

# **Regional inequalities in China**

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*Where do the western provinces stand?*

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## **Abstract**

This thesis studied the development of the western provinces, with regard to GDP growth and the impact of the forces of economic growth, across China. Six drivers of growth were identified, human capital, infrastructure, FDI, exports, government reforms and the level of S&T. The country was divided in two parts, the eastern provinces and the western provinces. The latter consists of the central and western provinces. It was found that the western provinces started catching up to the eastern ones, in terms of GDP per capita. With regard to the drivers of growth, it was found that exports and S&T do not follow this trend, while human capital and infrastructure do. The development pattern for FDI shows a faint move towards the eastern provinces. Additionally it was concluded that human capital adds more to growth in developed areas and FDI adds more to GDP growth in underdeveloped regions.

## **Keywords**

Regional inequality, economic growth, China, factors of growth

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# 1. Introduction

## 1.1 Background and problem statement

The past decades China experienced tremendous economic growth, unfortunately only part of the twenty-two provinces really profited from this boost (Ding & Knight, 2009) (Hong, Zinan, Rebelo 1998). The turnaround that initiated China's era prosperity came in 1978 with Deng Xiaoping as new leader of China (Gang, Perkins, Sabin. 1997) (Fleisher, Li, Zhao 2010). His aim was to transform China in an open market economy led by the industrial sector (Fleisher et al. 2010) (Pomfret, 1997).

Prior to 1978, during the reign of Mao, China operated in an agriculture-led planned economy (Pomfret, 1997). This meant fixed prices, no personal gain from trade and a disadvantageous position for the industrial sector (Gang et al. 1997). During that time the northeastern part of China was most industrialized and consisted mostly of heavy industries (Fleisher et al. 2010). Although China's participation on the world market was negligible, their main export products were primary goods (Mah, 2007). Eventually the emphasis shifted towards manufactured goods (Pomfret, 1997).

As from 1979 a lot changed in China. The first reform was the introduction of foreign direct investment (FDI) and partial ownership (Appleton, 2002). The inflow of capital provided a significant stimulus for economic growth and a gateway to the newest technologies available (Gang et al. 1997). In order to boost economic growth the government introduced preferential policies such as tax benefits and the implementation of Special Economic Zones (SEZs) (Fleisher et al. 2010) (Yang, 2002). Regrettably most the FDI went to the coastal provinces that provided the most desirable combination of drivers of growth, this shifted the highest level of GDP per capita from the north eastern provinces to the coastal provinces. Presently the level of GDP per capita in the coastal provinces is thirty percent higher than that of the north eastern ones (Fleisher et al. 2010).

A number of reforms were required to successfully transform China's planned economy to an open market economy. After the introduction of FDI the fiscal decentralization policy was the next big reform implemented in 1984 (Gang et al. 1997). This reform authorized local governments to share in the profits of the state-owned enterprises (SOEs) (Gang et al. 1997).

Some SOEs gradually became competitors, while others kept making losses and were eventually dismantled (Appleton, 2002).

Legal reforms were necessary to make the economical transition of China a success. This led to the introduction of corporate law, labor law and bankruptcy law. The reforms were implemented but the institutional changes required were lagging, so there was too little control to enforce the new laws right away. This was also the case with the intellectual property laws (Gang et al. 1997).

In 1992, Deng Xiaoping took off on the “South Trip” with three goals in mind. His first aim was to convince the Chinese to pursue personal wealth; secondly he aimed at countering the conservative efforts to prevent change. The third reason for the “South Trip” was to transmit confidence and thereby speeding up the transition towards an open market economy (Fleisher et al. 2010). This would become an important moment in the transition process of the Chinese economy (Gang et al. 1997).

Two years later, in 1994, the government tightened the regulations with regard to preferential policies and started to cancel the subsidies for loss-making SOEs (Fleisher et al. 2010). Additionally tax reforms were introduced (Gang et al. 1997).

The amazing transition towards an open market economy has one drawback; it increases the regional disparities in China (Cai, Wang, Du, 2002). Until the mid-eighties regional inequalities were decreasing, but rose sharply again in the nineties (Yang, 2002) (Fleisher et al. 2010). The Chinese government ignored the issue of regional inequality for a while, but initiated the “Grand Western Development” plan in 2000. This project’s aim is to develop the western regions in order for them to catch up with the Eastern provinces (Fleisher et al. 2010). The question that arises is whether the Western provinces are starting to catch up to the Eastern provinces, mainly in terms of economic growth, but also regarding the factors of economic growth.

*Problem statement:* In terms of GDP per capita, can one speak of convergence between the Eastern and the Western provinces? And do all the factors that add to economic growth develop in a similar way?



## 1.2 Research Questions

- Which factors contribute to economic growth in China?
- Are the identified drivers of growth significantly present in the eastern and western provinces?
- Does human capital contribute more to GDP growth in underdeveloped regions than it does in developed regions?
- Does FDI add more to economic growth in underdeveloped areas than it does in developed areas?

## 1.3 Theoretical Framework

This study is supported by the following three economic theories, Solow's (1956) neo-classical growth theory, Hobay's (1995) theory of Newly Industrializing Economies (NIE) and Fenge, von Ehrlich & Wrede's (2009) New Economics of Geography (NEG) theory.

Solow's growth model is an adaptation of the Harrod-Domar model (Solow, 1956). It lies at the heart of this analysis. This study is based on the intuition that there are several factors contributing to production. Where Solow identified capital, labor and technological progress (Solow, 1956), this research aims to identify a number of factors that contribute to production, and consequently add to economic growth. Solow's model was extended by Rao (2010); this study follows a similar intuition.

Hobay's theory of Newly Industrializing Economies (NIE) comes in together with Fenge et al.'s New Economics of Geography (NEG) theory follow up with additional drivers of growth. The NIE theory stresses the importance of Science & Technology (S&T), at the hand of four stages of economic development characteristic for emerging Asian economies (Hobday, 1995).

The NEG by Fenge et al. (2009) in turn describes factors that stimulate spatial concentration, which in turn is assumed to lead to higher economic growth. This leads to competition between regions, which can be advantageous for companies. Fenge et al. (2009) identify public inputs as a key factor in this process. Public inputs consist of investments in infrastructure, both transport and communication based infrastructure.

Additional factors that add to economic growth were extracted from scientific literature and are identified in the chapter discussing inequalities in China. Those factors are human capital and government reforms regarding economic conditions (Fleisher et al. 2010).

## 1.4 Variables

### Dependent variables:

*GDP per capita:* This variable represents the Gross Domestic Product per head of the population. This variable is used to measure economic growth of Chinese provinces.

### Independent variables:

*Exports:* This variable is represented by ‘Exports by their origin in China / total investment in fixed assets’ in the eastern model and by the value of exports in the western model. Most of China’s production is for exports, so the contribution of exports to economic growth is expected to be significant.

*Foreign Direct Investment:* Foreign Direct Investment (FDI) is represented by ‘invested FDI / number of foreign enterprises’. Ideally this variable should be lagged for its full effect to be measured, however in this study this won’t be done to avoid dealing with too few observations.

*Human Capital:* It is difficult to quantify human capital, therefore this study decided to use education as a proxy. More specifically, the ‘number of graduates from institutions of higher education’ was chosen to act as a proxy. Other studies use secondary school as cutoff point, this study chose to use only the higher education since interest is mainly focused on skilled labor. To increase the explanatory power of human capital, the number of graduates is related to the population of the respective provinces.

*Transport infrastructure:* This variable represents the full network of roads, ports and railways. In order to implement this variable a proxy was chosen, namely the ‘total length of express- & class I-IV highways per hectare of area under land survey’ for the eastern model and the ‘total length of express- and class I-IV highways’ for the western model. Relating the length of roads to the size of the provinces is anticipated to have a positive influence.

*Science & Technology:* It is hard to quantify innovative efforts or technological progress that is why this research opted for a proxy in the form of ‘number patents granted’.

## **1.5 Research method**

This research can be considered fundamental research, since its aim is to generate knowledge (Sekaran, 2003). Because it concerns data that was collected once over a period of fourteen years and it concerns one population, this study is considered to be longitudinal time-series data. This study is of a causal nature since it attempts to identify the nature of the relationship between economic growth and the forces that contribute to economic growth (Sekaran, 2003).

## **Research design and data collection**

The most appropriate method to identify the relationship between the dependent and independent variables is the hypothetico-deductive method (Sekaran, 2003). Hereby, a theory is formulated after gathering some information. This is followed by stating the hypotheses and collecting the empirical data. Finally the data is analyzed and conclusions can be drawn (Sekaran, 2003).

Secondary data has been the source of this research. The data for the literature review came from library research, while the empirical data was gathered from the Chinese Statistical National Yearbook (Sekaran, 2003). The data was obtained from the database of the National Bureau of Statistics of China (<http://www.stats.gov.cn>), for the period 1995-2008. With regard to the data it is important to consider that the western provinces and the provinces of Central China will make up the western group.

## **1.6 Academic relevance**

There have been studies regarding regional inequality, but their focus was different from the aim of this research. This study is academically relevant because it illustrates the development of Chinese provinces over the past fourteen years. Furthermore the factors that caused the growth of the Chinese economy are identified. This study also distinguishes between the performance of prosperous Eastern provinces and the following Western provinces.

## **1.7 Thesis structure**

This thesis is structured in the following way. The second chapter will start of by examining Solow's growth theory, followed by an explanation of the NIE-theory and NEG-theory. Subsequently, the third chapter will elaborate on growth and regional inequalities in China before proposing a number of forces driving GDP growth. The methodology will make up chapter four, consisting of data collection, the models and variable explanation. Chapter five will discuss the empirical results of the statistical analysis and provide descriptive statistics regarding the variables. The conclusions and recommendations for further research will be made in the sixth and concluding chapter.

## **2. Literature review**

### **Introduction**

The following sections will provide an insight in growth theory, the importance of technology and FDI, and the relevance of public inputs. In the first section Solow's model of growth will be discussed and extended. The following section will elaborate on Hobday's theory of Newly industrializing Economies. This theory emphasizes the importance of technology. Finally the New Economics Geography by Fenge et al. (2009) will be discussed. Fenge et al. accentuates the role of public inputs for GDP growth.

### **2.1 Augmented Solow model of growth**

#### **Introduction**

The Solow growth theory originated from the Harrod-Domar model. The Harrod-Domar model is an elaborated Cobb-Douglas function, with labor and capital as factors of production (Mankiw, 2000). When developing his theory of growth, Solow used the Harrod-Domar model as a base but discarded some assumptions and added new ones. He also adds a new production factor technological progress (Solow, 1956). This study is using an adapted growth model, with several added production factors apart from labor, capital and technological progress. In order to keep the analysis within the scope of this research, the variable capital is omitted. It is difficult to define the contribution of capital and it is expected to increase correlation.

#### **Solow growth model**

The Harrod-Domar model that stands at the base of Solow's model of growth does recognize technological progress as a production factor. This means that the outcome of the model is determined by the assessment of the natural growth rate and the guaranteed growth rate. The former is in the Harrod-Domar model represented by the growth in labor force, while the latter stems from the saving and investing behavior of consumers and enterprises (Solow, 1956).

One drawback of the Harrod-Domar analysis is that the instruments used are designed to measure short-term outcomes; therefore Solow adapted the model. The most important change

implemented by Solow was the rejection of the fixed proportions assumptions. Instead, the model is placed in a neoclassical environment. This setting entails variable proportions, constant returns to scale and the possibility of a steady state. Those changes altered the outcome of the model from a knife-edged equilibrium growth to a steady state. Furthermore Solow relaxed a number of assumptions of the Harrod-Domar model. For example, neutral technological progress and an interest elastic savings program are implemented in Solow's growth model. There are number of additional conditions for Solow's growth theory. There is the absence of scarcity of factors, as well as the assumption of continuous full employment. Solow assumes that wages will adjust in order for full employment to be possible. Furthermore there is the absence of monetary snags and risk. The latter is reflected in the lack of asset preferences (Solow, 1956).

The long run outcome of Solow's theory of growth is different from the outcome in the Harrod-Domar model. In the model built by Solow the long run outcome, constant returns to scale provided, is a steady state. The steady state originates from the convergence of the growth rate of capital towards the growth rate of labor (Solow, 1956). In Solow's model the steady state is achieved when total factor productivity is reached (Rao, 2010). Rao's (2010) perspective is that the steady state is a long run equilibrium and unobservable.

In his articles Solow tested the economic growth of the U.S., with the help of a Cobb-Douglas production function; this formula represents the division of capital (K) and labor (L) and the productivity of available technology (A) (Fogel, 2009) (Mankiw, 2000) (Solow, 1956). This model was inadequate and could only account for 13% of the increase in output. Solow believes the remaining 87% were accounted for by exogenous technological progress (Fogel, 2009). This resulted in a shift of focus, from labor productivity to total factor productivity (Fogel, 2009).

During the same period a number of researchers discussed endogenous technological change, claiming the importance of synergies between quality and quantity increases of labor and/or capital (Fogel, 2009). Endogenous models provide insight in the factors relevant to the steady state and whether a policy intervention can improve the steady state (Rao, 2010). However Rao (2010) opted for an extended growth model based on Solow's model of growth. Rao (2010) adds two externalities to his model, 'learning by doing' and 'trade openness'. The former will be discussed in the Newly Industrializing Economies theory below; the latter has been discussed as one of the conditions for a successful FDI-based development strategy in the descriptive chapter.

Both externalities play a role in incorporating knowledge from above, without significant investments in R&D.

Schultz is another author that upholds the theory of endogenous growth. Schultz claims that in the current era human capital enjoys a greater explanative power with respect to economic growth and income disparities than physical capital (Fogel, 2009). This makes human capital a key determinant in modern economic growth and might explain some of the variation in output (Fogel, 2009). Abramovitz supports the Schultz's theory regarding human capital. According to Abramovitz human capital became a key factor from the 1950s onwards (Fogel, 2009). This is in accordance with Fleisher et al.'s (2010) research that asserted the importance of human capital, and concluded that it is more profitable for developed regions to invest in infrastructures and that lagging regions should focus more on human capital first. There are economists that claim that the efficiency of technology is determining economic growth (Ding et al. 2009).

Ding et al. (2009) pose that a Solow model extended with human capital and structural change is sufficiently accurate in predicting the growth rate of China. About 80% of the variation is explained by the physical and human capital (Ding et al. 2009).

This research will follow the line of Rao (2010) and Ding et al. (2009) and base the analysis on an augmented Solow model of growth.

## **Conclusion**

Solow's model of growth is based on the Harrod-Domar model. This model is intended to predict the short run, not the long run. Solow altered the conditions and assumptions to fit the model to his theory. He assumed a neo-classical setting with new assumptions such as variable proportions and constant returns to scale. More important is that Solow added technological progress as a new variable. The new setting changed the long-run outcome of the model to a steady state.

The Solow model has been further developed into endogenous growth models; however, this study follows Rao (2010) and opts for an augmented Solow model of growth. Rao (2010) adds the externalities 'learning by doing' and 'trade openness' to the model. Schultz stresses the importance of human capital as determinant of economic growth. This is backed by Abramovitz in Fleisher et al. (2010).

This research does not add the externalities to model, but does support the claim that human capital is crucial to economic growth. Other factors will be added to the model to analyze their contribution to GDP growth and the stage of development of the eastern and western provinces. Are the eastern provinces reaching their steady state and are the western provinces catching up? This matter will be answered with  $H_1$ . Another hypothesis arose from this theory, regarding the performance of human capital related to the location, this is covered by  $H_2$ .

$H_1$ : *The growth rate of GDP per capita for the eastern provinces is lower than for the western provinces.*

$H_2$ : *The performance of human capital is stronger in the western provinces as opposed to the eastern provinces.*

## **2.2 Newly industrializing economies (NIE's)**

### **Introduction**

South Korea, Taiwan and Hong Kong, or the 'small dragons' as He et al. (2010) calls them, were referred to as Newly Industrializing Economies (NIE's) when they started to develop their industrial sector in the sixties. Over time they have become serious competitors in the global electronics market. This sector has been of crucial importance for their economic development. The electronics industry grew over the course of the eighties into the largest and fastest growing export industry in East Asia. The surge of this industry influenced the technological developments, employment and industrial output in the NIE's (Hobday, 1995).

There has been a limited amount of research regarding the strategy of manufacturers regarding their technological development in East Asia. The well-known studies by Dahlman or Ross-Larson concerning technological learning are focused on the general technological progresses instead of the strategies adopted by companies (Hobday, 1995).

After observing the successful development of the 'small dragons', China opted for a similar export-led and FDI-based economic development.



## **Newly Industrializing Economies**

The definition of latecomer enterprises is crucial in the debate regarding their technological capabilities. A latecomer firm is a manufacturing company, which is set back in two major ways with respect to its competitive position in the exports sector (Hobday, 1995). Both obstacles are related to their location. Location renders it difficult to service foreign markets in developed countries and the available technological resources in their home countries are inadequate to enable a competitive role in the market (Hobday, 1995). This is partly due to the low level of public inputs discussed by Fenge et al. (2009). The latecomer firms will have to find means to overcome the entry barriers of the market and to subsequently build user-producer linkages to ensure technological development (Hobday, 1995).

The evolution of the latecomer firms into full-fledged competitors did not happen overnight. It has been an ongoing process over four decades, starting in the sixties. They developed from assembly lines into engineering, requiring certain technologies and skills (Hobday, 1995).

