

# Implementation methods and economic impacts of national node strategies

QI Yuanjing<sup>1,2</sup>, LIU Tao<sup>3</sup>, JIAO Jingjuan<sup>4</sup>

1. School of Soil and Water Conservation, Beijing Forestry University, Beijing 100083, China;

2. Engineering Technology Research Center of Forestry Ecological Engineering, Ministry of Education (Beijing Forestry University), Beijing 100083, China;

3. Center for Population and Development Studies, Renmin University of China, Beijing 100872, China;

4. Beijing Jiaotong University, Beijing 100044, China

**Abstract:** Pilot reforms gradually implemented through key nodes have become an important pattern of regional development in China since the policy of reform and opening up was introduced in 1978. On the basis of an analysis of the evolution processes and characteristics of regional development policies in post-reform China, this paper develops the concept and analytical framework of national node strategies (NNS), defined as regional development strategies centered on specific spatial nodes, by addressing their theoretical basis and research scope. The regional economic impacts of NNS were explored quantitatively through the examples of the Shenzhen Special Economic Zone, Pudong New Area and Tianjin Binhai New Area in different stages of the reform and opening up. The results indicate that the evolution of China's regional development policies can be divided into three stages: the exploration stage led by Special Economic Zones (SEZs), the expansion stage dominated by Economic Development Zones and the optimization stage featuring State-level New Areas and National Comprehensive Reform Pilot Areas. During all the three stages, NNS have played an important demonstrative and leading role and promoted the rapid evolution of China's regional development policies from localized to widespread implementation, and the role of the government has also changed accordingly. As an innovative application and development of the growth pole theory in transitional China, NNS have become engines of regional development as well as important conduits of institutional innovations. NNS and regional development have achieved a benign coupling and formed a graded regional development model. Empirical research indicates that NNS are an important method used by the government to guide and regulate regional economic development, with complex and diverse economic effects that differ depending on the stage of regional development and the spatial scale of analysis.

**Keywords:** regional development strategy; national node strategies; growth pole; economic impact

---

**Received:** 2016-09-28 **Accepted:** 2016-11-02

**Foundation:** National Natural Science Foundation of China, No.41401121; The New Teachers' Scientific Research Program funded by Beijing Forestry University, No.BLX2013028

**Author:** Qi Yuanjing, PhD, specialized in urbanization and regional development. E-mail: qiyuanjing0506@163.com

## 1 Introduction

“Cognition, evaluation, construction and optimization” are the basic pathways and main modes of action of human beings in transforming their living environment (Jin, 2013). From an analysis of the construction of regional spatial structures and methods for optimizing spatial organization, it is evident that the formulation and implementation of a series of national spatial strategies, such as regional coordinated development, major function-oriented zoning, key economic zones (belts) and key development nodes, has effectively brought about greater regional spatial order and an improvement in spatial relations.

Since the reform and opening up policy was first introduced in 1978, China has implemented a host of spatial construction and optimization policies aimed primarily at key cities and regions (Lu, 2003). These regional development strategies, which are similar to pilot reforms and centered on key nodes, have played an important guiding role in this process (Lu *et al.*, 1999; Lu and Liu, 2000). These strategies are referred to as national node strategies (NNS) in this paper. Practice has shown NNS to be an extremely fruitful form of scientific exploration within the theoretical system of regional development strategies in the new period (Yang and Hu, 2007; Démurger *et al.*, 2002; Naughton, 2011; Yang, 1990; Wu and Yang 2015). It is foreseeable that in the near future, with the continued promotion of the Belt and Road Strategy, the Beijing-Tianjin-Hebei Economic Zone and the Yangtze River Economic Zone, as well as the ongoing optimization of spatial development patterns based on major function-oriented zoning, NNS will remain the main national strategies for realizing regional resource integration and spatial reorganization.

An analysis of the results of regional spatial development strategies and guiding strategies in China shows that NNS have had, and will continue to have, an important effect on China's regional spatial organization. A number of empirical studies have already shown the propulsive effects core cities (Zhou and Gong, 2000; Xu *et al.*, 2010) and national development zones (Zheng, 2007) have on regional development. However, the extent of this effect is determined by distance. Places located closer to central cities have bigger markets and stronger economic agglomeration; whereas, places located further from central cities tend to participate in regional economic competition by simply supplying those cities with basic products and services, and their market potential gradually decreases with distance. Once the distance to a central city increases to a certain level, interregional competition is significantly reduced and a place's own surrounding market size is also shared less with central cities, and its market potential increases (Fujita and Mori, 1997; Fujita *et al.*, 1999; Krugman, 1991). On the basis of this, Dobkins and Loannides (2000) combined this market potential analysis with spatial relations of urban development, pointing out the possibility of a “~”-style spatial relationship (Hanson, 2001; Partridge *et al.*, 2009). Xu *et al.* (2010) examined the influence of the two major international ports of Shanghai and Hong Kong on urban economic development in 131 Chinese cities, which further confirmed the existence of a “~”-style spatial relationship.

Some scholars have analyzed and evaluated the impact of NNS on regional economic development. These have shown that NNS promote the development of NNS regions and the central cities they are in by improving urban areas, infrastructure, innovation, resources, labor forces and other factors (Meng *et al.*, 2015; Peng *et al.*, 2015). For example, the Shenzhen Special Economic Zone, Pudong New Area and Binhai New Area have directly

driven the development of the Pearl River Delta, Yangtze River Delta and Beijing-Tianjin-Hebei urban agglomeration, respectively, thereby achieving radial development over larger areas (Liu *et al.*, 2008). The construction and development of national development zones, meanwhile, drives the development of the cities they are located in by leveraging their own agglomeration and diffusion effects (Zhang and Lu, 2002; Wang, 2007).

On the whole, existing studies that have evaluated the specific forms of NNS and their economic effects from theoretical and empirical perspectives have failed to systematically consider or comprehensively inspect the internal unity of different types of NNS, as well as to theoretically summarize their methods of action, transmission mechanisms and modes of action. At the same time, studies are limited in so far as they only looked at NNS in their early years when their economic effects were not yet fully apparent. Furthermore, the number of prefecture-level cities in China has nearly doubled since 1990, so the existing studies do not fully portray the impact of NNS on regional economic structures. To this end, this paper will summarize the basic connotations and modes of action of NNS on the basis of an analysis of the processes and characteristics of regional policy evolution in China and show that their influence on regional economic growth is indispensable and has vital practical significance.

