Infrastructure, Knowledge and Economic Growth in China: 1953–2004

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Abstract

This paper evaluates the economic development of China using the New Economic Geography (NEG) as a framework of analysis. The NEG addresses the formation of agglomeration economies accruing to physical linkages in one location leading to the formation of a core-periphery pattern between the regions of a country. However, the NEG cannot account for the role of knowledge creation linkages which are location independent in the formation of the core-periphery pattern. The main findings of this paper are that the formation of the core-periphery pattern predicted by the NEG depends upon government economic and development policy at a point in time. Furthermore, while the NEG does not allow for knowledge creation to be involved in the formation of the core-periphery pattern, this paper shows that once the core-periphery pattern is formed, the knowledge creation process sustains it. This paper also supports the hypothesis that investment in infrastructure and fixed assets, which has been concentrated in China due to the nature of the Special Economic Zones in the Coastal regions, and the interdependence between different types of infrastructure leads to the formation of the core-periphery pattern.

Keywords: Income disparity, Infrastructure, Knowledge Creation, China

JEL classification: O18, O53, P21

1. Introduction

This paper establishes that the New Economic Geography does not account for the role of time and knowledge in the formation of the core-periphery pattern by examining the economic development of China. This is done on the basis of comparing the infrastructure and knowledge creation attributes in three provinces. These three provinces include a Coastal province (Jiangsu), a Central Province (Hubei) and a Western province (Gansu). The location of the provinces in China can be seen from Figure 1, below. The reason for choosing a Coastal province, a Central province and a Western province is to illustrate core-periphery pattern formation in China following the post 1978 economic reforms.

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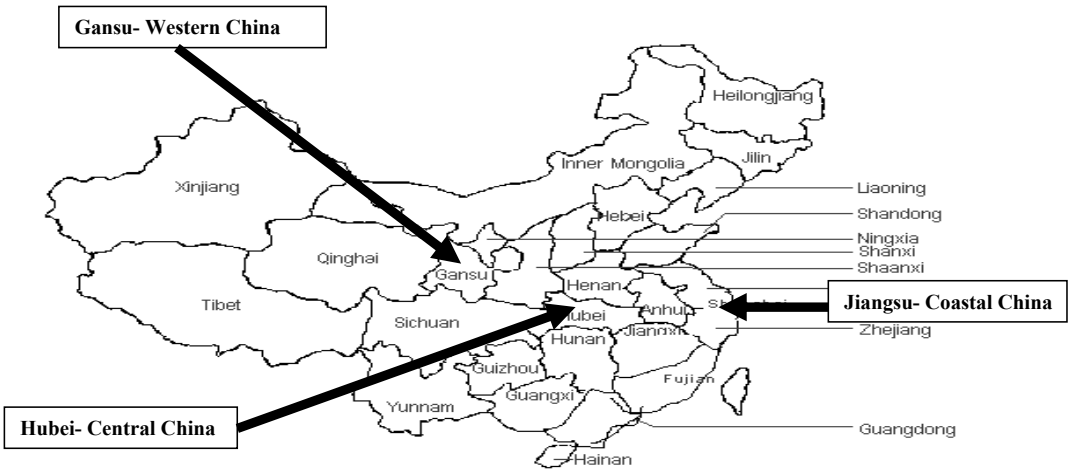
The core-periphery pattern in China has not been the same over the last 62 years and has evolved and metamorphosed over time depending on government policy. Currently, the Coastal region of China is generally regarded as the most developed region or core region of the country while the Central region is regarded as the next best developed region. The Western region is the least developed region of the country. In a wider context, the Central and Western regions of China can be considered to be the periphery. The period 1953-2004 has been specifically chosen to avoid the period in the run up to the Global Credit Crunch of 2008.

Figure 1: Map of China



Source: http://www.maps-of-china.net/chinamaps/enmap.html

Investment in different types of infrastructure is only one way in which rising rural-urban income disparities can be reduced. The rising rural-urban income disparities have been a feature which has characterised China's post-1978 reform years. However, there are a number of other ways of reducing the rural-urban income disparities. Firstly, increased investment in agriculture, agriculture is the key externality-generating sector of the

Chinese rural economy (Ravallion, 2002). Secondly, the development of non-farm enterprises and investment in town and village enterprises and local village co-operatives. Thirdly, the out migration from rural areas. The National Population Development Strategy Research Report released in January 2007 by the government stated that there were 150 million surplus rural labourers (Kwan, 2007). This represents a fall of 25 million workers from 1997 when the number of surplus rural workers represented an unemployment rate of 34.8% (Beijing Review, 1997). An uncontrolled move from rural to urban areas will cause serious political instability as continuing regional income disparities will also inevitably do so. In any event, it is likely that the urban industrial sector has already absorbed much surplus rural labour. Finally, an increased investment in the so-called knowledge

infrastructure (telephones, computers, networks, schools, universities, research institutes and libraries) in rural areas will increase knowledge linkages in the Chinese economy and aid in the formation of a national innovation System. This paper will only consider the impact of investment in infrastructure on China's economic growth from 1953 to 2004.

In contrast with other studies in the literature regarding the economic role of infrastructure this paper departs from using an econometric methodology. The purpose of this paper is not to quantify the impacts of infrastructure and spatial spillovers but to highlight the main features of development in specific regions of China. The case study methodology is often able to highlight features of economic growth which cannot be fully accounted for by multiple regression analysis. Multiple regression analysis usually involves running regressions of GDP against variables such as length of roads, telephone density and length of paved roads. However, in the case of China such an analysis would produce meaningless results because China's economic growth has been based on Special Economic Zones (SEZ's) and High Technology Development Zones (HTDZ's) in the coastal regions of the country. The first SEZ's were established in Shenzhen, Zhuhai, Shantou and Xiamen in 1980. Due to the continued state funding of the SEZ's and the failure of the SEZ's to attract substantial foreign investment further action was needed (Tracy, 1997). The action which resulted was the opening of 14 coastal cities to foreign investment. SEZ's were also established on Hainan Island and Shanghai Pudong SEZ in 1988 and 1990 respectively. Fifty percent of the SEZ's are located in Guangdong province which is on the coast and very close to established centres of commerce such as Hong Kong, Macao and Taiwan. The planning slogan for the SEZ's was 'seven linkages and one levelling', Kwok (1986). The seven linkages included the state provisioning of drainage, communications, sewage, storm drainage, land, electricity, water and gas while the formation of land was the one levelling, Kwok (1986). Furthermore, in order to connect the SEZ's to international markets the state also had to heavily invest in reservoirs, local transport networks, airports and ports. The post 1978 economic development strategy was based on a concentration in different types of infrastructure investment while the pre-1978 economic development strategy had been based on investment in extensive railway networks in the interior of the country to support the needs of heavy industry.

Regression analysis would produce misleading results with regards to the determinants of economic growth in China because infrastructure development in the SEZ's, the main centres of China's post 1978 economic growth, had been based on the seven linkages and the one levelling. This is contrast to networks of railways and railroads which are normally studied by econometricians in order to establish a link between infrastructure and economic growth using different proxies for infrastructure (Straub, 2008). Multiple regression analysis also has a tendency to oversimplify economic growth due to the constraints on the number of variables which can be modelled due to problems associated with multicollinearity, heteroskedasticity and autocorrelation. Economic growth is not only based on factors such as the length of roads or railways but on a more complex interplay between a diverse range of infrastructure not all of which can be quantified on a uniform basis for the purposes of multiple regression analysis. This is because different types of infrastructure have different

functions, all of which are needed to happen at the same time in order to facilitate economic activity.

2. The New Economic Geography

Krugman (1991) suggests how countries become differentiated into an agricultural periphery region and a manufacturing core region by mechanisms which are internal to the country. In this case Krugman (1991) suggests that in order to maximise scale economies and minimise transportation costs, manufacturing will tend to concentrate in regions of countries where demand will be higher.

