Innovation-driven, Export-driven and Optimization of Industrial Structure in National High-tech Zones

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Abstract: Based on the panel data of 52 national high-tech zones from 2013 to 2020, we empirically analyze the influence of innovation drive and export pull on the optimization of industrial structure of national high-tech zones and their mechanisms of action. It is found that innovation drive has a positive driving effect on industrial structure optimization of national high-tech zones, and its influence is stable, which is an internal factor with autonomy; export pull has a negative influence on industrial structure optimization of national high-tech zones in general, which is an external factor with non-autonomy, and the improvement of innovation drive level can suppress the negative influence brought by export pull to a certain extent. Further heterogeneity analysis shows that there is regional heterogeneity in the strength of the role of innovation drive and export pull on the optimization of industrial structure in national high-tech zones.

Keywords: innovation-driven; science and technology innovation; export-pull; industrial structure optimization; national high-tech zone

1 Introduction

The "Opinions of the State Council on Promoting High-Quality Development of National High-Tech Industrial Development Zones" released on July 17, 2020 proposed to "promote the industry to the middle and high end, and increase open innovation", marking a new development opportunity for national high-tech zones. As the frontier of economic development and scientific and technological innovation, the total factor productivity growth rate contributed by technological progress in national high-tech zones is significantly higher than that in their provinces and cities [1], and plays a supporting role in optimizing industrial structure [2], and should further cultivate innovative competitive advantages in the process of transformation of industrial structure to inward-driven [3]. However, the transformation role of gains in high-tech zones is not obvious in the open environment, and to some extent it is not conducive to the optimization and upgrading of their industries [4], and the development of national high-tech zones faces the stage of industrial structure optimization in the process of turning to high quality development after a longer period of high growth stage.

Previous studies have focused on the impact of innovation development, trade opening and economic growth on industrial structure optimization and upgrading. The

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research on the optimization of industrial structure within high-tech zones is less and more fragmented. In the process of high quality development led by opening up to the outside world and innovation, what is the internal mechanism of industrial structure optimization in high-tech zones? What are the factors that influence it more? Existing studies have not fully revealed. Therefore, in this paper, we focus on the internal mechanism of innovation-driven and export-driven industrial structure optimization within the national high-tech zones, and examine the influence of regional heterogeneity in the process.

2 Literature review

The optimization of industrial structure in high-tech zone is the micro expression of regional industrial structure optimization, while industrial structure optimization is the mutual adaptation and correlation level enhancement between different industries. The driving force of economic development growth lies in the division of labor, capital accumulation and technological progress (Smith, 1766), and the decline of Hoffmann coefficient represents the evolution of economic development or industrial structure (Hoffmann, 1931), while the optimization of industrial structure has regularity, Clark's law takes the classification of three industries as the basic theory, and measures the industrial structure by the distribution of labor force in each sub-industry In addition, the mechanism of technological progress contributing to economic growth cannot be ignored (Solow, 1957), and innovation and talent also have a long-term role in promoting economic growth (Romer, 1986). It can be seen that the optimization of industrial structure is an important path for high-quality economic development, and technological innovation is the fundamental guarantee for the optimization and upgrading of industrial structure. In the process of economic development, trade can generate real demand, promote new demand and new industries, and play an important role in the optimization of industrial structure. While trade goods experience import (export) and import substitution (export substitution), the industrial structure also evolves from labor-intensive to technology-intensive and capital-intensive, forming a goose pattern (Chikamatsu to be, 1956). The technological assets and knowledge spillover brought by FDI under open conditions will promote the establishment and development of new industries, and the resulting international division of labor accelerates the process of industrial structure heightening. Foreign trade liberalization enables a country or region to adjust the ratio of production factors according to the changes of international market, and the trade structure pulls the change of production structure to realize the optimization of industrial structure. Specifically to the study of industrial structure optimization mechanism in high-tech zones, the institutional innovation brought about by the open environment significantly improves the innovation capacity of enterprises (Feng Zhijun, 2015) , Zhou J (2021) [5] believes that the export of enterprises within national high-tech zones under open conditions positively affects innovation and helps to optimize the allocation of resources within enterprises (Fan Haichao, 2022) [6], trade liberalization improves the enterprises' export product structure and improve their new product export intensity and export status (Liu, Zhuqing, 2021)[7], but some scholars hold a different view that the geographical aggregation of high-tech industries does not necessarily lead to regional innovation [8], and innovation is the cornerstone of industrial structure optimization, Wang, Dazhou and Guan, Shixu (2000) [9] argue that most of the enterprise technological innovation in the open environment is technology transfer and market competitiveness is not strong, in addition, Yang Chang et al. (2013) [10, 11]argue that the revenue conversion capacity of high-tech zones is not high in the context of free trade, which is not conducive to industrial innovation development and transformation.