## **2 The evolutionary processes and characteristics of China's regional policies since reform and opening up**

### **2.1 Evolution of regional policies in China**

Since the policy of reform and opening up was first introduced, and in the course of China's integration with economic globalization, regional policies have undergone three major evolutions (Lu, 2003; Zhang, 2010) (see Figures 1 and 2) that have promoted orderly development in China, from south to north and from the coast to the interior (Qi *et al.*, 2013).

(1) The period of exploration led by SEZs (1979–1990): During this period, regional policies were mainly focused on eastern coastal areas, with the State developing important development nodes in four main special economic zones (SEZs), 14 open coastal cities and 14 national economic and technological development zones (NETDZ). By providing tax and policy concessions, decentralizing power, transferring profits and using other means to encourage development in these nodes, the government gradually promoted regional development in eastern coastal areas. From there it gradually established coastal open economic areas in seven provinces and two municipalities directly under the central government, including in the Yangtze River Delta, Pearl River Delta, Xiamen-Zhangzhou-Quanzhou Delta, Shandong Peninsula and Liaoning Peninsula. At that stage, regional policies were based on using exploratory and experimental spatial profit concessions in a limited number of places within a limited territorial region in order to stimulate economic growth. Of these, the success of the experimental Shenzhen Special Economic Zone played a key role as a model for other areas.

(2) The period of expansion guided by development zones (1991–2005): In order to promote further opening up of eastern coastal areas and coordinate development of central and western inland areas using the experiences of coastal areas, the State set up 13 national bonded zones, 35 national economic and technological development zones, 53 national

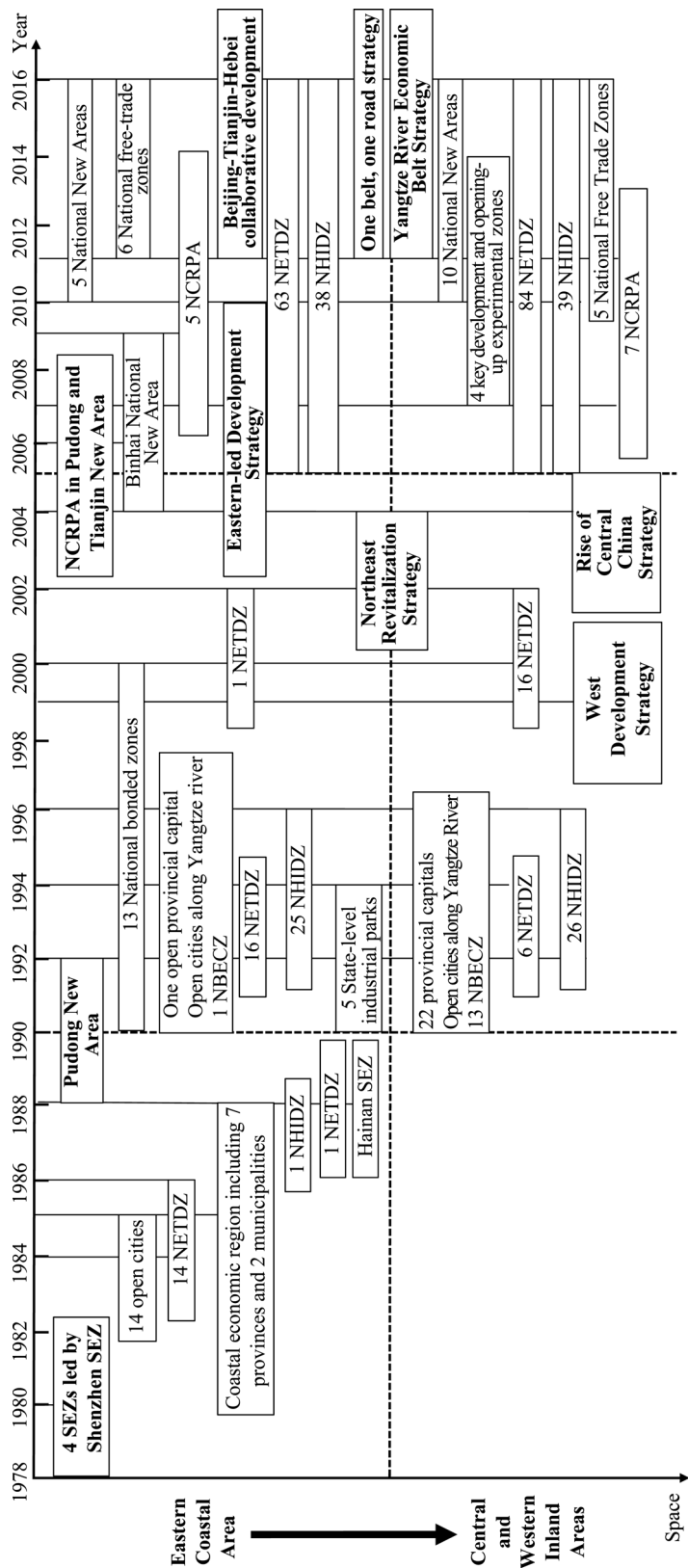
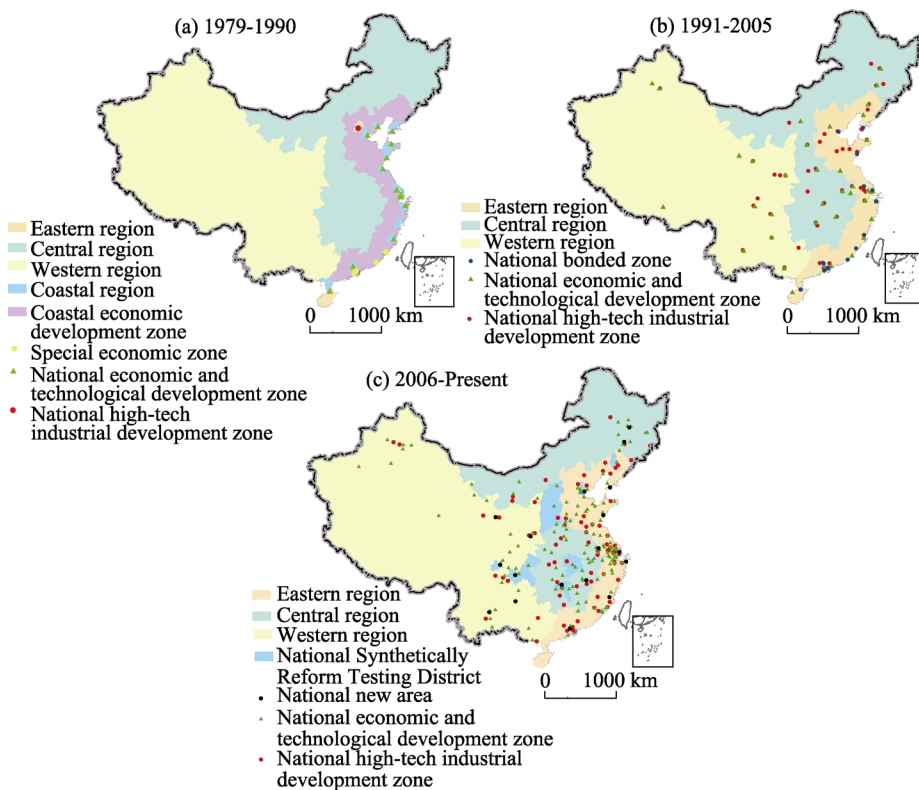