Broadly one can distinguish four phases in the development of latecomer firms. The first phase can roughly be set in the sixties and is characterized by *Industry start-up*. Phase two, more or less the seventies, is best described as *the take-off of simple manufactured goods*. The third stage unrolled during the eighties and is marked by *the take-off of professional electronics*. The fourth and final phase, which took place during the nineties, entailed *the shift towards advanced electronics and information technology* (Hobday, 1995). Hobday (1995) also states that the electronics industry follows a similar pattern of development in every country. This entails that it might hold for the Chinese electronics industry as well.

The industry start-up, the first phase of industrial development, in NIEs was mainly spurred by American and Japanese transnational corporations (TNCs). Japanese firms chose for a joint venture approach in order to profit from the cheap labor and to gain entry to the Chinese domestic market (Wen, 2007) (Hobday, 1995). Through joint ventures TNCs offered technical assistance and training, this was the very first learning stage. Overall the Japanese firms regarded their joint ventures with firms in NIEs as contract manufacturers for their exports. US firms chose for wholly owned subsidiaries or for contracts with manufacturers to benefit from the cheap labor costs. A well-known beneficiary of those activities was Samsung Electronics,

through their joint venture cooperation with, amongst others, Sanyo they were able to absorb some of the foreign technology for some of the manufactured products. The knowledge spillovers occurred through the training of employees and/or management. At this stage little technological knowledge was required. The joint ventures also assisted with and supported the initiation of the export industries in the NIEs (Hobday, 1995).

Over the course of the second phase of this industrial development of NIEs, the local manufacturing firms acquired the knowledge and skills to manufacture the foreign product innovations. They would acquire the technology through licensing or through the assistance paired with manufacturing contracts from foreign TNCs. At this stage R&D expenditures were low. Some technological know-how was gained through reverse engineering and other experiments, but cooperation with foreign TNCs yielded the best results (Hobday, 1995).

The manufacturing firms were focused on exports because of the underdeveloped domestic market. Halfway the seventies numerous firms emerged in Hong-Kong, manufacturing consumer electronics and aiming for the US market. This surge of electronics manufacturers spurred the growth of related industries such as plastics molding, metal plating and metalworking and parts (Hobday, 1995).

The take-off of professional electronics, as the third phase is referred to, broadly took place over the course of the eighties. NIEs witnessed a sudden growth of professional electronics. With their gathered skills, knowledge and technology the firms in NIEs also started doing their own designing and manufacture of semi-conductors (Hobday, 1995).

By the end of the eighties Taiwan's competitive advantage had shifted from cheap labor to high quality engineering. This led foreign TNCs to manufacture the products closer to the introduction phase of the product life cycle. The new automated facilities cooperated with local OEM (Original Equipment Manufacturer) suppliers (Hobday, 1995). It is over the course of the third phase that local firms and the related industries developed their technological capabilities in the different stages of advanced electronics production (Hobday, 1995).

Phase four entailed the final shift from electronics manufacture to information technology systems manufacture. Even though some of the more successful laggard enterprises managed to

catch up some of the distance to the market leaders, they are not quite there yet. They are operating behind the technological frontier set by international leaders and they still need their competitors for components and market outlets under OEM conditions (Hobday, 1995).

To become more competitive latecomer enterprises had to attract new technology. There were two channels through which this was possible. One way is to increase in-house R&D, but the scope of operation of local firms was too small to afford in-house R&D, leaving this alternative unviable. The other channel was to acquire technology through foreign cooperation; this did not only yield new technologies but also provided access to overseas markets (Hobday, 1995). Table 1 lists the different foreign channels through which the acquisition of technology could go.

<b>Technology procurement methods</b>
<ul style="list-style-type: none"><li>▪ FDI</li><li>▪ Licensing</li><li>▪ OEM (Own Equipment Manufacturer)</li><li>▪ ODM (Own Design Manufacturer)</li><li>▪ Joint venture</li><li>▪ Overseas acquisition/ equity investments</li><li>▪ Strategic partnerships</li><li>▪ Sub-contracting</li><li>▪ Foreign and local buyers</li><li>▪ Informal means</li></ul>

Table 1: channels of technology acquisition (Hobday, 1995)

The electronics manufacturing industry thrived on joint ventures and FDI. The local enterprises in NIEs learned from the foreign TNCs through the training of employees in their subsidiaries in. Additionally they received help from foreign buyers when entering overseas markets, which were new for the local enterprises in NIEs (Hobday, 1995).

Another way for local firms to get hold of required technology is through OEM. OEM implies that local firms are contracted to manufacture an end product according to the exact conditions of the TNCs. The companies were willing to spend the time needed to transfer the technology and train the employees. In practice, it turned out that the local firms were also taking care of the design of the products for the TNCs, leading to ODM. Domestic enterprises were officially partly in charge of the design part as well as the manufacture part of the production process. The shift to ODM resulted in additional learning. The acquired designing skills were aimed at the

improvement of the end product, incremental innovations, rather than aimed at radical product innovation (Hobday, 1995).

The OEM/ODM approach has some drawbacks, such as strict compulsory guidelines from TNCs, dependence on foreign technology and bad conditions for the manufacturer's sales activities. In spite of these drawbacks local companies have been able to reach economies of scale and invest in technology (Hobday, 1995). The biggest advantage for TNCs is the low cost capacity growth (Wen, 2007) (Hobday, 1995).

Eventually some of the local firms shifted to Own Brand Manufacturer (OBM). They manufactured products for the domestic market at first, and eventually some exported their goods to export markets, such as Samsung Electronics (Hobday, 1995).

## **Conclusion**

Latecomer firms are manufacturing enterprises that are set back in two ways by their location. They struggle with underdeveloped technological capabilities and it is difficult for them to service foreign markets. The development of the manufacturing industry and the initiation of the development of the rest of the economy know four stages.

The first stage, the industry start up, spanned the sixties. TNCs from Japan and the US transferred their manufacturing operations to China, to profit from the low wages. This was the initial learning stage where knowledge and skills were transmitted through training and technical assistance. The take-off of the manufactured goods industry took place during the second phase. This phase covered the seventies. During this period, Chinese manufacturers gathered expertise and knowledge through licensing and manufacturing contracts. The manufacturers were capable of producing the foreign product innovations, regardless of low R&D expenditures. In the eighties the professional electronics industry took off, that is the third stage. With the expertise and knowledge manufacturers had collected they started with designing and producing their own electronics. The shift from manufacturing to engineering enabled the TNCs to delegate the production closer to the introduction of the product. The new technologies worked together with the OEM suppliers, entailing additional learning. The final stage, starting in the nineties, involves the shift from electronics to IT-systems. At this point most latecomer enterprises do not operate at the technological frontier and they are dependent on competitors for parts. To solve this matter, enterprises had to gather new technology. There are two ways to gather new

technology, in-house R&D and foreign cooperation. The latter did not only provide new technologies, but access to overseas markets as well.

The knowledge base and expertise of the Chinese enterprises grew larger through the joint ventures and FDI inflow. OEM was an alternative to gather technology, they would produce under strict conditions, but they would also receive additional expertise to fulfill the contract.

In practice the OEM were doing part of the designing as well, giving rise to ODM. Under ODM enterprises would gain additional knowledge and perform incremental innovations. Drawbacks were the dependence on foreign technology and strict sales conditions. Some successful ODM evolved in OBM. Initially the OBM produced for the domestic market, later on they started exporting.

For each country and its economy a different set of conditions apply, so the model discussed above cannot be applied to other countries and industries without biasing the outcome (Hobday, 1995). Still the author believes that this development path roughly fits China's economic development over the past thirty years.

The NIE theory stresses the importance of technology progress. Is the level of technology relevant for GDP growth? The following hypotheses will test the impact of the level of technological development on GDP growth:

*H<sub>3A</sub>: There exists a positive relationship between technology and GDP per capita in the western provinces.*

*H<sub>3B</sub>: There exists a positive relationship between technology and GDP per capita in the eastern provinces.*

## **2.3 New economics of geography (NEG)**

### **Introduction**

Local governments are constantly trying to convince industries to locate in their area, to boost GDP growth (Bai & Qian 2010) (Fenge et al. 2009) (Narula & Dunning, 2000). Local governments can either offer tax benefits and/or subsidies, or they can also try to improve the quality of its public inputs (Fenge et al. 2009) (Kim, 2008). Examples of public inputs are public

transportation, IT- and communication infrastructure and R&D centers. Any mean provided by local governments to boost factor productivity can be considered a public input (Fenge et al. 2009).

A second factor originating from the growing economic integration is the geographical concentration, or clustering (Fenge et al. 2009). Several studies concerning this subject have been carried out, all observed the existence of spatial concentration<sup>1</sup> (Fenge et al. 2009). Ellison & Glaeser (1999) claim in Fenge et al. (2009) that state comparative leads cannot account for all the clustering, they claim that factors such as knowledge spillovers and vertical linkages are the most important reasons for the clustering. Cluster theory is broad and complex topic and is therefore outside the realm of this study.

### **Public inputs**

Regarding Public input competition, Fenge et al. (2009) set up a framework that they named New Economic Geography. Within this framework three factors boost spatial concentration, growing returns on the enterprise level, trade costs and finally monopolistic competition. Scale economies and consumer preferences are the two features that make up the trade costs.

This approach is very suitable when regions are comparable, like in the European Union; in the case of China an approach based on comparative advantages might be more successful. Some comparative advantages may arise from public inputs (Fenge et al. 2009).

The Core-Periphery model (CP model) identifies a number of core-regions, surrounded by small areas of growth and innovation (Commendatore, Currie, Kubin) (Fenge et al. 2009). This is in line with the development in China. The openness originated in the south eastern coastal provinces and slowly diffused north and inwards. The author believes in the importance of spillovers, however, due to the difficulties in measuring the impact of spillovers this factor has been ignored in this study.

When considering investments in infrastructure, local governments take planned investments by surrounding regions into account; in order to profit optimally from their resources (Fenge et al. 2009). There are two basic situations with regard to trade costs; one situation where trade costs is high and one situation where they are low. In case of the latter, regional governments may choose not to invest in public inputs and just to profit of the investments in infrastructure by neighboring regions. This will lead to spatial agglomeration in the investing region (Fenge et al.

2009). In case of high trade costs, the geographical concentration will be offset. High trade costs will entice other regions to make comparable investments to avoid high trade costs (Fenge et al. 2009). Even though investments in infrastructure may prevent industries from shifting away from the region, it might lead to an overinvestment in public inputs (Egger et al. 2006).

Investments in infrastructure give rise to two main externalities. First there is a negative externality, the fact that investments by one region might lure industries away from other regions. Second there is a positive externality arising from the investments in public inputs. Additional investments in public inputs lead to lower trade costs for other regions. If trade costs can be reduced to a significant level, the latter externality will be dominant (Fenge et al. 2009). There is a third externality that arises from additional investments in public inputs. In Fenge et al. (2009), Martin & Rogers (1995) look at public inputs from a firm-based point of view, they view investments in infrastructure as a way to cut trade costs (Fenge et al. 2009). There are different takes on the effect of public inputs on the productivity of the firm. Fenge et al. (2009) state that investments in infrastructure reduce the variable costs of a firm, whilst, Egger and Falkinger (2006) claim that investments in public inputs lower the fixed costs of the firm. Either way, enterprises benefit from additional investments in public inputs (Egger et al. 2006).

Studies of South Korea showed that heavy decentralization accompanied by the required alterations in government structures and radical reforms in sectors like law and regulation led the country to success (Kim, 2008). China has opted for a related approach; however they chose to keep some more control with the central government (Gang et al. 1997).

## **Conclusion**

Provinces try to lure industries by investing in public inputs or offering other preferential treatment such as tax benefits. They act this way to boost GDP growth, but also to receive extra tax revenues. Large industries result in high tax revenues. To achieve spatial agglomeration, three factors are important. There is increasing returns for enterprises, trade costs and monopolistic competition. By investing in public inputs provinces increase their attractiveness. The alternative is not to invest and to profit from investments in neighboring provinces. The result might be overinvestment if both regions invest in similar assets.

Investments in infrastructure provide a number of externalities. On the downside, the shift of an industry to another province means that it had to leave another one. On the upside, trade costs for

surrounding provinces are reduced as well as trade costs for enterprises in the province. Propositions regarding the relationship of public inputs, especially transport infrastructure, will be addressed in the next chapter.



### **3. Descriptives**

#### **Introduction**

Growth originates from the creation of new economic activities or from a totally different approach to existing activities. This process is referred to as a 'process of structural change' (Burgess & Venables, 2004). Lewis (1954) stated that this process entailed a shift from agriculture to manufacturing. This shift occurred because of the fact that the manufacturing sector experiences higher labor productivity than traditional sectors do. The new allotment of labor also spurs productivity in the traditional sectors (Burgess et al. 2004).

Before the economic reforms the economic growth of China was agriculture-led, as from the mid-eighties it shifted to a trade-led economic growth (He et al. 2010) (Pomfret, 1997). The shift came about as an increasing number of Township and Village Enterprises (TVE's) embarked on joint ventures with foreign firms (Pomfret, 1997). The focus of those joint ventures was on labor-intensive manufactured goods for export (Wen, 2007) (Pomfret, 1997). Until the end of the nineties exports were considered the main driver of economic growth (Pomfret, 1997).

China's GDP growth has averaged an amazing 9.5% over the past twenty five years. It took China nine years to double their GDP per capita and another nine years to double it again. This growth was accompanied with industrial structural adjustment. In the two decades following the economic reforms the primary sector experienced a growth rate of 4.7%, compared to a growth rate of 11.4% and 10.3% for the secondary and tertiary sectors, respectively. The lower growth rate for the primary sector is consistent with the Smith-Petty-Clark law. This law states that the share of the agricultural sector, or primary sector, decreases as income per capita rises, leading to an industrial structural adjustment. Whether this rate sustainable for the coming decades is the question, the growth rates of the economy fluctuated between 5% and almost 15%, inflation rates did not surpass the 10% for most of the years. Overall China experienced high growth rates without suffering from inflation (Cai et al. 2002).

Presently, increasing economic integration is a growing phenomenon on a global scale. An integrated global market has a positive effect on trade costs. Economic integration kindles inter-regional business and factor mobility (Fenge et al. 2009).

Another important aspect that is linked to economic growth is the growing spatial inequality. The development of the western regions lies behind when compared to the development of the eastern regions. The coastal regions, the epicenter of economic growth of China, thrive so well that they are able to cancel the slow pace of development of the western regions. It is important though to realize that the growth rates attained by the central and western regions are above average when compared to international standards (Cai et al. 2002) (Burgess & Venables, 2004). In order to counter the growing inequalities, to facilitate overall national economic growth and to prevent social unrest (Yang, 2002); the central government initiated the “Grand Western Development”. This project aims to develop the western provinces that are lagging. From 2000-2005 USD 121 billion is budgeted to start realizing this endeavor (Fleisher et al. 2010). Yang (2002) claims that similar institutions, penchants and level of technology smooth the progress of regional convergence. All provinces aim to reach their steady state equilibrium (Sonobe, Hu, Otsuka, 2004).

The next section will regard the development of regional inequalities alongside GDP growth in China for the past three decades. This is followed by a description of the major forces that drive GDP growth. Human capital, foreign direct investment, infrastructure, government reforms and exports will be examined.

### **3.1 Regional inequalities**

The past decades China experienced a high degree of economic growth, unfortunately not all provinces profited equally from this leap forward (He & Dunchin, 2009) (Fleisher et al. 2010). In 2000, China had the highest percentage of economic growth, but at the same time it also experienced the highest degree of income disparity (Yang, 2002; Fleisher et al. 2010). This is different from the Mao-era where inequality, mainly due to the rural-urban income disparity (Yang, 2002), was decreasing; this trend lasted till 1986.

In the nineties the regional inequality rose sharply (Fleisher et al. 2010; Yang, 2002). One reason was that provinces opted for different growth strategies, resulting in different market conditions

and policies. Taking the geographical location into account, this led to unequal growth of provinces. While the western provinces were struggling, the eastern provinces experienced a high degree of industrial agglomeration (Wen, 2007) (Fleisher et al. 2010; Yang, 2002). This was partly due to preferential treatment for foreign invested enterprises (FIEs) and the allocation of special status to certain cities, the so-called Special Economic Zones (Van Dijk, 2011) (Yao, 2009) (Gang et al. 1997). This was an additional incentive for foreign multinational enterprises to move their production operations to China. They were already enticed by the positive investing climate and low wages (Wen, 2007). When in the mid-nineties the legal protection of foreign enterprises and contracts was improved great amounts of FDI flowed into China, in one year the number of foreign enterprises operating in China almost doubled from 84,371 in 1992 to 167,507 in 1993 (Wen, 2007). Most of which were located in the eastern provinces, where there was less government involvement, markets were more developed and the legal framework was more efficient (Wen, 2007).

The shift towards an open market economy also caused a shift in wealth distribution. During the Mao-era the north eastern provinces had the highest GDP per capita. In 2008, the GDP per capita of the south eastern provinces was 30% higher than that of the north eastern provinces and 36.9% higher than the western provinces (Fleisher et al. 2010). Figure 1 shows the development of GDP per capita for the eastern and western provinces from 1995 till 2008.

