



**EKONOMI
HÖGSKOLAN**
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DEPARTMENT OF ECONOMICS

Master Thesis in Macroeconomics, 2010

China's Increased Export Influence

-An Empirical Analysis of the Impact on Sweden's and the United States' Industrial Production between 1994 and 2008.

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Abstract

- Title:** China's increased export influence: An empirical analysis of the impact on Sweden's and the United States' industrial production between 1994 and 2008.
- Topic/course:** NEKM01 Master thesis
- Author:** Anna Persdotter
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- Keywords:** Export, Comparative advantage, China, Sweden, the United States, Engle Granger, ECM
- Purpose:** The purpose of this thesis is to examine how China's increased export influence on the world market has impacted Sweden and the United States' industrial production. Further it is analyzed if China is a threat or a possibility to these countries in matters of their capital-intensive production.
- Method:** By using ADF tests and Engle Granger's estimation cointegration is found in the data. To determine the long- and short-run equilibriums, in China's impact of the two countries, an OLS and an error-correction model are estimated.
- Conclusion:** China is indeed growing on the world market. However today she is not seen as a threat to the industrial production of Sweden and the United States. The reason being that China's exports are value-adding for the production, which implies that the Chinese products are still labor-intensive in character. But this does not mean that China will not be a threat to these countries in the future, rather that China today has reached the position of being a threat to other countries producing labor-intensively.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
BLUE	Best Linear Unbiased
BOP	Balance of Payments
ECM	Error Correction Model
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
MFN	Most Favored Nation
OLS	Ordinary Least Squares
SOE	State-Owned Enterprise
SEZ	Special Economic Zone
TVEs	Township and Village Enterprises
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
WTO	World Trade Organisation

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1. Introduction

China's remarkable annual GDP growth of 9,6 % since reforms started, in the agricultural sector in 1978, has rearranged the market power of the world's economies (Naughton 2007). Today seen as the world's second largest economy in PPP terms, and the third largest economy in nominal GDP terms, China is indeed a giant with a large impact on world markets (Elekdag & Lall 2008). Being the largest exporter in the world, with 10 % of the world's exports originating in China, creates the possibility of imposing a threat to other countries. China is increasingly illustrated as a threat, even to countries capital-intensive in production (www.economist.com 2010-04-30).

China has, partly due to low labor costs, managed to grow 23 % in exports over the last decade. This is a growth of twice as much as the rest of the world. China's growth is also due to an undervalued currency which gives an advantage on the export market (www.economist.com 2010-04-30). The advantage of the currency added with the dumping, that China has been accused of on the world markets, creates advantages in trade on China's part. Mainly because of production losses for the markets affected (Millman 2010).

China's growth is hard to describe with traditional trade theories. However the Ricardian model has an advantage in describing the production in terms of comparative advantages. Since the Heckscher-Ohlin model describes trade patterns in terms of differences in factor endowments it also adds a bit to the explanation of the Chinese trade pattern. The new trade theory with the monopolistic Krugman model explains China's increased production in terms of economies of scale (Feenstra 2004). All of the models will be used to explain China's trade pattern, in section 2.

If China can be described by the comparative advantage theory she is a possibility in trade for countries which focuses on other parts of production, and therefore free trade is superior to autarky. However the increased evidence of China's "cheating" in trade, presented above, illustrates China as a threat to the world's economies.

Earlier research has focused on and confirmed China's effect on developing countries. With its labor-intensive comparative advantage China has taken market shares from countries similar in production. However in recent years China has increasingly focused its production on high-tech products (Winters & Yusuf 2007). This is an emerging threat for developed

countries, which makes these countries interesting to analyze. China is possibly breaking the rules of the classical comparative advantage theory. Patterns are shown of producing commodities of both labor-and capital intensive character, however still in a labor-intensive manner. This should indeed not be possible, according to theory, and is a threat to free trade where every country should gain from trade.

The United States is always of interest when China is analyzed as the two economies are a threat to one another, in terms of being the world's largest and second (third) largest economies. Since China might have a larger impact on a small capital-intensive economy Sweden will be used as the other comparable economy. To determine what effect China has on their markets the countries' industrial production will be used as the dependent variable, illustrating the capital-intensive nature in production for the two countries. By examining China's effect on these two countries evidence will be presented strengthening the comparative advantage theory.

The Chinese economy's massive GDP growth of an annual 9,6 % since reforms started, in the agricultural sector in 1978, has been a topic of interest for many researchers (Naughton 2007). Compared to the Swedish annual GDP growth of about 2 % (www.ekonomifakta.se 2010-05-27) since 1978 and the American ditto of 2,8 % (www.bea.gov 2010-05-27) China shows a potential possibility to outgrow developed countries in the future. In earlier research on the topic the affect on Latin America and other developing countries has primarily been investigated.