Figure 1 Spatio-temporal evolution of China's regional development policies



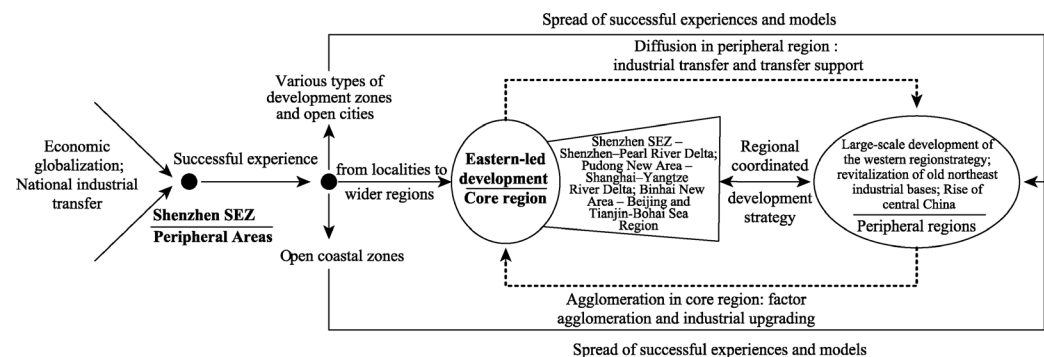
**Figure 2** Evolving spatial pattern of priority development zones in China

high-tech industrial development zones (NHIDZ), 23 open provincial capitals and cities along the Yangtze River, and 14 national border economic cooperation zones (NBECZ). The success of these initiatives is exemplified by the Shanghai Pudong New Area. The overarching plan was to expand development zones in size, number and type from eastern coastal areas to central and western inland areas using existing experience and models for the sake of overall economic structural optimization. In the more than 10 years of reform and opening up at that time, during which eastern areas experienced rapid economic development, the gap between eastern coastal areas and central and western inland areas had constantly grown. As such, to reduce the regional gap and promote coordinated development, the State also launched strategies for the large-scale development of the western region, rise of central China and revitalization of the old northeast industrial bases. This gradually created an overall plan for the coordinated development of the east, central, west and northeast regions.

(3) The comprehensive optimization stage led by national new areas and national comprehensive reform pilot areas (2006–present): The State announced 18 national new areas, including the Pudong New Area and the Tianjin Binhai New Area, 12 national comprehensive reform pilot areas (NCRPA), 11 free-trade zones and four national key development zones. The objective of regional policies during this period is clearer. It is not only to take on development objectives by taking the lead in creating growth poles, but also to propel the spatial mission of regional development and promote innovative national comprehensive reform pilot areas, with the overall characteristics of comprehensive content, diverse types and a hierarchical structure.

## 2.2 Features of the evolution of regional policies in China

Since the policy of reform and opening up was first introduced, China's regional policies and its regional economic structure have evolved systematically and cyclically (see Figure 3). First of all, the pilot reform of relying on key nodes has played an important demonstrative and leading role, and it has promoted the rapid development of China's regional policies. In the early stage of the reform and opening up process, against the background of economic globalization, the State lacked a clear reform plan, so it adopted a pilot reform strategy of relying on key nodes, which became important purveyors of innovation within the State system. Due to the path dependence of institutional evolution, especially the exploratory strategy of “crossing the river by feeling the stones”, the formation of key nodes led to subsequent policies being adapted to results in economic development. In other words, subsequent policies were altered based on the outcomes of previous pilot reforms.



**Figure 3** Pilot reforms and evolution of regional development policies

Analyzing the evolution of regional policy, the State chose Shenzhen, which was far from the nation's economic and political centers but adjacent to the Asian financial center of Hong Kong, to trial an SEZ pilot reform. The institutional innovations achieved by the Shenzhen SEZ drove development and created a regional growth pole, and its success proved the effectiveness of the key nodes development strategy. At the same time, under the bottom-up impetus of foreign and domestic capital, the State opened more nodes of new and varying types, including open economic zones and open cities, and encouraged development in these new nodes, eventually encouraging the development of the entire eastern coastal area through the effects of concentration and diffusion. This led to the following: First, regional disparity in China became no longer about differences within regions, but between regions. This meant that the government's regional policies could no longer be based on nodes; it had to be regional. In response to ever-growing regional disparity, the State introduced strategies for the large-scale development of the western region, the rise of central China and revitalization of old northeast industrial bases. Second, in order to further promote the reform and opening up of eastern coastal areas, and as the focus of reform shifted from labor-intensive secondary industries to high-tech and modern service industries, the State established the Shanghai Pudong New Area and other nodes, and reforms were constantly deepened and more favorable open policies and regions were introduced. In terms of institutional innovation, the disparity between coastal and inland regions at that time did not

derive from the depth of reform, but rather its scale, as there were no fundamental differences in the development models and institutional levels of the two regions. Institutional innovation was stagnant in central and western inland areas until the initial institutional innovations from eastern coastal pilot reform areas were expanded across regions and the entire country. As such, the State's strategy achieved a new upward spiral, and it once again implemented pilot reforms in key nodes in coastal areas in order to promote the next round of institutional innovation.

