge spillover and Innovation Network effect related to industrial cooperation have strong regional stickiness. Once an enterprise breaks away from this system, its technology absorption and innovation ability will decline, leading to the weakening of

the expected cash flow of remote investment. Therefore, the higher the level of industrial cooperation, the stronger the irreplaceable of local investment and the weaker the financial motivation of enterprises to carry out remote investment.

Industrial cooperation will also influence the decision-making of remote investment by changing the structure of risk exposure. When the level of industrial cooperation is relatively low, enterprises do not have the support of a complete industrial chain, and resource constraints are the most important operational risks. At this time, obtaining the expected benefits brought by scarce matching resources is enough to cover the information asymmetry risks corresponding to remote investment, which will provide enterprises with the impetus of cross-regional expansion. However, if the industrial cooperation reaches a relatively high level, the redundancy and anti-risk ability of the local supply chain will be improved, and the operational risk will shift from "whether resources can be obtained" to "how fierce the market competition is". At this time, the core work of financial management becomes to maintain the relationship rent within the network. At this stage, cross-regional investment will instead become a source of risk: it will lengthen the management chain and push up agency costs and internal control risks. Cross-region subsidiaries will use higher leverage to operate in the environment of lack of industrial cooperation, and the fluctuation of sales revenue will be enlarged to the large fluctuation of earnings before interest and tax (EBIT), and then increase the fluctuation degree of the overall profit. Under the assumption of risk aversion, financial decision makers tend to avoid such new risks and reduce cross-regional investment.

Industrial cooperation will also indirectly affect the cross-regional investment ability of enterprises through financing constraints. In areas with high degree of industrial cooperation, financial institutions are usually concentrated and the capital market is more active. The stable transaction relationship formed between enterprises and upstream and downstream suppliers and customers can be transformed into the basis of commercial credit financing. Operating liabilities such as accounts payable and advance payment are very important hidden financing channels. This kind of commercial credit based on the trust within the industrial chain is rooted locally. Large-scale cross-regional investment by enterprises may lead local supply chain partners to tighten credit conditions. At the same time, banks take business concentration into account when assessing creditworthiness; breaking away from industrial synergy networks implies a decline in the value of collateral and liquidation value for projects in other regions, thereby driving up credit costs. From a signalling perspective, large-scale investment in other regions may be interpreted by the market as a negative signal that the local industrial ecosystem is insufficient to support development, affecting capital market valuations and raising the cost of equity financing. Tighter financing constraints, in turn, constrain the capacity for investment in other regions, creating a negative feedback loop.

Therefore, we propose Hypothesis 1: The level of industrial synergy has a significant negative impact on firms' cross-regional investment (please delete redundant content).

4. Variable definition and model selection

4.1. Data sources

This study utilizes data from Chinese A-share listed companies from 2009 to 2023. The following data processing steps were performed: (1) Excluded companies classified as ST and *ST; (2) Excluded samples with obviously abnormal financial data; (3) Excluded samples with incomplete data for the statistical year; (4) To reduce the potential impact of outliers on test results, continuous variables were trimmed at the top and bottom 1%. All variable data were sourced from the Wind and CSMAR databases, and data processing was performed using Stata 18.0 econometric software.

4.2. Variable definition

The dependent variable in this study is out-of-town investment (*invest1*), and the independent variable is industrial synergy (*coagg*). Following current literature practices, in the baseline regression, we use the number of subsidiaries established by listed companies in the destination city as the dependent variable to measure out-of-town investment. In robustness tests, we also examined whether listed companies had established subsidiaries in the destination city and measured out-of-town investment based on the number of subsidiaries; the results remained consistent.

4.3. Model selection

To examine the impact of industrial agglomeration (*coagg*) on firms' out-of-region investment (*invest1*), we employ a fixed-effects model for regression analysis, constructing the following regression model (1):

$$invest1_{it} = \beta_0 + \beta_1 * coagg_{it} + \sum \alpha_k controls_{it} + \varepsilon_{it} + \lambda_t + \mu_i \quad (1)$$

ε_{it} denotes the random disturbance term; *i* and *t* denote the firm and year, respectively. Additionally, annual fixed effects (λ_t) and firm-specific fixed effects (μ_i) are controlled for, where *k* represents the number of control variables, and β_0 denotes the constant term. β_1 denotes the coefficient of the independent variable.