In Alvarez and Claro (2009) the Chinese impact is estimated in Chile, illustrating a developing country. Chilean data from 1990 to 2000 is used as to estimate the impact of the increased import competition in manufacturing. The impact of the imports is calculated as a share of China's, other low wage countries and the world's imports in sector-specific consumption. To estimate the potential negative effect of the Chinese imports several areas are tested using OLS models. The results demonstrate a negative effect on employment growth and a higher probability of exiting markets for the firms in Chile.

The effect on other developing countries is further studied in Jenkins, Peters & Moreira (2008). Latin America and the Caribbean region are analyzed in matters of their exports to China, imports from China and FDI. Market losses to China are analyzed qualitatively where several conclusions are drawn. The Chinese economy affects the regions in terms of BOP

deficit and a growth which does not generate positive effects for the poor population. However there are winners and losers where the countries exporting raw material are seen as winners and the countries specializing in the same goods as China are the losers on the market.

Chen, Chen & Wu (2009) estimates China's impact on oil prices internationally as a proxy for impact on the world market. Data from 1997 to 2007 is used for China and the six other biggest producers and consumers of oil. Johansen and Juselius' test for cointegration is performed on the variables and later estimated as a VECM. The results imply that the Chinese economy does not affect international prices on oil; rather the Chinese oil market is affected by Saudi Arabia and the United States.

Due to the increased Chinese growth Feyzioglu & Willard (2008) analyzes potential influential effects on Japan and the United States. Inflation rates between China and the two countries are estimated by Granger's causality test. The results show that China is not affecting the two countries, however due to large imports from the United States, China is affected by inflation from the United States. A VAR model is estimated to attain another angle but Chinese inflation is only found to have a weak and temporary impact on prices in Japan and the United States.

The conclusion of the previous research is that the Chinese economy indeed has an impact on developing countries. However the affect on developed countries is not investigated to the same extent. Most of the research is based on China's effect on the whole world and not on individual economies of both small and large character. It is for certain that China is a threat to countries that produce labor-intensively, however the effect on capital-intensive countries is yet to be determined.

The aim of this thesis will therefore be to investigate China's affect on countries capital-intensive in production. The empirical analysis is restricted to two countries, which have had an increased trade with China since reforms started, seen in Figures 5 and 7. The focus will be on the industrial production of the countries as to restrict the empirical analysis. Since the industrial production to a large extent is affected by exports, it is of interest to determine if China is a potential threat to these countries in terms of production affected. The questions to be answered through this thesis are:

- How are the Chinese exports affecting the industrial production in Sweden and the United States?
- Are the Chinese exports a threat or a possibility to a capital-intensive comparative advantage?

To determine what kind of relationship exists between the exports and the industrial production an analytical framework based on Engle Granger's estimation of cointegration is developed¹. An OLS model is estimated for the long-run and the short-run dynamics are analyzed by the estimation of an error-correction model. All of the data series are found in Thompson Financial DataStream Advanced.

The disposition will continue as follows: the theory with emphasize on the Ricardian, the Heckscher-Ohlin and the Krugamn model will be presented in section two. Section three explains China's background and how she became the world's largest exporter. In section four the method used in the empirical analysis is presented. Section five presents the empirical analysis with results. Section six concludes with a discussion of why China might not be a threat after all.

2. Theory

2.1 The Chinese Trade pattern Explained by Theory

How China became an export miracle can be explained by the specific comparative advantage China attains. Ricardo was the first to propose that trade is driven by comparative advantages, meaning relative opportunity costs. Even though the Ricardian theory is early it is still relevant because of the assumption that there are different technologies between countries. Therefore Ricardo's theory adds a bit to the explanation of China's trade pattern (Dunkley 2008). Even though the more advanced Heckscher-Ohlin model does not take account of different technologies it is relevant, in explaining trade in terms of differences in factor endowments between countries (Feenstra 2004).

¹ Initially Johansen's cointegration estimation was performed and VECM:s were estimated. However due to the small sample the generated results were not possible to analyze. Therefore the more robust OLS estimation is used, which is based on the Engle-Granger estimation of cointegration.

The concept comparative advantage defined is a comparison of how much production of one good a country must sacrifice to produce one unit of another good. Described by Ricardo himself: “England may be so circumstanced that to produce the cloth may require the labour of 100 men for one year; and if she attempted to make wine, it might require the labour of 120 men for the same time. England would therefore find it her interest to import wine, and to purchase it by the exportation of cloth” (Ricardo 1973).