The government has played a central role in the evolution of regional policy in China, but its specific role has fundamentally changed. First of all, the government has gone from being a facilitator of regional development to a promoter of regional coordinated development. The government first focused on choosing key nodes such as the Shenzhen SEZ through spatial profit concessions and other means, and then launched the large-scale development of the western region, the rise of central China and other strategies, the purpose of which was regional development but fundamentally differed from the Shenzhen SEZ and other key nodes, in order to achieve coordinated development between regions. Second, the government has gone from being a policy innovator to a policy promoter. After the establishment of SEZs and open economic zones, regional policies placed more emphasis on investment, tax incentives and similar institutional promotional policies. Comparing coastal reform and opening up policies and the strategy for the large-scale development of the western region, one can see the fundamental change that took place in the State's methods for promoting regional development, from institutional innovations in pilot areas to promoting investment in localities and then in wider regions. Third, the government has gone from being a system designer to a passive performer. In the process of institutional evolution and its effects on economic development and regional pattern change, the government is no longer an exogenous force, but has become an endogenous part of regional economic systems and spatial development.

### **3 Theoretical basis and mode of action of national node strategies**

#### **3.1 Definition of national node strategy**

Pilot reform strategies with Chinese characteristics have played an important role in China's regional development, with key nodes having also become engines for regional growth and starting points of institutional innovation. This reflects the notion that by identifying, guiding and controlling key nodes, superior areas drive the development of regions (Fan *et al.*, 2001). From a geographical perspective, taking the features and laws of the evolution of China's regional policies as a starting point, NNS are a type of regional development strategy with pre-established objectives that are implemented in selected cities and regions using preferential policies, institutional innovation guidance, active investment in factors of production and other methods, and that promote pioneering development, play an extremely useful role in promoting growth within regions and ultimately promote the development of surrounding regions and the evolution of the entire economic system. Pioneering, guiding and prospective construction design is a basic characteristic of NNS. Practice has shown that the use of these strategies can produce goal-oriented and distinctive regional development spaces, form regional development growth poles or hubs and guide changes in regional spatial structures, thereby getting closer to, and ultimately achieving, the objective of orderly regional development through their gradual spatial effects.

As an important method of the government for guiding and regulating regional development, NNS are engines of regional growth and conduits of institutional innovation. First, NNS are important growth poles of regional development. Using preferential policies, institutional innovation guidance, active investment in factors of production and other methods, NNS employ active intervention methods involving the addition of policy-type disturbance factors to the regional spatial system to differentiate a place in the spatial organization, thereby creating a polarizing force for regional spatial evolution that plays the role of a growth pole in influencing a region's overall spatial organization. This allows them to achieve their objective of reconstructing the regional spatial development order. The growth pole effect of the national new area strategy, which is an NNS from the new period, relies on fostering features such as becoming important gateways to the outside world, leading the transformation and upgrading of traditional industries, fostering emerging high-end industries and exploring scientific development models (Peng and Liu, 2014; Hao, 2008). Second, NNS are a type of unique policy-style growth pole. NNS are institutional innovations rooted in the inherent requirements of, and adapted to, regional economic development. This coincides with China's exploratory reform strategy of "crossing the river by feeling the stones", with institutional innovations in NNS regions practiced in wider regions. The main spatial form of NNS constantly changes, but the prominent policy guidance is a constant, the significance of which lies in one point driving the development of a wider region. NNS mainly consisted of special economic zones in the early period of the policy of reform and opening up. In recent years, however, they have included national new areas and other new forms. Unlike the open economic zones model which was introduced due to the system in the early years of reform and opening up, recent NNS have been growth poles of "institutional innovation" guided by internal institutional change and endogenous to the regional development pattern. They have needed to have specific objectives and be aimed at specific problems faced in a specific stage of regional development, and specific policy systems have had a certain timeliness and pertinence (Hao, 2008; Wei, 2011; Li, 2012). It can be seen that although the form of NNS has changed, they remain a way for the State to promote NNS regions and the cities and areas they support using such methods as preferential policies, institutional innovation guidance and active investment in factors of production, as well as interactions based on regional features, in order to form unique policy-style growth poles.

### 3.2 Theoretical basis of NNS

A basic analysis of the content of NNS shows that they are a practical extension of the growth pole theory. Hence the traditional growth pole theory can be seen as an important theoretical basis of NNS. Many studies have analyzed and evaluated the role and impact of growth pole strategy on the regional spatial development of countries including China. Some studies have concluded that this type of space-guiding strategy, which is based on important strategic nodes, has been widely used to boost technological progress, promote regional growth, and coordinate regional development and economic and spatial planning, and that it still has important practical significance (Thomas, 1975; Parr, 1999a; Parr, 1999b; Ke and Feser, 2010). Under the guidance of growth pole theory, the practice of regional development has not only spurred the rapid growth of growth poles, but also produced a trickle-down effect following polarization, which has driven the coordinated development of regions as a



whole. Nevertheless, achieving the latter has often required the implementation of supporting regional development policies; otherwise, negative effects from excessive polarization can occur (Ding, 1989). Extensive practical implementation and theoretical reflections on this have reinforced the position of growth pole theory in economic geography, and it has become an important theoretical basis of regional spatial organization (Ke and Feser, 2010; Angotti, 2001).

In China, the meaning of growth pole theory has been extended and developed in its applications. On the one hand, in the course of China's reform and opening up, market and social forces play an increasingly important role in regional economic development (Goldstein, 1995); on the other hand, the State and government have always played an extremely important guiding role in regional economic development and spatial reconstruction. This is actually a core characteristic of the market economy with Chinese characteristics. An important feature of Chinese economic reform has been the strategy of "crossing the river by feeling the stones", with many institutional innovations and reforms piloted in certain regions before being implemented nationwide once they have proved to be successful (McMillan and Naughton, 1992; Bach *et al.*, 2006; Walder, 1995; Nee and Oppen, 2010). These pilot regions have gradually become important strategic nodes in national and regional economic development, and pilot institutional reforms in these strategic node regions are a feature of NNS as well as a new application of growth pole theory in the field of institutional reform. As such, NNS are not only traditional growth points for industrial and regional development priorities, but they are also given the important tasks of driving institutional innovation and leading the way for other regions. In this sense, traditional growth pole strategy is not entirely suited to China's transformation and development practices, but NNS involve innovative applications of growth pole theory in areas such as economic transformation and institutional change, and they are thus a creative development of the growth pole theory itself.