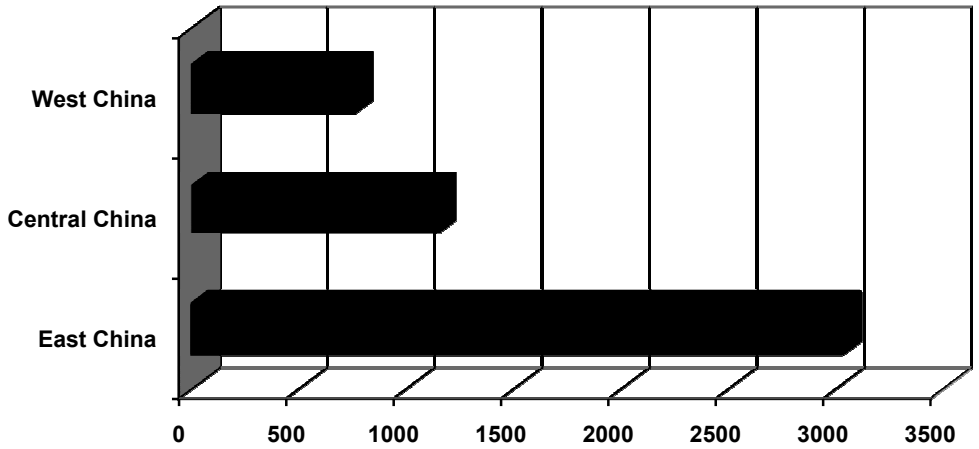
China embarked on economic reforms in 1978. The effect of these reforms is as predicted by the NEG with manufacturing activities concentrating in the Coastal region. The interior (Central and Western regions) of the country in contrast, remained agricultural on the whole. Over time China's Coastal region became its core, while the interior became the periphery in the post-reform period. Krugman (1991) also suggests that the development of a core-periphery pattern will depend on the levels of transportation costs, the level of the contribution of manufacturing to national income and the level of scale economies which can be achieved. However, Krugman (1991) does not provide a comprehensive analytical framework which can be used to evaluate economic development in a country. This is due to the fact that ***time, knowledge*** and ***non-transport infrastructures*** have no role in economic development within the context of the New Economic Geography. But, according to Krugman (1991) manufacturing tends to concentrate in regions of countries where demand is high, transportation costs are low and economies of scale are high. Nevertheless, he does not identify that it is the various types of infrastructure which actually give rise to increasing economies of scale. It is clearly evident that different types of infrastructure facilitate different levels of economic activity and differing speeds of knowledge diffusion. Moreover, a combination of different types of infrastructure in one place may lead to location specific economies of scale. On the other hand infrastructure may also give rise to location unspecific economies of scale depending on the type of infrastructure. For example, location specific infrastructure, such as roads and bridges will give rise to location specific economies of scale and increase productivity at that location. However, infrastructure which is location unspecific such as the telephone and the Internet will give rise to economies of scale and spillover effects over great distances. This will lead to a greater division of labour, substantially increased productivity and lower costs. Location unspecific infrastructure would tend to reduce the differentiation of regions based on the agricultural periphery and the manufacturing core. It is the stratification of regions of countries into the agricultural periphery and manufacturing core which gives rise to disparities in income. In this case the endogenous convergence of technologies should play a much more significant role in the reduction of income disparities between the regions of a country. In this case it is necessary to distinguish between the creation of knowledge and the application of knowledge. The common factor to the creation of knowledge and the application of knowledge is government policy.

3. Poverty and Development Policy

The period under evaluation is 1953-2004 but political crises such as the Great Leap Forward and the Cultural Revolution, three programs will not be considered. However, the 'Third Front', the Post-1978 economic reforms and the Western Development Program (WDP) are more relevant in the formation of the core-periphery pattern.

The size of China has made the formulation of a national development policy, which would bring prosperity to the whole country, very difficult. Therefore, it was decided that the Coastal regions of China would spearhead economic growth by focusing on export-oriented industries and foreign trade (Fan, 1995). It was hoped by government planners that the resulting economic prosperity of these Coastal regions would 'diffuse' to the whole country. This idea was suggested by Deng Xiaoping when he stated 'Let some prosper, so that others may follow' (Veeck, 1991). However, this belief was mistaken because the prosperity of the Coastal regions would diffuse to China's interior hinterland only if government policy facilitated it. In this case without government action the prosperity of the Coastal regions generated through the designation of SEZ's, creation of open Coastal cities and the creation of the open delta regions has not effectively diffused to the Central and Western regions of China as anticipated by the architects of China's reforms. Therefore, the stated policy of the post 2003 leadership of China is to reduce rural poverty by the urbanisation of developed regions of the country.

Figure 2: Domestic Patents (Invention) Granted By Region 2005



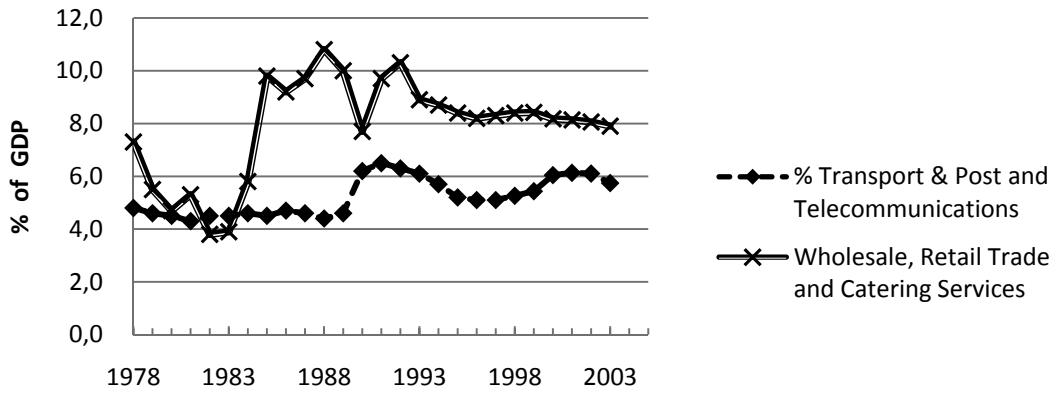
Source: China Statistical Yearbook 2005

The concept of urbanisation was an implicit component of the 2001-2005 Tenth Five Year Plan which encouraged the formation of small towns and cities (Li and Piachaud, 2004). Urbanisation was the strategy embraced by China's central planners to reduce disparities in income between regions. Increased urbanisation in formerly rural areas would

facilitate economic growth due to increased economic activity and give local people a motive for investing in the local economy (Ravallion and Jalan, 1999).

The central theme of this paper is that the market reforms of the post 1978 period have created the income disparities between the interior and the Coastal regions of China. However, it is the creation, transfer and the commercialisation of this knowledge which is sustaining these income disparities. This can be clearly seen from Figure 2 which shows that in the Coastal and the developed regions such as Guangdong, Zhejiang, Shanghai, Shenzhen, Jiangsu, Beijing and Shandong the knowledge creation process (as measured by the number of patents issued) is more pronounced than in Central provinces such as Hunan, Hubei and Henan. Similarly, the knowledge creation process in the Central provinces is more pronounced than the knowledge creation process in the Western provinces of China such as Tibet, Yunnan and Sichuan. While it is difficult to evaluate the overall contribution of the knowledge creation process to GDP, especially because of the difficulties associated with measuring spillover effects, Figure 3 shows that the contribution of infrastructure (Transport & Post and telecommunications) and trade and catering (including Wholesale and Retail Trade) to GDP for the period 1978 – 2004 is consistently below 6%. This would suggest that even in the reform years infrastructure contributed little to overall economic growth.

Figure 3: Infrastructure Contribution to GDP as a Proportion of GDP (1978 – 2004)



Source: China Statistical Yearbook 2004, Table 3.2
Note: GDP calculated in current prices

The experience of economic growth in Southern China, the Pearl River Delta area, illustrates the impact of focused infrastructure investment in the SEZ's and HTDZ's on China's economic growth. However, the precise nature of the linkage between road infrastructure development and economic growth is unclear. Nevertheless, studies indicate that the building of roads is a necessary but not sufficient condition for economic growth (Lin, 1999). The expansion of port facilities and improvements in the road network has reduced travel time in the region and this has enabled the efficient 'flow of human and capital resources in all directions' (Chan, 1996). In this case, Panyu in the Pearl River

Delta is an example of a region where heavy investment in transport infrastructure has led directly to substantial and prolonged economic growth (Lin, 1999). Two transport infrastructure projects which contributed to the opening up of Panyu, to the metropolitan area of Guangzhou, included the building of the Ruoxi Bridge, the Humen Ferry and Humen Bridge. It can be intuitively suggested that without transport infrastructure investment there would be very little inflow of foreign investment.