However if the other country in trade, Portugal, only has to sacrifice 70 men of labor to produce cloth and 90 men to produce wine England would export wine instead. This is because the theory is based on relative opportunity costs, meaning that the country that has to sacrifice the least has a comparative advantage in that specific commodity. Even though Portugal has an absolute advantage in both cloth and wine there can still only be one comparative advantage. This is because it is more advantageous to employ the capital where it can generate the cheapest output. Therefore wine would be imported from England. Even though England has an absolute disadvantage in both goods there will still be gains from trade by the specializing in wine, due to the higher quantity of cloths given for each unit of wine (Ricardo 1973).

If China would specialize completely in labor- intensive production she therefore could have been described well by the Ricardo Model. However the increased trade in high-tech products cannot be explained by the comparative advantage theory. The Ricardian Model lacks in the explanation of wages, since labor is seen as mobile between industries and immobile between countries. This does not create a foundation to explain China’s low wages in the labor-intensive sector, which has been an advantage in trade. According to the model every country gains from trade. With China’s increased market power this must not be the case. As seen in the earlier research many developing countries have not fared well since China started taking market shares, with its cheap labor and dumping strategies.

According to the Ricardian theory China should have an absolute disadvantage in the production of capital-intensive goods, since only one specialization can occur. Countries that produce capital- intensive commodities labor-intensively can therefore not be explained. This is a withdraw to the Ricardian model. Also the theory would categorize China as a developing country because of the labor-intensive comparative advantage, which is not the case for the world’s largest exporter. Since China would have to sacrifice more to produce high-tech than

low-tech products she should not produce high-tech products according to the theory, however this is a pattern increasingly seen on the market (Feenstra 2004). The Ricardian model has a better possibility of explaining the export success in early reform years, where China used its labor-intensive comparative advantage to the production of labor-intensive products.

The Heckscher-Ohlin Model predicts trade patterns of countries by the using of a model of two countries, two commodities and two factors. Identical technologies are assumed and free trade in commodities, however factors are not tradable. Factor prices are seen as equalized across countries. China, being a labor abundant country, is expected to export labor-intensive goods. Countries capital-intensive in character, like Sweden and the United States, will be expected to export capital-intensive goods. Even though China started its growth by exporting light-manufacturing goods (Naughton 2007) this is no longer the case. The increased exports of high-tech products cannot be explained by the H-O model, since that would only occur with capital as the abundant factor.

Winners and losers from trade within the country are determined by abundant and scarce factors. This means that the labor-sector in China should gain from trade and the capital-sector should loose from trade. China is according to the model not going to lower wages and factor prices are equalized through trade. The Heckscher-Ohlin model lacks in the same aspects as the Ricardian model since a growing country of labor-intensive character cannot be explained (Feenstra 2004). Rich developed countries are easier to explain because of their intensive use of capital, however poor countries cannot be explained if they are in fact not only producing labor-intensive commodities. Both of the models lack in explaining a country where the production occurs labor-intensively, but the outcome of commodities can be in both sectors. China does indeed not use factors in the traditional way since high-tech products are increasingly exported, however produced labor-intensively.

China's dumping strategies (Millman 2010) combined with the undervalued Yuan (www.economist.com 2010-04-30) is what determines the threat to developed countries. Since these features are not included in modern trade models China's trade pattern cannot be explained. Krugman introduces a monopolistic competition model where trade occurs because of countries producing differentiated products. When countries trade the equilibrium price decrease as a consequence of increased competition. China has indeed lowered prices of

products and taken market shares of other countries in this way. However the Krugman model implies that the number of varieties of commodities in each country falls, which is certainly not true for China. Since China is taking market shares in developing countries this means that more varieties are produced in China in the future. When China increases its output it is according to the Krugman model expected that there will be a decrease in the number of Chinese firms. This means that some firms in China attain economies of scale whereas others exit the market (Feenstra 2004). However China is known for its household based production, but to some extent this assumption might be true. Even though the Krugman model can explain the Chinese trade pattern to some extent it does not add to the explanation of the products produced in China.

Since the models cannot explain China's trade pattern a background review of China's growth since reforms started will be presented, as to give the reader an explanation of the unique features China attains.