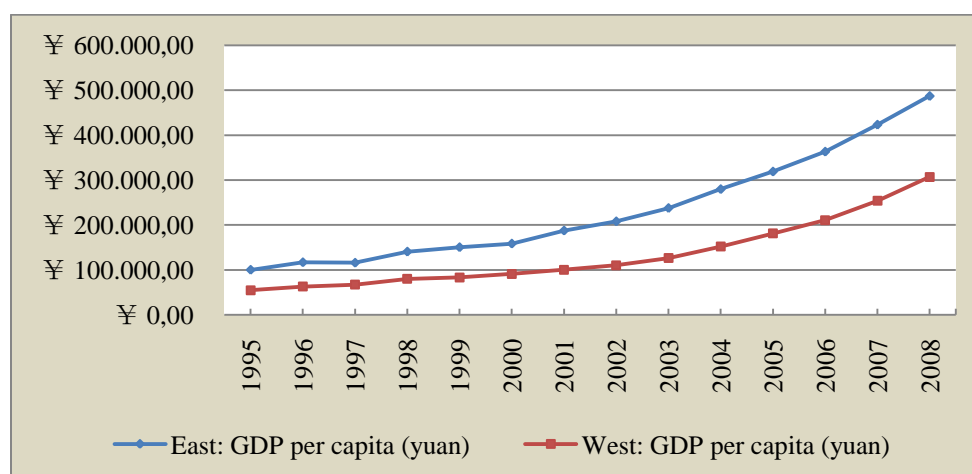


Figure 1: GDP per capita development (Yuan); 1995-2008.

Another factor of growth that illustrates the inequality between the eastern and western provinces is total investments (Van Dijk, 2011). In 2008 the eastern provinces received approximately

9644.9 billion Yuan worth of investments, while the western provinces roughly collected investments adding up to 7264.5 billion Yuan. The government also invests more in the eastern provinces than it does in the western provinces (Van Dijk, 2011). This is partly rooted in the inhospitable geographical conditions and the lack of business partners bordering China in the west. The government hoped that the west would profit from the development of the eastern provinces, some of the knowledge and wealth did trickle west, but not too the western provinces. It got to the provinces bordering the eastern provinces in Central China, but did not spill further west (Wen, 2007). The amount of investments received by both provinces over the period 1995-2008 is illustrated in figure 2.

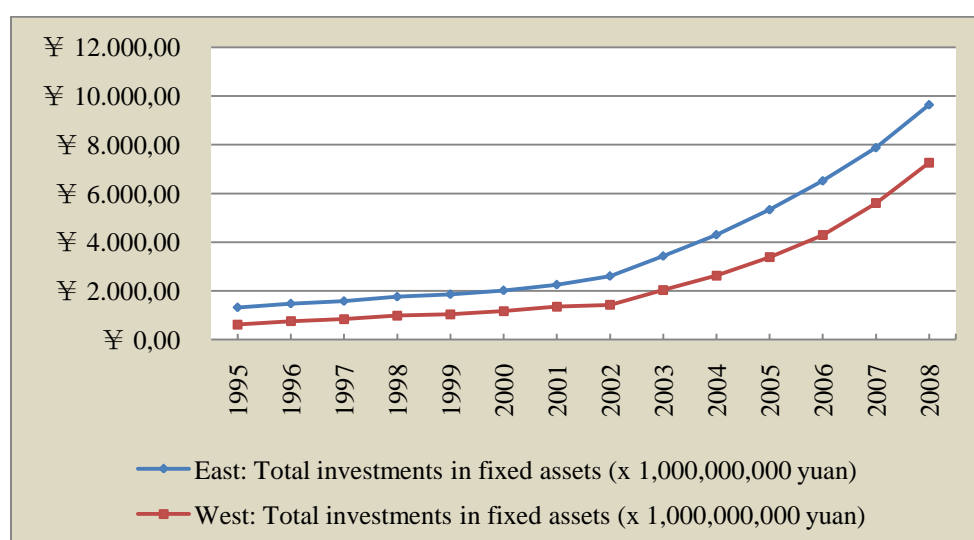


Figure 2: Total investments in fixed assets for the eastern and western provinces; 1995-2008

The central government makes efforts to develop the poorer regions because they want to avoid social unrest (Fleisher et al. 2010). They aim to sustain economic growth as well, but turmoil under the population is undesirable, and that is more likely when the situation of the population is deteriorating (Gang et al. 1997). The government can choose to transfer human capital, in order to spread it equally across provinces. This process is costly, troublesome and lengthy. The alternative it chose is to stimulate growth in the hope that the lagging provinces will catch up at a faster rate than the prosperous provinces grow. To sustain the national growth rate the government attempts to shift their economy from a cheap labor based economy towards knowledge based, more capital intensive production system (Van Dijk, 2011). This creates a national demand for skilled labor and a scarcity of skilled labor in the eastern provinces (He et al.

2009). Furthermore the eastern provinces intend to improve their transport infrastructure in order to accommodate companies operating in their region (Van Dijk, 2011).

While trying to upgrade the eastern provinces, the government endorses the western provinces as an ideal location for industries based on cheap labor. The government promotes the low wages and abundant space. The government even introduced special loans to enable a transfer to the western provinces. For cheap labor based sectors, a shift to the west might be the most efficient move. Even though the western provinces cannot provide all the benefits experienced in the eastern provinces, operating in the eastern provinces becomes more expensive with the growth of the knowledge based economy. In the western provinces wages are low, space is abundant and environmental laws are not enforced with the same vigor as in the eastern provinces (Van Dijk, 2011). Since 2000, the government also installed a number of growth policies for the western provinces, to stimulate economic growth for the coming decades (Wen, 2007) (He et al. 2009); It is called the Western Development Strategy. This strategy is discussed further on in the research. The central government even promotes the exploitation of comparative advantages (He et al. 2009).

## **Conclusion**

China has gone through a tremendous development over the past three decades. The country shifted from a planned economy to an almost completely open market economy, but this growth led to significant inequality across provinces. Reasons are a. o. the preferential treatment for coastal cities and the allocation of SEZs, on top of the cheap labor and a favorable investment climate.

Growth really took off when FDI started flowing in, during the mid-nineties. The central government was aiming for a spillover effect from the eastern to the western provinces, unfortunately that did not happen.

Since 2000 the central government aims to develop the western provinces, they devised a number of reforms and policies, bundled in the West Development Strategy.

This leads to the following hypothesis:

*H<sub>4</sub>: The western provinces' share of total GDP per capita has been growing over the period 1995-2008.*

## **3.2 Drivers of economic growth**

There are several factors that add to economic growth. Van Dijk (2009) and Yang (2002) discuss the role of FDI and exports as forces of growth. Additionally Fleisher et al. (2010) identified physical capital, human capital, infrastructure, new technologies and government policies. In a recent paper Van Dijk (2011) draws attention to migration as a major force of economic growth. The factor S&T was discussed in chapter two, since it is an important part of the Newly Industrializing Economies theory. Physical capital was, previously, briefly discussed in Solow's growth theory; it is not included in the rest of the research due to the difficulty of determining the value of physical capital. The factor migration is quite broad and is ignored for the purpose of this study. The following paragraphs will provide an insight in the development of these factors of growth and why they contribute to economic growth.

### **3.2.1 Human capital**

Even though several studies yielded varying results, human capital is judged to be crucial for regional development. This uncertainty comes forth from the fact that the environments in which the studies were conducted fluctuate. Factors such as size and composition of the labor force and quality of education are influential and differ across regions. This study adheres to the relevance of human capital for economic growth. There are two channels through which human capital can affect economic growth. First there is the direct effect. The direct effect refers to the workers that contribute directly to the production process. Absorption of spillovers and facilitation of domestic innovations are what make up the second channel through which human capital influences economic growth, the indirect effect (Fleisher et al. 2010).

All the available workers compose the human capital available. Fleisher et al. (2010) make a distinction between highly educated and poorly educated employees. The cutoff point for, what is considered to be highly educated is the secondary school level. Schooling below that level is deemed poorly educated, while schooling from secondary level onwards is judged to be highly educated (Fleisher et al. 2010) (Démurger, 2001). Poorly educated workers contribute directly to

the production process; however, highly educated workers contribute directly as well indirectly to economic growth. Their direct contribution is judged to be higher than that of unskilled labor because of their education (Fleisher et al. 2010).

Due to the unavailability of data this study chose the 'number of graduates from institutions of higher education' as proxy for human capital in this study. This means that both the direct and indirect effects are captured in this study. It is important to realize though that most if the direct effect is excluded since any worker with schooling lower than higher education is not taken into account.

The number of educated workers is relatively small in China. A country with the economic growth and per capita income such as China should have more workers with an educational level equal to, or higher than secondary school. The lack of investments in education in the past is an important cause of the absence of sufficient skilled labor. Developed countries spend on average 5.1% of its GDP on education. China spent, in 2004, 2.79% of its GDP on education, which is well below the average 5.1% of developed countries (Fleisher et al. 2010). Furthermore, in 1982, only 0.6% of the total population had enjoyed some degree of college education. This grew slowly to 1.3% in 1992. To increase the number of people with college education or higher the central government intervened in 1999 by seriously increasing the number college student enrollments. They reached an annual increase of 26.6% by 2003. In that same year only 5.2% of the population had a level of education equal to or higher than college. Even though the eastern provinces have a higher number of graduates, it is the western provinces that have displayed the highest growth rates. From 1996 till 2007 the growth percentage of the western provinces was higher. But there still exists disparity between the western and eastern provinces (He et al. 2009). According to Démurger (2001) the difference in educational level accounts for discrepancies in growth percentages among provinces. Another cause for this gap is the so-called 'brain drain'. It refers to the fact that once people have enjoyed higher education they leave for places where their marginal productivity is higher; the eastern provinces. This problem is partly countered by the system of residency (Hukou) system permits, preferential employment opportunities and health care system, but that is not effective enough (Fleisher et al. 2010) (Yang, 2002). The 'brain drain' might be the most important problem since the number of graduates is approximately equal in western and eastern provinces. The importance of educated employees stems from their indirect contribution to the production process. Sonobe (2004) shows that

higher levels of education may result in domestic innovations and spillover absorption; but it also facilitate organizational changes.

There is a positive relationship between human capital and spillovers. Because of the mobility of the labor force, technology diffuses at a higher rate. Neighboring provinces can profit from new technologies developed in wealthy provinces (Fleisher et al. 2010).

The current development strategy adopted by the eastern provinces, to shift the core of their economy from cheap labor to knowledge, requires a great number of educated employees while there are a great number of uneducated employees migrating to the eastern provinces (Van Dijk, 2011) (He et al. 2009) (Yang, 2002).

In the western provinces the number of graduates has been growing for the past decades (Van Dijk, 2011). The ‘number of graduates of institution of higher learning’, in the western provinces, grew from 370,865 in 1995, to 2,550,432 in 2008. In this respect the western provinces almost caught up to eastern provinces, because the ‘number of graduates of institutions of higher education’ in 2008, for the eastern provinces tallied 2,569,066. Figure 3 depicts the growth of the educated labor pool as well as the moment of intervention by the central government mentioned above.

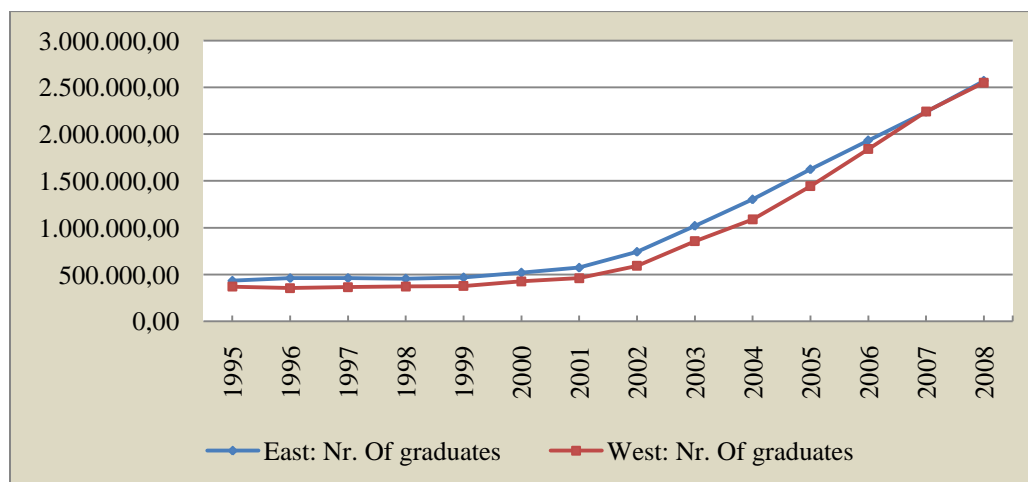


Figure 3: The number of graduate of institutions of higher learning for the eastern and western provinces; 1995-2008. Point of intervention was 1999/2000.



## **Conclusion**

The importance of human capital for economic growth has been discussed and proven before, that is why it is incorporated in this study of economic growth in China. There are two ways in which human capital affects GDP growth, the direct and indirect effects.

The direct effect is the contribution to the production process of goods and services. The indirect influence stems from the absorption of spillovers, aiding organizational flexibility and enabling in-house innovation. The latter only stems from educated workers, while poorly educated workers only add to GDP growth through their direct contribution to the production process. Presently the Chinese economy, mainly the eastern provinces, wants to shift from a cheap labor based economy to a knowledge based economy, but there is a shortage of educated workers. This is partly due to the absence of past investments in education. Especially the western provinces struggle since a lot of graduates search for locations where their marginal productivity is highest, often in the eastern provinces, and move away. In 2008 the ‘number of graduates of institutions of higher learning’ was almost equal between the western and eastern provinces, indicating a tremendous development of both regions.

Considering the above human capital can be expected leads to have a positive impact on GDP growth. Therefore the logic hypothesis to be derived becomes the following:

*H<sub>5A</sub>: There exists a positive relationship between human capital and GDP capita in the eastern provinces.*

*H<sub>5B</sub>: There exists a positive relationship between human capital and GDP per capita in the western provinces.*

### **3.2.2 Foreign direct investment**

There were two main forces that enabled China’s shift towards an open market economy; the push-force, the growth of local private enterprises (a.o. TVEs) and the introduction of partial foreign ownership (Fleisher et al. 2010). It has been a great help in the change of collective and state-owned sector. The rise of investment opportunities stems from a number of changes that took place during the first two decades of the transition period. First there were the high, sustained economic growth rates, approximately 9.6% between 1978 and 2001. A second reason for the attractiveness of investing in China is the potential for a big domestic market. The third

reason for the surge in foreign investments is the swift development of market institutions (Wen, 2007). Later on preferential policies encouraged further inflow of FDI (Yao, 2009).

From a company point of view profit maximization is most important; therefore it is logic that FDI flowed towards the location with the most desirable combination of public inputs and labor pool. Those locations were the coastal provinces (Fleisher et al. 2010; Yang, 2002). Since FDI boosts economic growth, local and central governments all make efforts to attract as much FDI as possible. Those efforts include preferential policies such as tax benefits and Special Economic Zones (SEZs) (Yang, 2002; Fleisher et al. 2010). The arrival of FDI meant technological and managerial spillovers (Fleisher et al. 2010) (Bai et al. 2010) (Wen, 2007). This led multinational enterprises to shift their production to China, where they could profit from the low wages and an interesting investment climate (Wen, 2007). Liu, Wang and Wei (2001) claims that apart from the direct investments in the Chinese economy, the inflow of FDI has a positive effect on the produced exports of the beneficiary country and it might trigger a so-called ‘demonstration effect’. The latter refers to showing investment opportunities to domestic investors with limited knowledge and experience, when compared to foreign investors (Wen, 2007).

The positive properties of FDI and the observed development of formerly newly industrializing economies, such as Japan and South Korea, led to the rise of FDI as a development approach. For this strategy to work optimally it is important that the country in question has good trade regimes and open trade policies (Wen, 2007). But the most important factor is to attract the ‘right kind’ of investment, as Narula et al. (2000) state. For developing countries to keep receiving FDI they need to supply optimal conditions for that kind of investment to flow into the country. The ‘right kind’ refers to FDI accompanied by technological spillovers or export channels, contributing something that cannot be obtained from domestic investments (Narula et al. 2000). Nowadays the amount of FDI flowing into cities is deemed to be a god measure of the cities’ attractiveness (Van Dijk, 2011).

The western provinces have been relatively successful at attracting successful. The term relative is used because they managed to attract 137.2 billion Yuan worth of FDI in 2008, compared to 27.2 billion in 1994. This is only a relative success since their share of attracted FDI has not changed; it was 13.8% in 1995 and added up to 13.7% in 2008. The amounts of FDI actually invested in the eastern and western provinces over the period 1994-2008 are illustrated in figure

4.

