Industrial Policy, Structural Distortions and Economic Growth

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This paper constructs a general theoretical framework to analyze the effectiveness of industrial policies combination under given conditions. Effective industrial policies promote economic growth by mitigating structural distortions between an economy's factor endowment structure and its production structure. This paper develops a theoretical model of two typical industrial policies to identify the effectiveness boundary of industrial policies. First, when structural distortions are strong enough, selective industrial policy works and functional industrial policy does not. Conversely, functional industrial policies are effective but selective ones are ineffective when structural distortions are weak. Second, selective industrial policy plays a more aggressive role when markets fail. Finally, in the dynamic change process of regional industrial structure from lower level to higher level, selective industrial policy is gradually ineffective and functional industrial policy is gradually enhanced. This paper selects the database of Chinese industrial enterprises from 1998 to 2013 and the relevant data at the provincial level in China to construct econometric model to confirm the inferences of the theoretical model. (JEL E61*,* O11, O24*)*

Since the late 1980s, the Chinese government has been comprehensively implementing industrial policies to achieve economic catch-up (Barwick et al., 2022). Under the background of intensive use of industrial policy, China has entered a period of economic take-off for more than 40 years. With the improvement of the market system and the deepening of the reform of the economic system, China has moved from the stage of high-speed development to the stage of high-quality development. The economic growth index represented by GDP is no

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longer the only criterion to judge the economic development performance, and issues such as the optimization and transformation of economic structure and the synergistic effect of reducing pollution and carbon have received wide attention. Many scholars began to reflect on the bad results brought by extensive development in the past. Due to government failure, the use of industrial policies also failed, and the wrong use of industrial policies resulted in the distortion of industrial structure and the misallocation of resources, and caused serious environmental problems (Greaker and Rosendahl, 2008). Based on the above facts, some scholars criticize that the government should not directly intervene in the market by administrative means, and believe that industrial policy is actually ineffective or even wrong. The debate about industrial policy is intensifying.

The key reason why the academic community disputes the use of industrial policy is that it does not clearly distinguish between different types of industrial policy and identify the economic conditions under which different industrial policies are effective based on the mechanism by which they work. This paper uses the panel data at the enterprise level and the provincial level to construct a measurement index of the distortion degree of industrial policy and regional industrial structure, and empirically tests the mechanism by which selective industrial policy and functional industrial policy exert the effect of economic growth through the construction of an econometric model, and further tests when the selective industrial policy and functional industrial policy are effective. The results of empirical analysis show that: First, both selective and functional industrial policies effectively promote economic growth during the sample period. Second, selective industrial policies are effective but functional industrial policies are ineffective in regions with strong structural distortions. In regions with weak structural distortions, selective industrial policies are ineffective while functional industrial policies are effective. Third, selective industrial policies are effective but functional industrial policies are ineffective in regions with higher marketization level. In

regions with low marketization level, selective industrial policies are ineffective while functional industrial policies are effective. Fourth, in the process of dynamic change of regional industrial structure from lower level to higher level, selective industrial policies are gradually ineffective and functional industrial policies are gradually enhanced. Finally, the paper also finds that the selection of industrial catch-up strategy can inhibit the function of functional industrial policy, but has no significant effect on the effect of selective industrial policy.

The possible contributions of this paper are as follows: First, it puts forward that the effectiveness of industrial policy should be judged according to whether it leads to the loss of enterprises' self-viability and the distortion of regional industrial structure, which provides a new perspective for the evaluation of industrial policy; Secondly, it reviews the methods of constructing autogenerative variables in previous studies, discusses several existing measurement methods, and innovatively constructs the proxy variable of autogenerative capacity at firm level using the database of Chinese industrial enterprises, and further constructs the proxy variable of regional industrial structure distortion. Thirdly, the micro-mechanism of industrial policy is analyzed theoretically, and the heterogeneous effects of selective and functional industrial policy under different economic conditions are analyzed and tested empirically. The conclusion of the study provides theoretical and practical basis for how to choose industrial policies in regions with different economic structure conditions. Finally, the paper considers the possible influence on the choice of industrial policy under the background of China's post-industrial catch-up strategy.

The following contents of this paper are arranged as follows: the second part is a review of the debate on industrial policy, the third part is theoretical analysis and research hypothesis, the fourth part is research design, the fifth part is empirical analysis, the sixth part is the use of industrial policy in the era of post-industrial catch-up strategy, and the seventh part is conclusions and policy recommendations.

I. A review of the industrial policy

There is no unified definition of industrial policy in academia, and many debates around industrial policy originate from different definitions of industrial policy. Therefore, it is necessary to define industrial policy before discussing the use of industrial policy. Komiya (1984) first defined industrial policy as "policies adopted by the government to change the allocation of resources among industries and certain business activities of private enterprises in various industries". However, Komiya's definition of industrial policy is limited to the government's direct assistance to the industry, ignoring the government's efforts in the construction of the business environment and market system. Lin's definition of industrial policy addresses these limitations. Lin Yifu (2013) believes that any policy measure consciously taken by the central or other government to promote the development of a certain industry in the country or place is industrial policy. Industrial policies designed for the government should not only be limited to direct support for a certain industry through government subsidies, tax rate reduction and other ways, but also include the provision of soft and hard public infrastructure, and even all government initiatives to develop the economy. Based on the above views, this paper holds that industrial policy refers to some policy measures consciously taken by the central government or local government in order to promote the development of a certain industry in the country or region. Industrial policy includes not only the government's differentiated direct support for enterprises, but also the soft and hard infrastructure provided by the government.

Industrial policy is divided into selective industrial policy and functional industrial policy (Lall, 2001). Selective industrial policy is an industrial policy led by the government to promote the production, investment, research and development, and industrial modernization and upgrading of specific enterprises through a series of policy tools. The role of selective industrial policy is to directly

support enterprises in strategic industries and emerging industries through tax relief, low-interest loans and government subsidies (Eaton & Grossman,1986; Neary & Leahy,2000; Kollmann & Roeger,2012) to shorten the evolution process of industrial structure and finally achieve the goal of economic catch-up (Cao Ping and Wang Guijun,2018). Functional industrial policy refers to policies that support the innovation and diffusion of industrial technology, establish a systematic and effective public service system for it, and help workers improve their skills to meet the needs of industrial development (Ye Guanglong et al.,2022). Specifically, selective industrial policy mainly plays a role by coordinating externalities. Functional industrial policy works by reducing the transaction costs of enterprises, while both selective and functional industrial policy can work by reducing the production costs of enterprises.

The original debate about industrial policy focused on whether industrial policy was effective. Some scholars believe that the use of industrial policies by the government can encourage enterprises to innovate and improve the allocation efficiency of credit funds (Li Guangzi and Liu Li,2020), so as to promote the adjustment of industrial structure (Zhang Tongbin and Gao Tiemei,2012; Yu Minggui et al.,2016; Yang Guochao and Rui Meng,2020), improving industrial productivity (Song Lingyun,2013) to correct private sector failures (Andreoni & Chang,2019). But at the same time, there are also studies that show that industrial policies will lead to the distortion of enterprise factor allocation (Jiang Guanhong,2022) and reduce the investment efficiency of enterprises (Wang Kemin,2017; Dai Xiaoyong and Cheng Liwei,2019), inhibit the transformation of enterprises (Yang Xingquan,2018), and have a negative impact on the upgrading of enterprises' global value chains. Moreover, industrial policies will worsen the negative impact of the "vertical structure" (Qian Xuefeng et al.,2019), exacerbate market distortions (Ma Jie,2022), and cause serious misallocation of industry and space resources (Yang Jidong,2018). At the same time, due to the "promotion

tournament" mechanism in China, local officials, influenced by promotion incentives, are more inclined to choose industrial policies that can achieve quick results in order to achieve short-term rapid economic growth (Zhou Li 'an,2007; Yao Yang,2013). However, such industrial policies are often contrary to regional comparative advantages, that is to say, policy support enterprises do not have the ability to obtain reasonable profits under the loss of support. In order to keep companies that violate their comparative advantages alive, the government needs a lot of fiscal expenditure to subsidize enterprises. Although such an approach can achieve short-term economic growth, the mismatch of production factors caused by the catch-up strategy has distorted the industrial structure and seriously hindered the long-term economic growth (Xiong Ruixiang and Wang Kangkai,2017).