In summary, there are more research results on innovation development, trade openness and regional industrial structure optimization, and little literature has focused on the high-tech zone level to demonstrate the impact of innovation drive and trade openness on industrial structure optimization. Under open conditions, exports, as an important driving force for economic growth, are an important part of trade openness. The existing literature has not been interested in identifying the impact of export pull on industrial structure optimization, and lacks the mechanism of the impact of both systems of innovation drive and export pull on industrial structure optimization. In view of this, this paper will analyze the intrinsic influence mechanism of innovation drive and export pull on the optimization of industrial structure of national high-tech zones, and select the 52 national high-tech zones in 2013— The economic statistics of 52 national high-tech zones in China in 2020 are selected to study the influence of innovation drive and export pull on the optimization of industrial structure of national high-tech zones and to examine their regional heterogeneity.

3 Mechanism analysis and theoretical hypothesis

3.1 Innovation drive and industrial structure optimization

The transformation of industrial structure is an important evaluation criterion for measuring economic and social development, and the change of social development stage is in turn manifested as the change of industrial structure [12]. Innovation drive promotes the continuous optimization of industrial structure through R&D innovation effect, science and technology innovation effect and technology spillover effect. Among them, R&D innovation stimulates the pre- and post-R&D correlation effect and promotes the upstream and downstream structural adjustment of industry; science and technology innovation is the internal driving force of industrial structure adjustment [13], which promotes the optimization of industrial structure with four aspects of technology correlation, technology supply, market demand and enterprise restructuring, breaks the tension between scarce resources and long-term economic growth, and promotes the change of industrial structure [14], and at the same time, realizes the introduction of innovation to system integration innovation and source innovation is also an inherent requirement for innovation to promote structural transformation [15]; the technology spillover effect in the innovation-driven process can improve the overall production efficiency, and the increase of technology utilization rate can in turn improve the industrial output per capita [16], increase capital investment in technological innovation activities in the process of industrial transformation and optimization, and improve the coverage and use efficiency of innovative technology use, which can promote the development of target industries and make industrial structure rationalized. On the other hand, industrial structure is the key external factor that determines the technological innovation conducted by enterprises [17], and the industrialized innovation emerging from industrial structure optimization in turn promotes technological innovation and transforms the industrial structure to the middle and high end [18]. This leads to the first hypothesis: innovation drive, as an internal factor with autonomy, has a positive and stable influence effect on industrial structure optimization and constitutes the driving mechanism of industrial structure optimization in national high-tech zones.

3.2 Export pull and industrial structure optimization

The adjustment of the general equilibrium in the process of opening up the economy will lead to the evolution of the industrial structure [19]. As a window of reform and opening up, trade opening is a booster of China's original innovation model of "import-absorb-imitate-re-innovate" and has an important impact on technological innovation in high-tech zones. The export drive influences the optimization of industrial structure by bringing international demand, adjusting export structure and changing trade patterns. . Export trade pulls enterprises to expand international markets, the link between international markets and product markets is conducive to the competitive effect [20], but at the same time, developing country enterprises are in the process of climbing from the low-end link to the high-end link, there is a high risk of suffering deliberate blows from the international market [21]; export product elimination mechanism drives the continuous adjustment of export trade structure, export industries must enhance their competitiveness, and constantly adjust and optimize industrial structure, trade opening alleviates the problem of commodity surplus by reducing trade costs and increasing input markets, and ultimately motivates the vertical integration of industrial structures within enterprises [22], capital and technology-intensive industries in the export sector grow significantly faster than labor-intensive industries, showing signs of industrial upgrading [23], increased revenues from export trade can pull the scale of demand and structural changes in demand in the market However, under open conditions, the failure of low-end industries to optimize and upgrade will intensify the accumulation of primary factors [24]; under free trade conditions, general trade is conducive to the optimal allocation of resources, while the increase in the intensity of processing trade will intensify the mismatch of resources in the industry and inhibit the optimization of industrial structure [25]. This leads to second hypothesis: export pull is a non-autonomous external factor, which is more influenced by the international environment and may have a negative effect on the optimization of industrial structure in national high-tech zones.