The 'Third Front' program, which was implemented from the mid 1960's to the mid 1970's, can be interpretated not only as ensuring China's productive capacity remained independent of the Coastal regions during a time of war but also has an extension of Mao's philosophy that there should be even economic development across all of China. This can be broadly interpretated as suggesting that 'to each according to their need' (Veeck, 1991). During the 'Third Front' program the dispersion of Coastal industries into the interior consolidated and stimulated the process of urbanisation of Sichuan. This was due to the fact that much industrial activity was located along railway routes .Consequently, a growing population and an abundant supply of labour led to 'the emergence of new towns and industrial centres' (Chan, 1996). Naughton (1988) points out that the 'Third Front' program was ineffective and led to the inefficient use of physical and human capital prior to the pre-reform periods. As a result of the 'Third Front' program productive capacity was located at a distance from centres of urbanisation as well as markets for the produced goods. The inland drier climate often meant that productive capital assets literally rusted away. A lack of infrastructure meant that qualified maintenance personnel could not be easily moved to where they were needed. In contrast, a Coastal locality such as the Pearl River Delta (PRD) enjoys superior factor mobility because it has better infrastructure than a Western region such as Yunnan Province. Furthermore, private and State Owned Enterprises in the PRD have greater access to trade because the PRD's Coastal location gets them closer to international markets. Transport costs from the Coastal region to overseas markets are low. Efficiently functioning and connected factor markets, which offer employment opportunities, will allow individuals to improve their initial factor endowments by working and acquiring skills. Indeed, connecting markets in different regions will reduce the urban-rural income gap and can be achieved by investing in infrastructure and linking the Coastal regions to the interior regions of China.

Recent research suggests that the urban-rural income differential is the main cause of wide spread income disparity amongst China's regions (Chang, 2002). If the economic prosperity of the Coastal region is excluded then the rural-urban income divide can be explained by the fact that those working for state owned enterprises and / or living in urban centres receive benefits like subsidised housing, heating and education for their children. However, those living in the rural sector are dependent on the size of the annual harvest for their income. The annual harvest varies from year to year depending on weather conditions. The urban-rural income gap caused by fluctuations in the size of the annual harvest can be eliminated by 'absorbing all rural surplus labour to the modern sector', Chang (2002). Nevertheless, according to Brandt (1999) if one region has different endowments from another and assuming fixed prices this will explain the income inequality that arises

'between and within localities'. Furthermore, market imperfection in factor markets may increase income inequality, as the least endowed will have the lowest shadow prices.

In response to the rising disparities in income between China's Coastal region and the interior hinterland the WDP was initiated in 1999. At the heart of this program is investment in infrastructure in ten Western provinces and two other provinces. A significant amount of the infrastructure investment was associated with irrigation, communication, transportation and energy, Lai (2002). The WDP may go a long way to address the imbalance in investment in infrastructure between the interior and Coastal provinces of China since 1978. This is because the WDP may facilitate the movement of natural resources, goods and people from the interior to the coast. It may also act as a force which acts to integrate the fragmented national Chinese economy. However, the WDP is not seen as a program specifically designed to integrate the Coastal, Western and Central regions of China.

4. Case Study: Propositions, Data and Criteria

The foundation of case study research methodology is based on propositions, data and criteria, Yin (2003). For the purposes of the case study five propositions were put forward with each proposition having associated data and criteria. The variables to be analysed are aggregated within the following major headings of infrastructure, manufacturing, Science & Technology (S&T) Research Parks, education and the indicators of knowledge creation. When the results of the case study are interpretated there are two guidelines which need to be considered. Firstly, the accuracy of the data needs to be considered. Secondly, the availability of consistent and comparable data for each province over different time periods needs to be considered. This case study is based on five propositions:

a) ***Proposition 1:*** states that knowledge creation has sustained income disparities between the Coastal regions of China and the interior hinterland since the post 1978 economic reforms. The framework of the NEG relies on transport infrastructure, as opposed to the seven linkages and one levelling, due to the importance of transport costs for the formation of a core-periphery pattern. However, this proposition suggests that the knowledge creation process sustains disparities in income between regions once the core-periphery pattern has formed. This is not acknowledged by the NEG framework.

   Data: education and patent registration

   Criteria: university graduates, R&D expenditure and patents registered.

b) ***Proposition 2:*** states that infrastructure simulates the effects of urbanisation by increasing the geographical and population densities of space by facilitating the mobility of people and resources. This proposition suggests that transport infrastructure such as roads and railways are responsible for the formation of the NEG's core-periphery pattern.

   Data: transport infrastructure

   Criteria: freight traffic, passenger traffic, highway and railroad length.

c) ***Proposition 3:*** states that investment in fixed assets leads to the specialisation of labour leading to the integration of fragmented local markets and market integration. This

proposition suggests a mechanism by which the NEG's core-periphery pattern forms due to the concentration of manufacturing activities within the core region.

Data: manufacturing output

Criteria: Imports, exports and gross input output value (GIOV).

d) ***Proposition 4:*** states that the NEG is inadequate in accounting for the role of knowledge creation in the core-periphery pattern formation because it does not account for the role of the micro-foundations of knowledge creation in the economy.

Data: Knowledge factors.

Criteria: Scientific Personnel, University enrolments, R&D expenditure, Internet domain names and websites.

e) ***Proposition 5:*** states that the speed with which knowledge is exchanged varies with the type of infrastructure. This proposition suggests that knowledge can be exchanged at different rates depending on the type of infrastructure. For example, the exchange of knowledge by telephone is almost instaneous and can occur over great distances. On the other hand the exchange of knowledge via transport infrastructure takes a longer time and occurs over smaller distances. The differing speeds of knowledge exchange according to type of infrastructure are not accounted for by the NEG. The type of knowledge transmitted may be tacit or explicit. However, the purpose of this proposition is not to distinguish between the types of knowledge which are exchanged but to assert that regions of China with more advanced communications infrastructure like the Internet will be more knowledge intensive that regions where there may only be the possibility of face to face knowledge exchange via transport infrastructure.

Data: Infrastructure

Criteria: Road transport to face to face transport and telecommunications and the internet.

In order to evaluate the effects of the post 1978 reforms from the perspective of the pre-reform years this case study will focus on the provinces of Jiangsu (Coastal), Hubei (Central) and Gansu (Western) as well as three political periods. The first period will cover the Maoist period from 1952-1977. The second period will cover Deng Xiaoping's 'Four Modernizations' (Agriculture, Industry, Science/Technology, and Defence) from 1978 – 1995. The third period will cover the projection of China's economic future period from 1996-2010. The latter period includes the WDP which began in 1999.

5. Results

A general profile of the main economic features for each province is shown in Table 1. Each economic feature is quantified by being represented as a percentage above the national one. This is assumed to be 100%. From Table 1 it can be clearly be seen that Jiangsu has more of each spatial feature compared to Hubei and Gansu except land area. Similarly, Hubei has more of each economic feature than Gansu except land area.

Table 1: Percentage Comparative Statistics 2005

Economic Feature	Jiangsu*	Hubei*	Gansu*
Area	1.10	1.90	4.73
Population	5.70	4.60	2
FDI	6.90	1.35	0.02
S&T Personnel	9.50	4.97	2.20
GDP	10.60	4.60	1.14
Exports	14.80	0.56	0.02
Imports	16.30	0.60	0.01
Domain Names Registered (excluding .edu)	6.20	2.10	0.30
WWW. Websites	7.70	2.20	0.40
GDP Per Capita	184	99	56
Population Density	536	239	42

Source: National Bureau of Statistics, China Statistical Yearbook 2005 & CNNIC, 16th Statistical Survey Report on the Internet Development in China

Note: *differences in percentage points above the national values

The percentage figures for Domain Names registered, WWW. Websites and Population Density are particularly revealing and relevant to the knowledge economy. Table 1 shows that Jiangsu has 4.1% more Domain names than Hubei and 5.9% more than Gansu. With regards to the number of WWW websites, Jiangsu 5.5% more than Hubei and 7.3% more than Gansu. In terms of Population Density, Jiangsu is 297% more densely populated than Hubei; and 494% more densely populated than Gansu. With regards to the indicators of manufacturing such as exports and imports, the figures suggest even more disparity between Jiangsu, Hubei and Gansu. Clearly, the post 1978 economic reforms have had a self-sustaining effect on the economic growth and prosperity of the Coastal provinces. The spatial characteristics of the three provinces can be divided into four categories which includes infrastructure, administrative, economic and geographical. Table 2 details these features and such categorisation helps to establish which province has more or less of one spatial feature than another.