The above debate revolves around whether industrial policy is effective. Yang Ruilong and Hou Fangyu (2019) believe that the real issue is not whether industrial policy is effective, but when industrial policy is effective, that is, the effectiveness boundary of industrial policy needs to be found. Some scholars have proposed that whether industrial policies conform to comparative advantages is the key to the effectiveness of industrial policies. Chen Zhao and Xiong Ruixiang (2015) and Zhou Yi et al. (2022) believe that industrial policies can only play a role when they are in line with the comparative advantages of regions or industries. Huang Xianhai (2015) believes that industrial policy has an optimal implementation space characterized by industry heterogeneity such as the degree of industry competition, and the more it deviates from the optimal implementation space, the more the policy effect may deviate from the original intention of policy makers. Zhao Ting and Chen Zhao (2019) and Dai Xiaoyong and Cheng Liwei (2019) found that underdeveloped regions tend to follow the central key industries closely in order to obtain national policy support, but these industrial policies often deviate from their own comparative advantages, and thus have negative effects. Some scholars also believe that the effective industrial policy needs to meet many prerequisites. Zhu

Zhujun et al. (2021) believe that industrial policies can effectively stimulate the innovation vitality of enterprises only when implemented in industries with high productivity and research and development levels. Hong Junjie and Zhang Chenyan (2020) argue that a moderate industrial policy can improve social welfare only if it is budget-neutral. He Jun (2022), on the basis of the fact that China's mobile communication industry has caught up, demonstrated that selective industrial policies can complement competition policies without seriously affecting market mechanisms. Lin Chen et al. (2023) believe that the realistic policy combination of "downstream market-oriented reform + upstream industrial policy" has the greatest promotion effect on economic output.

The effectiveness of industrial policy and its effectiveness boundary have been fully discussed in the existing literature. Even if some studies reach consensus on certain issues, it is more common that many studies on the same issue from different research perspectives have conflicting conclusions. One reason for the debate is that existing research does not clearly distinguish between different types of industrial policy and find reasons for when and why different types of industrial policy work. The government can use effective industrial administration according to the situation, as demonstrated by Wang Yong et al. (2019), to eliminate the distortion of regional production structure and improve the transaction efficiency of enterprises, make up for market failures, achieve Pareto optimal industrial upgrading, and thus promote economic growth. Specifically, from the micro-mechanism of industrial policy analysis, effective industrial policy can cultivate enterprises' self-generative ability, coordinate the externalities of enterprises, reduce the transaction costs of enterprises, and further transform enterprises' self-generative ability into endogenous innovation ability, thus driving economic growth. Based on this, this paper constructs the index system of selective industrial policy and functional industrial policy respectively, and constructs the micro (enterprise level), medium (industry level) and macro (regional level) economic

structure indicators at the provincial level, so as to empirically test the economic growth effect of industrial policy under a specific economic structure.

II. Theoretical analysis and hypothesis

A. *The mechanism of industrial policy*

To analyze when industrial policy is effective, we must first find the criteria for whether industrial policy is effective or not. From the implementation purpose of industrial policy, effective industrial policy can promote economic growth. Effective industrial policy can iron out the structural distortion of regional industrial structure and technological structure and drive economic growth. Ineffective industrial policies misallocate resources in industries contrary to comparative advantages, thus aggravating regional structural distortions, resulting in low efficiency of economic production activities and inhibiting economic growth.

The economic growth effect of industrial policy is realized through the micro-mechanism of improving the production efficiency of enterprises. Market failure is a prerequisite for the government to allocate resources through industrial policies to correct the structural distortion of industrial structure and technological structure, that is, the market mechanism cannot spontaneously make enterprises enter industries that are in line with comparative advantages, nor can it internally drive the technological structure of enterprises to change to the technological structure that matches the regional factor endowment structure. Therefore, more closely, effective real estate policies should be able to compensate for the loss of efficiency caused by market failures. For enterprises, market failure first brings about the rise of production costs. Market failure leads to the failure of the price feedback mechanism of the market, the market cannot give accurate price signals to reflect the relative scarcity of factor endowments, and it is difficult for enterprises to choose the production mode with the lowest actual production cost, and the actual

production cost of enterprises is higher than the lowest production cost of enterprises. Secondly, due to market failure and the defects existing in the market itself, it is difficult to define the rights and responsibilities of enterprises, so it is difficult for the market to coordinate the externalities existing among enterprises through the market mechanism. Finally, market failure reduces the transaction efficiency between enterprises and increases the transaction cost between enterprises. The increase in circulation cost hinders the division of labor and cooperation within industries, reduces the flow speed of production factors between industries, and hinders the normal economic activities of enterprises. To sum up, an effective industrial policy should be able to eliminate the problem of rising production costs and transaction costs caused by market failure and coordinate the externalities among enterprises.

Industrial policy can guide enterprises to enter the industry that is in line with the potential comparative advantages of the region, and then make enterprises have the ability to survive. Selective industrial policy helps enterprises through the transition stage from non-conforming industries to conforming industries through direct protection subsidies; Functional industrial policy can reduce the entry threshold of industries that meet the comparative advantage through the construction of soft and hard infrastructure, and reduce the business risk caused by the rising cost of enterprises in the transformation period. If an enterprise is located in an industry with potential comparative advantage determined by the regional factor endowment structure, the cost price of the factors required by the enterprise production will be the lowest, and the production cost of the enterprise will be the lowest. The lower the cost of production, the more self-sustaining the enterprise is. Because of transaction costs and externalities, enterprises with self-generating ability may not have innovative ability.

Industrial policy can transform the potential comparative advantage of enterprises into competitive advantage, which will enable enterprises to have

innovation ability on the basis of self-generating ability. Functional industrial policy mainly includes hard infrastructure construction such as transportation infrastructure and signal base station construction and soft infrastructure construction such as institutional system construction. The soft and hard infrastructure provided by the functional industrial policy to the industry reduces the transaction costs such as information asymmetry and communication costs between enterprises, and improves the transaction efficiency between enterprises. The selective industrial policies are mainly direct government subsidies, low-interest loans and tax relief and other direct assistance to enterprises. The subsidy of selective industrial policy to innovative enterprises can be regarded as the government's subsidy to innovation risk. Technological innovation brought about by innovation has Marshall externality, and technological spillover makes innovators unable to enjoy the full benefits brought by innovation, but at the same time bear the huge risk of possible failure. Government assistance can reduce the innovation risk of the "first crab" to a certain extent, and coordinate the externalities to a certain extent through taxation and other means, so that innovators can obtain normal profits through innovative activities and encourage enterprises to carry out innovative activities.

To sum up, the micro-mechanism of economic effects of industrial policies can be expressed as follows: effective industrial policies guide enterprises to enter industries that meet potential comparative advantages, minimize production costs of enterprises, cultivate enterprises' self-generating ability, reduce transaction costs, and coordinate externalities among enterprises to make enterprises have competitive advantages. For a region, the more enterprises in the region have self-generating capacity, the more enterprises are located in industries with comparative advantages, the more regional industrial structure and technical structure conform to the most appropriate industrial structure and technical structure determined by the regional factor endowment structure at a given point in time, and the smaller

the regional production structural distortion will be. Therefore, the macro-mechanism of the economic effect of industrial policies can be expressed as follows: effective industrial policies eliminate the distortion between the actual regional production structure and the most suitable production structure determined by the endogenous factor endowment structure, improve the efficiency of production activities, and promote economic growth.

B. *Theoretical model of industrial policy*

Theoretical model of Industrial policy This paper builds a mathematical model to prove the economic growth effect of industrial policy under different structural distortions.Suppose that the total utility function of the representative firm discounted to period 0 in the indefinite period is:

$$U\big(c(t)\big) = \int_0^{\infty} e^{-\rho t} \frac{c(t)^{1-\theta}-1}{1-\theta} \mathrm{dt}\,, \tag{1}$$

Where c(t) represents the consumption of enterprises in period t, ρ is the subjective discount rate, and θ is the relative risk avoidance coefficient. For the sake of brevity, the following derivation omits the t in parentheses. Suppose that the firm uses two factors of production, capital and labor, for production, and conforms to the Cobb-Douglas form of the production function:

$$Y_{ik} = A(n_{ik}) K_{ik}^{\alpha} L_{ik}^{1-\alpha}, \tag{2}$$

Where Y_{ik} is the output of enterprise k in phase t of industry i. $A(n_{ik})$ is the total factor productivity of the firm, and the hypothesis of Lin et al. (2015) is used to describe the exogenous given Marshall externalities among firms located in the same industry, n_i is the number of firms in industry i, and $A(n_{ik})$ is the strictly increasing function of n_{ijk}. Where: $A(n_{ik}) = A_0 e^{\xi n_{ik}}$, ξ is the strength of the

Marshall externality, and when $\xi = 0$, there is no Marshall externality for the industry.