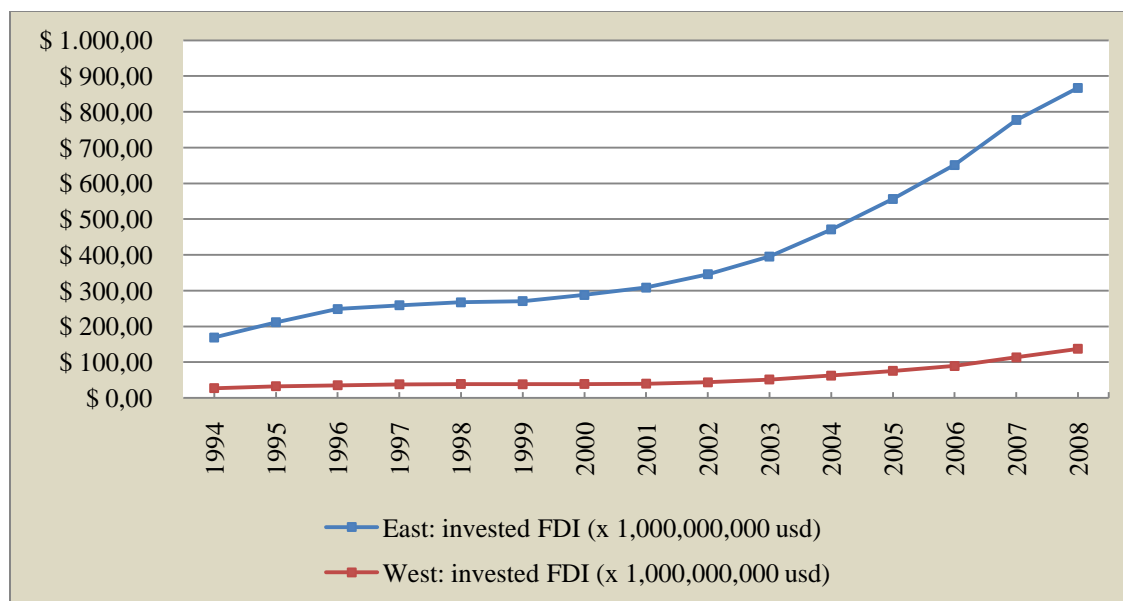


Figure 4: Actually invested FDI in western and eastern provinces; 1994-2008.

According to Wen (2007) FDI has a bigger impact on GDP growth in regions where GDP per capita is lower, as opposed to a higher level of GDP per capita. This should mean that the effect of FDI on GDP growth should be bigger in the western provinces than in the eastern provinces.

## Conclusion

The role of FDI in the Chinese economy is significant. The authorization of partial foreign ownership enabled the shift from a planned economy to an open market economy. FDI also aided the transformation of the collective and state-owned sector.

Initially foreign investors had two incentives to invest in China, the latent sizeable domestic market and the quick implementation of market institutes. Eventually preferential treatments and the installation of SEZs were added to the list of investment incentives.

Most FDI flowed to the eastern provinces because they provided the best set of conditions in terms of location, labor pool, public inputs and government policies. The entrance of preferential policies and SEZs led multinationals to transfer their cheap labor based production operations to China, together with a continued flow of FDI.

There are three channels through which FDI affects GDP growth; through direct investments, amelioration of export performance and through the demonstration effect. Witnessing the success of South Korea and Japan, the Chinese government opted for a similar approach to their 'FDI development strategy'.

Presently the concern of local and central governments is to attract the ‘right kind’ of FDI, that is FDI that brings more than just capital investments, such as spillovers or access to foreign markets. The impact of FDI is supposed to be more significant in regions with lower levels of GDP per capita compared to regions with higher levels of GDP per capita.

The information provided prompts a number of hypotheses.

*H<sub>6A</sub>: There exists a positive relationship between FDI and GDP per capita in the eastern provinces.*

*H<sub>7B</sub>: There exists a positive relationship between FDI and GDP per capita in the western provinces.*

*H<sub>8</sub>: The impact of FDI on GDP per capita is bigger in the western provinces, as opposed to the eastern provinces.*

### **3.2.3 Infrastructure**

Another force that is positively related to GDP growth is infrastructure. The term infrastructure encompasses three distinct sectors. First is transport infrastructure, this is the whole network of railways, ports and roads. Most traffic and transport of goods occurs via roads or railways (He et al. 2009). Communications infrastructure is another sector; this covers the phone lines, mail systems etc. (Fleisher et al. 2010) (Sonobe et al. 2004). Finally there is the energy sector which can also be considered part of infrastructure. The growth of the electricity sector over the past three decades is similar to the GDP growth over the past thirty years; on average 9.1% for the electricity sector and 9.8% for GDP. This is a tremendous growth (Bai et al. 2010). Similar to the transport infrastructure sector, the majority of investments in the electricity sector came from the government or from state owned enterprises. FDI is barely present in the electricity sector because parts of the sector have not been opened to FDI yet (Bai et al. 2010).

Transport infrastructure is the only sector of the three that is included in the analysis; this is due to the unavailability of sufficient data for the remaining two sectors.

As we know, companies look to operate in the environment that is most suited to their needs and production process, they try to exploit their competitive advantage (Egger & Falkinger, 2006). Therefore public inputs become crucial in improving a city’s attractiveness and the presence of public inputs can reduce the operating costs of companies (Egger et al. 2006) (Bai et al. 2010).

Local governments have another reason to attract big enterprises to their region; taxes. Large companies are big tax payers (Bai et al. 2010).

In the past, investments in infrastructure were lacking (Fleisher et al. 2010; Sonobe et al. 2004). This is due to the fact that while investments in infrastructure might generate social returns, they don't guarantee adequate private earnings (Bai et al. 2010). Fortunately both the central and local governments have made significant investments in infrastructure over the years, providing a boost for economic growth (Fleisher et al. 2010; Sonobe et al. 2004). To illustrate the magnitude of the investment consider that the total amount of kilometers of highway tripled from 1995 till 2008, from 1,157,009 km. in 1995 to 3,730,162 km. in 2008. The gradual increase in the length of highways is shown in figure 5, it spans the period 1995-2008. There is a sharp increase in 2005; the cause is unknown to the researcher.

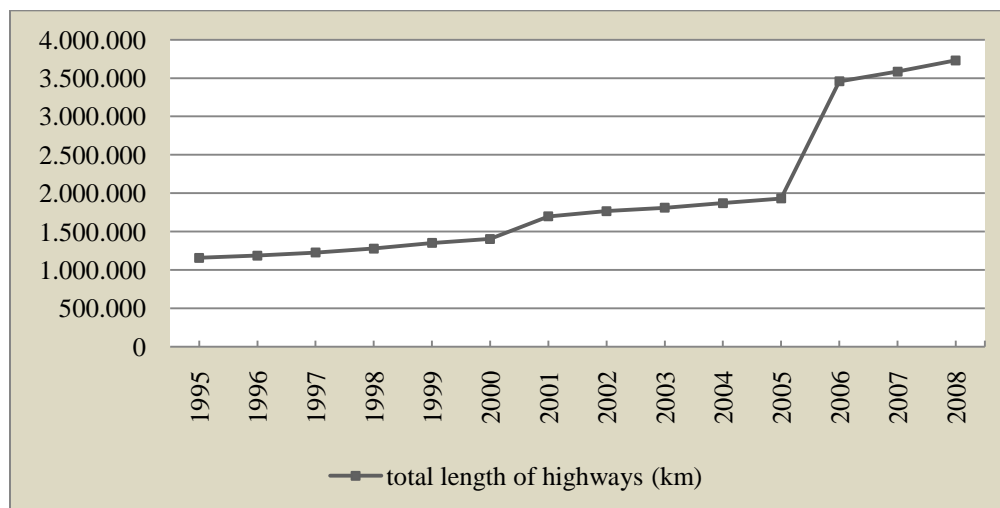


Figure 5: Total length of highways in kilometers; 1995-2008.

According to Fleisher et al. (2010), the boost created was twofold. Economic growth was directly enhanced through the investments itself, but it also increases the productivity of human capital (Fleisher et al. 2010). This development was initiated in 1980 when the construction of roads became a burden for the local governments. Prior to 1980 the central government was responsible for the build and maintenance of a select number of roads. Local governments implemented extra taxes, such as vehicle purchase tax, to pay off the construction of roads (Bai et al. 2010). One year later, in 1981, Guangdong province experimented with highway tolls. The province had borrowed heavily from foreign investors to build a number of bridges and installed

the toll system to earn back the money invested. Certain roads, depending on the technical grade and scale could qualify for a toll highway. This does not mean it is allowed to indefinitely collect toll from those highways. Government toll roads in prosperous regions are allowed to collect toll for 15 years, in the lagging regions this term is prolonged to 20 years. Commercially built roads have terms of respectively 25 and 30 years (Bai et al. 2010). Bank loans are not the only way to finance the construction of roads, local governments can gather the funds through joint stock companies, by issuing bonds or by selling the rights to collect toll on the road in question. Still bank loans are the method that is used most, approximately 40% of investments in infrastructure (Bai et al. 2010).

Most companies operating in this sector are somehow connected to the government since the pre-reform era; this leads to corruption but also acts as an entry barrier. Companies without political connections have a hard time surviving in this sector, because they are at a disadvantage when it comes to getting the required permits; this is the reason that FDI shies away from this sector as well. Another barrier for private enterprises to enter this sector is the requirement to have at least 30% equity to qualify for bank loans (Bai et al. 2010).

However, Wen (2007) also states that the presence of infrastructure was an active force in attracting enterprises. By 1995 most foot-loose sectors had moved to eastern China (Wen, 2007). In order to develop the western provinces the central government devised a number of policies, bundled in the West Development Strategy. The aim is to invest in infrastructure to promote trade, but especially interregional trade. The latter is supposed to be a major force interregional development (He et al. 2009). The strategy depicted by Egger et al. (2006) is in line with the goal of the central government. They claim that the western provinces need to develop a basic transport infrastructure network first, and then they should attempt to identify opportunities to differentiate from the eastern provinces and develop their own competitive advantage (Egger et al. 2006) (He et al. 2009). There are both short term and long term benefits to receive from the construction of roads. The short run returns are employment opportunities and the capital investment itself, the long run effects are the reduction of transport costs and the improvement of the trade conditions. Research showed that western provinces are the prime beneficiary of investments in infrastructure (He et al. 2009).

## Conclusion

The driver of economic growth infrastructure actually entails three distinct sectors. There is the energy sector, the communications infrastructure and the transport infrastructure. In this study only transport infrastructure is considered.

In the past there were few investments in infrastructure. Since the private returns were unsure, the central government was responsible for the construction and maintenance of roads. During the reform period significant investments were made in the infrastructure sector. When the burden of construction and maintenance of roads was growing, the central government passed on the responsibility to local governments. In turn the local governments implemented new taxes on vehicles to pay back the investments in transport infrastructure.

In 1981 Guangdong province was the first to experiment with toll collection on certain roads. From then on depending on the scale and grade of the road it was possible to apply for the qualification as toll roads. Most enterprises in this sector have some ancient connection to the government, which is an advantage to get the required permits. Therefore there are few private players in this sector and also FDI shies away from investments in infrastructure.

To enable the western provinces to catch up the central government initiated the West Development Strategy, a number of policies and investments. One important aspect of this strategy is substantial investments in infrastructure. The value of the investments in infrastructure, in the western and eastern provinces, is unknown to the author. It is therefore impossible to tell if the new investments tally up to a higher sum than the investments in the east. There are a number of ways through which infrastructure affects GDP growth. The investments in infrastructure form a direct boost to GDP growth, but the construction of roads also provides with employment opportunities. In the long run transport costs are cut back and the trading conditions have improved. The contribution of infrastructure, in this case transport infrastructure, has been discussed and proven above.

Two hypotheses come forth:

*H<sub>9A</sub>: There exists a positive relationship between transport infrastructure and GDP per capita in the eastern provinces.*

*H<sub>9B</sub>: There exists a positive relationship between transport infrastructure and GDP per capita in the western provinces.*

### **3.2.4 Government reforms**

The Chinese government played an important role in the development of the economy, from a planned economy to an open market economy. Quantifying the efforts made by the central and local governments is complex and beyond the scope of this research. Therefore this research opted to discuss the reforms and policies implemented in the various sectors over the years, and their effects, to illustrate the enabling and stimulating role the government has played.

#### **Introduction**

China has started in 1978 to fundamentally change the structure of their economy. After two decades the renewed Chinese economy had to deal with a severe economic crisis that struck East Asia (Gang et al. 1997).

In the 1950's prices were determined by the government and were set favorably for the agricultural sector and unfavorably for the industrial sector. The growth achieved in the pre-reform years was slow and was mainly due to the relatively high rate of growth of capital stock.

After the reforms were implemented, China still enjoyed high rates of investments. Those high rates of investment do not automatically mean that GDP growth will remain as high as previously, because since the economic reforms were implemented TFP was the biggest contributor to GDP growth (Gang et al. 1997).

Even after the reforms the Chinese economy is not experiencing free market as advanced economies do. If the government manages to successfully implement the remaining reforms, the economy might be capable of upholding a growth of 8%.

Prior to the reforms the government tried to develop the heavy and producer goods industry through great amounts of investment. This strategy backfired and left the government with an expensive and low-productivity industry, consisting of uncompetitive and poorly organized firms. At the end of the seventies, economic reforms were realized, starting with the agricultural sector. The reforms brought about by the Chinese government led to growth and structural change in the economy, but did not solve all the existing problems (Gang et al. 1997).

#### **Incremental reforms and the dual-track transition to a new market economy**

The implementation of the reforms has been a bumpy road. New market factors were accepted, but the transformation of existing institutions struck severe opposition. People within the



government opposed some reforms, resulting in an incremental reform plan where new structures were set up without taking down the old ones (Gang et al. 1997). Most sectors experienced this to a certain extent. Since some sectors only gradually shifted towards a liberalized approach the transition to a market economy was smooth (Gang et al. 1997) (Wen, 2007).

Three stages can be identified when considering the development of market institutions. The first, from 1980 till 1983, is the conversion of SOEs into more active autonomous economic units, giving foreign investors the opportunity to get in the market through joint ventures. Second was the dual-track approach, which spanned from 1984 till 1992 (Wen, 2007). The dual-track approach showed in the price reforms first. Over the course of the evolution period, three prices were used. There was the market price, the state-guided price and the planned fixed price. It took thirteen years for the old and new prices to come together (Gang et al. 1997). Since 1992 the third stage was initiated, the shift to market prices and opening up of the majority of intermediate goods markets for competition (Wen, 2007).

### **Evolution of a legal system**

The shift from a planned economy to a market economy required the government to install a legal framework to accompany it. This has been a difficult task. The Chinese government has adopted over forty sets of laws over the past three decades. Some of the laws implemented are the *bankruptcy law*, *corporate law* and *labor law*. The second part of the legal system is the enforcement of the laws; regrettably so far the enforcement is inadequate (Greeven ACO 2011) (Gang et al. 1997).

As with the economic reforms, the Chinese government encountered obstacles in the installation of their legal reforms. The following three elements were prohibiting the smooth setting up and activation of the new legal system.

*Preference for informal rules and arrangements.* In general most laws render old laws obsolete before the new institutions are built up. Temporary informal arrangements can overcome this period but often generate new rules and arrangements that obstruct the implementation of laws.

*Arbitration and administrative decisions are decisive.* People turn to court in a last resort, but abide to administrative decisions and arbitration.

*Private property rights are underdeveloped.* The protection of contracts is lacking as well as their enforcement. The high percentage of overdue bank debt is an example of this phenomenon. (Gang et al. 1997)

### **Ownership change and state-owned enterprise reform**

The most significant factor of the dual-track transition of the Chinese economy is without a doubt the change in ownership structure. It was the dynamic growth of the non-state sector that was the catalyst of the high growth rates of the market economy system (Gang et al. 1997).

Prior to the reforms all sectors were state-owned. Things started as from 1979 to 1983 the Chinese government abolished the commune system in the agricultural sector and implemented household farming. This resulted in the rapid growth of TVEs, a community-owned enterprise. Over the past decades the TVEs have grown as well and evolved into more adequate organizations (Gang et al. 1997).

Another factor that provided a stimulus for the change in ownership structure was the increasing formation of capital and the growing number of joint ventures with foreign firms. The coastal regions that experienced a swift installation of the economic reform and opening up of the economy thrived on the FDI flowing in. In 1995 the non-state sector in the coastal regions added up to 70% of GDP (Wen, 2007) (Gang et al. 1997).

The greatest obstacle of the Chinese government, in their efforts to transform their economy, was the state sector. This constitutes amongst others of SOEs, state-owned banks and the government administration. The reforms in the state sector were related to decentralization of decision making, giving local governments more power and autonomy, but leaving the ownership structure untouched. Even though nothing changed about the ownership structure, analyses from Byrd & Tidrik (1987) show that managers, in an early stage of the reforms, started to focus on profits over gross value output, contrary to the past. The incentive for this transition came from the fact that bonuses depended on profits made. Granick (1990) claims that as from 1984 flexibility also significantly increased.

Gang et al. (1997) discusses an analysis by Li *et al.* (1993) showed that productivity grew in 24 out of 32 sectors from 1981 till 1987. Even the spurt in productivity growth could not turn it around for the SOEs, their profitability was continuously decreasing. The SOEs that benefited

from monopolies previously were not able to compete with the private enterprises; this coincided with the restrictions on subsidy allocations (Gang et al. 1997).

The change in ownership structure of SOEs started in 1984; the process of shareholding was used to achieve this goal. The introduction of two stock exchanges in 1988 sped the process up. A corporate structure was widely adopted in new businesses or joint ventures (Gang et al. 1997). The biggest encumbrance with respect to the reformation of SOEs was the enterprise-linked welfare system for state employees, consisting of a pension program, medical care, housing and unemployment insurance. The housing and pension reform were successfully implemented in the mid-nineties, but the restructuring of the medical care has not been successful yet. Unemployment insurance is a tricky element, since unemployed workers are often still on the payroll as *off duty workers*. They get basic wages and welfare benefits. In 1995 for example, there were 2.1 million registered unemployed workers and 7.5 million *off duty workers* (Gang et al. 1997).