4 Model setting and variable description

In this paper, multiple panel models (static panel model, dynamic panel model and mixed regression model) are selected to test the influence of innovation-driven and export-pull on the optimization of industrial structure of high-tech zones, and because the number of high-tech zones has expanded rapidly since 2010, in order to make the data consistent and valid, this paper refers to the Catalogue of China's Development Zone Audit Bulletin (2006 edition) and (2018 edition), with reference to information such as the name of national high-tech zones, approval time, approved area and leading industries, 52 national high-tech zones approved by the State Council to be established between 1991 and 1992 were selected as the research objects, and the specific models were.

$$iso = \alpha + \beta_1 inno + \beta_2 exp\beta_3 + inno\_exp + \sum_i^4 \delta_i x_i + \varepsilon \quad (1)$$

Where iso is the explanatory variable, indicating the level of industrial structure optimization in the national high-tech zone; inno and exp are the core explanatory variables, indicating the innovation-driven ability and export-pull ability respectively, and inno_exp measures the interaction between innovation-driven and export-pull; x indicates a series of control variables that affect the industrial structure optimization in the national high-tech zone;α is a constant term and ε is a random disturbance term; the coefficientsβ_1 andβ_2 are the core parameters, which indicate the influence of innovation-driven and export-pull capabilities on the level of industrial optimization in high-tech zones, respectively.β_3 It measures the influence of the interaction between innovation drive and export pull on the optimization of industrial structure in high-tech zone. The names of variables and calculation methods are shown in Table 1.

Explained variable: industrial structure optimization level (iso). At present, when domestic scholars measure the optimization level of industrial structure, they mostly choose industrial structure rationalization index and industrial structure heightening index, or construct industrial structure optimization and upgrading index to reflect the optimization and upgrading level of industrial structure, and high-tech zones, as special functional zones, according to the China Development Zone Audit Bulletin Catalogue (2018 version), their leading industries are mostly automobile, medicine, textile, electronic information, equipment manufacturing etc. manufacturing industries, the level of industrial structure optimization cannot be measured by the deviation degree of industrial structure and the proportion of primary, secondary and tertiary industries, and because the specific industrial statistics caliber of each national high-tech zone is different, this paper measures the level of industrial structure optimization from two aspects: industrial structure rationalization and industrial structure heightening. The optimization and upgrading of industrial structure is an eternal statistical law [26], and the statistical indexes of the new dynamic energy index of economic development released by the National Bureau of Statistics include the proportion of the added value of strategic emerging industries to GDP, the proportion of the added value of high-tech manufacturing industries to the added value of industries above the scale and the proportion of the export value of high-tech products to the total export value as transformation and upgrading indicators. In order to scientifically reflect the optimization level of industrial structure of national high-tech zone and combine with the availability of data, the rationalization of industrial structure of high-tech zone is measured by the proportion of employees above college level, the proportion of product sales revenue to business revenue and the proportion of net profit to business revenue, and the heightening of industrial structure of high-tech zone is measured by the proportion of high-tech enterprises to registered enterprises, the proportion of technical revenue to business revenue and the proportion of scientific and technological activity personnel to business revenue. The proportion of technical revenue is the business income of high-tech industry, which is the threshold of high-tech enterprise recognition [27]. Principal component analysis was used to synthesize the comprehensive indexes, and the principal components with cumulative variance contribution rate higher than 80% were selected.

Core explanatory variables: (1)innovation drive capability (inno): this paper adopts principal component analysis to construct innovation drive indicators, using R&D personnel, internal expenditure of R&D funds, and full-time equivalent of R&D personnel to synthesize comprehensive indicators, and selecting principal components with cumulative variance contribution rate greater than 80%; (2) export pull capability (exp): this paper adopts an open measure to It reflects the export intensity at the national high-tech zone level, and the export amount is converted into RMB using the exchange rate of RMB to USD in that year; (3)Interaction term of innovation drive and export drive (inno_exp): It measures the impact of the interaction between innovation drive and export drive on the optimization of industrial structure in high-tech zone.