Assuming that all production factors are occupied by enterprises and there are m heterogeneous industries, the factor market clearing conditions are:

$$K = \sum_{k=1}^{n} \sum_{i=1}^{m} K_{ik}\,,\ L = \sum_{k=1}^{n} \sum_{i=1}^{m} L_{ik}, \tag{3}$$

Define the endowment structure $k \equiv K/L$, so when the endowment structure is constrained at the time of factor market clearing, $x = k$.In this case, the relative price of the endowment structure satisfied $r = f'(x = k)$. Under the constraint of endowment structure, the choice of production function will affect the relative price of factor in factor market, which is mainly determined by the relative scarcity of factor. The conditions for profit maximization can be expressed as:

$$max_f \pi_{ik}(f) = R_{ik}(f) - C_{ik}(f), \tag{4}$$

$R_{ik}(f)$ and $C_{ik}(f)$ represent the benefits and costs of production function selection, respectively. For the sake of simplification, the product price is standardized, then:

$$R_{ik}(f) = Y_{ik},\ C_{ik}(f) = rk_{ik} + tc_i = f'(x = k)k_{ik} + tc_i, \tag{5}$$

tc is the transaction cost, assuming that the transaction cost of all enterprises in the same industry is the same, and is determined by the internal hard and soft infrastructure of the industry. Transaction cost is a strictly increasing function of hard and soft infrastructure input, and it is weakly convex.

The density characteristic of production function is defined as $\alpha \equiv {f'(k)k}\big/{f}$, which is used to describe the structural change of production mode. Under the

production function set in this paper, the selection condition for solving the optimal production function is $\alpha = 1 - \frac{1}{ln^{K}/_{L}}$, and the optimal production function is:

$$Y_{ik} = A(n_{ik})K_{ik}^{1-\frac{1}{\ln K/_{L}}}L_{ik}^{\frac{1}{\ln K/_{L}}}, \tag{6}$$

For the firm, the endowment structure of the factor market determines the relative price of the factor and thus determines the factor input mix with the lowest cost. However, in fact, the factor input mix of the firm may deviate from the optimal factor input mix, so it may lose part of the producer surplus in a completely cleared market. Combining equation (5) and equation (6), the actual profit of an enterprise can be expressed as:

$$\pi_{ik}(f) = Y_{ik} = A(n_{ik})K_{ik}^{1-\frac{1}{\ln\ ik-lnL_{ik}}}L_{ik}^{\frac{1}{\ln K_{ik}-lnL_{ik}}} - \frac{1}{\ln K_{ik}-lnL_{ik}} - tc_i(G), \tag{7}$$

$tc_i(G)$ is the cost of production when the government invests G in hard and soft infrastructure. The profit loss of enterprises can be broken down into two parts:

$$\Delta_1\pi_{ik}(f) = A(n_{ik})\left(K_{ik}^{1-\frac{1}{\ln K/_{L}}}L_{ik}^{\frac{1}{\ln\ /_{L}}} - K_{ik}^{1-\frac{1}{\ln K_{ik}-lnL_{ik}}}L_{ik}^{\frac{1}{\ln K_{ik}-lnL_{ik}}}\right) - \left(\frac{1}{\ln K/_{L}} - \frac{1}{\ln K_{ik}/_{L_{ik}}}\right), \tag{8}$$

$$\Delta_2\pi_{ik}(f) = -tc_i(G), \tag{9}$$

$\Delta_1\pi_{ik}(f)$ and $\Delta_2\pi_{ik}(f)$ represent, respectively, the structural distortion between the producer-selected production function and the factor market endowment structure and the welfare loss caused by transaction costs. $\Delta_1\pi_{ik}(f)$ is actually the increase in production cost caused by the inconsistency between the factor input

combination selected by the enterprise and the optimal input combination, and $\Delta_2\pi_{ik}(f)$ is actually the transaction cost of the perfect soft and hard infrastructure.

The profits of enterprises are used for consumption, human capital accumulation and capital accumulation respectively:

$$(10)\pi_{ik}(f,t) = C_{ik}(t) + r_k(t)[k_{ik}(t+1) - k_{ik}(t)] + r_L(t)[l_{ik}(t+1) - l_{ik}(t)],$$

With $r_k(t)$ and $r_l(t)$ is the price of capital and human capital respectively, and $\frac{r_k(t)}{r_l(t)} = r$. Considering that capital and human capital are depreciated at constant depreciation rates $\delta_{k,ik}$ and $\delta_{l,ik}$ respectively, the accumulated capital and human capital in period t are:

$$(11) \qquad \dot{k_{ik}}(t) = k_{ik}(t+1) - \left(1 + \delta_{k,ik}\right)k_{ik}(t),$$

$$(12) \qquad \dot{l_{ik}}(t) = l_{ik}(t+1) - \left(1 + \delta_{k,ik}\right)l_{ik}(t),$$

Since the market may fail, the price producers in the factor market may not be able to accurately capture the price, considering that the price actually accepted by the enterprise in the t period is $r_{ik}^* = Mr_{ik}$, g is the parameter of the degree of market failure, and there is no market failure when M=1. If equation (10) is substituted into equation (1), the accumulation quantity of capital and human capital is respectively a function of the actual price r_{ik}^* accepted by the producer. When $r_{ik}^* \neq r_{ik}$, the producer cannot accumulate the two types of production factors according to the optimal path, that is, the factor accumulation path of equation (11) and equation (12) is distorted. It intensifies the deviation between the producer's production structure and the most suitable production structure. The efficiency loss caused by market failure is essentially caused by the deviation of the producer's production structure from the most appropriate production structure, so this part of the efficiency loss can be seen as a part of $\Delta_1\pi_{ik}(f)$.

Assume that the government decided to G into price subsidies and hard and soft infrastructure: $G = \sum_{i=1}^{m_i} G_{i,S} + \sum_{i=1}^{m_i} G_{i,F}$. $G_{i,S}$ and $G_{i,F}$ respectively represent the government's direct subsidies to the i industry and the investment in the construction of soft and hard infrastructure in the i industry, and also represent the government's selective industrial policy and functional industrial policy for the i industry. For industry i, $G_i = G_{i,S} + G_{i,F}$. And $\beta = G_{i,S}/G_{i,F}$ is the choice between the government's selective industrial policy and the functional industrial policy.

The selective industrial policy distorts the factor prices faced by producers through direct subsidies and other ways, and then affects the mix of factor inputs of producers. The effective selective industrial policy can guide the producer's production structure to converge to the most appropriate production structure, and play a role by reducing $\Delta_1 \pi_{ik}(f)$. Functional industrial policies reduce transaction costs through road network construction and legal supervision, and effective functional industrial policies play a role by reducing $\Delta_2 \pi_{ik}(f)$.

Then the optimal value of β under the condition of profit maximization can be expressed as a function of the ratio of two kinds of welfare losses: $\beta = g\left(\frac{\Delta_1 \pi_{ik}(f)}{\Delta_2 \pi_{ik}(f)}\right)$.

C. *The effectiveness boundary of industrial policy*

Since the late 1980s, the Chinese government has been comprehensively implementing industrial policies to achieve economic catch-up (Barwick et al., 2022). Under the background of intensive use of industrial policy, China has entered a period of economic take-off for more than 40 years. With the improvement of the market system and the deepening of the reform of the economic system, China has moved from the stage of high-speed development to the stage of high-quality development. The economic growth index represented by GDP is no longer the only criterion to judge the economic development performance, and issues such as the optimization and transformation of economic structure and the

synergistic effect of reducing pollution and carbon have received wide attention. Many scholars began to reflect on the bad results brought by extensive development in the past. Due to government failure, the use of industrial policies also failed, and the wrong use of industrial policies resulted in the distortion of industrial structure and the misallocation of resources, and caused serious environmental problems (Greaker and Rosendahl, 2008). Based on the above facts, some scholars criticize that the government should not directly intervene in the market by administrative means, and believe that industrial policy is actually ineffective or even wrong. The debate about industrial policy is intensifying.

Effective industrial policies can promote economic growth, and the effectiveness of different types of industrial policies varies under different economic structure conditions.