### **Fiscal reforms**

The economic reform and growth in the early eighties was mainly driven by the fiscal decentralization initiative. In 1984 the *fiscal responsibility system* and *contract responsibility system* were installed. In the new system local governments and SOEs were allowed to hold on to a share of their revenues after payment of a fixed amount to the central government. This led to a severe fall in revenues for the central government and thus, also to a serious drop in government expenditures. This hampered the government's initiative to carry out fiscal policy and redistribute income, but gave rise to increased efficiency within enterprises (Gang et al. 1997). To increase government revenue, the central government set up a new tax system in 1994, containing a.o. a value-added tax. The tax system was not without problems. There were complaints regarding corruption and its dependence on informal administrative mechanisms was disliked because of a lack of transparency (Gang et al. 1997).

### **Reforms in the financial sector**

In the eighties, the Chinese government chose to transfer a lot of their fiscal obligations to the financial sector, to compensate for the fall in budget revenues. State banks were now responsible for investment funds and SOE operating funds. Along with this shift local governments and

SOEs got the permission to borrow money. By 1995 the debt/GDP ratio had grown to 80%, banks were now swamped with bad loans or non-performing assets. In 1993 the government had installed *policy banks* to alleviate the burden of state banks. The new banks were responsible for long term development loans and agricultural development credit and foreign trade credit. The loans to SOEs remained a task for the, reluctant, state banks, which were more and more focusing on profits since the initiation of the reforms of the banking sector.

Another problem in the financial sector was the lack of private commercial banks. Since the reforms were initiated the number of non-state companies has grown vastly, but the number of commercial banks was far behind (Gang et al. 1997).

### **Economic cycles and stabilization policies**

In times of institutional transition and fast economic growth it is hard to provide a stable macroeconomic atmosphere. Contrary to other countries with a planned economy, China struggled for stability in the period prior to the reforms. Proof is given by the crises caused by the Great Leap Forward (1959-1961) and the Cultural Revolution (1967-1968 mainly).

The late seventies were characterized by similar structural imbalances and overheating because of the modernization plans of the government. The instability experienced in the field of macroeconomics was due to the effectiveness of macro-policies. The decentralization of decision making gave local governments a lot of decision power together with the state companies. Even after the changes in ownership structure little changed for state enterprises and public control was absent. Since they were able to operate under limited restrictions they generated macroeconomic expansion, but on the downside they also generated microeconomic inefficiencies. Each economic cycle experienced overheating due to huge fixed investments in the state sector (Gang et al. 1997).

The financial reforms yielded a more decentralized system with more decision power for banks and non-bank financial institutions. Additionally, policymakers attempted to restructure the monetary policy through the relaxation of direct quantitative controls on credit and the installation of market policy instruments. The dual-track approach was an obstacle for the government in their macroeconomic efforts, because banks were compelled to back up bad loans, while they tried to compete in the market. Eventually the government had to intervene and re-

instated the administrative controls and recentralized certain elements of the decision making (Gang et al. 1997).

### **Effects of government reforms**

As presented in the introduction of this chapter, China experienced an era of decreasing inequality during Mao's time. As from 1979, the new leader, Deng Xiaoping, aimed to shift the Chinese economy towards an open market economy. Such a fundamental change in the economy calls for serious changes in the institutional infrastructure. One of those significant institutional reforms was the introduction of partial foreign ownership. Even though FDI greatly boosted economic growth and facilitated the transition of both the collective and state-owned sector, it also has a drawback. FDI, coming from companies, aims for profit maximization and therefore chooses the location with the most desirable combination of public inputs and labor pool. This led to growing inequality across provinces from halfway the nineties onwards. Another reform that had positive influence on economic development is the introduction of preferential policies. In order to attract more FDI, tax benefits and other special treatments were awarded to foreign companies. SEZs were created, where companies enjoyed approximately 50% tax cuts (Fleisher et al. 2010; Yang, 2002). Other formats were Duty-free zones, economic development zones or opening city. Together with the focus of FDI on prosperous provinces, regional inequalities only grew further (Fleisher et al. 2010; Démurger, 2001; Yang, 2002).

In 1992 Deng Xiaoping initiated the "Southern Trip". This tour was meant to encourage Chinese to pursue personal wealth, but at the same time it sped up the transition to an open market economy and it countered the efforts of conservative forces within the government to impede this process (Fleisher et al. 2010). The pursuit of personal wealth was previously only possible in SEZs or with the help of FDI. 1994 was an important year for the Chinese economy. That year regulations for receiving special status were seriously sharpened, giving domestic companies a chance to compete. More important was the financial reforms that were implemented (Fleisher et al. 2010). As from 1994 the central government started cancelling subsidies to loss-making SOEs. Its strict enforcement came about in 1997, but it started gradually in 1994. The new system of fiscal federalism meant more autonomy for local governments and more responsibilities and freedom for SOEs. In this new situation SOEs had to compete on an open market, while suffering from new budget constraints. This resulted in an increase in

unemployment in two ways. First, SOEs started reducing the number of Xiang workers (Appleton, 2002). Second, to increase productivity SOEs used new technology, requiring fewer employees. The latter effect was gradual since technology needs time to be widely diffused.

As to be expected from a shift to an open market economy, the contribution of SOEs to GDP growth has been decreasing significantly. In 1992 48.1% of gross industrial output came from SOEs, this was only 13% in 2003. Another advantage coming forth from the financial reforms is that local governments made significant efforts and investments to attract FDI to their provinces (Cao, Qian, Weingast, 1999). All the implemented reforms changed the business environment into a more competitive one (Gang et al. 1997).

## **Conclusion**

The new leader of China, Deng Xiaoping, initiated a shift from a planned economy to an open market economy.

The first reforms were implemented in the agricultural sector in 1979. The changes struck opposition and resulted in a dual-track approach where new institutions were installed while old ones remained intact.

The market reforms can be categorized in three stages of development. It started with giving more operating space to SOEs, followed with a dual-track approach with regard to prices. When the second stage started there were three prices, and over the course of thirteen years they merged into one. The final stage consists of opening up the remaining markets.

All the reforms required a legal system that grew along with the new institutions. New laws were put into practice, such as bankruptcy law and corporate law. Unfortunately this strong new legal framework is not backed by an equally strong enforcement.

Another important change in the transition of the Chinese economy is the change in ownership structure. The first change was in the agricultural sector where farmers cooperated in TVEs, when foreign partial ownership the structure of SOEs started changing as well and the focus shifted from gross output to profit. This change did give rise to a problem regarding social benefits. Originally social benefits were provided by SOEs, but to become competitive they could not sustain this responsibility and started firing xiang workers.

Fiscal reforms also applied to SOEs. Both SOEs and local governments were authorized to keep some of their proceeds, leading to a significant drop in government revenue. To overcome this issue, the central government implemented a new tax system.

The state banks had to change as well, especially after the central government made them responsible for the bad loans to SOEs. This burden made competing in the open market difficult. The government acted and created policy banks, which are responsible for long term investments in development. The banking sector's only concern is the absence of private banks.

Considering all the reforms, new policies and investments made by the government it is not unreasonable to conclude that the government enabled GDP growth through investments, but also through the facilitation of trade. This partly answers two research questions. It confirms that government reforms have enabled GDP growth and thus can be considered a factor of economic growth. Furthermore one can conclude that government reforms and policies are present in both the eastern and western provinces.

### **3.5 Exports**

Economic growth is influenced by several factors. One factor that influences economic growth is the growth of exports. The expansion of exports is said to lead to an increase in factor productivity, which in turn enables externalities, such as technological spillovers, and economies of scale (Mah, 2007). He & Zhang (2010) claim the same consequences, but they believe the cause is participation in the world market. They assert that opening up to world trade requires enterprises to become more competitive and operate as close to the technological frontier as possible (He et al. 2010).

Prior to the reforms implemented by the government in 1978, China did not really participate in the global market of exports. This changed through the economic reform policies. Nowadays China is a serious participant of the export markets. This development has actively been supported by the government and it resulted in spectacular growth. China experienced a shift in the composition of their exports, from primary goods to manufactured goods. Mah (2007) states that a structural change in export composition has a positive influence on economic growth as well.

The first economic reforms were initiated in 1978, but it was in 1979 that the *foreign trade and exchange rate systems* were opened up. This was the start of the exponential growth of trade volumes; this is depicted by figure 6.

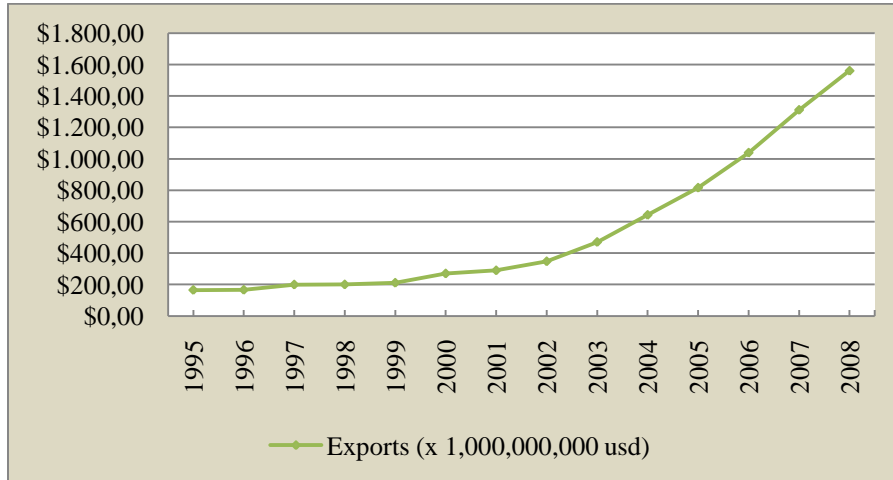


Figure 6: Total value of exports; 1995-2008.

China's trade volumes rose from 21 billion Yuan (ca. €2.2 billion) in 1979 to 2203 billion Yuan (ca. €228.9 billion) in 2001 (Mah, 2007). Another factor that contributed to the growth of exports is FDI (Liu et al. 2001) (He et al. 2010). Liu et al. (2001) pose that when imports from a country increase, so will the FDI inflow from that country. As a consequence of the increased amount of FDI, exports will rise (Liu et al. 2001). Liu et al.'s theory is proven by watching the development of FDI and exports over the past fourteen years. This progress is pictured in figure 7.

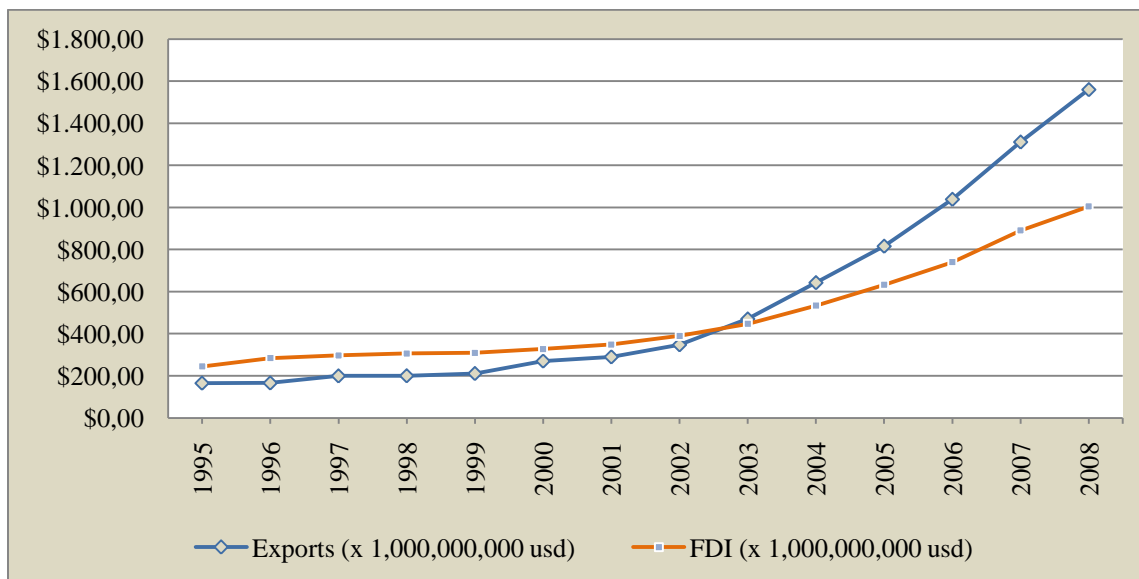


Figure 7: Total quantity of FDI invested in China and total value of Chinese exports for 1995-2008.



He et al. (2010) argues that FDI played a different role to enhance the growth of exports. According to He et al. (2010) it started with the intention of the central government to update its capital stock and technological level. Observing the success of the “small dragons” Singapore, South Korea, Taiwan and Hong-Kong, the Chinese government decided to pursue a similar export-led growth strategy. This resulted in new policies regarding foreign trade; preferential treatment for foreign invested enterprises (FIEs) and tariffs cuts (He et al. 2010). Furthermore, they implemented SEZs. The SEZs gave access to foreign markets and spillovers from the SEZs helped develop the domestic economy, but to make sure that the FIEs would not hamper the domestic development they obliged them to sell a major part of their production abroad (He et al. 2010). In the late nineties Chinese policymakers realized that international competition could be the factor that compelled the SOEs and banks to increase efficiency. In order to increase competition, policymakers implemented a number of domestic reforms in order to be able to access the World Trade Organization (WTO). Accessing the WTO would not only improve the performance of domestic enterprises but also provide access to overseas markets (He et al. 2010). The changes pushed through by the government did result in productivity growth among SOEs. Overall China benefited from WTO-access in five ways. Access to overseas markets was guaranteed, economic reforms could not be undone, domestic enterprises and banks started operating more efficiently, the trading environment became friendlier and technology spilt from foreign enterprise to domestic companies (He et al. 2010). The reasoning of the Chinese policymakers is backed by research of Fu & Floor (2004) in He et al. (2010) that state that export-oriented sectors are more efficient than sectors with a domestic focus.

Wen (2007) discusses the findings of Zhang and Song’s (2000) study over the period 1986-1997; they found that a rise in regional FDI inflow resulted in higher export volumes. The immense coastline of china, spanning approximately 14500 km is another feature that enabled the growth of exports. The coastline with its ports and closeness to Hong-Kong, which is duty-free were of great help (Wen, 2007). The initial opening up of the economy started in Pearl River delta and shifted north, to the east coast before moving up further north. This process is clearly illustrated in figure 8.



Figure 8: Channels leading to openness of China. Start is in Pearl River delta in the south-east. Gradually the openness spread north and inwards. (Research by Feng, X. 2010)

The eastern provinces are presently focused on exports (Wen, 2007). This fed the belief that the Chinese economy is depending too much on exports, while the share of gross output that is meant for exports is smaller for the Chinese economy than it is for Japan or South Korea (He et al. 2010). It is true though that compared to 1997 the dependency ratio of China in 2002 had increased, from 18.2% to 20.7%. Even though it is increasing, the dependency ratio is still below the ratio of the small dragons; especially Singapore and Taiwan have a high dependency rate, of 31.7% and 55.2% respectively (He et al. 2010).

An important matter to consider, when discussing export dependency, is the distinction between ordinary trade and processing trade. The latter's contribution to GDP growth is expected to be much less than from the former (He et al. 2010). Processing trade refers to a preferential policy, initially meant, for enterprises operating in SEZs. It means that imports were free of taxes and VAT, provided that the products manufactured with those imported goods would be sold overseas (Yao, 2009). The processing trade cut costs on production but did not really stimulate exports (Yao, 2009). The reliance percentage of processing trade in 2002 was 4%, one-third of the reliance rate of the ordinary exports that have a percentage of 13%. When considering that about 50% of China's foreign trade consists of processing trade and that its dependency rate is lower than Singapore or South Korea, it is difficult to maintain that the Chinese economy is too dependent on exports (He et al. 2010).

He et al. (2010) claims that the effect of net exports on GDP growth has been increasing in the past years, or rather the change in net exports. They claim it is the change in net exports that alters GDP growth (He et al. 2010). Apart from the direct contribution to economic growth, exports also add to growth indirectly. First there is a rise in employment opportunities when exports grow, second is the increased wages that stem from exports growth. Both effects did not significantly occur in China because of the abundant number of available unskilled labor (He et al. 2010). Finally the economy benefits from spillovers associated with exports as well (Mah, 2007).

## **Conclusion**

Until the reform period, China barely participated in the world market. China started with exports in 1979, but really took off when FDI started flowing in. Studies have shown that a rise in FDI inflow led to an increase in exports.

Observing the growing volume of exports and incoming FDI, the Chinese government chose to follow the example of countries like Japan and South Korea and adopt an export-led growth strategy. To stimulate exports the government issued new policies, provided tax cuts and created SEZs. One condition to receive those benefits was that a part of production had to be sold overseas; this was to protect the domestic enterprises. The domestic enterprises profited from the spillovers of foreign firms as well as from the access to foreign markets. An important reason that contributed to the success of this approach was the Chinese coastline. Located close to duty-free Hong-Kong was an additional gain.

The access to the WTO was a big step for China, it provided continued access to foreign markets, but it acted as an incentive for Chinese businesses to operate more efficiently as well. Other benefits from WTO access are spillovers, friendlier trade conditions and a lock-in of implemented reforms.

It is argued that China might depend too much on exports, but a study by He et al. (2010) proved that this is not the case. The dependency rate of China is higher than the US' but lower than Taiwan and Singapore's ratio. Furthermore, over 50% of exports is processing trade and contributes less to GDP growth than ordinary trade.