### 3.3 Modes of action of NNS

According to relevant theories in economic geography and new economic geography, the evolution of regional economic structures is the result of the interaction between the forces of agglomeration and diffusion (centrifugal force). Growth pole, center-periphery and point-axis theories all stress the central role of agglomeration in the process of regional economic development and the evolution of its spatial organization. They hold that sustainable development of the "center" is a powerful argument of economies of agglomeration. At the same time, cities and economic development are affected by the role of centrifugal forces that drive the development of surrounding areas. On the whole, the role of growth pole theory in NNS is to promote the functional upgrading and spatial expansion of cities through agglomeration and diffusion, thereby achieving radial development among urban clusters and greater regions, and forming a graded regional development model from "the core to the periphery" and from "NNS regions to core cities, to urban agglomerations, to greater regions" (Liu *et al.*, 2008).

The path for implementing NNS can be divided into four stages (see Figure 4). (1) Fostering nodes: NNS have been formulated to meet the relevant objectives of the different periods of the reform and opening up policy. Such methods as preferential policy interventions,

institutional innovation guidance and active investment in factors of production have been used to deviate from the conventional development paths of NNS regions, forming regional development growth poles and leveraging strategic regional development. (2) Strengthening the core: Positive interactions between NNS and central cities and regions are the original intention and ultimate goal of their formulation. Under the impetus of NNS, rapid development of NNS regions creates perfect conditions for the spillover of traditional urban functions, the development of modern service industries and the creation of new high-end functions. On the other hand, as important platforms for integration into economic globalization, NNS regions are clusters of regional new and emerging high-end functions that change the traditional industrial structures of the cities they are based in through technological diffusion and industrial incubation, and that promote the upgrading of urban functions. (3) Integrating the margins: Rapid development of core cities can promote the functional upgrading and structural optimization of urban agglomerations by transferring traditional functions to marginal towns and cities and linking development of emerging functions in order to reconstruct the system of functions of urban agglomerations. (4) Developing the periphery: Using such effects as the distribution of population and economic factors of production as well as linking regional functional spaces, the rapid development of urban agglomerations reduces the resource and environmental pressures on peripheral areas and guides their individual development.

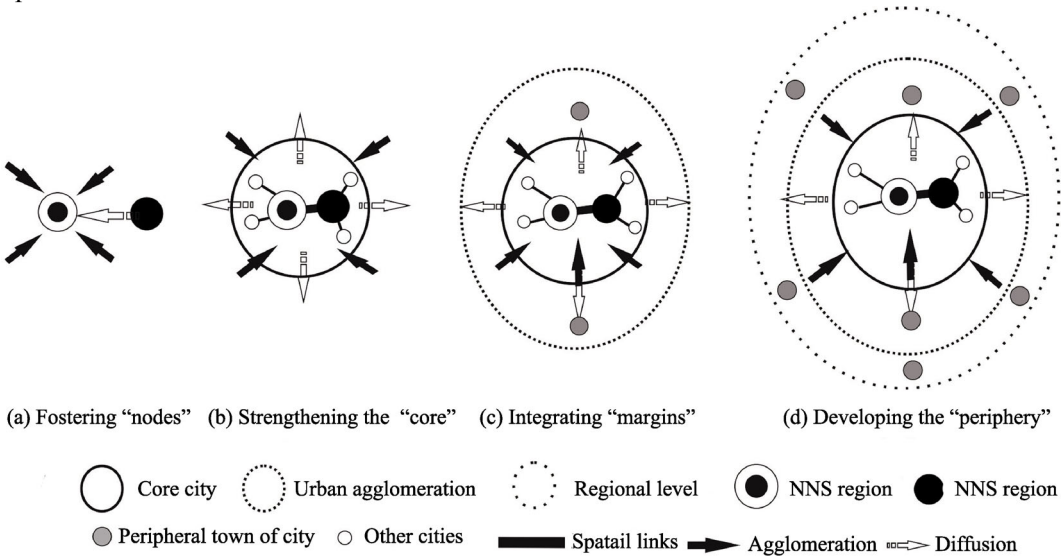


Figure 4 Mode of action of national node strategies

## 4 Testing the impact of NNS on the evolution of China's regional economic structure

### 4.1 Models and data

Based on the processes and characteristics of the evolution of regional policies in China, combined with the large-scale emergence of NNS in such forms as State-level New Areas after 2011, as well as their cross-regional impacts, this study takes the economic growth of

338 prefecture-level administrative units across China during the period 2010–2011 as its research focus, and uses an economic growth model to empirically estimate the impact of three major NNS from different periods of China's reform and opening up, namely the Shenzhen Special Economic Zone, Pudong New Area and Tianjin Binhai New Area, on China's economic landscape reconstruction (Xu *et al.*, 2010).

$$GrowtI_i = \beta_1 disnode_i + [(disnode)_i] + \beta_3 [(disnode)_i]^3 + \gamma X_i + \varepsilon_i \quad (1)$$

The model's dependent variable is the GDP growth rate of each prefecture for 2010–2011. The core independent variable (*disnode*) is the distance from the city (*i*) to the three major node strategy cities of Shenzhen, Shanghai and Tianjin. There are two commonly used metrics for the distance to node strategy cities. The first is the transport distance, and the other is the linear distance. Because the former is closely related to economic development, it theoretically generates severe endogeneity, which means regions with faster economic growth are more likely to become key areas of regional transportation development, thereby shortening the transport distance to node strategy cities, but not affecting the exogenous variable of the linear distance between the two. Therefore, this study uses the linear distance from each city to the three major strategic nodes (*disSZ*, *disSH* and *disTJ*) and calculates the nearest distance of the three. This is a common approach in academic research when looking at the impact of spatial factors on economic growth. Given that we are seeking to analyze the spatial gradient of the influence of these variables on economic growth and identify possible spatial inflection points, the model does not include the quadratic and cubic components of these distance variables. Nevertheless, the relationship between the economic growth of these localities and their distance from node strategy cities can only prove the correlation between the two. In order to examine the causal relationship of the impact of distance on growth, it is necessary to control other important variables that may affect urban economic growth. Therefore, based on existing results of economic growth studies, the model controls the impact of important variables, such as economic development level, factor inputs, openness and government capabilities, and relative variables ( $X_i$ ), including the logarithm of initial GDP, the proportion of investment in fixed assets to GDP, the proportion of the population that is employed, years of education per capita, the ratio of FDI to GDP and the ratio of local fiscal expenditure to GDP. Other control variables generally used in studies on Chinese economic growth include three dummy variables, namely regional urbanization level (the ratio of urban population to total population), population density (the number of people per square kilometer of land) and its quadratic term, and whether a municipality is directly under the central government, a provincial capital, or a city in the central or western region specifically designated in the state plan.