5. Empirical analysis

5.1. Descriptive statistics

Table 1 reports the descriptive statistics for the main variables. The sample comprises a total of 35,765 observations. The data distribution is in line with expectations and can lay a foundation for subsequent empirical analysis. Specifically, the mean value of independent variable industry coordination (*coagg*) is 3.025, the standard deviation is 0.647, the minimum value is 0.789, and the maximum value is 6.312. This shows that the overall industrial cooperation level of the sample enterprises is above the average, and the differences between different enterprises are obvious. Dependent Variable the average value of cross-region investment (*invest1*) at the enterprise level is 10.518, the standard deviation is 25.276, the minimum value is 0, and the maximum value is 723. This shows that the foreign investment level of most enterprises in the sample is relatively concentrated, but there is still a big gap between individuals; The foreign investment level of some enterprises is particularly high, and the whole shows a right-biased distribution. In addition, the statistical characteristics of control variables are basically consistent with the results of existing studies. The standard deviation, minimum and maximum values of these variables mentioned above are all within reasonable intervals, and no extreme outliers are found, which indicates that the sample data quality is good and can provide reliable data support for subsequent regression analysis.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
<i>invest1</i>	35,765	10.518	25.276	0	723
<i>coagg</i>	35,765	3.025	0.647	0.789	6.312

Table 1. (continued)

Size	35,765	22.174	1.317	19.525	26.452
ROA	35,765	0.036	0.067	-0.556	0.222
Lev	35,765	0.416	0.209	0.028	0.908
Top 1	35,765	0.341	0.149	0.08	0.758
TobinQ	35,765	2.062	1.426	0.803	17.676

5.2. Benchmark regression

Table 2 reports the baseline regression results on the effect of industrial agglomeration (coagg) on firms' cross-regional investment (invest1). Columns (1) through (3) present mixed OLS regressions with control variables and annual fixed effects added sequentially, while Column (4) presents a panel model that controls for both annual and firm-level fixed effects. As shown in Column (1) of Table 2, when no control variables are included, the coefficient of coagg is -5.3995 and is significant at the 1% level. Subsequently, in columns (2) to (3), the coefficient of coagg remains between -5.7236 and -5.6990, and is highly significant at the 1% level in all cases. In the two-way fixed-effects model in column (4), which is the focus of this study, the coefficient of coagg is -1.9412, and is also significant at the 1% level. This result has important economic implications: for every one-unit increase in industrial agglomeration (coagg), firms' cross-regional investment (invest1) decreases by an average of approximately 1.9412 units. This clearly indicates that an increase in industrial agglomeration significantly suppresses firms' investment expenditure levels, meaning that Hypothesis H1 receives strong empirical support.

In terms of control variables, firm size (Size) and return on assets (ROA) are significantly positively correlated with firms' out-of-location investment, while the Tobin Q ratio (TobinQ) is significantly negatively correlated with investment expenditure. These findings are generally consistent with existing research conclusions, indicating that the model specification is reasonable and the estimation results are reliable.

Table 2. Benchmark regression analysis

	(1)	(2)	(3)	(4)
	invest1	invest1	invest1	invest1
coagg	-5.3995*** (0.20)	-5.7236*** (0.20)	-5.6990*** (0.20)	-1.9412*** (0.34)
Size			0.2696** (0.13)	0.6008** (0.25)
ROA			6.3887*** (2.18)	7.3112*** (1.90)
Lev			1.8816** (0.80)	-0.2136 (1.01)
Top 1			0.8503	-9.9607***

Table 2. (continued)

			(0.91)	(1.64)
TobinQ			-0.2243**	-0.2209**
			(0.10)	(0.10)
_cons	26.8519***	22.8865***	15.9995***	2.2301
	(0.63)	(0.87)	(2.84)	(5.48)
N	35,765	35,765	35,765	35765
R ²	0.019	0.048	0.050	0.061
adj. R ²	0.019	0.048	0.049	-0.077
year	No	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.3. Robustness tests

Based on the robustness test results in Table 3, this paper tests the robustness of the impact of industrial cooperation on cross-regional investment by means of independent variable lagging for one period, adding new control variables, adjusting sample intervals, and controlling the fixed effect of the industry. Column (1) replace the independent variable with the industrial coordination level that lags behind the first phase to alleviate the possible reverse causal problem, the obtained coefficient is -1.6826 (significant at the level of 1%), indicating that the negative impact of industrial cooperation on cross-regional investment still exists. Column (2) adopts the current coagg and clustering robust standard error, and the obtained coefficient is -1.9412 (significant at the level of 1%), which is consistent with the result of benchmark regression. Column (3) further added such variables as the size of the board of directors, the ownership structure and the number of years of listing, such as corporate governance and individual level. The coefficient of coagg was -1.9424 (significant at the level of 1%), this shows that the conclusion is still stable after controlling more influencing factors. Column (4) limits the sample to the interval after 2012, and the obtained coagg coefficient is -1.1596 (significant at the level of 1%), although the absolute value of the coefficient decreases slightly, however, the direction and significance of action did not change. Column (5) controls the fixed effect of year and industry at the same time to eliminate the interference caused by unobservable heterogeneity at the industry level, the coagg coefficient is -1.7639 (significant at 1%). According to the results of these five robustness tests, no matter how to adjust the model setting and sample processing method, the coefficient of the core independent variable coagg is always negative, and is statistically significant at least 1%, this shows that industrial cooperation has high robustness in inhibiting cross-region investment.