The role of industrial policy in regions with different levels of structural distortion also varies. The self-generating ability of enterprises is the micro manifestation of the structural distortion of regional production structure. The enterprises that do not have self-generating ability are mainly innovative enterprises in the early stage of entrepreneurship and enterprises that violate comparative advantages. For enterprises that do not have self-generative ability, the government adjusts the externalities of enterprises by using selective industrial policies, encourages the transformation of enterprises that violate comparative advantages, and promotes the self-generative ability of enterprises in the region. And subsidize innovative enterprises that already have potential comparative advantages (Dollar,1993), reduce innovation costs and corporate financing risks, transform potential comparative advantages into competitive advantages, and promote economic development. However, since functional industrial policies designed by promising governments mainly provide soft and hard infrastructure supporting industries with comparative advantages to reduce production costs, even promising governments are not able to identify potential comparative advantages existing in

regions (Jiang Feitao and Li Xiaoping,2018) and cannot provide soft and hard infrastructure in a predictable way. At the same time, due to the budget constraints of the government's overall industrial policy, selective industrial policy is obviously more effective at this time. The government's choice of functional industrial policy will crowd out the use of selective industrial policy, resulting in resource misallocation and inhibiting economic growth. Therefore, in regions with weak self-generating capacity, that is, regions with large distortions in production structure, selective industrial policies are effective, while functional industrial policies are ineffective.

In the region with less distortion of production structure, most firms in the region meet the comparative advantage determined by the regional factor endowment structure, that is, most firms have the ability to generate themselves and have the ability to obtain acceptable expected profit rate in a perfectly competitive market. Enterprises with self-generating capacity can earn normal profits in a competitive market and do not need to enter government-anchored industries in order to seek government help, which means that these enterprises are less sensitive to selective industrial policies. The main factors that restrict the development of self-generating enterprises are the transaction cost of elements and the circulation cost of commodities. Functional industrial policy provides enterprises with supporting soft and hard infrastructure to reduce the transaction cost between enterprises, reduce the total cost in the production and circulation process of enterprises, and thus enterprises have competitive advantages. Therefore, in regions with strong self-generating capacity, that is, regions with small distortions in the production structure, selective industrial policy is ineffective, while functional industrial policy is effective.

Hypothesis 1.—Selective industrial policy is effective for regions with large structural distortions, but ineffective for regions with small structural distortions;

Functional industrial policies are ineffective for regions with large structural distortions and effective for regions with small structural distortions.

The main purpose of industrial policy is to make up for the market failure caused by various defects of market mechanism, so it is necessary to include market factors in the analysis of the effectiveness boundary of industrial policy. The level of marketization refers to the extent to which the market plays a role in the allocation of resources. In the regions with weak marketization level, frequent market failure seriously affects the effective allocation of factor resources by the market. The high transaction cost and information asymmetry make it difficult for enterprises to effectively identify and enter the industry with the lowest production cost, and the industrial structure gradually deviates from the industrial structure in line with comparative advantages determined by the inherent endowment structure of the region, and the market is difficult to play its role. In order to alleviate the reduction of enterprises' self-viability caused by the violation of comparative advantages, there are some governments to compensate for the structural distortions caused by the absence of market mechanisms through selective industrial policies. In regions with higher marketization level, enterprises can obtain correct price signals by virtue of effective market mechanisms and spontaneously enter industries that meet comparative advantages. Different from selective industrial policies, the upgrading of soft and hard infrastructure brought about by functional industrial policies does not act on enterprises through market mechanisms. Therefore, the effectiveness of functional industrial policy has nothing to do with regional marketization level.

Hypothesis 2.—Selective industrial policy is effective for regions with weak marketization level, but ineffective for regions with strong marketization level; Functional industrial policies are effective for regions at all levels of marketization.

The cultivation of enterprise's self-viability by industrial policy is carried out in the market. It is necessary to consider both the direct impact of industrial policy on

the self-viability of firms and the indirect impact on the substitution of market systems.

The main idea is that the self-generating ability of enterprises in a region is an important embodiment of the regional microstructure, and the enterprises with self-generating ability have the ability to obtain normal profits. A sound marketization system can reduce information asymmetry. On the one hand, it can reduce the standing cost of enterprises by reducing financing constraints and financing costs (Qu Wenzhou et al.,2011), and reduce the incentive dislocation caused by the moral hazard of deliberately underreporting and other fraud to obtain policy support (Liu Guangqiang,2015), which has a positive effect on the normal profits of enterprises. At the same time, due to the disappearance of information barriers and the reduction of industry access threshold, the entry of more enterprises has intensified the competitive pressure among enterprises, and may even cause vicious competition to seek the monopoly position of the industry to grab excess profits. Making more companies lose the ability to make normal profits. Since the two effects may exist at the same time, and it is impossible to judge which effect is dominant theoretically, in order to verify the structural differences in the cultivation of enterprise self-viability by industrial policies under different marketization degrees during the sample period, the following competitive hypothesis is proposed:

Hypothesis 3a.—Selective industrial policies with a higher degree of marketization are more likely to cultivate enterprises' self-viability and promote economic growth.

Hypothesis 3b.—Selective industrial policies are easier to cultivate enterprises' self-viability and promote economic growth when the degree of marketization is low.

Hypothesis 3c.—Functional industrial policies are easier to cultivate enterprises' self-viability and promote economic growth when the degree of marketization is higher.

Hypothesis 3d.—Functional industrial policies are more likely to cultivate enterprises' self-viability and promote economic growth when the degree of marketization is low.

In essence, the selective industrial policy is the intervention policy of the government to directly help various industries in a planned way. In order to achieve sustainable economic development and the improvement of global value chain, the government tends to support strategic industries such as high-tech industries and emerging industries (Kenderdine, 2017), which promotes the high-level transformation of industrial structure. At the same time, the government will correct the structural distortion and factor mismatch caused by the heavy industry catch-up strategy through selective industrial policies (Wang Yong and Hua Xiuping,2017), cultivate industries in line with regional comparative advantages, and promote the rational transformation of industrial structure. In order to transform the industrial structure to the economic structure designed by the government, the government not only uses selective industrial policies to promote the transformation of economic structure, but also uses functional industrial policies to guide enterprises to spontaneously transfer to advanced industries and advantageous industries under the effective market mechanism. The mechanism of functional industrial policy is that it can attract enterprises by increasing investment in hard and soft infrastructure of a certain industry in a targeted way, reducing the entry threshold and production cost of the industry.

Hypothesis 4.—Both selective industrial policies and functional industrial policies can promote the dynamic changes of regional industrial structure and thus promote economic growth, but the economic effects of industrial policies are different at different stages of industrial structure development.

III. Theoretical analysis and hypothesis

A. *Econometric model*

Economic growth effect test of industrial policy.—Before discussing when industrial policies are effective, this paper first constructs a benchmark model to test whether industrial policies effectively promote economic growth during the sample period:

$$EG_{it} = \alpha_1 FIP_{it} + \beta X_{it} + \gamma_i + \delta_t + \varepsilon_{it}, \tag{13}$$

$$EG_{it} = \alpha_1 SIP_{it} + \beta X_{it} + \gamma_i + \delta_t + \varepsilon_{it}\ , \tag{14}$$

Where, EG_{it} represents the economic growth of i region during t period; FIP_{it} represents the functional industrial policy variable of region i in t period, reflecting the intensity of government's use of functional industrial policy in the current period. SIP_{it} represents the variable of selective industrial policy in t period of region i, which reflects the intensity of government's use of selective industrial policy in the current period. *Xit* is the control variable; γ_i represents the regional fixed effect and δ_t represents the time fixed effect. ε_{it} is a random error term.

Excessive use of industrial policy will lead to structural distortion and resource mismatch, that is, although industrial policy may be effective in promoting economic growth to a certain extent, the government's excessive use of industrial policy tools to intervene in the market may cause more serious price signal errors. Considering the possible nonlinear effect of industrial policy on economic growth, this paper includes the quadratic term of industrial policy variables into the model to verify the existence of nonlinear characteristics:

$$EG_{it} = \alpha_1 FIP_{it} + \alpha_2 (FIP_{it})^2 + \beta X_{it} + \gamma_i + \delta_t + \varepsilon_{it}, \tag{15}$$

(16) $$EG_{it} = \alpha_1 SIP_{it} + \alpha_2 (SIP_{it})^2 + \beta X_{it} + \gamma_i + \delta_t + \varepsilon_{it} ,$$

The mechanism test of economic growth effect of industrial policy

Micro mechanism: Structural distortion: Viability is an important micro-mechanism for industrial policy to exert the effect of economic growth. For a region, the self-generating capacity of enterprises corresponds to the structural distortion degree of the region, and the more enterprises in the region have self-generating capacity, the weaker the structural distortion degree. Since there may be estimation bias in directly constructing the intermediary effect model, in order to test whether such a mechanism exists, this paper uses heterogeneity analysis to verify the above causal inference. The specific approach is as follows: Using K-means clustering method, samples are divided into regions with strong autogenesis ability and regions with weak autogenesis ability according to autogenesis ability, and regression is carried out on the two groups of samples respectively, and finally the difference of regression results between the two groups is compared to determine the existence of the above mechanism. The specific model is set in the same way as model (15) and model (16).