All explanatory variables in the model use data from the selected base year 2010. For many of the above variables, particularly after zonal dummy variables and the degree of opening to the outside world are added to the model, there is very reason to believe that the effect on regional economic growth of the distance to the three node strategy cities is not a simple geographical factor, but rather it is the effect of the focus of this paper, NNS, on spatial structures of national economic growth.

There are three data sources for this paper: the China Statistical Yearbook for Regional Economy (2011 and 2012), county data from the Sixth National Population Census of the

People's Republic of China, and data on distance, area and other spatial variables calculated from a GIS map supplied by the National Fundamental Geographic Information System.

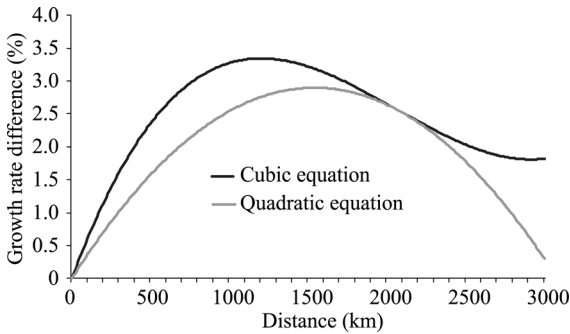
## 4.2 Empirical results

Using the ordinary least squares estimation technique involving cross-sectional data, together with data on closest node strategy cities and quadratic and cubic components, it was discovered that the cubic component is not significant (Model I), so it was removed and new estimations made (Model II). In order to examine the effects of different eras, strategic objectives and location criteria of the three NNS, we used similar approaches for their estimations (Model III and Model IV). Estimation results from the models are shown in Table 1.

**Table 1** Estimation results of the economic impacts of national node strategies

Variable	Model I	Model II	Model III	Model IV
lnGDP	−0.194 (−0.80)	−0.123 (−0.52)	−0.141 (−0.58)	−0.124 (−0.51)
disnode	0.00645*** (3.13)	0.00376*** (3.65)		
disnode_2	−0.00000379** (−2.19)	−0.00000122*** (−3.92)		
disnode_3	6.14e−10 (1.51)			
disTJ			0.00687*** (2.73)	0.00296** (2.52)
disSH			0.00691*** (2.81)	0.00286*** (3.63)
disSZ			0.00414* (1.88)	0.00380*** (3.62)
disTJ_2			−0.00000302 (−1.29)	−0.000000648 (−1.56)
disSH_2			−0.00000416* (−1.83)	−0.000000836** (−2.52)
disSZ_2			−0.000000559 (−0.41)	−0.00000102*** (−3.75)
disTJ_3			4.97e−10 (0.91)	
disSH_3			6.57e−10 (1.47)	
disSZ_3			−1.66e−10 (−0.60)	
<i>N</i>	338	338	338	338
<i>R</i> <sup>2</sup>	0.174	0.169	0.227	0.212
adj. <i>R</i> <sup>2</sup>	0.136	0.133	0.176	0.168

Note: This table includes regression results of control variables; \**p* < 0.1, \*\**p* < 0.05, \*\*\**p* < 0.01; the value in parenthesis is “*t*”

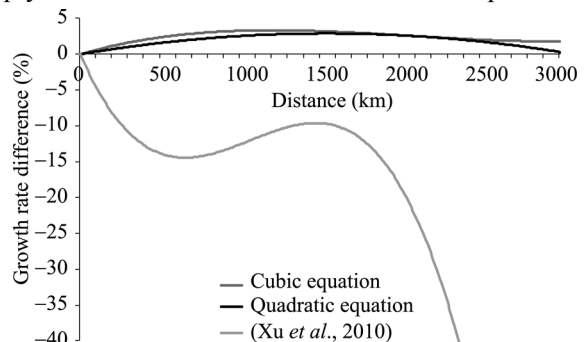


**Figure 5** Estimation results of the economic impacts of national node strategies

Based on the estimation results, it is possible to plot the relationship between regional economic growth rate and distance to an NNS city (see Figure 5). The results show the following: (1) After several years or decades of rapid development and expanding roles, node strategy cities are no longer centers of economic growth. On the contrary, after controlling other factors that affect regional economic growth, the economic growth rate differential of cities where

NNS are located is positive. In other words, cities where NNS are located have become one of the city types with the slowest economic growth. (2) Areas around cities where NNS are located are gradually entering a stage of economic adjustment. As the distance to a node strategy city increases, the economic growth rate does not decrease, but continues to increase. The rational explanation for this is that the level of urban economic development around node strategy cities is already generally high, most of them having already gone through a stage of rapid extensive growth and entered the stage of structural adjustments and stable growth. From another point of view, it could be said that the impact of NNS on regional economic growth is expanding. (3) The area of influence of NNS on regional economic growth has extended to approximately 1200–1500 km, a distance that covers the entire central region of China, which has been the fastest growing region in recent years. Within this distance, the closer a place is to a node strategy city, the higher its economic development level is, the greater the pressure for economic restructuring gets and the slower its economy grows. Beyond this distance, however, the effect of NNS on economic growth gradually weakens and economic development gets slower and slower.