Table 2: Provincial Spatial Features 2004

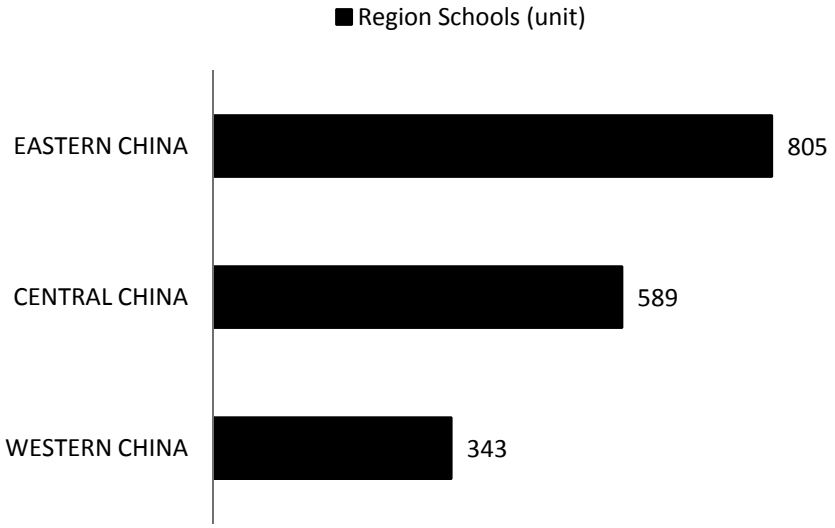
Infrastructure	Administrative	Economic	Geographical
Railway Length	Regions	Highway Freight	Length of Coastline
Highway Length	Districts	Waterway Freight	Cultivated Land
Navigable Inland Waterway Length		Urban Population	
		Rural Population	
		Post & Telecommunications Business Volume	
		Vehicles Owned	
		Highway Passenger Traffic	
		Waterway Passenger Traffic	
		Railway Freight Traffic	

Source: National Bureau of Statistics, China Compendium of Statistics 1949-2004
Note: Compiled by Author from Table 1, 4, 5 and 6

The features in Table 2 which are in bold italic font are those for which Hubei province has greater capacity than either Jiangsu or Gansu. The features in non-bold italic font are those for which Jiangsu has greater capacity than either Hubei or Gansu. In can be clearly determined from Table 2 that Hubei province has greater transport infrastructure capacity with regards to railways, highways and navigable inland waterways. However, the only economic features which Hubei has greater capacity than Jiangsu are waterway passenger traffic and railway freight traffic. The fact that Jiangsu has greater highway passenger traffic may be explained by the fact that Jiangsu has a greater preponderance for car ownership. With regards to Gansu, the only feature it has which is larger than any of Hubei's features is administrative in nature and relates to the number of regions at county level. However, Gansu is superseded by Jiangsu which has a larger number of regions at county level. It can now be established that Hubei acts as the province through which resources are transported from the interior of China to its coastal provinces where manufacturing predominantly takes place. The polarisation effect of the concentration of manufacturing in a region on

knowledge can be established using Figure 4. The latter shows that the number of regular institutions of higher education is highest in Eastern (or Coastal) China and is followed by Central China and Western China. Some other key spatial distinctions can also be discerned from the data. Firstly, the number of S&T personnel, Internet usage and population density decreases moving from Coastal to Western China. Secondly, government grants and bank loans as sources of funding for innovation increases moving from West to East (NBSC, 2006). Thirdly, Hubei has the largest capacity compared to other provinces with regards to length of railway, highway and navigable inland waterway. Finally, in contrast to Jiangsu, Hubei has the largest number of waterway passengers and railway freight traffic carried.

Figure 4: Regular Institutions of Higher Education by Region 2004

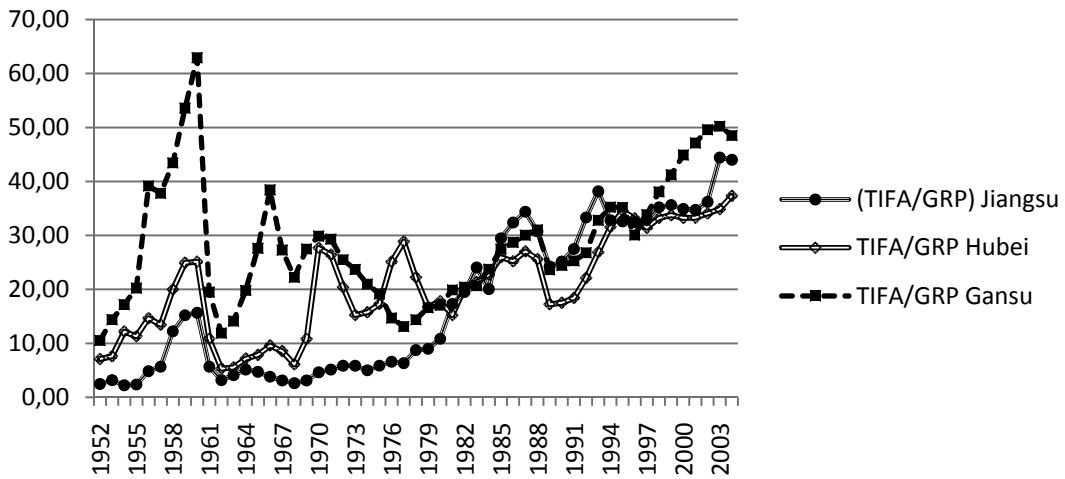


Source: China Statistical Yearbook 2004, Chapter 21, Table 21.25, National Bureau of Statistics

The implications of Proposition 1 are twofold. Firstly, there has been a 'brain drain' from China's interior region to its Coastal regions. Secondly, the increased prosperity of the Coastal regions, typified by Jiangsu, has given these regions increased resources to invest in the education system. In this case, due to the decentralisation of funding for education the Coastal provinces have been better able fund provincial education than the interior provinces have been able to. Proposition 4 suggests that the framework of the NEG cannot account for the individual factors needed for knowledge creation in China. Moreover, Proposition 5 suggests that the NEG also cannot explain the fact that different types of infrastructure allow for knowledge to be exchanged at different rates. Propositions 2 and 3 are justifiable on the

grounds that the economic growth of the Coastal region has made a bigger contribution to China's economic growth in the reform years. Furthermore, exports from Jiangsu province have been greater than the exports from either Hubei or Gansu provinces in the post-reform years. The prominent increases in exports from China's Coastal regions in the post-reform years are matched by the increases in TIFA. Figure 5 shows that after 1980 adjusted TIFA in Jiangsu overtook that in Hubei or Gansu. However, after 1995 this trend reversed. The trend in adjusted TIFA after 1980 maybe due to investment in SEZ's and high technology development zones. These were located in the Coastal regions. The reversal in the trend of adjusted TIFA after 1995 may be due to the impact of the Western Development Program. However, the adjusted GIOV of Jiangsu began to diverge from Hubei and Gansu in 1972, the divergence becoming greater after 1980. This may be accounted for by the emergence of primordial TVE's in the early 1970's; and the start of economic reforms after 1978.With regards to Proposition 4, it is apparent that knowledge creation seems to be more significant in the Coastal regions due to the regions larger number of Science & Technology personnel as well as the larger number of patents registered in that region.