Intermediate mechanism: Marketization: Similarly, in order to test whether industrial policies promote regional economic growth by promoting regional marketization process, this paper also uses K-means clustering method to divide samples into two categories according to marketization level and then group them for grouping regression. The specific model is set in the same way as model (15) and model (16).

The mixed effect of structural distortion and marketization: Considering that both the level of marketization and the degree of structural distortion will affect the role of industrial policy, the interaction term between the degree of structural

distortion and industrial policy is included in the equation, and the samples are divided into two categories according to the marketization level according to the above method, and then grouping regression is carried out to observe the effect of industrial policy on economic growth by eliminating structural distortion under different market conditions. The group adjustment effect model is set as follows:

(16) $EG_{it} = \alpha_1 FIP_{it} \times SD_{it} + \alpha_2 FIP_{it} + \alpha_3 SD_{it} + \beta X_{it} + \gamma_i + \delta_t + \varepsilon_{it}$,

(17) $EG_{it} = \alpha_1 SIP_{it} \times SD_{it} + \alpha_2 SIP_{it} + \alpha_3 SD_{it} + \beta X_{it} + \gamma_i + \delta_t + \varepsilon_{it}$,

Where SD_{it} indicates the degree of structural distortion of the region.

Heterogeneous industrial policy effect in the industrial structure dynamic change

In the process of dynamic change of industrial structure, the characteristics of industry also change, and the role of industrial policy is also different. In order to test the heterogeneous role of industrial policy in the process of dynamic change of industrial structure, this paper classifies the development stage of industrial structure with the relative index of industrial upgrading as the proxy variable of industrial structure upgrading, and conducts grouping regression based on this classification standard. The specific model is set up in the same way as model (16) and model (17).

B. *Econometric model*

Economic growth—The first-order difference after logarithmic GDP at the provincial level is used as the proxy variable of economic growth to reduce the impact of regional economic volume on economic growth estimation while reducing data fluctuation. In order to eliminate the influence of inflation on economic growth calculation, this paper uses 1998 as the base period to calculate

the data in the sample period at constant prices. The specific construction is as follows:

$$EG_{it} = ln\, GDP_{i,t} - lnGDP_{i,t-1} = ln\,(\frac{GDP_{i,t}}{GDP_{i,t-1}}), \tag{18}$$

Industry policy—Industrial policy can be divided into selective industrial policy and functional industrial policy.

The main implementation strategies of selective industrial policy include government subsidies, tax relief and low-interest loans. Subsidy income/total income, income tax payable/total profit and interest expense/total profit are measured respectively. It is worth noting that the reason why tax rate relief is chosen to use income tax to measure it is because income tax is different from other taxes and has a strong policy tendency. That is, other taxes are mostly determined by regulations, while the industry and region of income tax vary greatly, so the choice of income tax can better reflect the local government's support for a certain industry.

Functional industrial policy is mainly the soft and hard infrastructure used by the government to reduce the transaction costs of enterprises. This paper uses three secondary indexes of information infrastructure, transportation infrastructure and human capital to describe the government's functional industrial policy.

The impact of industrial policy is at the enterprise level, while the research sample in this paper is at the regional level, so it is necessary to use the data at the enterprise level to calculate the data at the regional level. The proxy index of industrial policy is calculated by entropy weight method in benchmark regression. The specific indicator system is shown in Table 1. Secondary index calculation method synthesis method

TABLE 1- THE INDEX CONSTRUCTION OF INDUSTRIAL POLICY

Primary index	Secondary index	calculation method
Selective industrial policy	Government subsidies	Subsidize income/total income
	Tax rate reduction	Income tax payable/total profit
	Low interest loans	Total interest expense/ total profit
Functional industrial policy	Information infrastructure	Internet access rate
	Transportation infrastructure	High-speed rail mileage/urban area
	Human capital	Number of employees in related industries

Viability—Industrial policy can be divided into selective industrial policy and functional industrial policy. Enterprise self-viability is defined as the ability of an enterprise with normal management to survive without any external support and protection in an open and competitive market, and to obtain the expected profit rate acceptable in the market.

This paper selects the decentralized capacity utilization rate, which is stripped of government factors, as the proxy variable for the self-generating capacity at the firm level. The theoretical basis of this approach lies in: (1) Assuming that the market is efficient and the enterprise does not receive government subsidies, it only considers whether the enterprise can obtain normal profits. Capacity utilization rates measure the ratio of actual output at a given input to the optimal output given that input. The higher the capacity utilization rate, the lower the production cost of the enterprise. Without considering the government support, the capacity utilization rate of the enterprise determines whether the enterprise has a comparative advantage in the perfectly competitive market, so as to have the ability to obtain reasonable profits. (2) Next, the assumption of non-existence of government support is relaxed. Considering the existence of government subsidies, in order to remove the impact of government intervention on the estimation of enterprise self-viability, this paper further takes direct government subsidies, low-interest loans and tax deductions into consideration in the calculation process, and calculates the capacity utilization rate of removing government support factors. (3) Finally relax the assumption of perfect competition market. Considering that the market

conditions of enterprises in the same four-digit industry in the same region are similar, the capacity utilization rate of enterprises minus the average capacity utilization rate of enterprises in the four-digit industry in the region can reflect the survival ability of the enterprises when the market utility is stripped away to some extent.

This paper uses the database of Chinese industrial enterprises[†] to clean up the data with reference to Cai & Liu(2009) and Lin et al. (2018). The specific operation method is as follows: refer to the methods of Brant et al.(2012) and Chen et al.(2011) to screen out invalid samples, and delete data that does not conform to general accounting principles according to the method of Feesnstra(2014). Finally, the capital depreciation rate was calculated to estimate the capacity utilization rate of industrial enterprises, and the proxy variable of enterprise self-generating capacity was constructed on this basis. The specific calculation method is as follows:

Suppose that the factors affecting the output of the firm include capital, labor, intermediate input and productivity, and the production function of the firm can be expressed by the following equation: $Y = f(K, L, M, T)$. Where, Y, K, L, M and T represent the output, capital, labor, intermediate input and total factor productivity of the firm respectively. In the short run, the available capital stock is considered to be fixed; Given a firm's output Y, the firm maximizes profits by minimizing variable costs when constrained by the fixed capital stock K. The variable cost function of an enterprise can be expressed as $VC = g(Y, K, PL, PM, T, Gov)$. P_L and P_M respectively represent the price of labor and the price of intermediate inputs, and Gov represents the direct subsidies

[†] There are two main reasons for choosing the database of Chinese industrial enterprises. First, China's industrial enterprise database is one of the most comprehensive enterprise-level data at present. Compared with commonly used listed enterprise data, it can effectively reduce the estimation bias caused by ignoring small and micro enterprises, and can reflect the impact of industrial policies in a more comprehensive way. Second, industry is the industry most obviously interfered by government policies represented by industrial catch-up strategy (Mendoza, 2010), the use of industrial data can better reflect the intensity of the government's use of policy tools

of the government to enterprises. Equation (9) shows the minimum variable cost that a firm can achieve to produce a given output given the labor price, intermediate input price, firm size, technology level, and government subsidies. Approximation is made using a short-term variable cost function in the form of translogarithms:

$$
\begin{aligned}
(19)\quad ln\,VC = {} & \beta_0 + \beta_Y ln\,Y + \beta_K ln\,K + \beta_L ln\,P_L + \beta_M ln\,P_M + \beta_T ln\,T + \\
& \frac{1}{2}\beta_{YY}(ln\ Y)^2 + \frac{1}{2}\beta_{KK}(ln\ K)^2 + \frac{1}{2}\beta_{LL}(\ln P_L)^2 + \\
& \frac{1}{2}\beta_{MM}(\ln P_M)^2 + \frac{1}{2}\beta_{TT}(ln\ T)^2 + \beta_{YK} ln\ Y \times ln\ P_K + \\
& \beta_{YL} ln\ Y \times ln\ P_L + \beta_{YM} ln\ Y \times ln\ P_M + \beta_{YT} ln\ Y \times ln\ T + \\
& \beta_{KL} ln\ K \times ln\ L + \beta_{KM} ln\ K \times ln\ M + \beta_{KT} ln\ K \times ln\ T + \\
& \beta_{LM} ln\ L \times ln\ M + \beta_{LT} ln\ L \times ln\ T + \beta_{MT} ln\ M \times ln\ T + \\
& \beta_{Gov} lnGov + \varepsilon
\end{aligned}
$$