There are a number of ways through which exports contributes to GDP growth, it can be through investments in exports, additional employment opportunities and spillovers. The hypotheses that are logically derived from the above are the following:

*H<sub>10A</sub>: There exists a positive relationship between exports and GDP per capita in the eastern provinces.*

*H<sub>10B</sub>: There exists a positive relationship between exports and GDP per capita in the western provinces.*

## **4. Methodology**

### **4.1 Introduction**

The first objective of this study is to determine the effect of a selection of drivers of economic growth in both the western and eastern group, on economic performance. Second, the main goal of this research is to ascertain whether the economic performance of the western group is catching up with the economic performance of the eastern group. The third objective of this research is to assess if it is true that human capital and FDI contribute more to GDP growth in underdeveloped regions compared to developed regions. For the purpose of this research secondary data was gathered on economic activities of the China. This analysis is supported by secondary resources such as scientific articles and literature.

### **4.2 Research design**

This study can be considered to be of a fundamental nature since its aim is to generate knowledge on the economic developments of the developing provinces in China (Sekaran, 2003). This is a quantitative research, because the data spreads from 1995 up to 2008 and it is concerned with a single population it is considered as longitudinal time-series data (Sekaran, 2003)(<http://dss.princeton.edu/training>). The advantage of longitudinal panel data is that it enables the addition of variables with different units of analysis (<http://dss.princeton.edu/training>). There are two options to deal with panel data, a fixed effects model or a random effects model. This study used the fixed effects model since that is most suited when researching the influence of variables over time (<http://dss.princeton.edu/training>); and this study attempts to identify the weight of the drivers of economic growth on GDP per capita.

In the analysis process this dataset is split in two groups, the western and eastern group. The empirical data supports the theories postulated in chapter two with objective results. Furthermore the presence of quantitative data helps to prevent biased results. The information for the literature review consists of scientific articles, books, newspapers and websites and can therefore be judged to be of a secondary nature (Hardy & Bryman, 2004). The scientific articles are

gathered from several databases such as Jstor, Wiley and ProQuest. The literature review provides the setting within which the research is conducted.

### **4.3 Method**

The research technique chosen for this study is the OLS regression approach combined with descriptive statistics, based on the hypo-deductive method. The first step of the hypo-deductive method consists of formulating hypotheses. Second is testing the validity of those hypotheses through empirical analysis, and eventually draw conclusions with respect to the previously set up hypotheses (Sekaran, 2003). Even though using the natural logarithm provides the possibility to obtain standardized results and to interpret the results as elastic, it was decided not to use this alternative for this analysis. The reason not to use the natural logarithm comes from the fact that, for this study, ln-variables don't yield a fully significant model in any combination of variables. To illustrate the differences between the eastern and western, graphs were constructed.

### **4.4 Variables**

The aim of this research is to establish the economic performance of Chinese provinces; therefore the most suitable dependent variable is GDP per capita. GDP per capita is the value of a region's output of goods and services divided by the midyear population, in a given year (worldbank). The independent variables are made up from the factors that are supposed to influence economic performance. This study identified seven drivers of economic growth, of which five have been included in the analysis. Those factors are innovation, human capital, transport infrastructure, FDI and exports.

It is difficult to measure the level of S&T present in a region, therefore this study opted to use 'patents granted' as a proxy for the innovative capabilities of regions. The intuition following the previous chapters is that a rise in the innovative skills will lead to increasing economic growth. Therefore the expectation is that the beta of 'patents granted' will have a positive value.

The second independent variable in the model is human capital. The issue of measurement is encountered again for this variable. Following the example of previous studies, this research has

chosen to use education as a proxy for human capital; more specifically the 'number of graduates of institutions of higher education'. The importance of skilled labor is increasing that is why only the highest level of education was chosen. However, this variable turned out insignificant in most combinations of variables. It was therefore decided to relate the number of graduates to the population of the provinces. The theories discussed in the preceding chapters support a positive relationship between economic growth and human capital. Theory also states that provinces in lower stages of development have more use for skilled labor than provinces that are more developed. This leads to the expectation that the human capital variable will have a greater impact on the performance of the western provinces than on the performance of the eastern provinces.

The next factor that results in economic growth is transport infrastructure. Transport infrastructure refers to the complete network of roads, ports and railways. For this research transport infrastructure was originally represented by the 'total length of express- and class I-IV highways', this led to high degree of correlation with other variables and was thus altered to 'total length of express- and class I-IV highways per hectare of area under land survey'. Again, based on the information from the earlier chapters, the expectation is for the relationship between this variable and economic growth to be positive.

The fourth driver of economic growth is FDI. The role of FDI in the Chinese economy is significant; it was one of the forces that paved the way towards an open market economy. One can distinguish between registered and invested FDI, this study chose for 'invested FDI'. This choice is based on the fact that that represents FDI actually invested, not only the intention. Even though the explaining power of the variable would increase if it were lagged one or two years, it was decided not to do so in order not to lose too many observations. Regardless of this fact the 'invested FDI' variable exhibited collinearity with other independent variables; that is why FDI has been related to the 'number of foreign enterprises'. This amplified the significance of the FDI variable. This study predicts a positive relationship between economic growth and FDI. Additionally, FDI is expected to contribute more to growth in underdeveloped regions than developed ones.

Exports are the fifth and final force driving economic growth in China. A great part of Chinese production is meant for exports, whether it is regular or processing trade. This means that exports

can be considered to be a contributor to economic growth. The value of 'exports by their origin in China' was initially decided upon as the measurement for exports in the analysis. A high degree of correlation with other variables forced the researcher to alter this variable for the analysis of the eastern provinces. The new variable became 'total exports by their origin in China / total investments in fixed assets' and it is expected to positively influence economic growth. For the western provinces the variable 'exports by their origin in China' was chosen, the collinearity level was acceptable,  $VIF < 5$  and tolerance  $> 0.2$ .

#### **4.5 Missing Values**

The only missing data in the dataset are the observation for Chongqing province, for the years 1995 and 1996. The missing value are considered to be Missing Completely At Random (MCAR), this means that the missing data doesn't rely on underlying data (Hardy & Bryman, 2004) (Jansen, 2010). The solution for this problem is case deletion and the method used is 'listwise deletion', also known as 'Complete case analyses. This method is acceptable since it only spans ten observations and the values of Chongqing province for the following years can be deemed to be average. Another solution would be imputation, where the value of the missing data is predicted in line with the observed data (Hardy & Bryman, 2004).

#### **4.6 Time lag**

For this study the researcher opted not to implement time lags. The main reason for this is that the number of observations would drastically decrease. It is however not unreasonable to expect a certain time delay between the arrival of FDI and its impact on economic growth. This might also apply for patents, graduates and investments to a certain extent.

#### **4.7 Period of interest**

1994 was an important year for China. In 1994, the government implemented a new tax system including value-added tax (VAT), they restricted the allocation of special status to industrial zones and cities and they cut down the subsidies for a number of loss making SOEs. At the same



time the number of private enterprises rose. This looked more and more like a regular open market economy. This study wants to see how the economy developed from the point where the economy resembled an early western one. Furthermore, Gang et al. (1997) point to the mid-nineties as the period when regional disparity started to grow.

#### 4.7 The model

To see the effect of the factors on economic growth for the eastern and western group, two more models were built. By grouping the provinces together based on where they stand in their development, disparity in levels of technology and institutions are controlled for. This approach also controls for parameter heterogeneity (Ding et al. 2009). The model meant to test the effect of drivers of growth on the eastern group is model (2), to test the western group model (3) was built.

$$(1) \text{GDP\_p\_cap}_{it} = b_0 + \text{Patent\_gr}_{it} * b_1 + \text{Tot\_express\_class\_ha}_{it} * b_2 + \text{Exports\_tot\_invest}_{it} * b_3 + \text{FDI\_p\_for\_firms}_{it} * b_4 + \text{Grads\_high\_p\_cap}_{it} * b_5 + \epsilon_{it}$$

$$(2) \text{GDP\_p\_cap}_t = b_0 + \text{Patent\_gr}_{it} * b_1 + \text{Tot\_express\_class\_highways}_{it} * b_2 + \text{Exports}_{it} * b_3 + \text{FDI\_p\_for\_firms}_{it} * b_4 + \text{Grads\_high\_p\_cap}_{it} * b_5 + \epsilon_{it}$$

#### 4.8 Provinces

The complete dataset consists of all the provinces of China. This dataset is used to measure the performance of the drivers of economic growth. To measure the performance of the eastern and western provinces two datasets were compiled from the complete one; one for the western provinces and one for the eastern provinces. For the purpose of this study the provinces located in the west and central China were joint in the western group. The division of the provinces is illustrated in table 2.

Eastern Provinces	Western provinces
Beijing	Anhui      Shaanxi

Liaoning	Guangxi	Henan
Jilin	Chongqing	Yunnan
Heilongjiang	Hubei	Guizhou
Tianjin	Hunan	Inner Mongolia
Hebei	Jiangxi	Xinjiang
Hainan	Sichuan	Tibet
Fujian	Shanxi	Qinghai
Guangdong	Gansu	Ningxia
Jiangsu		
Shandong		
Shanghai		
Zhejiang		

Table 2: Division of Chinese provinces in the eastern and western group (Research by Feng, X.)

## **5. Empirical results**

### **Introduction**

This chapter will examine the results from the analysis of the western and eastern provinces. The first section will discuss the performance and progress of the drivers of growth over the period 1995-2008. This is expected to provide an answer for the problem statement. The second section of this chapter will briefly discuss the descriptive statistics accompanying the analyses of both models before testing the propositions put forth in chapter two and three. The final section will bundle the conclusions to be drawn from the descriptive analysis and the statistical analysis, in an attempt to provide answers to the problem statement and research questions stated in chapter one.

### **5.1 Variable development and performance**

This section will elaborate on the developments of economic growth and the identified factors of growth over the past fourteen years. This part of analysis will attempt to answer the problem statement of this study, which is the following: “In terms of GDP per capita, may one speak of a degree of convergence between the eastern and western provinces? And do the forces that affect GDP growth show the same tendencies of convergence as GDP per capita?”

#### **GDP per capita**

This study chose to measure economic growth in GDP per capita; it is defined as, the value of a region’s output of goods and services in a given year. In the pre-reform era agriculture was leading the Chinese economy. With the start of the reform period, in 1978, the shift from agriculture to secondary and tertiary industries as leaders of the economy was initiated. The increasing number of TVEs and joint ventures boosted GDP growth. Over the past twenty-five years China averaged an annual GDP growth of 9.5%, doubling its GDP twice in less than twenty years. Those numbers do not represent the whole of China; the eastern provinces have been responsible for most of GDP growth. The question is, did the western provinces start catching up to the eastern provinces in terms of GDP per capita? Figure 9 depicts the development of GDP per capita in the western and eastern provinces for the period 1995-2008, while table 3 shows the share of the eastern and western provinces of total GDP per capita.

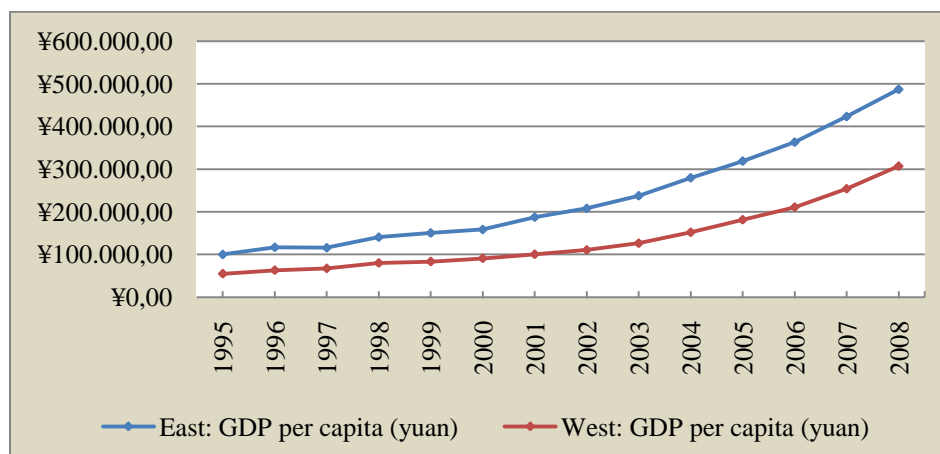


Figure 9: GDP per capita for the eastern and western provinces; 1995-2008

Year	Total GDP per capita (Yuan)	Eastern provinces (%)	Western provinces (%)
1995	¥154.889,65	64,64	35,36
1996	¥179.876,94	64,98	35,02
1997	¥182.947,66	63,31	36,69
1998	¥220.590,55	63,75	36,25
1999	¥233.787,32	64,34	35,66
2000	¥249.381,90	63,55	36,45
2001	¥287.880,49	65,15	34,85
2002	¥318.442,49	65,32	34,68
2003	¥363.863,64	65,30	34,70
2004	¥431.508,85	64,82	35,18
2005	¥500.177,81	63,75	36,25
2006	¥574.010,84	63,28	36,72
2007	¥677.161,56	62,50	37,50
2008	¥794.034,05	61,33	38,67

Table 3: Total GDP per capita and share of total GDP per capita for the eastern and western provinces; 1995-2008.

Figure 9 shows that GDP per capita experienced a similar development in the period 1995-2008, both increased at an approximately equal rate until 2001. The level of GDP per capita in the western provinces grew slightly harder from 2002 onwards. This stems from table 3 as well. The table shows that compared to 1995 the share of total GDP per capita contributed by the western provinces has grown from 35.36% to 38.67%, meaning a 3.4% increase in contribution over fourteen years. Considering the growth period from 2002 onwards yields an augmentation of the

contribution by 3.99% over six years. Table 4 shows the average growth rate of GDP per capita for the eastern and western group for the period 1995-2008 and the average growth rate for the period 2000-2008 corresponding with the initiation of the West Development Strategy. It shows that the western provinces experience a slightly higher GDP per capita growth, but it does not show clearly the impact of the new policies aiming to develop the western provinces. This entails that as from 2002 the western provinces have started to show signs of convergence. This answers the first part of the problem statement regarding the convergence of western province towards the eastern ones, in terms of GDP per capita. Appendix A provides a table with the values of GDP per capita for both groups as well as their growth rates, and a graph depicting the share of total GDP per capita for the eastern and western provinces.

period	west	east
1995 - 2008	14,31	13,10
2001 - 2008	15,68	14,01

Table 4: growth rates GDP per capita; 1995-2008 and 2000-2008.

## Human Capital

Human capital affects GDP growth in two ways, directly and indirectly. The direct effect stems from the contribution to the production process, and the indirect effect comes from the absorption of spillovers and the enabling of domestic innovations. This study used ‘Number of graduates from institutions of higher learning’ as a proxy for human capital.

The number of educated workers in China is too small when held to the degree of economic growth. This is partly due to the lack of investments in education in the pre-reform era and during the first decade of the reforms. In 1999, the Chinese government intervened and stimulated enrollment in educational programs. Figure 10 illustrates the increase in the number of graduates since 1995, till 2008. One can notice an increase from 1999 onwards, really taking off in 2001.

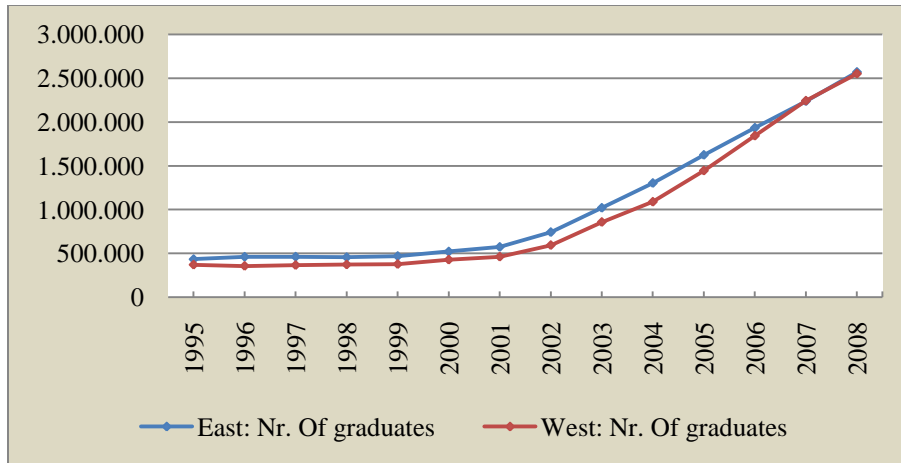


Figure 10: Number of graduates of institutions of higher learning for the western and eastern provinces; 1995-2008.

The contribution of both groups to the total number of graduates has changed and is now pretty much balanced. In 1995 the share of the total number graduates that was coming from the western provinces tallied 46.06%, in 2008 the western provinces contributed 49.82% of the total number of graduates. Unfortunately, the western provinces cannot profit fully from this development. A lot of graduates in the western provinces move east to find a job where their marginal productivity is higher than in the western provinces. This is called a ‘brain drain’.

Table 5 illustrates that as from 2003 the contribution of the western provinces to the total number of graduates has been increasing. This is in line with the development of GDP per capita for the western provinces, although it should be noted that, even if the gap closed by both is 3.4% and 3.77%, the number of graduates is approximately equal in both groups. This means that if this trend continues the majority of the graduates will come from the western provinces in the near future.

A graphical illustration of the table below can be found in appendix B, together with a table of the yearly number of graduates and its corresponding growth rate.