Figure 5: Adjusted Total Investments in Fixed Assets (TIFA) 1952-2004



Source: National Bureau of Statistics .China Compendium of Statistics 1949-2004
Note: Total Investment in Fixed Assets (TIFA) adjusted for inflation by dividing by the respective provincial Gross Regional Products (GRP)

Table 3: 1953-2004: Average Percentage Annual Growth of Knowledge Factors

Time Period	Province	Teachers Secondary Schools (%)	University Enrolments (%)	Telephone Subscribers (%)
1953-1976	**Jiangsu**	11.91	77.92	7.27
	Hubei	17.37	24.28	8
	Gansu	15.36	21.38	0
Time Period	**Province**	**Teachers Secondary Schools (%)**	**University Enrolments (%)**	**Telephone Subscribers (%)**
1979-1995	**Jiangsu**	1.98	6.83	25.59
	Hubei	0.21	6.92	25.47
	Gansu	2.422	6.69	17.89
Time Period	**Province**	**Teachers Secondary Schools (%)**	**University Enrolments (%)**	**Telephone Subscribers (%)**
1997-2004	**Jiangsu**	0.44	20.28	24.44
	Hubei	2.71	21.31	19.52
	Gansu	4.98	18.61	30.61

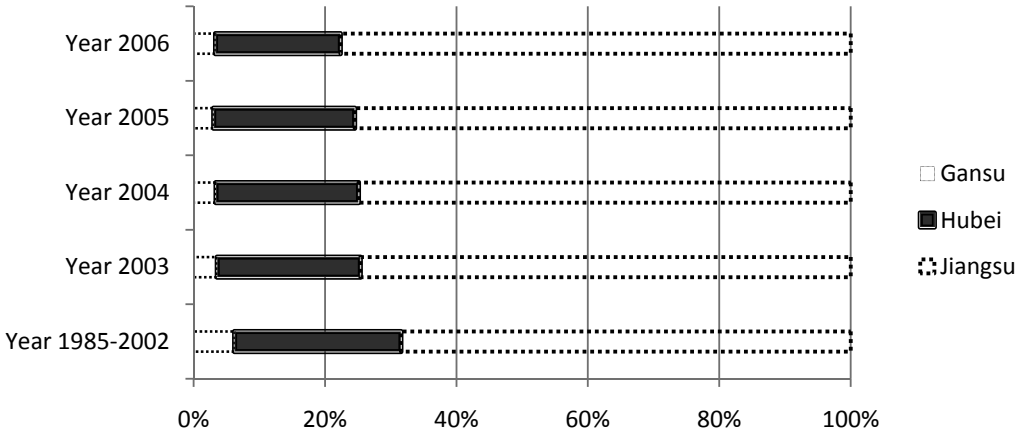
Source: National Bureau of Statistics, China Compendium of Statistics 1949-2004

Another noticeable feature in the Chinese economic landscape moving from east to west is the reliance on heavy industry and increase in natural resources.

6.1 Proposition 1

Other observable features moving from east to west are the increasing population diversity, differing geographical terrain and reduced population density. The overall impact must be a reduction in the effectiveness of education. In terms of the creation of knowledge it would seem that annual average increases in Teachers employed at Secondary Schools, University Enrolments and Telephone subscribers would play a significant role. Telephone subscribers have been included in the knowledge creation category because the use of the telephone facilitates the diffusion of knowledge and knowledge creation amongst the general population. Table 3 shows the average percentage change in Telephone Subscribers, University Enrolments and Teachers in Secondary Schools for the period 1953 to 2004. This period encompasses the pre-reform period 1953-1976 and the early reform period 1979-1995 and the late reform period of 1997-2004.

Figure 6: Distribution of Domestic Applications for Patents Received from 1985 to 2006

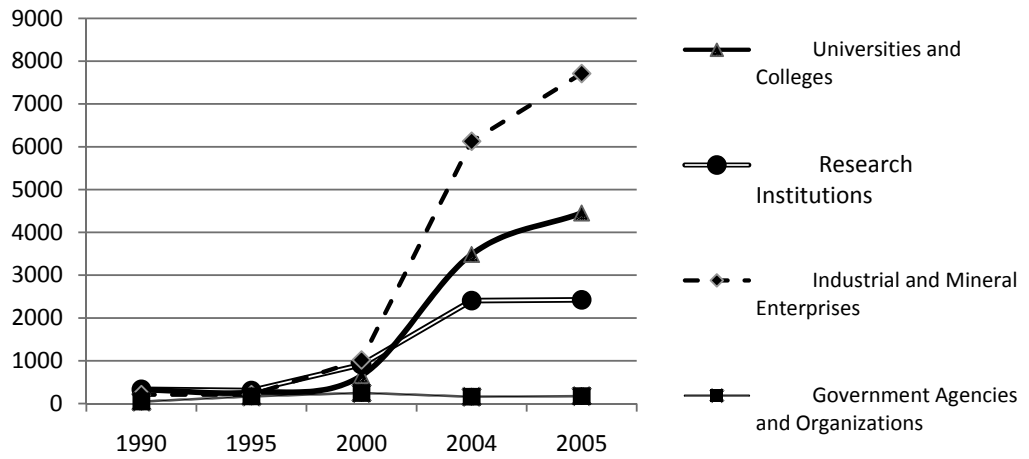


Source: Intellectual Property Office of PRC
Note: Patents are in units of numbers received

It can be seen that in the 1997-2004 period the percentage change in secondary school teachers and telephone subscribers was greater for Gansu province than for the other two provinces. This may reflect the impact of the Western Development program. However, the economic prosperity of the Coastal regions and the decentralisation of education funding have resulted in the development of Coastal innovation systems at the expense of a national one. The comparison of the growth of telephone subscribers, university enrolments and teachers in secondary schools between the three periods does indicate that Gansu has been engaged in a 'catch-up' with other provinces with regards to the capacity to enhance knowledge. However, it is clear from Figure 6 that the Coastal provinces such as Jiangsu are doing better than inland provinces such as Hubei and Gansu with regards to knowledge creation. It is possible to say this if knowledge creation can be measured in term of patents filed and granted. In each of the years 1985 to 2004, Jiangsu is ahead of both Hubei and Gansu with regards to the number of patents filed with the Chinese Intellectual Property Office. Similarly, Hubei is ahead of Gansu in each of the years 1985 to 2004 in terms of patents filed. It has already been established in Figure 2 that the Coastal Region (Jiangsu) is ahead of both the Central (Hubei) and Western Regions (Gansu) of China with regards to granted patents. However, the data has not been differentiated to distinguish between the patents of multi-national corporations (MNC's) and the patents of Chinese companies. In this context, research in China by MNC's is carried out by indigenously educated researchers. These researchers are perhaps being managed by foreigners because it is cheaper than hiring foreign educated researchers. Therefore, the domination of the Coastal region by MNC's and manufacturing operations as well as the embedding of the knowledge creation process in China's Coastal region as resulted in sustaining disparities in income between the Coastal regions of China and its interior hinterland. However, the propensity of MNC's

and manufacturing operations to condense in the Coastal region has been reduced in recent years (Ramesh, 2010). Nevertheless, entrepreneurial activity in China's Coastal region has been greater due to the open Coastal cities, SEZs, NHTIDZs (National High Technology Development Zones), Science and Technology Research Parks as well as the associated influx of FDI. Moreover, it would seem that the government reforms which facilitated horizontal linkages between Research Institutes and Universities research and development (R&D) with entrepreneurial activity ensured that the greatest knowledge creation activity occurred in the Coastal regions of China. Research is promoted by potential economic gain.

Figure 7: Trend of Invention by Type of Institution



Source: Chinese Statistical Survey 2006, Table 21.45, National Bureau of Statistics

Figure 7 illustrates the point that the trend of invention by type of institution has favoured industrial and mineral enterprises. Enterprises tend to be more innovative as well as being favourable to risk-taking activities .This kind of behaviour is evidenced by the borrowing of funds at commercial rates of return to finance innovative activities. It may also involve having access to Enterprise Funds. Enterprises were located mainly in the Coastal region.

The post-reform trend in the annual average percentage increases, shown in Table 3, in university enrolments, telephone subscribers and teachers employed in secondary schools in inland provinces, such as Hubei and Gansu compared to Jiangsu, suggests two things. Firstly, it can be inferred that educated individuals migrated to the Coastal provinces from inland provinces because of the increased work opportunities. Migration was much easier in the reform years because educational reform facilitated individual choice as students were not educated to plan; and were free to choose courses which offered better employment prospects. The inland provinces, therefore, experienced a 'brain drain' to the Coastal provinces. Secondly, the educational reforms resulted in the decentralisation of educational funding. This allowed the Coastal provinces to better fund education compared

to China's interior provinces (Kai-Ming, 1998). These two features in conjunction with the localisation of MNC's and manufacturing activity in the Coastal region of China ensured the diffusion of knowledge creation activities and its agglomeration in the Coastal region of China. This sustained the income disparities between China's Coastal regions and its interior.