For the translogarithmic cost function, the coefficient of the variable input price must satisfy the parameter restriction of linear homogeneity:

$$
(20)\qquad \beta_L + \beta_M = 1, \beta_{LL} + \beta_{LM} = 0, \beta_{MM} + \beta_{LM} = 0\ ,
$$

$$
\beta_{YL} + \beta_{YM} = 0, \beta_{LT} + \beta_{MT} = 0, \beta_{KL} + \beta_{KM} = 0\ .
$$

Given the output, capital and technology of an enterprise, the differential of lnP L and lnP M can be obtained to get the proportion of labor cost and intermediate input cost in the total variable cost: $\frac{\partial\, ln\, VC}{\partial\, ln\, P_L} = \frac{P_L}{VC}\frac{\partial VC}{\partial P_L} = \frac{P_L \times L}{VC} = \beta_L + \beta_{LL}\, ln\, \beta_L + \beta_{YL}\, ln\, Y + \beta_{KL}\, ln\, K + \beta_{LM}\, ln\, M + \beta_{LT}\, ln\, T$. Assume that the total fixed cost of the enterprise is: TFC=r×K, where r is the cost of capital. Then, the short-term average total cost curve of the enterprise can be divided by the short-term total cost by the output of the enterprise, and the mathematical expression is as follows:

(21) $$SRATC = (VC + TFC + Gov)/Y = VC/Y + r \times K/Y + Gov/Y,$$

When the production function of the firm is the optimal production function determined by its factor endowment structure, the production cost of the firm is the lowest, and the firm reaches the optimal output Y0, that is:

(22) $$\frac{\partial SRATC}{\partial Y}|Y = Y0 = \frac{1}{Y_0^2} \times \left[\left(\frac{\partial VC}{\partial Y} + \frac{\partial Gov}{\partial Y}\right) \times Y0 - (VC + Gov)\right] - \frac{r \times K}{Y_0^2} = 0,$$

(23) $$1 + r \times K \times \left(\frac{1}{VC} + \frac{1}{Gov}\right)\Big|_{Y=Y_0} = \beta_Y + \beta_{YY}\, ln\, Y_0 + \beta_{YK}\, ln\, K + \beta_{YL}\, ln\, P_L + \beta_{YM}\, ln\, P_M + \beta_{YT}\, ln\, T.$$

Since it is difficult to solve Y0 directly, the iterative method is used to solve Y0. Finally, the capacity utilization rate of each enterprise $CU=Y/Y0 \times 100\%$ is estimated. Due to the large gap in production nature between different industries, the gap in capacity utilization is also large. Autogenerative ability reflects the competitive ability that an enterprise can have in a perfectly competitive market. The substitution effect between different industries is small, so enterprises with lower production costs in this industry can obtain competition. In order to remove the measurement error caused by the average capacity utilization difference between industries, further decentralized processing is done in the industry:

(23) $$RV_{kt} = \frac{Y_{kt}{}'}{Y_{kt}} - \frac{\sum_{k=1}^{n} \frac{Y_{jkt}{}'}{Y_{jkt}}}{n} = CU_{jkt} - \overline{CU_{jt}},$$

Where RV_{kt} is the self-generating capacity of k enterprise in period t, $Y_{kt}{}'$ is the actual calculated output in the current period, Y_{kt} is the theoretical optimal output, and n is the number of enterprises in the four-digit industry in which the enterprise is located. CU_{kt} is the actual capacity utilization rate of k enterprise during the

period t, and $\overline{CU_{jt}}$ is the average capacity utilization rate of the four-digit industry j in which the enterprise is located.

The above method calculates the self-generating capacity at the firm level, which is reflected in the distortion degree of regional production structure at the regional level. Each industry is located in different positions in the industrial chain and value chain, and its contribution to the economy cannot be completely measured by industrial added value. Similarly, the degree of regional structural distortion can not be simply regarded as the weighted average of the value added of each industry to the enterprise's self-generating capacity. This paper mainly considers the effectiveness boundary of industrial policy. The most important role of industrial policy is to help enterprises overcome externalities and coordination problems, reduce the standing cost of enterprises, achieve technological innovation and industrial upgrading, and improve labor production level. The production attributes owned by manufacturing enterprises can most intuitively reflect the effect of industrial policy. Considering the non-homogeneity between industries, in order to avoid the synthesis fallacy, this paper chooses manufacturing enterprises as research samples to construct the structural distortion degree at the provincial level, and further deals with the following:

$$SD_{it} = \frac{TO_{jt}}{\sum_{j=1}^{m} TO_{jt}} \times RV_{jt}, \tag{24}$$

Where SD_{it} is the distortion degree of industrial structure in period t of region i, the more distorted the industrial structure SD_{it} is the smaller, TO_{jt} is the total industrial output value of the enterprise, $\sum_{j=1}^{m} TO_{jt}$ is the sum of the total industrial output value of the manufacturing industry in the region, m is the number of manufacturing enterprises in the region. The weighted average of all manufacturing industries in the region by gross output value is calculated as a proxy variable for regional structural distortions.

Control variables—Human capital (HC), measured by the ratio of the population with a college degree or above to the population at the end of the year, reflects the knowledge, skills, cultural and technical level and health status of regional workers. The urbanization rate (UR), measured by the ratio of the number of urban and rural employed persons to the number of urban and rural employed persons, reflects the process of urban-rural integration in a region. House price (HP), measured logarithmically using the ratio of commercial housing sales to commercial housing sales area, reflects the average price of commercial housing in the region. Transport facilities (TC), measured logarithmically using the total number of railway miles, reflect the accessibility of the area. Openness to the Outside World (OD), measured by the ratio of total imports and exports to gross regional product, reflects the level of economic trade between the region and foreign countries. Foreign Direct investment (FDI), measured using a logarithmic measure of the total foreign direct investment in the region, reflects the level of foreign investment in the region. Income gap (IG), measured by the ratio of the average annual net income of urban households per capita to the average annual net income of rural households per capita, reflects the urban-rural income gap under the urban-rural dual pattern. Wage level (WL), measured logarithmically using the total average money wages of employees, reflects the average income level of the region. Industrial structure (IS), measured by the proportion of tertiary industry GDP, reflects the relative development level of the regional service industry.

IV. Empirical results

A. *Baseline results*

Table 3 reports the results of baseline regression. In columns (1) and (2), the coefficients of selective industrial policy (SIP) and functional industrial policy (FIP) are both significantly positive, indicating that both selective industrial policy and

functional industrial policy have significantly promoted economic growth during the sample period. In column (3), the quadratic coefficient of selective industrial policy is not significant, indicating that there is no significant nonlinear effect of selective industrial policy on economic growth during the sample period. In column (4), the quadratic coefficient of functional industrial policy is significantly positive, that is, functional industrial policy has a positive "U-shaped" relationship to economic growth. This shows that when the implementation level of functional industrial policies is low, the government will strengthen the implementation of functional industrial policies, but will inhibit economic growth. When the implementation level of functional industrial policy crosses the inflection point, continue to strengthen the implementation of functional industrial policy, it can effectively promote economic growth.