3. Background

3.1 China: From a Planned Economy to the World's largest Exporter

China's plans to enhance growth started in 1949. The period between 1949 and 1978 is characterized by heavy investments and squeezed consumption. This specific development strategy is known as "Big Push Industrialization". During the heavy industrialization China's comparative advantage to produce labor-intensively was ignored. Instead focus was put on capital-intensive production in heavy industry. The reason for the investments starting in 1949 was China's increased understanding of the rest of the world and the need to catch up in growth and industrialization. The goals of heavy industrialization were not hard to achieve in a planned economy steered under Chairman Mao. Since the government owned everything and consumption was squeezed a large share of the capital could be invested in the strategy (Naughton 2007). During the Big Push China invested 26 % of their annual GDP, where 80 % of those investments were focused on the heavy industry (Naughton 2007).

The Chinese reforms started in 1978 with China's opening up to the rest of the world. Focus was placed mainly on implementing a policy towards becoming a market economy (Naughton 2007). What characterizes China's transition is the gradual implementing of that policy (Hung 2008). From organizational theory this approach is known as the M-form. The form implies

giving potential blueprints specific try-out areas before being implemented in the country as a whole. The local experiments make the economy flexible, which was one of China's characteristics during the reforms. The gradual approach protects the economy of bad quality in blueprints and against bad implementation. Therefore it has certain advantages to the Soviet approach, the so called "Shock therapy". The Soviet reform is known as a U-form where the blueprints are implemented all over the country. The problematic feature of this strategy is that a bad blueprint or a bad implementation has severe consequences (Qian, Roland & Xu 1999).

The gradual approach taken in China was combined with decentralization. To get the best effect of the gradual approach economic decisions were taken where they later were implemented. Not only were local governments given the responsibility of SOEs but also in administrative and budgetary matters. Decentralization was a step towards a market-oriented economy where increased competition in consumer markets between regions was desired. Enterprises got the chance to sell to the market at market prices which differed a lot from the planned system with production quotas. The outcome of the increased competition was that SOEs were found not to be as productive as the other company-forms. To improve efficiency managers were given more autonomy, costs were decreased and gaining market shares was the main goal (Li, Vertinsky & Zhou 2004).

China had some unique conditions that made the transition a success. Apart from the decentralized system there were low subsidies to the population and a large agricultural labor force (Lin & Cai 1996). China's reforms started in the collectives in the agricultural sector. The collectives were characterized by underemployment. This was the state's way of controlling labor, hence keeping the people pleased with the politics since everyone was employed (Ding & Knight 2009). Pre-reform there were only state-owned enterprises legally operating on the market and agriculture was in collectives which meant that the state decided quantities of what should be produced (Lin & Cai 1996). The transformation of agriculture started when the state increased grain prices and let the farmers produce outside the production quotas. This led to a bigger share of the harvest for the farmers (Naughton 2007).

The increased grain prices and more independent farmers was the start of an illegal phenomenon later to be known as the household responsibility system. The farmers in the collectives started to divide production between households which created a higher

productivity due to larger incentives. Even though starting out illegally the state had to acknowledge the behavior and legalized it gradually. When the system finally was legalized in China as a whole in 1981 45 % of the collectives had already implemented the system. The collectives had land lease of a few years which decreased incentives. With more farmers adopting the system, the land lease had to be extended, this happened gradually from two to thirty years (Li & Cai 1996). Later it was legalized to sell output on the market at market prices. Due to the increased efficiency in agriculture many farmers were found to be without a job or working very ineffectively. Therefore rural enterprises were formed, at first illegally and later legalized, known as the township-village enterprises. The main reason for legalizing the enterprises was because they produced light manufacturing goods which the SOEs failed to deliver (Ding & Knight 2009).

When the rural areas were decollectivized the Chinese economy started opening up to foreign capital in the form of foreign direct investments (Hung 2008). Because of the downsizing of SOEs there was an oversupply of labor which could be employed in the new foreign enterprises. Joint ventures were legalized which was the start of privatization. Privatization was initially not the plan from the state's perspective. At first it was not performed legally but rather raised as an imitative process amongst the Chinese people. The increased competition and potential to sell to the market was what gave birth to privatization. Privatization was definitely not a goal from the state's point of view but when it emerged and continued to grow it was impossible not to legalize it after a while. In a sense the privatization legitimized itself (Li, Vertinsky & Zhou 2004).

The economic opening in China started when the law of joint ventures was implemented, in 1979 (Ng & Tuan 2001). The four special economic zones were a natural outcome of the law where foreigners could invest in China. Because of the SEZs being located at coastal areas this was where the development initially took place (Nee 1992). Preferential treatment for regional investments was created in the zones as a gradual implementing of the policy. Because of the successful policy the Pearl River Delta was later opened up in 1985. As of today the initial SEZs are ahead of other areas when it comes to FDI (Ng & Tuan 2001).