6.2 Proposition 2

In this section the relevance of Proposition 2 is assessed using annual average yearly growth rates in waterway passengers, highway passengers, railway passengers, length of railways, length of highways, rail freight, waterway freight and highway freight. Table 4 shows the average percentage growth of provincial freight traffic in the period 1953 to 2004 for Jiangsu, Hubei and Gansu. In the period 1953 to 1976 the annual average percentage increase in railway freight is biggest in Gansu province. This may have been due to the requirements of a centrally planned economy which promoted a heavy industrialisation strategy in the interior provinces.

Table 4: 1953-2004: Average Percentage Growth of Provincial Freight Traffic

Time Period	Province	Highway Freight*	Waterway Freight*	Railway Freight*
1953-1976	**Jiangsu**	17.68	11.75	**0**
	Hubei	20.82	27.92	0
	Gansu	15.32	0	30.44
	Province	**Highway Freight***	**Waterway Freight***	**Railway Freight***
1979-1995	**Jiangsu**	33.16	13.82	5
	Hubei	1.08	6.1	6.13
	Gansu	20.46	0	4.63
	Province	**Highway Freight***	**Waterway Freight***	**Railway Freight***
1997-2004	**Jiangsu**	3.72	11.33	1.82
	Hubei	622.51	19.71	7.59
	Gansu	4.31	0	7.77

Source: China Compendium of Statistics 1949-2004, National Bureau of Statistics
Note: * denotes a percentage value

This development strategy was based on the mistaken notion that railways lead to prosperity. In the same period Gansu showed the largest annual average percentage increase in the length of highways, length of railways and railway passengers. Similarly,

Hubei showed the largest annual average percentage increases with respect to waterway passengers and highway passengers. The dominance of the interior compared to the Coastal region may be accounted for the fact that it was in this period that the 'Third Front' program was being actively implemented by the Chinese government. The 'Third Front' program called for the balanced economic development of all of China's provinces as well as the industrialisation of China's interior regions due to military necessity. In this period Hubei shows the biggest increase in the annual average increase in highway passengers. Knowledge creation activities were associated with process design and military need. Most of China's knowledge creation activity was military related. Nevertheless, there was a lack of facilitation of knowledge creation in the educational sector as well as a lack of knowledge spillovers from institutional research into entrepreneurial activity due to the vertical structure linking research with the end user. Table 4 also shows the average percentage growth of provincial freight traffic during the period 1997 to 2004. As can be seen, the data is dominated by Hubei which shows a 600% annual avearge increase in highway freight for the period. This can be accounted for by the fact that the higway freight in Ton per KM jumps from 500 in 2002 to 22400 in 2003. If this outlier is removed it can be seen that Hubei and then Jiangsu register the biggest increases in Waterway Freight .Similarly ,Gansu and Hubei register comparatively similar increases in Railway Freight.

Table 5: 1953-2004: Average Percentage Growth of Length of Highways and Railways

Time period	Province	Length of Highways (%)	Length of Railways (%)
1953-1976	**Jiangsu**	6.3	-0.2
	Hubei	0	0
	Gansu	10.03	39.56
Time period	**Province**	**Length of Highways (%)**	**Length of Railways (%)**
1979-1995	**Jiangsu**	2.21	0.13
	Hubei	0.5	2.21
	Gansu	0.13	0.09
Time period	**Province**	**Length of Highways (%)**	**Length of Railways (%)**
1997-2004	**Jiangsu**	18.12	0.59
	Hubei	9.44	1.03
	Gansu	1.82	0.18

Source: China Compendium of Statistics 1949-2004, National Bureau of Statistics

Table 5 shows the average percentage growth of the length of highways and railways. On the other hand Table 6 shows the average percentage growth of highways and railway

passenger traffic for the three periods 1953-1976, 1979-1995 and 1997-2004. From Table 5 it can be seen that for the period 1953-1976, Gansu showed the biggest average percentage increases in the length of highways and the length of railways. On the other hand in the periods 1979-1995 and 1997-2004, Jiangsu showed the largest average percentage increase in the length of railways and Hubei with regards to the length of railways. These findings suggest that in the pre-reform period of 1953-1976 interior provinces such as Gansu played a greater role in the government's economic growth strategy. The implication of this is that Gansu assumed the role of the core region while the Coastal region played a periphery role in the pattern of development of China. However, in the post-reform periods of 1979-1995 and 1997-2004, Jiangsu shows the largest average percentage increases in the length of highways while Hubei shows the largest average percentage increases in the length of railways. These findings suggest that Hubei was the 'hub' province, in the post-reform period. In this case, natural resources were transported from the west of the country to the Coastal regions. The railways were important in this process. These findings also suggest that in the post-reform period manufactured goods had to be transported from the site of manufacture to ports. Due to the fact that a significant amount of manufacturing was done in Jiangsu, it is easy to see why the largest increase in the length of highways took place in this province. These changes in the length of highways and the length of railways, in the post reform period, suggest that the Coastal region had become the core and the interior the periphery.

Table 6: 1953-2004: Average Percentage Growth of Highways and Railways Passenger Traffic

Time Period	Province	Highway Passengers (%)	Waterway Passengers (%)
1953-1976	**Jiangsu**	15.66	7.7
	Hubei	21.09	15.53
	Gansu	14.98	0
Time Period	**Province**	**Highway Passengers (%)**	**Waterway Passengers (%)**
1979-1995	**Jiangsu**	15.06	-4.41
	Hubei	9.8	4.14
	Gansu	10.08	0
Time period	**Province**	**Highway Passengers (%)**	**Waterway Passengers (%)**
1997-2004	**Jiangsu**	7.12	-21.65
	Hubei	20.93	9.53
	Gansu	7.4	0

Source: China Compendium of Statistics 1949-2004, National Bureau of Statistics

From Table 6, it can be seen that in the pre-reform period of 1953-1976 Hubei registered the largest average percentage increase in the number of highway and waterway passengers. On the other hand in the first post-reform period of 1979-1995 Jiangsu registered the largest increase in the average percentage increase in the number of highway passengers. But in this period Jiangsu also shows the largest decline in the average percentage of waterway passengers. This would imply that people in Jiangsu switched from using waterways to highways. However, in the second post-reform period, 1997-2004, Hubei shows that largest average percentage increase in the number of highway passengers while Gansu and Jiangsu show a similar level of increase. These changes maybe associated with the WDP which would have entailed the transportation of personnel and capital goods from the Coastal regions to the Western Regions .The changes in the length of highways and the length of railways in the post reform period suggest that the Coastal region had become the core and the interior the periphery. These results would tend to support Proposition 2. Moreover, this finding is supported by the pre-eminence of SEZ's in the Coastal regions in the reform period. The importance of the SEZ's can be associated with a shift towards the significance of highways as opposed to railways in moving from the interior of China to the Coastal regions over the years.

6.3 Proposition 3

Investment in fixed assets leads to the specialisation of labour, leading to the integration of fragmented local markets and market integration. In the post reform period a large amount of investment in fixed assets took place in the SEZ's and the NHTIDZ's. This is due to the fact that a variety of physical and non-physical infrastructures were required to be concentrated in these specially designated areas. Thus, it can be expected that the effects of increased infrastructure investment can be evidenced by the percentage changes in Imports, Exports, Gross Regional Product (GRP), GRP per Capita and Total Investments in Fixed Assets over time. Table 7 shows the average percentage growth of Total Investments in Fixed Assets and GRP per capital. Table 8 shows the average percentage growth of GRP, Exports and Imports.