Year	Total nr. of graduates	Eastern Provinces (%)	Western Provinces (%)
1995	805397	53,95	46,05
1996	818695	56,46	43,54
1997	829070	55,85	44,15
1998	829833	55,08	44,92
1999	847617	55,48	44,52
2000	949767	54,93	45,07
2001	1036323	55,41	44,59
2002	1336769	55,58	44,42
2003	1877492	54,35	45,65
2004	2391152	54,49	45,51
2005	3067956	52,93	47,07
2006	3774708	51,21	48,79
2007	4477907	49,95	50,05
2008	5119498	50,18	49,82

Table 5: Total number of graduates of institutions for higher learning for the period 1995-2008, and their share of total number of graduates for the same period.

### Foreign direct investment

FDI was crucial to the development of the Chinese economy; it is one of the two forces that enabled the move to an open market economy. It played a big role in the transformation of the state-owned and collective-owned sector. During the first twenty years of the reforms a lot of FDI flowed into China. The reason was threefold, cheap labor, high growth rates and potential access to the Chinese market.

Once the Chinese government had decided to choose for FDI-based development they initiated a number of reforms and preferential policies to attract FDI to China.

The majority of FDI that was invested in China was invested in the eastern provinces. They provided the best environment to conduct business. Infrastructure, labor pool, location etc., they were all better in the eastern provinces compared to the western provinces. This situation has not changed; figure 11, which illustrates the development of FDI for the eastern and western provinces, shows that the gap grew wider over the past fourteen years.

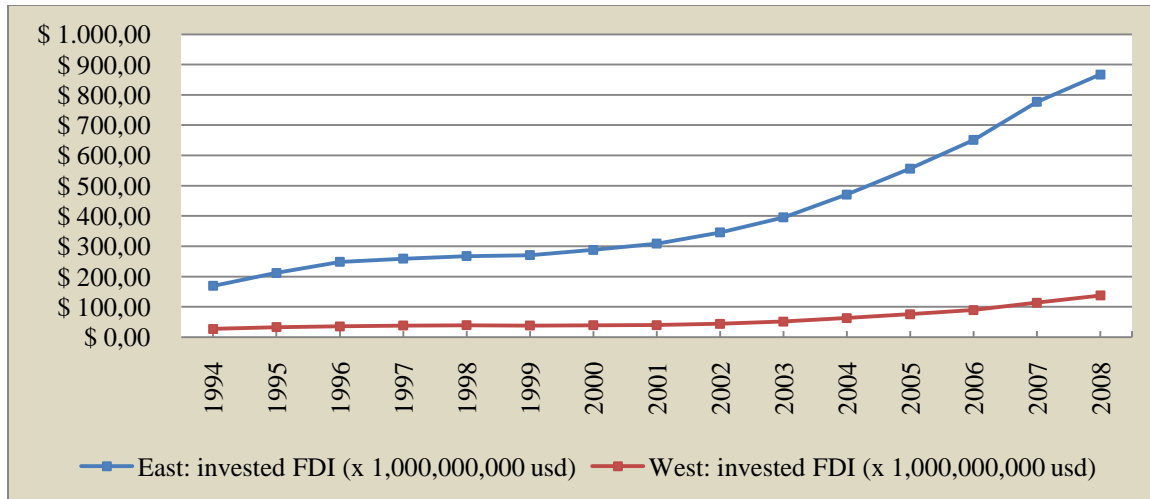


Figure 11: FDI invested in the eastern and western provinces; 1994-2008.

In 2001 the inflow of FDI into the western provinces started to grow more significantly, averaging a growth rate of 19.52%. In that same period the eastern provinces experienced an average growth of 15.93%. The same development stems from table 6 that shows the contribution to total FDI inflow since 1994, until 2008. One can thus conclude that the amount of FDI flowing into the eastern provinces is many times higher than the amount flowing into the western provinces. Still, the western provinces have experienced a higher growth rate, on average, since 2001. It is also possible to consider the period 2002-2008, over this period the contribution of the western provinces grew at a rate of 2.42%. This would show evidence of a starting tendency of FDI to flow increasingly into the western provinces. Appendix C contains a graph displaying the share of the western and eastern regions of total invested FDI and a table with the actual amounts of FDI invested and their respective growth rates, for the period 1994-2008.



Year	Total invested FDI	Eastern provinces (%)	Western provinces (%)
1994	\$196.314.860.000,00	86,16	13,84
1995	\$244.126.800.000,00	86,69	13,31
1996	\$283.641.290.000,00	87,62	12,38
1997	\$296.965.650.000,00	87,17	12,83
1998	\$306.377.930.000,00	87,32	12,68
1999	\$308.757.360.000,00	87,61	12,39
2000	\$326.976.290.000,00	88,07	11,93
2001	\$348.445.950.000,00	88,63	11,37
2002	\$389.626.080.000,00	88,76	11,24
2003	\$446.688.734.025,00	88,51	11,49
2004	\$533.695.000.000,00	88,25	11,75
2005	\$631.820.000.000,00	88,07	11,93
2006	\$740.500.000.000,00	87,94	12,06
2007	\$890.775.710.200,00	87,24	12,76
2008	\$1.004.472.441.600,00	86,34	13,66

Table 6: Total amount of FDI invested in China for the period 1995-2008, and the corresponding contribution of the eastern and western provinces to total invested FDI.

## Infrastructure

Infrastructure actually entails transport, communication and energy. Of these three only the transport infrastructure is considered in this study. The importance of infrastructure to GDP growth stems from the reduction in operation costs for enterprises and the large tax revenues for local governments when industries are located in their region.

In the pre-reform era there were barely any investments in infrastructure, this changed with the start of the shift to an open market economy. As from 1980 local governments had to bear responsibility for the construction of roads and 1981 Guangdong province experimented with toll highways. The latter was a success, stimulating the construction of roads.

For the purpose of this analysis a proxy was used to represent transport infrastructure. The proxy chosen was the 'total length of expressways and class I-IV highways per hectare of area under land survey'. Relating the length of roads to the size of the provinces was done to give meaning to the variable. The western provinces stretch a much bigger area than the eastern one do. Appendix D contains the graphs depicting the accumulated length of roads for both groups without any relation to the size of provinces; the results are completely opposed to the results shown in figure 12.

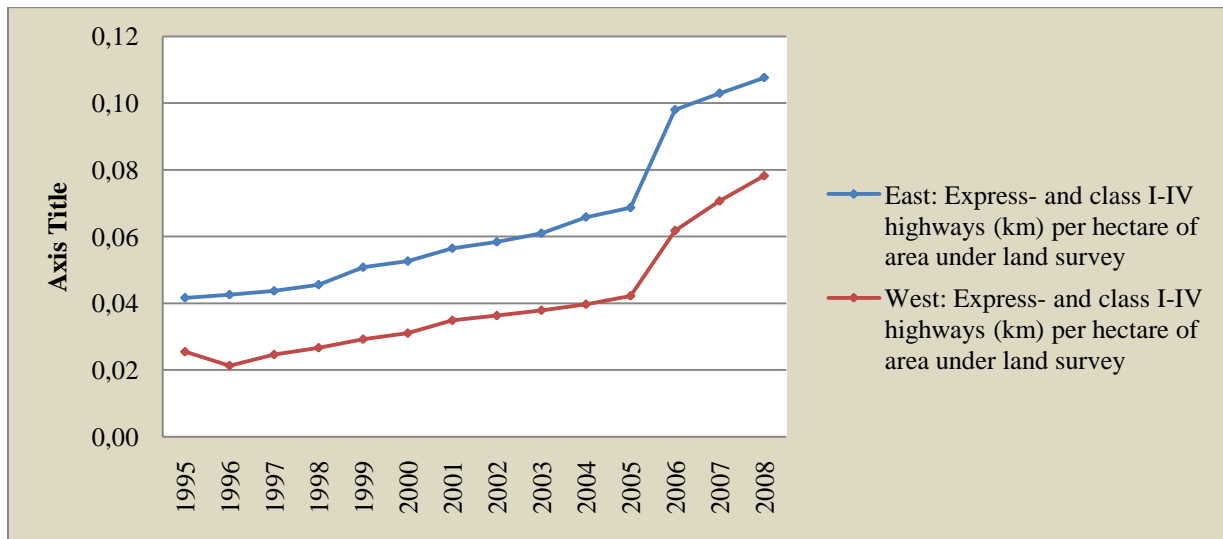


Figure 12: Total length of expressways and Class I-IV highways (km) for the eastern and western provinces; 1995-2008.

The contribution of both groups to the total length of express- and highways did shift a little in favor of the western provinces. In 1995, the western provinces represented 37.92% of the total length of express- and highways; in 2008 this number had grown to 42.1%. Over the past fourteen years the gap between both groups shrunk 4.18%. The figure below illustrates the contribution of the eastern and western province over the years; the increased contribution of the western provinces is clearly visible.

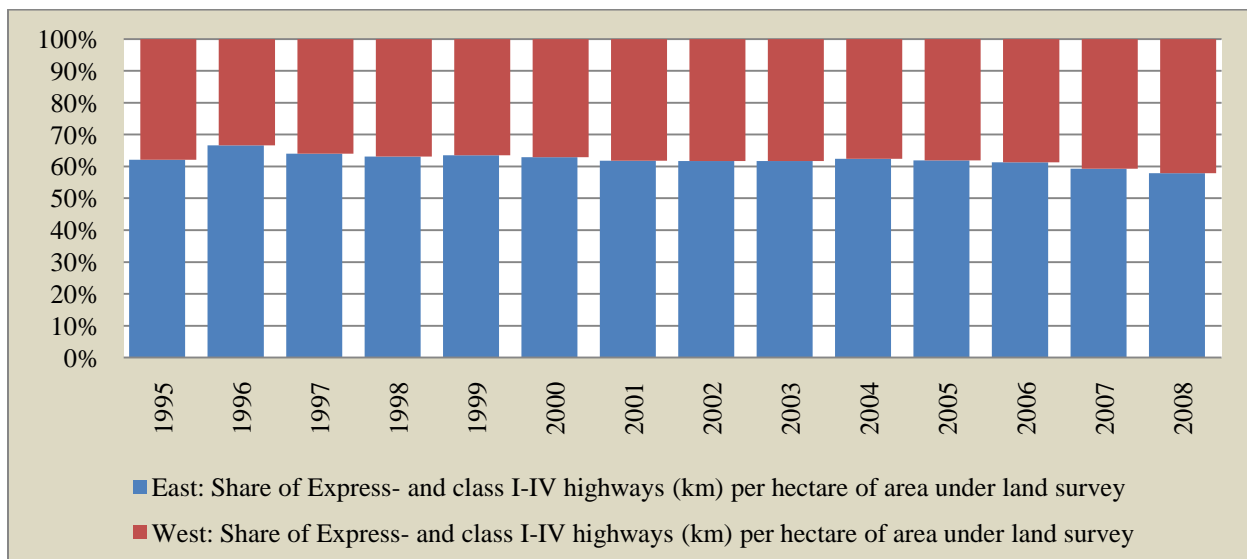


Figure 13: Contribution of the eastern and western provinces to the total length of expressways and class I-IV highways; 1995-2008.

From the figure above one can clearly identify a tendency from the western provinces to converge. During the researched time span the divide between the eastern and western provinces was narrowed by 4.18%. This development coincides with the start of the West Development Strategy, planning to develop infrastructure in the western provinces in order to achieve economic growth. Appendix D contains a table with the actual, annual length of roads constructed in the eastern and western provinces.

**Exports**

Exports are of great importance to the development of the Chinese economy. Before the reforms China exported small amounts of primary goods, this changed with the shift to the open market economy. Exports shifted from primary goods to manufactured goods. In a short time the exports sector grew tremendously. This is due to the fact that the government greatly stimulated this sector with preferential policies and SEZs. The stretched coastline and the proximity to Hong-Kong were helping the cause.

Figure 14 shows that in the eastern provinces keep growing strongly, while in the western provinces exports have been taking off slowly.

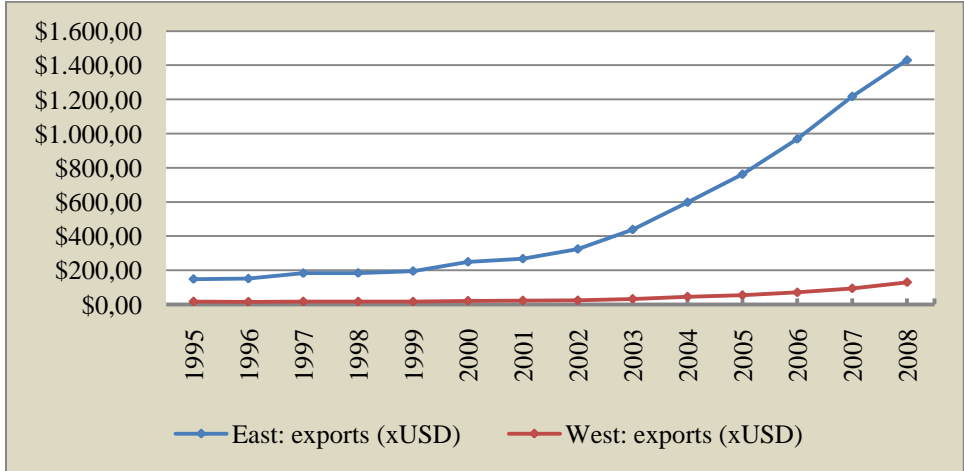


Figure 14: Trade volumes for the eastern and western provinces; 1995-2008

Over the fourteen years studied in this thesis, the eastern provinces enjoyed a growth rate of exports averaging 19.62%. The western provinces averaged a growth ratio of 18.42%, which is lower than that of the eastern group. The widening gap that is shown in figure 14 is confirmed by table 7. Apart for minor decreases here and there, the eastern provinces’ share of total exports has been growing since 1995. This means that exports does not show the same trend as GDP per

capita, and does not show any signs of convergence between the eastern and western provinces. A table with the annual values of the trade volumes of the eastern and western provinces, with their respective growth rates, and a graph illustrating the development of the contribution to the total trade volume can be found in appendix E.

yr	East: Share of total exports (%)	West: Share of total exports (%)
1995	0,900	0,100
1996	0,910	0,090
1997	0,916	0,084
1998	0,918	0,082
1999	0,924	0,076
2000	0,923	0,077
2001	0,922	0,078
2002	0,933	0,067
2003	0,932	0,068
2004	0,930	0,070
2005	0,934	0,066
2006	0,933	0,067
2007	0,929	0,071
2008	0,917	0,083

Table 7: Annual share of total exports for the eastern and western group; 1995-2008.

## Science & Technology

The importance of technology for GDP growth in China is significant. Initially the level of technology was low in China. From the sixties onwards, the Chinese manufacturing industry started developing their skills and knowledge through cooperation with TNCs that shifted their cheap labor operations to China. Over the following three decades Chinese manufacturers further developed their skills, while the electronics industry and later on the IT-industry started evolving. Through new skills and knowledge they were able to move up to the next stage, with the economy growing along. Presently the Chinese high-tech industry is competing at the technological frontier in a number of fields.

For this research the degree of technological development is represented by a proxy, namely, ‘number of patents granted’. This variable represents the successful innovations and therefore the most advanced developments in the field of science and technology (S&T).

When comparing the progress of the S&T sector for the eastern and western provinces it is clear that the western provinces are not catching up to the east in terms of S&T, the eastern provinces are actually widening the gap. Over the period 1995-2008, the western provinces enjoyed an average growth of 15.81%; however, the eastern provinces averaged a growth rate of 20.58%. This is clear in figures 15 and 16, which illustrate the growth of the S&T sector in both the western and eastern provinces, and the increasing share of the eastern provinces with regard to S&T, respectively.

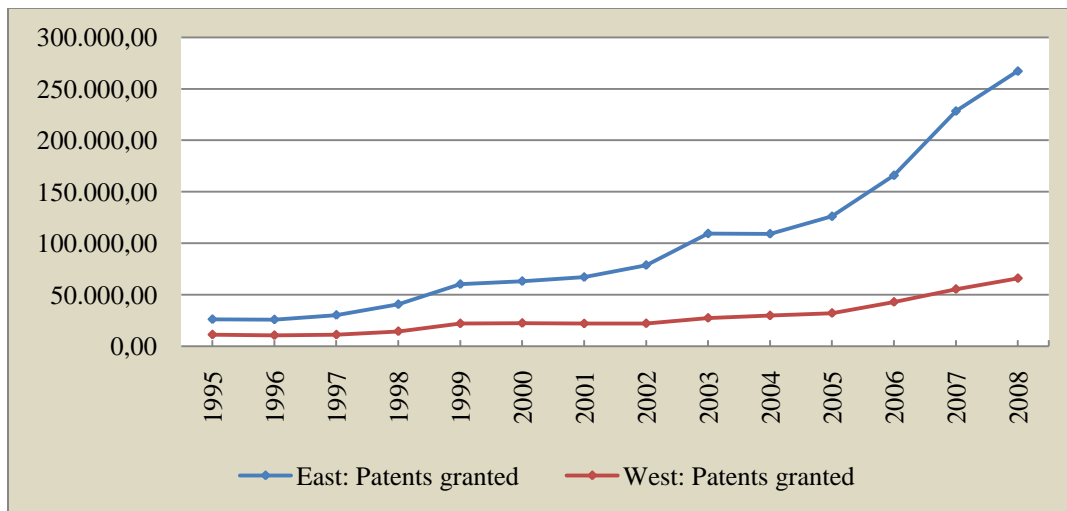


Figure 15: The progress of S&T in the western and eastern provinces; 1995-2008.