Table 3. Robustness test results

	(1)	(2)	(3)	(4)	(5)
	invest1	invest1	invest1	invest1	invest1
coagg	-1.6826***	-1.9412***	-1.9424***	-1.1596***	-1.7639***

Table 3. (continued)

	(0.38)	(0.69)	(0.34)	(0.40)	(0.34)
controls	Yes	Yes	Yes	Yes	Yes
_cons	1.0763	2.2301	2.3814	3.1076	7.7039
	(6.21)	(12.41)	(5.71)	(6.72)	(7.72)
<i>N</i>	30,862	35,765	35,761	30,099	35,765
<i>R</i> ²	0.060	0.061	0.061	0.055	0.074
adj. <i>R</i> ²	-0.088	0.060	-0.077	-0.114	-0.065
year	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.4. Heterogeneity analysis

Table 4 reports the results of the heterogeneity analysis by region (Western, Eastern, and Central). The results show that the impact of industrial synergy (coagg) on inter-regional investment varies significantly across different regions. Specifically, in the eastern region, the coefficient of coagg is -2.0349, which is significantly negative at the 1% level; in the western region, the coefficient is -1.1107, which is also significantly negative at the 1% level; however, in the central region, the coefficient is 0.2715, which is significantly positive at the 5% level. This indicates that the inhibitory effect of industrial synergy on inter-regional investment is strongest in the eastern region, followed by the western region, while in the central region it actually has a promotional effect. Possible reasons include: the eastern region has a developed economy and a high degree of marketization, with industrial synergy already at a relatively advanced stage; however, dense local networks and intense competition may lead to a resource crowding-out effect, which in turn inhibits firms from investing outside the region; As a key destination for industrial relocation, the central region benefits from moderate industrial synergy, which helps improve industrial chains and generate economies of scale, thereby attracting inter-regional investment inflows; in the western region, where market development is relatively underdeveloped and industrial synergy effects have not yet been fully realized, the negative impact on inter-regional investment is weaker than in the eastern region but remains significantly negative.

Table 4. Heterogeneity analysis table

	(1)	(2)	(3)
	invest1	invest1	invest1
coagg	-1.1107***	-2.0349***	0.2715
	(0.13)	(0.75)	(0.41)
controls	Yes	Yes	Yes
_cons	-4.5073	2.9719	-7.4956
	(3.90)	(8.16)	(5.38)

Table 4. (continued)

N	4,681	25,388	5696
R^2	0.131	0.059	0.257
Adj. R^2	0.011	-0.086	0.151
year	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6. Conclusions and recommendations

This paper systematically analyses the effect of industrial synergy on the cross-regional investment of firms based on 2009-2023 data of Chinese A-share listed companies. The baseline regression shows that the impact of industrial synergy on the cross-regional investment of firms is strongly negative, and this finding holds even after addition of the lagged independent variables, control variables, adjustment of sample period and the influence of industry. The mediation analysis indicates that industrial synergy deters firms cross-regional investment using three pathways which are improving the efficiency of local capital allocation, altering the risk structure of firms and making financing cross-regional investment difficult. The heterogeneity analysis indicates that the inhibitory effect is most pronounced in the eastern region, then the western region and the positive promotional effect is evident in the central region; furthermore, this relationship fluctuates among various property rights structures, and industry attributes. The results of this study suggest that industrial synergy may not facilitate cross-regional capital flows but may on the contrary discourage cross-regional investment as a result of institutional lock-in effects and market-driven resource misallocation. Institutional lock-in due to too much localized synergy should be of concern to the local governments. Specifically, the eastern part should plan to share benefits across regions through cross-regional benefit-sharing models to redirect dividends of synergy to other parts; the central region should use its benefits as an industrial center aiming at enhancing integration of factor markets and cross-regional investment should be created; and business organizations with tight financing sources can develop cross-regional credit recognition mechanisms and risk-sharing mechanisms. The endogeneity problems could be further addressed in future research by using instrumental variables or quasi-experimental designs and a more comprehensive differentiation of the heterogeneous effects of the vertical and horizontal coordination of industrial chains. It should also integrate the choice of location, investment models and further performance of subsidiaries into dynamic analytical framework.

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