Table 7: 1953-2004: Average Percentage Growth of Inflation Adjusted Total Investments in Fixed Assets and GRP Per Capita

Time Period	Province	*Total Investments in Fixed Assets (%)	GRP Per Capita (%)
1953-1976	**Jiangsu**	18.85	2.86
	Hubei	23.21	5.64
	Gansu	16.32	4.73
Time Period	**Province**	***Total Investments in Fixed Assets (%)**	**GRP Per Capita (%)**
1979-1995	**Jiangsu**	31.45	11.62
	Hubei	22.81	16.28
	Gansu	20.25	11.9
Time Period	**Province**	***Total Investments in Fixed Assets (%)**	**GRP Per Capita (%)**
1997-2004	**Jiangsu**	17.43	11.1
	Hubei	11.66	9.46
	Gansu	17.11	9.51

Source: National Bureau of Statistics .China Compendium of Statistics 1949-2004
Note: *Total Investment in Fixed Assets (TIFA) adjusted for inflation by dividing by the respective provincial Gross Regional Products (GRP)

Table 8: 1953-2004: Average Percentage Growth of GRP, Exports and Imports

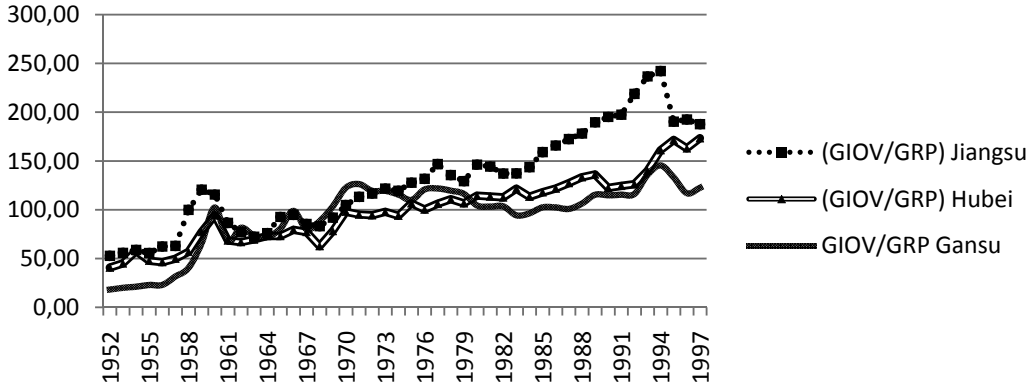
Time Period	Province	GRP (%)	Exports (%)	Imports (%)
1953-1976	**Jiangsu**	6.2	**0**	**0**
	Hubei	7.8	0	0
	Gansu	0.07	0	0
Time Period	**Province**	**GRP (%)**	**Exports (%)**	**Imports (%)**
1979-1995	**Jiangsu**	11.89	21.11	69.55
	Hubei	17.9	17.96	39.68
	Gansu	0.14	37.49	40.42
Time period	**Province**	**GRP (%)**	**Exports (%)**	**Imports (%)**
1997-2004	**Jiangsu**	12.72	29.67	33.58
	Hubei	9.96	12.35	16.36
	Gansu	0.1	19.82	26.78

Source: China Compendium of Statistics 1949-2004, National Bureau of Statistics

As can be seen from Tables 7 and 8, in the period 1953 to 1976 Hubei shows the biggest average annual increases in Total Investments in Fixed Assets, Gross Regional Product (GRP) and Gross Regional Product Per Capita. These effects may be due to the 'Third Front' program and changes in the agricultural sector which was the predominant sector in this period. This was in contrast to manufacturing. During this period, Jiangsu which also had a buoyant agriculture sector showed the biggest annual average increase in GRP than Gansu.

In the period 1979 to 1995 Gansu shows the biggest average annual increase in Exports than either Jiangsu or Hubei. Gansu produces oil and other natural resources which would have been in demand. Nevertheless, Hubei shows bigger average annual increases than Gansu with regards to GRP, GRP Per Capita and Total Investments in Fixed Assets (TIFA). However, in the same period Jiangsu shows the largest average annual increase with regards to Imports and TIFA than either Hubei or Gansu. The increase in imports maybe due to the fact that it was cheaper for Coastal provinces to import resources than to have it transported from other inland provinces. This can be explained by the poor transportation infrastructure, in terms of quantity and quality, which resulted in bottlenecks in the transport system (Riskin, 1987). It must also be remembered that the period 1979-1995 was a period in which the economic growth rates of China's Coastal provinces converged with those of its interior provinces which relied heavily on the agricultural sector. The high prices of agricultural produce meant that the interior provinces were more prosperous than the Coastal provinces. However, this changed when the prices of agricultural produce fell towards the late 1980s, early '90s. After this time the growth rates of the Coastal provinces began to diverge from the growth rates of the interior provinces following a period of convergence.

Figure 8: Adjusted Gross Input Output Value (GIOV) 1952-1996



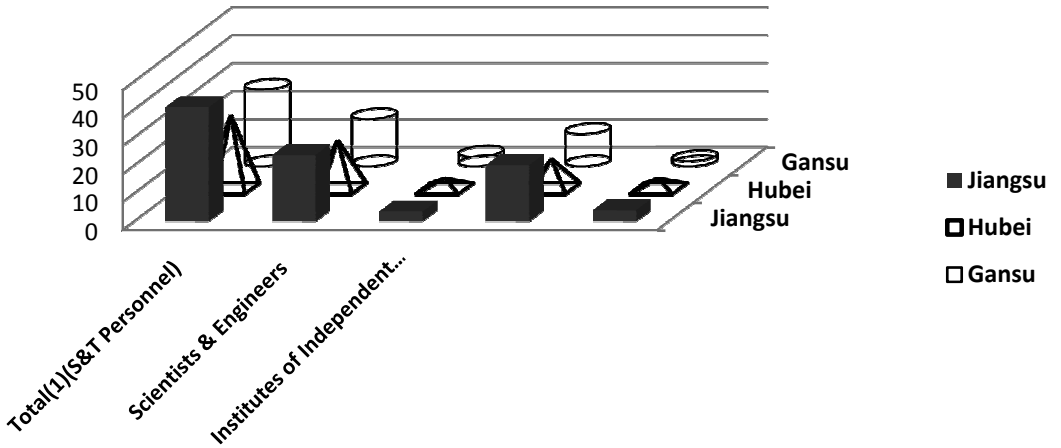
Source: Compendium of Statistics 1949-2004, National Bureau of Statistics China
Note: Gross Input output Value (GIOV) adjusted for inflation by dividing by regional GRP

Thus, due to the reforms initiated by the government and the fall in agricultural prices a shift occurred in the core-periphery pattern in China from interior-Coastal to

Coastal-interior. However, during the period 1997 to 2004 there is a perceptible change in the annual average percentage changes of economic factors. It can also be seen that Gansu shows the largest average annual percentage increases with regards to Imports, Exports and Total Investment in Fixed Assets compared to Hubei. Nevertheless, with regards to average annual increases in GRP per Capita, Gansu is approximately on par with Hubei. These effects may be associated with the WDP which was instituted in 1999. It is interesting to note that in the period 1979-1995, the increase in Total Investment in Fixed Assets (TIFA) was greatest in Jiangsu compared to either Hubei or Gansu. This can be accounted for by the fact that SEZs were being constructed in the Coastal provinces during this time period. However, in the period 1997-2004, the increase in TIFA was approximately at the same level in Gansu and Jiangsu. This may be accounted for by the effects of the WDP in China's interior provinces; and the emergence of NHTIDZs in the Coastal provinces. It can also be seen that in the period 1997-2004 that the growth rates of GRP per Capita, Imports, Exports and GRP was greatest in Jiangsu province. This demonstrates the contribution to the economic dominance of the Coastal regions of the SEZs and NHTIDZs.

Figure 8 shows that the inflation adjusted GIOV between Jiangsu and Gansu begins to diverge after 1972. In this case, Jiangsu's GIOV is on an upward trajectory compared to the GIOV of Gansu. This may have resulted from the fact that TVEs began to start emerging in Jiangsu around this time, well before the start of the 1978 economic reforms (Riskin, 1987). Furthermore, TVEs were also predominant in other Coastal provinces such as Fujian where the government was reluctant to invest in State Owned Enterprises for fear of military attack. The inflation adjusted GIOV of Hubei and Gansu begins to diverge after the early 1960's.