Control variables. In order to exclude the influence of other factors and refer to the existing literature, this paper introduces control variables: scitech_fina: the logarithm of the internal expenditure of science and technology activity funds of national high-tech zone, taxes: the logarithm of the tax paid by national high-tech zone, assets at the end of the year: the logarithm of the assets at the end of the year of national high-tech zone, liabilities at the end of the year (liabilities): take the logarithm of year-end liabilities of NHTZ, return_stu: take the logarithm of return_students of NHTZ.

Table 1. Variable names and calculation methods

Variable Category	Variables	Metrics	Indicator Description
Explained variables	Industrial structure (*iso*)	Rationalization of industrial structure	The proportion of people with college education or above in the workforce (%)
			Product sales revenue as a percentage of operating revenue (%)
			Net profit as a percentage of operating income (%)
		Highly structured industry	The proportion of high and new technology enterprises in the total number of enterprises (%)
			Technology revenue as a percentage of operating revenue (%)
			The proportion of scientific and technological activity personnel in the workforce (%)
Core ex-	Innovation driven	Innovation	R&D personnel (people)

planatory variables	(inno)	Drive Index	Internal expenditure on R&D expenses (in thousands)
			R&D personnel full time equivalent (person years)
	Export pull (exp)	Export pull level	Logarithmic value of the export value of the High Tech Zone
	Innovation-driven and export-pull interaction term (inno_exp)	Interaction level	Innovation-driven indicators multiplied by the logarithmic value of exports
Control variables	Technology input (scitech_fina)	Internal expenses for scientific and technological activities	Logarithmic value of internal expenses for scientific and technological activities
	Tax contribution (taxes)	Taxes and fees paid	Logarithmic value of taxes and fees paid
	Capital accumulation (assets)	Year-end assets	Logarithmic value of assets at the end of the year
	Debt level (liabilities)	Year-end liabilities	Logarithmic value of year-end liabilities
	Talent introduction level (return_stu)	Returnees	Numerical values for returning students

This paper takes the relevant data of 52 national high-tech zones and their cities from 2013-2020 as the sample, and the data are obtained from the China Torch Statistical Yearbook 2014-2021, China City Statistical Yearbook and the local government statistical bulletin 2014-2021, including Data on internal expenditures on scientific and technological activities, the number of personnel in scientific and technological activities, annual business income and other relevant indicators of 52 national high-tech zones in each province and city across China. The descriptive statistical information of the main variables is shown in Table 2.

Table 2. Descriptive statistics of the main variables

Variable Name	Variable abbreviation	Number of samples	Average value	Standard deviation	Minimum value	Maximum value
Industry Structure	iso	416	2.230	1.017	0.033	5.124
Innovation Driven	inno	416	0.719	1	0.007	7.018
Export pull	exp	416	16.846	1.491	13.347	19.854
Innovation-driven and export-driven	inno_exp	416	12.975	19.253	0.089	136.146

Technology input	scitech_fina	416	15.848	1.106	13.314	19.844
Tax Contribution	taxes	416	16.491	0.858	14.586	19.465
Capital Accumulation	assets	416	19.675	0.988	17.597	23.474
Debt Level	liabilities	416	19.101	1.027	16.749	22.892
Talent Introduction Level	return_stu	416	6.538	1.493	3.045	10.937