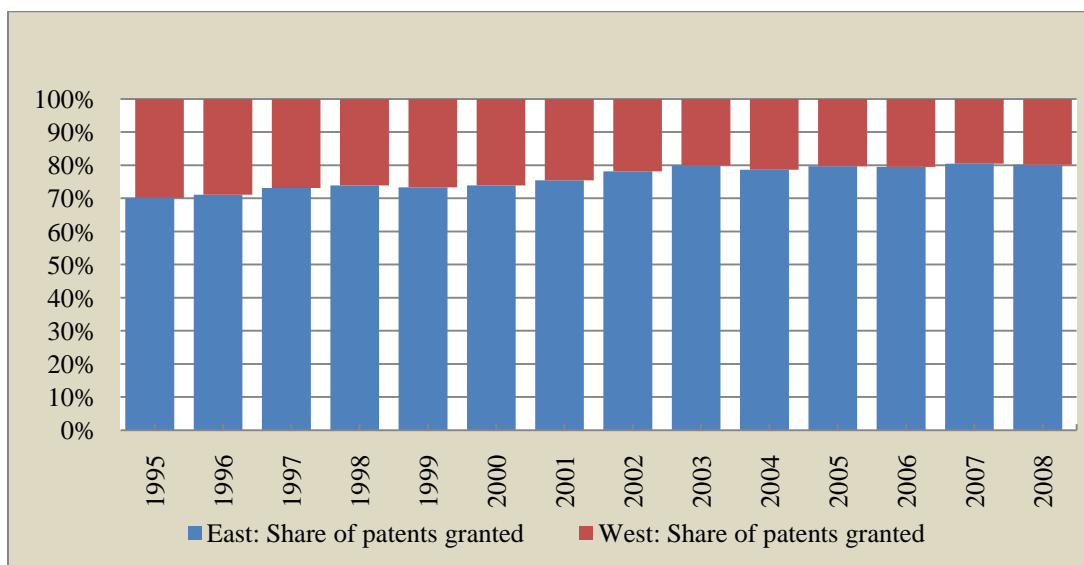


Figure 16: Contribution of the western and eastern provinces to S&T; 1995-2008.

Considering the results provided above, one can conclude that there is no sign of convergence of the S&T activities of the western provinces towards the S&T sector of the eastern provinces. From 1995 till 2008 the gap between the eastern and western only widened; over this period the gap grew with 10.01%.

A table with the numbers of patents granted from 1995 till 2008 and a table with the annual contribution to the total number of patents granted can be found in appendix F.

## **5.2 Statistical analysis**

### **Introduction**

This section will briefly discuss the descriptive statistics of the variables corresponding with the models for the eastern and western group. The issue of normal distribution will be discussed. Subsequently, the statistical analysis will be talked about. The analysis will test the hypotheses brought forward in chapters two and three. The conclusions matching the outcome of the tests will be provided in the final section.

### **Descriptive statistics**

The descriptive statistics corresponding with the analysis of the eastern and western provinces respectively will be reviewed in the following section. Descriptive statistics provide information regarding the distribution of the variables used in the statistical analysis. When using descriptive statistics one can a.o. assess whether the distribution of the observations of the variables used in the analysis approximate normal distribution. There are several ways to assert whether a variable is normally distributed, a variable is considered normally distributed if the skewness (S) is close to zero and the kurtosis (K) is approximately three.

For the eastern model one can observe that the S&T proxy, 'number of patents granted', is having a value for S and K that deviates strongly from the values related to normal distribution. For the other variables it holds that they are approximately normally distributed. The statistics can be found in table 8. The reason that the variables are not perfectly normally distributed stems from the fact that they reflect the progress of different sectors over the years; this has not been a gradual development with equal annual increases.

variable	N	Mean	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic
GDP per capita	220	7841.76	1.637	3.685
Total express- & class I-IV highways per hectare	250	50065.80	1.197	1.419
Exports	220	2.3702E9	2.470	7.672
Graduates of institutions of higher education per capita	220	.001268	1.853	3.979
FDI per foreign enterprise	220	1.7495E6	1.806	4.637
Nr. Of patents granted	220	7679.87	2.751	10.489

Table 8: Descriptive statistics for the analysis of the eastern provinces.

There are two variables in the model for the western provinces that are not normally distributed. The proxy for S&T activities shows the highest deviation with a kurtosis of 10.489 and a skewness of 2.751. The other variable that does not approximate normal distribution is the proxy for transport infrastructure, ‘total length of express- and class I-IV highways’. It measures a K of 0.793 and an S of 1.170. The same reason could apply with respect to the absence of normal distribution among some variables. The descriptive statistics of the model for western provinces can be found in table 9. Appendix G displays the full table of the descriptive statistics for both models.

variable	N	Mean	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic
GDP per capita	182	18062.82	1.680	2.892
Total express- & class I-IV highways	182	0.004921	1.170	0.793
Exports	182	0.096482	1.694	2.482
Graduates of institutions of higher education per capita	182	0.002324	1.479	2.047
FDI per foreign enterprise	195	7.99385E5	1.183	2.129
Nr. Of patents granted	182	7679.87	2.847	9.034

Table 9: Descriptive statistics for the analysis the economy of the western provinces.

## Analysis

For this analysis of two models were designed, one for the eastern provinces and one for the western ones. First the validity of the model for the eastern provinces will be examined. This model is significant and has a positive F-value of 322.911. The value of the adjusted  $R^2$  is 0.899,

this yields that 89.9% of the variation in GDP per capita is explained by the variables in the model. This model is considered to have a high explanatory power. There is no evidence pointing towards multicollinearity, all variables exhibit a VIF-value lower than 5 and a tolerance exceeding 0.2, denoting the absence of multicollinearity in this model. This model is also free of autocorrelation since the Durbin-Watson statistic has a value of 1.863, which is higher than 1.5 but lower than 2.5, and thus falls within the area of no autocorrelation. The model summary, ANOVA and coefficient overview can be found in appendix H.

The western model is significant as well and has a positive value of 133.694. With an  $R^2$  of 0.753 its explanatory power is lower than that of the model analyzing the eastern provinces. But the variables still accounts for 75.3% of the variations in GDP per capita, this is considered reasonable. Similar to the variables in the eastern model, there are no signs of multicollinearity. All variables show a VIF-value and corresponding tolerance that falls within the acceptable range. The Durbin-Watson statistic of the western model has a value of 2.137; this is also within the range of no autocorrelation. This model's ANOVA, coefficient overview and summary are displayed in appendix I. With the validity of the models confirmed, the next step is to test the hypotheses from chapter two and three. The analysis is performed with  $\alpha = 0.1$ . The reason to choose for  $\alpha = 0.1$  instead of  $\alpha = 0.05$  is that with the latter the FDI variable becomes insignificant for the eastern provinces.

The first pair of hypotheses that will be considered are the propositions concerning the relationship between human capital and GDP per capita and the value of human capital for developed regions compared to underdeveloped regions. The proxy for human capital in both models is the number of graduates per capita. In both models the variables are significant and have positive betas of 0.645 for the eastern provinces and 0.460 for the western provinces. The results can be found in table 10 and 11. This means that human capital positively affects GDP growth in the western provinces as well as the eastern ones. The beta of the human capital variable of the eastern provinces is higher than the variable of the western provinces. This means that human capital is better put at use in developed areas. This rejects  $H_2$ , which states that human capital adds more to economic growth in underdeveloped regions.



<b>Eastern model</b>	<b>beta</b>	<b>t-value</b>	<b>significance</b>
Graduates per capita	0.645	14.916	0.000
FDI per foreign enterprises	0.055	1.732	0.085
Exports	0.167	4.989	0.000
Express- and class I-IV highways	0.183	4.00	0.000
Patents granted	0.123	3.456	0.001

Table 10: Independent variables in the analysis of eastern provinces.

<b>Western model</b>	<b>beta</b>	<b>t-value</b>	<b>significance</b>
Graduates per capita	0.460	7.431	0.000
FDI per foreign enterprises	0.288	6.524	0.000
Exports	0.255	4.549	0.000
Express- and class I-IV highways	0.094	2.337	0.020
Patents granted	- 0.105	-2.242	0.026

Table 11: Independent variables in analysis of western provinces.

The following propositions to be tested are the propositions regarding FDI. Three propositions will be tested, two about the relationship between GDP per capita and FDI in both regions and one about the worth of FDI to underdeveloped provinces opposed to developed provinces. The proxy used for FDI, 'FDI/ number of foreign enterprises', is significant and positive for both models. The positive relationship between FDI and GDP per capita is confirmed with the betas of the models. In the model for the eastern region, the FDI variable measures 0.055. The value of the beta for the western model is 0.288. The third proposition concerning FDI stated that FDI contributes more to GDP growth when invested in underdeveloped regions, such as the western provinces, as opposed to FDI in developed regions. This proposition is accepted as well since the beta of the western model is higher than the beta of the eastern model;  $0.288 > 0.055$ .

The proxy for transport infrastructure in the model for the western provinces is the 'total length of express- and class I-IV highways', for the model of the eastern provinces the proxy is the 'total length of express- and class I-IV highways per hectare of area under land survey'. Both variables are significant and have a positive t-value. The betas are 0.183 and 0.094 for the

eastern and western provinces respectively. This proves the propositions stating the positive relationship between infrastructure and GDP per capita.

The relationship between exports and GDP per capita is supposed to be positive. In the analysis of the eastern provinces the value of exports is used as variable. However, the variable in the western model is 'exports/ total investments in fixed assets'. The latter is chosen because the value of exports as a variable itself exhibited too much correlation with FDI. In both models the variables are significant with positive t-values, as predicted. The betas are 0.167 for the eastern provinces and 0.255 for the western provinces. This result proves a positive relationship between exports and GDP per capita, but suggests that exports contribute more to the economic growth of the western provinces than to the eastern ones; this is unlikely to be true, especially when considering that the contribution of exports originating from the western provinces has been decreasing since the start of the researched period in 1995.

The propositions regarding the relationship between the level of technology and GDP per capita are the final hypotheses to be reviewed. This relationship is supposed to be positive. The variables are significant for both models but the t-value of the variable for the western provinces is negative, while the t-value of the variable for the eastern provinces is positive. The corresponding betas are -0.105 and 0.123. This suggests that while a higher level of technology adds to GDP growth in the eastern provinces, the level of technology is considered to harm GDP growth in the western provinces. The latter is not likely.

## **Conclusion**

With the conclusions drawn from the analysis above, one can answer the problem statement and the three remaining research questions. Chapter two and three identified the forces that push GDP growth. In chapter five the performance, progress and impact of those forces has been determined.

The problem statement, whether the western provinces catch up with the eastern provinces in terms of GDP per capita, and whether the forces of growth show the same trend as GDP growth is answered using the descriptive analysis. The contribution of the western provinces to total GDP per capita has grown with 3.4% over the past fourteen years, or 3.99% from 2002 till 2008. The latter is more convincing. The average growth rate of GDP per capita was higher in the western provinces than in the eastern provinces, the west averaged an annual growth of 14.31%

while the east averaged a growth rate of 13.1%. Not all drivers of growth follow the same trend as GDP per capita. Exports and S&T do not reveal signs of convergence, human capital and infrastructure do. This means that in terms of human capital and infrastructure the western provinces are performing increasingly well and might eventually reach the same level as the eastern provinces. The results for FDI are inconclusive. Over the fourteen years examined in this study, the contribution of the western region declined. It must be noted though that since 2002 the share of total FDI invested in the western provinces has been increasing. The pace is slow at 2.41% over seven years.

The second research question was meant to confirm the presence of the drivers of growth in both regions. From the propositions tested above one can conclude that all variables are present and significant in all provinces. The interpretation of these results is that all the forces of growth are present in both regions.

Whether human capital is of more use in developed or underdeveloped regions was the topic of the third research question. Proposition H<sub>2</sub> stated that human capital has a bigger impact in the western region than in the eastern region. This proposition is rejected since the beta of the eastern regions is 0.645 while the beta of the western regions is 0.460 regarding human capital. One can conclude that human capital has a higher marginal product in developed areas. This can be of importance to policymakers.

The final research question is also asked from a policy point of view. The claim of proposition H<sub>8</sub> is that FDI adds more to GDP growth in underdeveloped areas than in developed areas. This claim is accepted because the beta of the western model is higher than the beta of the eastern model. The beta for the western region is 0.288 and the beta for the eastern region it measures 0.055. This entails that FDI contributes more to economic growth when invested in underdeveloped areas. This may also have implications for policymakers when developing new policies for both regions.

## **6. Conclusion**

### **Introduction**

This chapter will discuss the limitations of this research in the first section. The second section will draw conclusions based on the research that is done and the analysis that was performed and discuss some policy implication. Finally recommendations for further research will be made.

### **Limitations of the thesis**

The scope of this research was limited, that is why some factors that could have a positive influence on GDP growth are not included in this study, and examples are wages, employment, migration patterns and spillovers. Mainly the latter could be of interest, but is difficult to quantify. To be able to determine the contribution of factors it would be better to include externalities in the model, however, the statistic complexity of such a model goes beyond the reach of this study.

Another limitation of this research is its time span. This study examines a time period from 1995 till 2008. The reform period started in 1979, one year after the new leader was instated, to really capture the progress of economic growth and its drivers, a longer time span would be more suitable. Unfortunately data going back to 1979 is not readily available.

### **Conclusion and policy implications**

China started moving towards an open market economy in 1978 when a new leader was installed. This shift was the result of an increase in TVEs and the introduction of partial foreign ownership. Starting in the south east China opened its doors to foreign enterprises. They offered preferential treatment and tax benefits to foreign enterprises. The government created SEZs where imports were duty-free provided the end product would be exported again. China followed the same strategy as Japan and South Korea had, they promoted the inflow of FDI and focused their economy on exports. In return, the Chinese industry gathered skills, knowledge and access to overseas markets.

This amazing shift towards an open market economy did have one disadvantage; it led to rising inequality, as not all provinces were developing at the speed of the coastal provinces. In 2000 the

central government initiated the West Development Strategy to stimulate GDP growth in the west. This inspired the main issue of this study, do the western provinces show evidence of catching up to the eastern provinces in terms of GDP per capita, and are the factors of growth showing similar tendencies?

First it is important to identify the drivers of GDP growth; this is the first research question. This study identified six forces that boost GDP growth, government reforms, human capital, S&T, infrastructure, FDI and exports. The government reforms have provided an environment where business could be conducted. Furthermore the government developed policies and made significant investments in several sectors to enable economic growth. It is clear that the role the government has played boosted economic growth, however, due to the complexity of quantifying such a role it has been excluded from the analysis.

The answer to the problem statement is twofold. The western provinces did narrow the gap in terms of GDP per capita, in the fourteen years studied in this research, the share of total GDP per capita coming from the western provinces did increase from 35.3% in 1995, to 38.7% in 2008. This yields an annual rate of 0.24%. If one considers that the share of the western region declined until 2001 and only took off in 2002 it means the gap shrunk with 3.99% over a period of six years. This results in a yearly convergence rate of 0.57%, which is about twice as large as the 0.24% over fourteen years. In that respect the signs of convergence are stronger, but still weaker than the annual rate of approximately 2% that Kim (2008) found for South Korea.

The second part of the problem statement regards the development patterns of the drivers of economic growth. As discussed in the previous chapter two of the five driving forces of growth do not show signs of convergence towards the eastern provinces; those are exports and S&T. The reason exports do not show signs of convergence could lie in the fact that the eastern provinces still experience significant growth in exports. A second reason could be the geographical location, as discussed in chapter three, location is important. The openness started in the south east close to duty-free Hong-Kong and with a long coastline, this was conducive to exports. The reason why S&T does not show signs of convergence and even harm economic growth is unknown to the author. One possibility is that the western provinces are not apt at exploiting higher levels of S&T, but there is no proof for this fact. The development of human capital and transport infrastructure points towards eventual convergence, not very strong though. Human capital stemming from the western provinces narrowed the gap with the eastern provinces with

3.77% over fourteen years; this rate is comparable with the catch up rate of GDP per capita. Transport infrastructure experienced a slightly larger growth, over the period researched the contribution of transport infrastructure grew with 4.18%. The pattern of FDI is inconclusive, over the whole period less FDI is flowing into the western provinces, but, considering the period 2002-2008, FDI shows a faint sign of catching up with the eastern provinces.

The answers to the remaining two research questions are relevant to policymakers. The third research question concerns the performance of human capital in underdeveloped regions compared to developed regions. The results from the analysis reject this claim. This means that educated people add more to economic growth in developed regions; this confirms the 'brain drain' discussed by Fleisher et al. (2010) in chapter three. The last research question addressed the same matter as the previous one, but with respect to FDI. This hypothesis is accepted, meaning that FDI contributes more to economic growth in underdeveloped areas than in developed areas. With this knowledge policymakers can aim to transfer educated workers to the eastern provinces where their marginal product is higher. A second goal for policymakers could be to further stimulate the inflow of FDI into the western region.

### **Recommendations for further research**

There are a number of issues that could be interesting to examine more closely. The first issue, that would probably interest policymakers as well, is to find out which factors of economic growth stimulate the development of the domestic market the most. This could help in the formulating of new policies. Another interesting point of research would be to include more variables to the analysis. Factors such as wages and externalities could be added to further determine the contributors to growth. At the same time one could also include forces that hamper economic growth such as congestion costs. Some provinces could show to be better at dealing with obstacles than others. This could be transferred to provinces incapable of dealing sufficiently with the barriers they encounter.

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