TABLE 3-ECONOMIC GROWTH EFFECT TEST OF INDUSTRIAL POLICY

VARIABLES	Economic Growth			
	(1)	(2)	(3)	(4)
SIP	0.0834***		0.0636	
	(0.0298)		(0.0823)	
FIP		0.2518***		-0.1171***
		(0.0870)		(0.0114)
SIP^2			0.0350	
			(0.1352)	
FIP^2				0.4474*
				(0.2339)
IS	-0.5796***	-0.7380***	-0.5722***	-0.6938***
	(0.1580)	(0.1715)	(0.1609)	(0.1723)
HP	-0.0312	-0.0221	-0.0308	-0.0224
	(0.0412)	(0.0411)	(0.0413)	(0.0410)
TC	0.0593**	0.0454	0.0592**	0.0385
	(0.0282)	(0.0290)	(0.0283)	(0.0291)
OD	-0.7858**	-0.7310**	-0.7917**	-0.7746**
	(0.3391)	(0.3399)	(0.3403)	(0.3393)
FDI	0.0711***	0.0548***	0.0712***	0.0559***
	(0.0156)	(0.0162)	(0.0156)	(0.0162)
HC	0.1153	0.0247	0.1080	0.0652
	(0.2798)	(0.2776)	(0.2816)	(0.2772)
UR	0.0294	0.0276	0.0277	0.0128
	(0.0638)	(0.0637)	(0.0642)	(0.0640)
IG	0.0143	-0.0054	0.0152	-0.0112
	(0.0267)	(0.0275)	(0.0269)	(0.0276)
WL	0.6580***	0.6785***	0.6590***	0.7299***
	(0.0696)	(0.0701)	(0.0698)	(0.0748)
Constant	1.6745**	1.6803**	1.6582**	1.2842*
	(0.7114)	(0.7108)	(0.7152)	(0.7376)
Year FE	YES	YES	YES	YES
Province FE	YES	YES	YES	YES
Observations	380	380	380	380

Within R-squared	0.1605	0.3785	0.3776	0.3854

B. *Mechanism test result*

Micro mechanism.—Table 4 reports the results of grouping regression based on the degree of structural distortion. Columns (1) and (2) report regression results for samples with stronger structural distortions, and columns (3) and (4) report regression results for samples with weaker structural distortions. By comparing the regression coefficients of the selective industrial policy (SIP) in column (1) and column (3), it is found that the selective industrial policy is effective in the regions with strong structural distortions but not in the regions with strong structural distortions. By comparing the regression coefficients of functional industrial policy (FIP) in column (2) and column (4), functional industrial policy is effective in regions with weak structural distortions but not in regions with weak structural distortions. In other words, functional industrial policies are only effective in regions with weak structural distortions, while selective industrial policies are only effective in regions with strong structural distortions, which shows that structural distortions are the mechanism by which industrial policies play a role, and effective industrial policies can iron out distortions and promote economic growth. The conclusion of this paper further illustrates that there is no causal relationship between whether an industry follows comparative advantage and the effectiveness of industrial policy. The important question is what kind of industrial policy can help enterprises enter the industries following comparative advantage.

TABLE 4- MICRO MECHANISM - STRUCTURAL DISTORTION

VARIABLES	Economic Growth			
	Low viability		High viability	
	(1)	(2)	(3)	(4)
FIP		0.0193		0.5272***
		(0.1045)		(0.0958)
SIP	0.0970***		0.0078	
	(0.0360)		(0.0226)	
IS	-0.1074	-0.0654	-0.5890***	-0.9036***
	(0.2127)	(0.2420)	(0.1542)	(0.1415)
HP	-0.0477	-0.0381	0.0775**	0.0777***
	(0.0496)	(0.0507)	(0.0337)	(0.0284)

TC	0.0782**	0.0817**	0.0965***	0.1227***
	(0.0327)	(0.0353)	(0.0299)	(0.0255)
OD	-2.4207***	-2.4869***	-0.4732	-0.9410*
	(0.4673)	(0.4886)	(0.6169)	(0.5271)
FDI	0.1148***	0.1095***	-0.0340***	-0.0346***
	(0.0209)	(0.0235)	(0.0118)	(0.0100)
HC	0.2114	0.1343	0.4551	0.1351
	(0.2970)	(0.3007)	(0.9735)	(0.7909)
UR	0.0725	0.0853	-0.0040	-0.0102
	(0.0820)	(0.0834)	(0.0427)	(0.0355)
IG	0.0213	0.0195	0.0013	-0.0251
	(0.0308)	(0.0329)	(0.0342)	(0.0284)
WL	0.5563***	0.5509***	0.2226**	0.2409***
	(0.0821)	(0.0853)	(0.0872)	(0.0734)
Constant	2.2475***	2.2331***	5.4518***	5.1972***
	(0.8330)	(0.8474)	(0.9375)	(0.7915)
Year FE	YES	YES	YES	YES
Province FE	YES	YES	YES	YES
Observations	263	263	117	117
Within R-squared	0.4649	0.4468	0.3690	0.5514

Intermediated mechanism—Table 5 reports the results of grouping regression based on marketization level. Columns (1) and (2) report the regression results of regional samples with low marketization level, while columns (3) and (4) report the regression results of regional samples with high marketization level. By comparing the regression coefficient of the selective industrial policy (SIP) in column (1) and column (3), the selective industrial policy is effective in the region with low marketization level but not in the region with high marketization level. By comparing the regression coefficients of functional industrial policy (FIP) in column (2) and column (4), functional industrial policy (FIP) can play a role regardless of the level of marketization. This shows that the marketization level is the mechanism through which industrial policy plays a role.

TABLE 5- INTERMEDIAED MECHANISM - STRUCTURAL DISTORTION

VARIABLES	Economic Growth			
	Low marketization level		High marketization level	
	(1)	(2)	(3)	(4)
FIP		0.3554***		0.3726**
		(0.0786)		(0.1584)
SIP	0.0588*		0.0417	
	(0.0317)		(0.0299)	
IS	-1.0252***	-1.2068***	-0.4642**	-0.7419***
	(0.1556)	(0.1555)	(0.1936)	(0.2291)
HP	0.0456	0.0667	-0.0350	-0.0469
	(0.0474)	(0.0453)	(0.0462)	(0.0463)
TC	0.0380	0.0496	0.0664**	0.0416
	(0.0341)	(0.0324)	(0.0319)	(0.0335)
OD	-1.0017***	-0.7943**	0.1041	0.1201

	(0.3596)	(0.3462)	(0.3601)	(0.3576)
FDI	0.0376**	0.0148	0.0777***	0.0694***
	(0.0173)	(0.0169)	(0.0170)	(0.0170)
HC	-1.5214*	-1.2880	0.2012	0.1733
	(0.8779)	(0.8413)	(0.2403)	(0.2366)
UR	0.0957*	0.0939*	0.0799	0.0555
	(0.0516)	(0.0494)	(0.1003)	(0.0998)
IG	-0.0736**	-0.1140***	0.0269	0.0194
	(0.0351)	(0.0350)	(0.0288)	(0.0288)
WL	0.4350***	0.4785***	0.8028***	0.8009***
	(0.0718)	(0.0696)	(0.0905)	(0.0898)
Constant	4.3116***	3.8458***	-0.0131	0.4091
	(0.7336)	(0.7106)	(0.8827)	(0.8978)
Year FE	YES	YES	YES	YES
Province FE	YES	YES	YES	YES
Observations	237	237	292	292
Within R-squared	0.4541	0.4988	0.3670	0.3762

Mixed effect of structural distortion and marketization.—Table 6 reports the results of a mixed test of the degree of structural distortion and the level of marketization. Column (1) and column (2) used regional samples with low marketization level for regression, and column (3) and column (4) used regional samples with high marketization level for regression. In column (1), the interaction coefficient between selective industrial policy and the degree of structural distortion (SIP×SD) is significantly negative, indicating that selective industrial policy can effectively eliminate regional structural distortion and promote economic growth when the degree of marketization is low. Comparing the results of column (1) and column (3), the interaction coefficient of selective industrial policy and structural distortion degree (SIP×SD) is not negative but fails the significance test, which indicates that industrial policy is ineffective when the marketization level is high, which is also consistent with the conclusion in Table 5. According to the results of column (2) and column (4), the interaction coefficients of functional industrial policy and structural distortion (FIP×SD) are significantly positive, and the regression coefficient of the group with lower marketization level is significantly greater than that of the group with higher marketization level. This shows that functional industrial policies can effectively eliminate the distortion of regional production structure regardless of the level of the market, and this effect is stronger when the

marketization level is low, which is also consistent with the conclusion obtained in Table 5.