5 Empirical test and analysis

5.1 Model setting test

Since the development scale, technology level and leading industry development stage of each national high-tech zone differ greatly, the adjustment time and action mechanism of innovation-driven and export-pull for the optimization of industrial structure in high-tech zones may be different, in order to analyze the heterogeneity brought by the different geographical locations of high-tech zones, the individual effect term is introduced in the model; in addition, considering the existence of time cost for the realization of the innovation link, the In addition, considering the time cost of innovation, a time effect is introduced. Table 3 shows the results of the tests on model selection. Breusch and Pagan (1980) provide an LM test to test the individual effects, and the results of the LM test show that there is heterogeneity in the model, so the parameter estimates obtained by estimating the mixed regression model with Pooled OLS are not statistically convincing, while further using the LSDV method to examine , most of the individual dummy variables were significant, so the original hypothesis was strongly rejected and it was concluded that individual effects existed and mixed regression should not be used. After assuming the existence of individual effects, based on the results of the Hausman test, it can be determined that the individual effects of the model are consistent with the fixed effects hypothesis, and the joint significance of all annual dummy variables is tested by considering the time effects (Two-way FE) in the fixed effects model, and the results conclude that the model does not include time effects. Thus, in the estimation of the static panel model, the results obtained by applying the fixed-effects model were chosen over the random-effects model. In Table 4, the estimation results for the three types of models (fixed effects, random effects, and mixed regression models) are presented. In Table 5, the panel data for the high-technology zones in the four regions of East, Central, West, and Northeast are analyzed by applying the fixed effects model.

Table 3. Model setting test

Original hypothesis	$H_0: \sigma_\mu^2 = 0$	$H_0: E(\mu = \vert X) = 0$
Test statistic	LM test. chibar2(01) = 372.67 Prob > chibar2 =0.0000	Hausman test. Chi-square=8 p-value=0.0100
Test results	Consider that there are individual effects in the model	Consider that a fixed effects model should be used

5.2 Static panel model estimation

The estimation results from the static panel model of national high-tech zone show that the explanatory variables have significant influence on the optimization of industrial structure. Among them, the innovation drive indicator has a significant positive influence on the level of industrial structure optimization, thus confirming hypothesis 1: innovation drive, as an internal factor with autonomy, has a positive and stable influence on industrial structure optimization in high-tech zones through R&D innovation, science and technology innovation investment, and innovation talent capital, which constitute the driving mechanism of industrial structure optimization in national high-tech zones. The interaction term of innovation drive and export drive also has a negative effect on the optimization of industrial structure, but the negative effect is low compared with that of export drive. This paper further empirically analyzes the data at the inter-provincial level in China, and finds that on the inter-provincial panel data, export pull still has a certain negative influence on industrial structure optimization, and the index of industrial structure optimization decreases by 0.0495% for every 1% increase in the level of export pull, i.e. the degree of negative response of industrial structure optimization to export pull ability is weaker compared with that of national development zones, indicating that national high-tech zones as special economic function zone, its industrial structure optimization is more sensitive to the response of exports. The reason for this is that the resource allocation role of the expansion of export trade is more special, the premise that the labor and resource-intensive industries in the zone have not completed the transformation, the increase of export intensity in the high-tech zone strengthens the use of primary factors, in addition, the development of high-tech industries has not yet left the reliance on the use of low-level factors of production, but enterprise innovation can suppress the negative impact of the export effect [28], and the increase of the level of innovation drive In addition, the development of high-tech industries has not yet broken away from the dependence on the use of low-level factors of production. This confirms hypothesis 2: the influence of export on the optimization of industrial structure in high-tech zones is a non-autonomous external factor, which is influenced by the international environment, and the possibility of negative effect is not excluded.

Table 4. Estimation results of the panel data model for industrial structure optimization in national high-tech zones

variables	Fixed effects	Random effects	Mixed regres-sion	Dynamic Panel
	iso	*iso*	*iso*	*iso*
L.iso	-	-	-	0.142**
				(-0.0878)
L2.iso	-	-	-	-0.00734
				(-0.0714)
inno	3.032**	3.083**	3.689**	2.99
	(-1.376)	(-1.368)	(-1.799)	(-2.566)
exp	-0.171**	-0.170**	-0.191***	-0.117
	(-0.072)	(-0.0666)	(-0.0671)	(-0.0981)
inno_exp	-0.149***	-0.153**	-0.186**	-0.152
	(0.0476)	(0.0699)	(0.0910)	(0.132)
scitech_fina	0.527***	0.555***	0.713***	0.529**
	(-0.184)	(-0.182)	(-0.181)	(-0.268)
taxes	-0.243*	-0.232*	-0.228	-0.102
	(-0.135)	(-0.121)	(-0.142)	(-0.134)
assets	-0.0833	-0.000445	0.435	0.0904
	(-0.421)	(-0.391)	(-0.439)	(-0.464)
liabilities	0.264	0.148	-0.427	0.0186
	(-0.373)	(-0.349)	(-0.427)	(-0.413)
return_stu	0.152***	0.158***	0.186***	0.160*
	(-0.0529)	(-0.0496)	(-0.0584)	(-0.0941)
_cons	-3.864**	-3.949**	-3.958*	-6.145***
	(-1.911)	(-1.745)	(-2.13)	(-2.253)
R-squared	0.603	-	0.636	-
Sargan test	-	-	-	0.3271
N	52	52	52	52