Figure 9: Science & Technology Personnel by Region and Weighted by Provincial Population

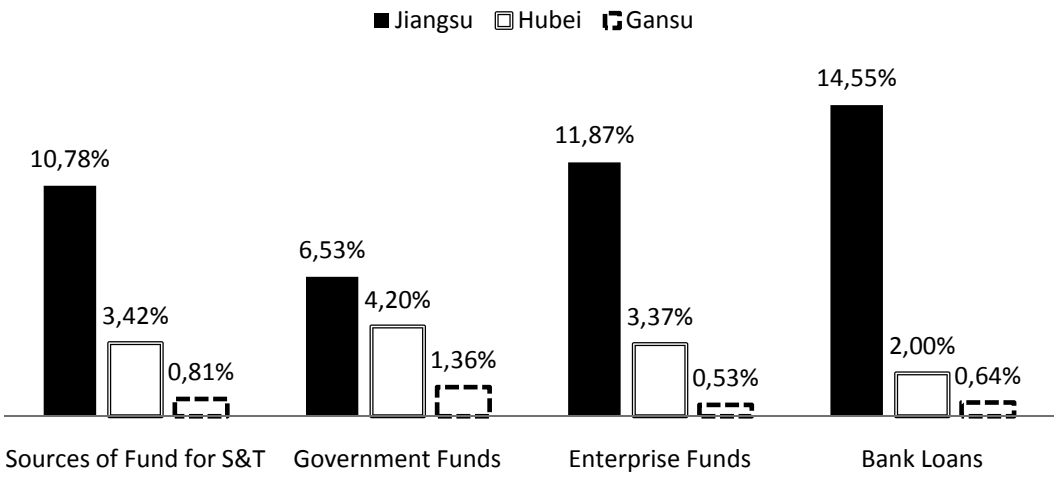


Source: China S&T Statistical Yearbook 2003: Table 1.18: S&T Personnel by Region (2001), National Bureau of Statistics

6.4 Proposition 4

States that the NEG is inadequate in accounting for the role of knowledge creation in the core-periphery pattern formation because it cannot account for the role of the interplay of individual factors of knowledge creation in the economy. According to Krugman (1991) there is no role for the creation of knowledge in the framework of the New Economic Geography (NEG) because only the manufacturing and agricultural sectors are relevant to the formation of the core-periphery pattern. However, traditional economic theory suggests that innovation and knowledge creation in an economy are essential for long term economic growth (Rosenberg, 2004). Figure 9, above, shows the numbers of Science and Technology personnel by region in various categories. In Figure 9, Gansu is represented by the cylinder, Hubei by the pyramid and Jiangsu by the solid object. One obvious feature is that in Jiangsu, in the Coastal region, Large and Medium Sized Enterprises (LME's) employ more Science and Technology personnel than they do in either Gansu or Hubei in 2003. This will facilitate more knowledge creation in the Coastal region.

Figure 10: Source of Funds for Innovation* by Region – 2003



Source: China S&T Statistical Yearbook 2004: Table 1.15: Science & Technology Source of Funds by Region (2003), National Bureau of Statistics
Note: *Percentage of national total

Another surprising feature, which can be observed in Figure 9, is that in Gansu LME's employ more Science and Technology personnel than does Hubei. LME's are important for economic growth because they are both entrepreneurial and innovative. However, Gansu remains one of the poorest provinces in China (Qian et al., 2009).

According to Figure 10 Jiangsu receives more funds for innovation from the government than does either Gansu or Hubei. Figure 2 has already established that the Coastal region has the largest number of domestic patents (invention) granted by region in 2005. These facts would suggest that the knowledge creation process has been embedded in the Coastal region in the post-reform period. Further evidence for this assertion is that, as can be seen from Table 1, the Coastal region as represented by Jiangsu had the largest number of registered domain names and www.websites in contrast to the other two regions. The Internet is seen as a symbol of the knowledge economy. However, the micro-foundations of the knowledge creation process are not accounted for by the NEG.

6.5 Proposition 5

With regards to Proposition 5, it is easy to see that picking up the phone and speaking to someone at the other end, who may be thousands of miles away, is a quicker method of transmitting knowledge than by driving a car or taking a train to speak to them. Moreover, in contrast to network theory, tacit knowledge and explicit knowledge are assumed to be indistinguishable because the purpose of this proposition is to assert that the speed at which knowledge is exchanged will vary with different types of infrastructure. The more knowledge oriented regions such as Jiangsu will have more advanced communications infrastructure such as the Internet, characterised by features such as websites and domain names.

7. Conclusion

This paper has evaluated the economic development of China, using a comparative case study methodology, based on a Coastal, Central and Western province using the NEG has a framework of analysis. The time period of the study is from 1953 to 2004. This time period was purposefully selected in order to avoid a conflict with the events leading to the global credit crunch of 2008. If this had not been done then the results of this paper would not be reliable as the global credit crunch directly led to an inland momentum in economic activity, from the Coastal region to the interior of China (Ramesh, 2010). In the long run this may lead to a shift in the gravitas of the core-periphery balance in China. Furthermore, while the NEG allows for the formation of a core-periphery pattern between the regions of a country based on the concentration of manufacturing industry, taking advantage of low transportation costs, it cannot account for the role of time and knowledge in that agglomeration process. Furthermore, the NEG only considers transportation infrastructure and so excludes the interplay between this type of infrastructure and other types of infrastructure which is essential for economic growth.

This study has shown, by evaluating five propositions based on associated data and criteria that the core-periphery pattern formation envisaged by the NEG is dependent on government economic and development policy. This tends to vary across different time

periods. Moreover, once the core-periphery pattern has formed due to the concentration of light manufacturing activity in one region of a country, knowledge creation sustains the income disparities which result from such a concentration. In the case of China there are three political periods of importance, 1953-1976, 1979-1995 and 1997-2004. Government policy has had a role in shaping the formation of the core-periphery pattern in each three periods. However, the post 1978 economic reforms ensured that the Coastal region of the country became the core and the interior the periphery. Furthermore, even though the WDP in the late 1990's changed the forces of development from the core Coastal region to the West of the country, the gravitas of the Coastal region in conjunction with the effects of the educational reforms and entrepreneurship in these regions ensured that the Coastal region remained the core. However, in the period 1953-1976 it is evident that due to programs such as the 'The Third Front' the forces of economic growth were skewed against the Coastal region and focused very much towards the country's interior. In this case, the interior was in effect the core and the Coastal region the periphery. Nevertheless, in the post-reform period after 1978 the momentum of economic activity, as a result of government policy, shifted towards the Coastal region. Moreover, after the fall in the prices of agricultural goods in the late 1980's and early 1990's the process of divergence in economic growth rates between China's interior and its Coastal region began to increase and the Coastal region became the core and the interior the periphery.

Propositions 1, 4 and 5 support the hypotheses that:

a) Knowledge creation sustains the core-periphery pattern,
b) The NEG does not acknowledge the interaction between the individual factors of knowledge creation and,
c) The speed of knowledge exchange varies with the type of infrastructure.

On the other hand, Proposition 2 and 3 support the notion that investment in different types of infrastructure and fixed assets leads to the concentration of manufacturing industry. In the case of Proposition 1 it is clear that the post 1978 educational reforms in China have, in conjunction with the presence of entrepreneurship and MNC's, led to the consolidation and enhancement of knowledge creation in the Coastal region. This has helped in sustaining the core-periphery pattern formed by the concentration of manufacturing activity in the Coastal region. With regards to Proposition 4, it is clear that the NEG does not account for the role of scientific personnel, universities, R&D expenditure, telephones and the Internet in the knowledge creation process as measured by the number of patents issued by region. Therefore, the NEG cannot account for how knowledge linkages form in the economy. Furthermore, according to Proposition 5, even though the speed of knowledge exchange varies by type of infrastructure (telephone network, roads, railways and the Internet) this is unaccounted for by the NEG. Propositions 2 and 3 tend to support the notion that the post-reform core-periphery, Coastal-interior, pattern formed in China due to increased investment in infrastructure and fixed investment in the Coastal region as compared to the interior.

The evaluation of the five propositions based on associated data and criteria does tend to support the idea that core-periphery pattern formation is not a static one but depends on government policy at a point in time. Furthermore, while economic reforms of the post 1978 period began the process of the divergence in the economic growth rates of the interior and Coastal regions of China, due to the localisation of manufacturing industries in the Coastal region, the fall in agricultural product prices in the late 1980's exacerbated it. In this case, the Coastal region became the core and the interior the periphery of the country. However, once the core-periphery pattern had formed knowledge creation sustained it.

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