TABLE 6- MIXED TEST OF STRUCTURAL DISTORTION DEGREE AND MARKETIZATION LEVEL

VARIABLES	Economic Growth			
	Low marketization level		High marketization level	
	(1)	(2)	(3)	(4)
FIP		0.3554***		0.3726**
		(0.0786)		(0.1584)
SIP	0.0588*		0.0417	
	(0.0317)		(0.0299)	
IS	-1.0252***	-1.2068***	-0.4642**	-0.7419***
	(0.1556)	(0.1555)	(0.1936)	(0.2291)
HP	0.0456	0.0667	-0.0350	-0.0469
	(0.0474)	(0.0453)	(0.0462)	(0.0463)
TC	0.0380	0.0496	0.0664**	0.0416
	(0.0341)	(0.0324)	(0.0319)	(0.0335)
OD	-1.0017***	-0.7943**	0.1041	0.1201
	(0.3596)	(0.3462)	(0.3601)	(0.3576)
FDI	0.0376**	0.0148	0.0777***	0.0694***
	(0.0173)	(0.0169)	(0.0170)	(0.0170)
HC	-1.5214*	-1.2880	0.2012	0.1733
	(0.8779)	(0.8413)	(0.2403)	(0.2366)
UR	0.0957*	0.0939*	0.0799	0.0555
	(0.0516)	(0.0494)	(0.1003)	(0.0998)
IG	-0.0736**	-0.1140***	0.0269	0.0194
	(0.0351)	(0.0350)	(0.0288)	(0.0288)
WL	0.4350***	0.4785***	0.8028***	0.8009***
	(0.0718)	(0.0696)	(0.0905)	(0.0898)
Constant	4.3116***	3.8458***	-0.0131	0.4091
	(0.7336)	(0.7106)	(0.8827)	(0.8978)
Year FE	YES	YES	YES	YES
Province FE	YES	YES	YES	YES
Observations	237	237	292	292
Within R-squared	0.4541	0.4988	0.3670	0.3762

The heterogeneous role of industrial policy in the process of dynamic change of industrial structure.—Table 8 reports the heterogeneous role of industrial policy in the process of dynamic change of industrial structure. Columns (1)-(3) report the effects of selective industrial policies on economic growth at different stages of industrial structure development. The coefficients of interaction items and industrial policy items in column (1) and column (2) are significantly positive, while the coefficients of interaction items in column (3) are negative and fail the significance test. It shows that when the industrial structure is relatively primary, the government's selective industrial policy can effectively eliminate the economic losses caused by the regional structural distortion, but with the continuous

upgrading of the industrial structure, the selective industrial policy gradually becomes ineffective. The coefficient of column (1) is greater than that of column (2), indicating that in the early stage of industrial transformation of the economy, the government needs to subsidize and protect the industries that violate the comparative advantage to enter the industries that meet the comparative advantage. Columns (4)-(6) report the economic growth effects of functional industrial policies in different stages of industrial structure development. The interaction coefficients in columns (4)-(6) are significantly positive, and the higher the industrial structure upgrading stage, the greater the interaction coefficient. This shows that with the continuous upgrading of the industrial structure, the soft and hard infrastructure provided by the government can play a greater role.

TABLE 8- INDUSTRIAL POLICY HETEROGENEOUS IN THE INDUSTRIAL STRUCTURE DYNAMIC CHANGE

VARIABLES	Economic Growth					
	Low	Middle	High	Low	Middle	High
	(1)	(2)	(3)	(4)	(5)	(6)
SIP×SD	1.5092***	1.2521**	-0.7743			
	(0.5080)	(0.5082)	(0.6064)			
SIP	1.2206***	1.0354***	0.5943			
	(0.3874)	(0.3875)	(0.4556)			
FIP×SD				2.1991***	5.9222*	9.7101***
				(0.7753)	(3.1029)	(1.7958)
FIP				-1.6430***	-4.5508*	-8.1760***
				(0.6040)	(2.5657)	(1.4576)
IS	-0.8587***	-0.5768***	0.1325	-0.7036**	-0.5984	0.3292
	(0.1716)	(0.1568)	(0.2814)	(0.2885)	(0.4658)	(0.2980)
HP	-0.0206	-0.0370	-0.1867***	0.2036***	-0.2870***	-0.2238***
	(0.0425)	(0.0410)	(0.0574)	(0.0491)	(0.0639)	(0.0532)
TC	0.1134***	0.0605**	-0.0779**	0.2247***	-0.0733	-0.1060***
	(0.0307)	(0.0280)	(0.0389)	(0.0357)	(0.0476)	(0.0351)
OD	-1.5669***	-0.9251***	-0.7601	-0.6394	-3.4952***	-1.8161***
	(0.3586)	(0.3412)	(0.6010)	(0.3872)	(0.8423)	(0.5910)
FDI	0.0846***	0.0735***	0.0430**	-0.0463*	0.0870***	0.0494***
	(0.0183)	(0.0155)	(0.0180)	(0.0249)	(0.0249)	(0.0163)
HC	0.1531	0.1561	0.3651	0.2346	0.5027*	0.4508
	(0.2705)	(0.2781)	(0.3145)	(0.4108)	(0.2860)	(0.2871)
UR	0.0555	0.0291	0.0401	0.1587**	0.1985	0.0927
	(0.0662)	(0.0633)	(0.0965)	(0.0681)	(0.1258)	(0.0887)
IG	0.0278	0.0150	-0.0115	-0.1223***	0.0234	-0.0181
	(0.0264)	(0.0265)	(0.0310)	(0.0429)	(0.0309)	(0.0289)
WL	0.5867***	0.6561***	0.8943***	0.5812***	0.7528***	0.8076***
	(0.0708)	(0.0691)	(0.1315)	(0.0775)	(0.1245)	(0.1191)
Constant	1.9312**	1.7179**	1.1900	0.6546	3.3086***	2.5284**
	(0.7501)	(0.7062)	(1.1041)	(0.9164)	(1.0565)	(1.0171)
Year FE	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES
Observations	152	154	74	152	154	74
Within R-squared	0.4410	0.3888	0.3651	0.5355	0.5117	0.4848

V. Conclusion

The key to the effectiveness of industrial policy is whether it is compatible with the regional factor endowment structure and institutional structure, and the key to judging whether it is compatible is whether the use of industrial policy can effectively eliminate the distortion of regional industrial structure and improve the transaction efficiency of enterprises. Due to the huge differences in the ways that different industrial policies play their roles, there are serious theoretical defects in the analysis of the effects of various industrial policies as a whole policy combination without distinction. This paper subdivides industrial policy into functional industrial policy and selective industrial policy, and tries to identify the economic conditions under which they can play a role on the basis of analyzing the mechanism of action of the two kinds of industrial policies, that is, to identify the effectiveness boundaries of different types of industrial policies under different economic structures.

The main conclusions of this paper are as follows: First, in the sample range, both selective industrial policy and functional industrial policy effectively promote economic growth; Second, selective industrial policies are effective but functional industrial policies are ineffective in regions with strong structural distortions. In regions with weak structural distortion, selective industrial policy is ineffective while functional industrial policy is effective. Third, marketization level is an important mechanism for selective industrial policy to play a role, while functional industrial policy does not depend on regional marketization level. Fourth, the economic growth effect of selective industrial policies to eliminate regional structural distortions is not significant when the marketization level is low, but has a negative effect when the marketization level is high. The economic growth effect of functional industrial policy to eliminate regional structural distortion is significantly positive under all marketization levels, and the effect is more obvious

when the marketization level is higher. Fifth, in the process of dynamic change of regional industrial structure from lower level to higher level, selective industrial policies are gradually ineffective and functional industrial policies are gradually enhanced. Further analysis shows that industrial catch-up strategy can inhibit the function of functional industrial policies, but has no significant effect on selective industrial policies

This paper provides a possible perspective for the discussion of the effectiveness boundary of industrial policy, and makes a quantitative analysis of when two types of industrial policy are effective. At the same time, this paper has important policy significance. First of all, the government should clearly distinguish the types of industrial policies before using industrial policies, and choose the right industrial policy mix according to the regional economic structure; Secondly, attach importance to the cultivation of enterprises' self-generating ability. Industrial policy is an important means to cultivate self-viability. It should be used according to the regional economic structure and enterprises' self-generated endowment structure in order to transform the potential comparative advantage of enterprises into comparative advantage. Thirdly, emphasis should be placed on the use of functional industrial policies. For a long time, the Chinese government has preferred to use selective industrial policies, while neglecting functional industrial policies that are important for long-term economic development. In areas where selective industrial policies are ineffective, it is more necessary to promote the functional transformation of industrial policies. In order to improve the efficiency of functional industrial policy, we should not only rely on the rational use of functional industrial policy by the government, but also guide the transformation of industrial structure to alleviate the loss in the transmission process of industrial policy caused by structural distortion. Finally, the role of selective industrial policy in the new stage of development cannot be completely denied. Many studies hold that the combination of industrial policies based on selective industrial policies is no longer

suitable for China's current national conditions, but the role of selective industrial policies cannot be completely denied because of the failure of selective industrial policies in some areas. In areas lacking self-generating capacity, selective industrial policies should be designed rigorously to cultivate the self-generating capacity of enterprises in the region to eliminate the distortion of industrial structure, and dynamically adjust the transformation of industrial policies according to the changes of economic structure. This paper only provides a general framework for analyzing the effectiveness of industrial policy, only considers the informed boundary between functional and selective industrial policy, and makes many assumptions about the characteristics of industrial policy. More research is needed to introduce other features of an industrial policy to more accurately identify the effectiveness boundary of a particular industrial policy.

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