Note: ***, **, and * indicate significant at the 1%, 5%, and 10% levels, respectively, and the standard errors of coefficient estimates are in parentheses.

From the analysis of the panel data (fixed effects) of the eastern, central, western and northeastern regions, it can be seen that both innovation drive and export pull have different degrees of promotion effect on the optimization of industrial structure of high-tech zones in different regions, the innovation drive of the eastern region has a significant promotion effect on the optimization of industrial structure of national high-tech zones, for every 1% increase in the innovation drive of the eastern region national high-tech zones, the optimization of industrial structure increases by 3.200%. For every 1% increase in the innovation driving ability of the national high-tech zones in the eastern region, the industrial structure optimization increases by 3.200%, and the export driving has a negative influence on the industrial structure optimization, for every 1% increase in the export driving, the industrial structure optimization decreases by 0.262%. The relatively low degree of openness in the central and western national high-tech zones has weakened the inhibiting effect of "low-end lock" on industrial structure optimization brought by export trade to some extent; while the innovation drive and export drive in the northeastern national high-tech zones are not statistically significant. This is due to the difference in the time effect of R&D innovation on industrial restructuring and the scale of R&D investment [18]. The industrial structure transformation of western national high-tech zones has not yet been clearly reflected [29], and the process of industrial structure optimization is slow, while the opening level, economic income and R&D scale of eastern and central national high-tech zones are higher than those of northeastern ones, and the gap between economic level and science and technology level leads to the spatial gap of industrial structure optimization level.

Table 5. Results of panel data (fixed effects) analysis of industrial structure optimization of national high-tech zones by region

variables	East	Middle	West	Northeast
	iso	iso	iso	iso
inno	3.200**	1.270**	1.824**	-4.946
	(1.356)	(1.320)	(2.364)	(7.455)
exp	-0.262***	-0.0800*	-0.148*	-0.181
	(0.0813)	(0.122)	(0.0704)	(0.265)
inno_exp	-0.154**	-0.0779	-0.0768	0.272
	(0.0702)	(0.0679)	(0.121)	(0.391)
scitech_fina	0.670**	0.888***	0.142	0.456
	(0.245)	(0.189)	(0.135)	(0.354)
taxes	-0.367**	-0.00153	-0.141	-1.040**
	(0.169)	(0.230)	(0.383)	(0.305)
assets	-0.549	-0.221	0.291	0.526
	(0.559)	(0.767)	(1.209)	(0.847)
liabilities	0.595	0.229	0.203	0.0831
	(0.483)	(0.737)	(1.161)	(0.866)
return_stu	0.201***	0.241**	-0.0172	0.148
	(0.0669)	(0.0775)	(0.187)	(0.115)
_cons	-0.112	-11.66***	-4.950	2.198
	(2.467)	(2.107)	(6.889)	(3.107)
R-squared	0.663	0.842	0.501	0.533
Sargan *test*	0.969	0.374	1.000	0.210
N	23	10	11	8

Note: ***, **, and * indicate significant at the 1%, 5%, and 10% levels, respectively, and the standard errors of coefficient estimates are in parentheses.