If the results of this paper are compared with those of the study by Xu *et al.* (2010), which used data from the 1990s and early 21st century, one can see that they are really quite different (see Figure 6). Because the data and methods of the two papers are similar, their different results cannot be due to model specifications, and there must be a consistent theoretical explanation behind it instead. It is simply due to different results from different periods. There is a typical stage during which NNS have an impact on regional economic development. One can appreciate the very different results from this perspective. (1) In the initial stage of a strategy's implementation, institutional innovation and inputs of national resources have an important stimulating effect on the growth of node strategy cities and on surrounding areas in the economic take-off stage; as such, the

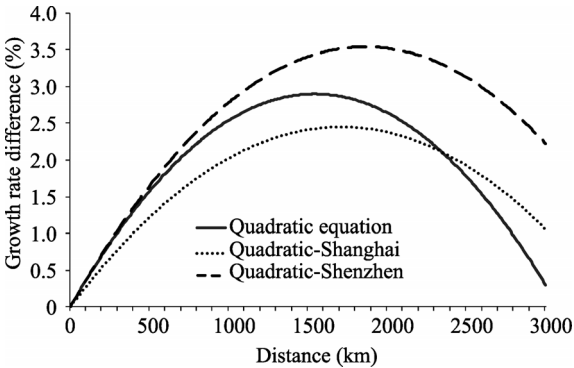


**Figure 6** Comparison of the estimation results of this paper with the previous study

economic growth rate of node strategy cities and surrounding cities is higher than other regions. Moreover, this difference in the speed of economic growth is huge. In the model-fitting results of Xu *et al.*, the economic growth of cities where NNS are located is 14–15 percentage points higher than cities 600 km away, which although incredible is understandable given the circumstances at the time. (2) In the initial period of the implementation of NNS, their impact on regional economic growth declined rapidly because this ultra-rapid economic growth was heavily dependent on institutional innovations and resource inputs attached to NNS, and the spatial diffusion of these elements did not happen very quickly, which meant their scope was limited. Following several decades of development, the impact of NNS on regional economic development has already changed from simply promoting growth to promoting deeper transformation and upgrading. Indeed, the economic growth rate of urban agglomerations, and even larger areas, where node strategy cities are located is far lower than the national average. It is no longer a way of achieving a short-term economic take-off, but a way of achieving long-term cumulative and gradual structural adjustments. As such, compared with the initial stage of implementation of a strategy, the effect is broader, reaching more than 1000 km, but the intensity of the effect is weaker, with economic growth generally 2–3 percentage points lower than elsewhere.

This study also separately examined the effects of three NNS on regional economic growth. As with the results of the comprehensive effect model, the cubic component is not significant, so a quadratic equation was used. However, because of the limited implementation period of the strategy, which means that the impact of the Tianjin Binhai New Area on regional economic growth would not be significant, Figure 7 only compares the impacts of the Shenzhen Special Economic Zone and Shanghai Pudong New Area NNS, which were implemented earlier. The results show that the spatial influence of the NNS is consistent, but with differing intensities. Economic growth of cities surrounding the earlier strategy of the Shenzhen Special Economic Zone is slower. This echoes the recent high-intensity economic structural adjustment policies of the Pearl River Delta and other areas, which reflect the fact that the influence of NNS on regional economic growth is entering a new stage. This situation is similar in the Yangtze River

Delta, but because the strategy has only recently been implemented, it is far less intense than the Pearl River Delta. In the foreseeable future, it will be difficult to maintain rapid economic growth in the Yangtze River Delta, with structural adjustment becoming a core issue that the region must face up to, along with a corresponding sustained lower rate of economic growth. As a result, the trend of higher economic growth retreating further into China's interior will continue to strengthen in the long-term.



**Figure 7** Comparison of the economic impacts of the Shenzhen Special Economic Zone and Pudong New Area

## 5 Conclusions and discussion

Since the policy of reform and opening up was introduced in 1978, China's regional development policies have gone through three stages, namely the exploration stage led by Special Economic Zones (1979–1990), the expansion stage dominated by Economic Development Zones (1991–2005) and the optimization stage featuring State-level New Areas and National Comprehensive Reform Pilot Areas (2006–present). Pilot reforms implemented through key nodes have played an important exemplary and leading role in the evolution of regional policies in China and promoted the rapid evolution of China's regional development policies from localized to widespread implementation. At the same time, the government has gone from being a facilitator of regional development to a promoter of regional coordinated development, from being an institutional innovator to a policy promoter and from being an institutional designer to a passive implementer.

In this paper, strategies involving pilot reforms implemented through key nodes have been referred to as national node strategies (NNS). NNS are typical topics in economic geography in studies concerning the construction of regional spatial organizational forms and spatial intervention, as well as innovative applications and developments of growth pole theory in transitional China. From an analysis of their basic characteristics, it is evident that NNS are engines and important policy-style growth poles of regional development, as well as important conduits of institutional innovations in the transitional era. In terms of their mode of action, positive coupling interactions occur between NNS regions and regional development, forming a graded regional development model of “NNS regions, central cities, urban agglomerations and greater regions.”

Empirical research shows that the Shenzhen Special Economic Zone, Shanghai Pudong New Area and Tianjin Binhai New Area have had profound and sustained impacts on China's regional economic pattern in different periods of post-reform China. During the initial period of the implementation of NNS, State-led economic and resource investments as well as institutional innovations, including a series of preferential policies, effectively facilitated the rapid growth of economies of NNS cities and their surrounding areas. Nevertheless, although the effects were considerable, their spatial scope was limited, leading to high concentrations of national economic growth centers around NNS regions. As preferential policies have weakened and State investment has fallen, cities where NNS are located have gradually entered a stage of sustained stable growth as well as optimization and upgrading of their economic structures. This is gradually spreading to surrounding areas, along with a corresponding spread in lower economic growth rates, the impact of which is slow and low-intensity but occurring over a vast space. The inevitable result of this is the concentration of rapid economic growth in China's interior regions. Analysis at the national level shows that the trend of higher economic growth retreating further into China's interior is an inevitable outcome of the long-term implementation of NNS and is being accompanied by economic structural adjustments and upgrading of areas surrounding node strategy cities. Moreover, the latter are displaying typical characteristics of spatial diffusion and will become core forces affecting the next stage of China's regional economic development pattern. It is also worth pointing out that results at the national scale do not necessarily apply at a regional or local scale, just as results from an analysis of prefecture-level cities cannot be compa-

red to those from an analysis of county-level cities. Results from analyses of different times, samples and spatial scales may be very different, and comprehensive analysis of these results is the way to analyze spatial effects. In future, further analysis is needed of the spatial effects of NNS at urban and regional scales in order to obtain a more detailed picture of the reality.