5.3 Dynamic panel model estimation

The adjustment and optimization of industrial structure in the process of construction and development of high tech new area has its own inertia. There exists a long cycle of national industrial structure optimization, and this evolution of industrial structure is reflected in economic indicators. Based on the perspective of econometric modeling, this paper argues that the model may have some dynamic structure. Therefore, this paper creates a dynamic panel model that includes lagged terms of the explanatory variables and eliminates the problem of endogeneity of the explanatory variables with the help of the generalized moment estimation (GMM) method to ensure the consistency of the estimation results. According to scholars Arellano and Bover (1995) and Blundell and Bond (2002), the generalized moments approach in dynamic panels is chosen as a systematic GMM model with only the endogeneity of the lagged term of the explanatory variable considered, while the higher-order lagged term of the explanatory variable and the difference term of the explanatory variable are introduced as instrumental variables, whose coefficient estimates have smaller standard errors and are more effective compared to the difference GMM. In Table 4, the Sargan test results indicate that the choice of the systematic GMM model for estimation is reasonable and the original hypothesis of "all instrumental variables are valid" can be accepted at the 5% significance level. In addition, since the paper uses short panel data, the unit root of the data is not considered in the empirical analysis. In this paper, the two-step estimation method is used to better estimate the weight matrix of GMM, and the estimation results are shown in Table 4.

The results from the dynamic panel estimation show that the effect of $t-1$ period of industrial structure optimization has a significant impact on period t, while the impact of $t-2$ period of industrial structure optimization on period t is insignificant, which indicates the existence of dynamic characteristics of industrial structure optimization and adjustment in national high-tech zone, with a lag period of one year and a one-period lag coefficient of 0.142, which indicates the existence of self-evolution in the process of industrial structure optimization in national high-tech zone, and the dynamic influence period obtained from the test of this paper is period 1. The characteristics of self-evolution of industrial structure optimization in national high-tech zone can be explained in the following two aspects: (1) The new trend and tendency of industrial structure optimization comes from the rapid development of high-tech industries, the increase of the proportion of technology-intensive industries and knowledge-intensive industries, and the development of leading industries such as information, biology and new materials in national high-tech zone becomes the key to influence the progress of high-tech and industrial structure optimization in the zone. The contribution of high and new technology to the growth of industrial output and the improvement of production efficiency has increased, and the increase of the proportion of industrialization and information technology has further promoted high and new technology to become an important driving force to guide the optimization of industrial structure; (2) the traditional industries transformed by high and precise technology in the national high-tech zone have renewed vitality and expanded new space for survival and development, and the development of industrialization and information technology has made the traditional leading industries that originally lagged behind the development of the times (such as textile industry, automobile manufacturing industry, chemical industry, etc.) reshape development, rapid growth of technology-intensive industries, the integration of physical industry and Internet technology, making the production sector of technological innovation breakthroughs and transfer, in the process of technological innovation, industrial structure changes, because the impact of technological innovation needs time to transfer between different industries or sectors, so a technological breakthrough requires a certain Since the impact of technological innovation needs time to be transferred among different industries or sectors, it takes a certain amount of time for a technological breakthrough to form matching production and inventions, thus the optimization of industrial structure needs a period of time to complete the self-evolutionary process. From the test results of other independent variables, innovation-driven and export-pull are not significant in the systematic GMM estimation and have no significant contribution to industrial structure optimization.

6 Conclusion

The conclusions of this paper are as follows: (1) Innovation has a positive driving effect on the optimization of industrial structure in high-tech zones through R&D innovation, science and technology innovation investment and talent capital, etc. The influence of innovation drive on the optimization of industrial structure in national high-tech zones is stable and belongs to internal factors with autonomy. (2) Export pull affects industrial structure optimization by bringing international demand, adjusting export structure and changing trade mode, which has negative influence on industrial structure optimization of high-tech zone in general and is an external factor with non-autonomy, while the improvement of innovation drive level suppresses the negative influence of export pull on industrial structure optimization to a certain extent. (3) The strength of innovation drive and export pull on industrial structure optimization of national high-tech zones has regional heterogeneity, the promotion or suppression of innovation drive and export pull on industrial structure optimization of national high-tech zones in the eastern region is more obvious, while the promotion or suppression of innovation drive and export pull on industrial structure optimization of national high-tech zones in the central, western and northeastern regions is weaker, meanwhile the industrial structure optimization of national high-tech zones There is a self-evolution phenomenon in the process of industrial structure optimization in national high-tech zones. (4) The dynamic characteristics of industrial structure optimization and adjustment of national high-tech zones exist with a lag period of one year and a lag coefficient of 0.142, which indicates that there is a self-evolution phenomenon in the process of industrial structure optimization of national high-tech zones.

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