## References

- Angotti T, 2001. Ciudad Guayana: From growth pole to metropolis, central planning to participation. *Journal of Planning Education and Research*, 20(3): 329–338.
- Bach D, Newman A L, Weber S, 2006. The international implications of China's fledgling regulatory state: From product maker to rule maker. *New Political Economy*, 11(4): 499–518.
- Das D K, 1996. *Emerging Growth Pole: The Asia-Pacific Economy*. Prentice Hall.
- Démurger S, Sachs J D, Woo W T *et al.*, 2002. Geography, economic policy, and regional development in China. *Asian Economic Papers*, 1(1): 146–197.
- Ding S, 1989. Growth pole and economic development in undeveloped region: Taking the southern region of Italy. *Economic Geography*, 9(4): 297–301. (in Chinese)
- Dobkins L H, Ioannides Y M, 2000. Dynamic evolution of the US city size distribution. In: *The Economics of Cities* (217–260). Cambridge: Cambridge University Press. (Reprinted)
- Fan J, Cao Z, Zhang W *et al.*, 2001. The consideration of strategic innovation of west development based on theories of economic geography. *Acta Geographica Sinica*, 56(6): 711–721. (in Chinese)
- Fujita M, Krugman P, Mori T, 1999. On the evolution of hierarchical urban systems. *European Economic Review*, 43(2): 209–251.
- Fujita M, Mori T, 1997. Structural stability and evolution of urban systems. *Regional Science and Urban Economics*, 27(4/5): 399–442.
- Goldstein S M, 1995. China in transition: The political foundations of incremental reform. *The China Quarterly*, 144: 1105–1131.
- Hanson G H, 2001. Scale economies and the geographic concentration of industry. *Journal of Economic Geography*, 1(3): 255–276.
- Hao S, 2008. *Study on National Integrated Support Reform Support Pilot Area*. Beijing: Science Press. (in Chinese)
- Jin F, 2013. *Study on Organization Mechanism of Function Space and Space Welfare*. Beijing: Science Press. (in Chinese)
- Ke S, Feser E, 2010. Count on the growth pole strategy for regional economic growth? Spread–Backwash effects in Greater Central China. *Regional Studies*, 44(9): 1131–1147.
- Krugman P, 1991. Increasing returns and economic geography. *Journal of Political Geography*, 99: 483–499.
- Li X, 2012. The diamond structure: On the evolution of the national spatial strategy. *Urban Planning Forum*, 200(2): 1–8. (in Chinese)
- Liu N, Liu X, Zhao L, 2008. Evolution of regional development and spatial structure in China. *Journal of Finance and Economics*, 34(11): 76–87. (in Chinese)
- Lu D, 2003. *Theory and Practice of Regional Development in China*. Beijing: Science Press. (in Chinese)
- Lu D, Liu W, 2000. Analysis of geo-factors behind regional development and regional policy in China. *Scientia Geographica Sinica*, 20(6): 487–493. (in Chinese)
- Lu D, Liu Y, Fan J, 1999. The regional policy effects and regional development states in China. *Acta Geographica Sinica*, 54(6): 496–508. (in Chinese)
- McMillan J, Naughton B, 1992. How to reform a planned economy: Lessons from China. *Oxford Review of Economic Policy*, 8(1): 130–143.
- Meng G, Wang H, Yang S, 2015. Study on evolution and dynamic mechanism of Tianjin pilot free trade zone. *Acta Geographica Sinica*, 70(10): 1552–1565. (in Chinese)
- Naughton B, 2011. China's economic policy today: The new state activism. *Eurasian Geography and Economics*,



- 52(3): 313–329.
- Nee V, Oppen S, 2010. Political capital in a market economy. *Social Forces*, 88(5): 2105–2132.
- Parr J B, 1999a. Growth-pole strategies in regional economic planning: A retrospective view: Part 2. Implementation and outcome. *Urban Studies*, 36(8): 1247–1268.
- Parr J B, 1999b. Growth-pole Strategies in Regional Economic Planning: A retrospective view: Part 1. Origins and advocacy. *Urban Studies*, 36(7): 1195–1215.
- Partridge M D, Rickman D S, Ali K *et al.*, 2009. Do new economic geography agglomeration shadows underlie current population dynamics across the urban hierarchy? *Papers in Regional Science*, 88(2): 445–466.
- Peng X, Liu J, 2014. Grand strategy, large platform and remarkable accomplishments: The role of national new districts in West China to the new-type urbanization. *City Planning Review*, S2: 20–26. (in Chinese)
- Peng J, Wei H, Li G *et al.*, 2015. Research on location accessibility of national new areas based on urban agglomerations. *Geographical Research*, 34(1): 3–14. (in Chinese)
- Qi Y, Yang Y, Jin F, 2013. China's economic development stage and its spatio-temporal evolution: A prefectural-level analysis. *Acta Geographica Sinica*, 68(4): 517–531. (in Chinese)
- Thomas M D, 1975. Growth pole theory, technological change, and regional economic growth. *Papers in Regional Science*, 34(1): 3–25.
- Walder A G, 1995. China's transitional economy: interpreting its significance. *The China Quarterly*, 144: 963–979.
- Wang H, 2007. The NSDZs-LED urban sprawl in Xi'an: A non-typical suburbanization? *China Soft Science*, (10): 93–103. (in Chinese)
- Wei H, 2011. Evaluation and Prospects of Regional Policy in China. Beijing: Economy & Management Publishing House. (in Chinese)
- Wu H, Yang Z, 2015. Study on the national strategic space evolution basing on the analysis of the national new area strategy. *Urban Development Studies*, 22(3): 1–11. (in Chinese)
- Xu Z, Chen Z, Lu M, 2010. The core-periphery model of urban system in China. *The Journal of World Economy*, (7): 144–160. (in Chinese)
- Yang D, 1990. Patterns of China's regional development strategy. *The China Quarterly*, 122: 230–257. (in Chinese)
- Yang J, Hu X, 2007. The comprehensive reform based on the comparative study on Shanghai, Tianjin and Shenzhen. *Shanghai Journal of Economics*, (3): 3–12. (in Chinese)
- Zhang K, 2010. Regional Strategies and Regional Development in China. Beijing: China Development Press. (in Chinese)
- Zhang X, Lu D, 2002. Land use in the development areas and its interactive relationship with regional development. *Resources Science*, 24(5): 32–38. (in Chinese)
- Zheng G, 2007. Research on the driving effect of economic and technological development zone on region. *Areal Research and Development*, 26(2): 20–25. (in Chinese)
- Zhou S, Gong L, 2000. The effect of unbalanced theories applied in the Yangtze Delta. *Economic Geography*, 20(4): 1–6. (in Chinese)