The urban areas were not influenced by reforms until 1985. It was mainly the SOEs that were reformed by the managerial autonomy. This created larger incentives for the managers and had a positive effect on output (Ding & Knight 2003). In the 1990s the iron rice bowl, life-

time employment in the SOEs, was dissolved. This created huge layoffs of workers, for the means of profiting. This was the beginning of a new class distinction with wealthy capitalists and an urban underclass (Hung 2008).

The dual track price system was created in 1984 when enterprises were allowed to sell output in excess of the quotas at market prices. The duality of the system is due to the quotas controlled by the state and the selling of goods on the market according to prices determined by supply and demand. Eventually the state had to let go of the controlled part of the system completely. This was because of increased demand for inputs, created by the higher autonomy in enterprises. When the market mechanism was allowed to steer enterprises non-state owned enterprises moved forward. TVEs produced three times the output of SOEs in 1981-91. The market conditions present forced enterprises to produce according to China's comparative advantage (Li & Cai 1996).

The last stage of economic reform began in 1993 when Deng Xiaoping travelled to the south as an attempt to create more radical reforms (Ding & Knight 2009). Xiaoping's aim of these travels was also to improve relations with both the United States and the Soviet Union through foreign policy awareness (Sutter 2006). It was not until after 1993 that the exports in China increased (Zheng, Bigsten & Hu 2009). However it was not only due to Xiaoping's travels. In 1979 the Yuan was undervalued which led to an incapability to pay for imports. A dual rate system was implemented where the commodity trade was set to 2.8 Yuan per dollar. In the meantime there was an official rate of 1.53 Yuan per dollar which applied to every transaction apart from commodities. After 1985 the Yuan was gradually devalued until 1994 when the dual rate system was to see an end. A floating system was created in 1994 which improved the ability to pay for imports and led to an increased volume of cheap exports (Li & Cai 1996).

3.1.1. The Chinese Export Miracle

China's growth and emergence to a market economy is to a certain extent due to the booming exports. Initially they were not a big part in the transition, today increasingly so. From the late 1970s the export orientation was primarily focused on the coastal areas. The four SEZs made a clear distinction possible between the coastal areas and the Chinese inland. The real export boom did however not start until 1994 when the Chinese Yuan was devalued 50 % against the American dollar. China gained market shares by the competitive currency. Market shares

primarily taken were from other Asian countries similar in production pattern. The devaluation and the export boom are two reasons as to why the Chinese economy was not affected by the Asian financial crisis in the 1990s.

The large export volumes got a further push by foreign direct investments. Initially it was not a large amount, due to the instability in the Chinese macroeconomic environment and within politics. However so called round-tripping increased the volumes. The round-tripping was primarily from Hong Kong, performed by Chinese businesses. Soon enough China became the largest receiver of FDI world-wide (Wickman 2005).

Since 1978 exports has grown faster than GDP. China's exports were initially seen as solvency for a large volume of imports, not being self-sufficient in some areas. Imports mainly consisted of technological products. When the economy increasingly opened up the exports rose. In the early 1990s exports were the major factor behind economic growth. With an exception for 1993, when inflation fluctuated too much, the path of exports has been rapid and unstoppable.

China started by exporting petroleum, foodstuffs and textiles. After 1985 manufactured goods became dominant in exports. In 1986 manufacturing accounted for 63 % of the exports whereas in 1995 the share had increased to 85 %. Petroleum has naturally decreased in exports since China today is a net-exporter of natural resources, feeding the demand of a highly-productive country. Since the middle of the 1990s a new category has been added to exports which is machinery. Parts of this more high-tech exports have been the fastest in growth, interpreted it can be seen as a start of a change from exporting labor-intensive to more capital-intensive products (Chan, Tracy & Wenhui 1999).

After China's entry into the WTO trade increased even more. In 2002 electronics and machine tools sustained of almost half of China's exports. With China now producing high-tech products its competitiveness increased on the world market. In 2002 China produced value added products which was a step forward compared to the initial semi-processing of raw material. In 2003 high-tech products had reached over 50 % of exports (Pei & Shen 2006). In recent time China's exports have changed even more and have become more sophisticated. China's export bundle with highly sophisticated goods is seen as having a higher probability of belonging to a country with three times as high GDP. China's trade pattern is indeed hard to describe with classical models of trade. Since 1992 China has grown rapidly in the area of

sophisticated products, however the quality is not as great as that of the OECD countries. This is because China so far produces the high-tech products labor-intensively. At the same time China has passed by South Korea in matters of unit value of TVs and video monitors. The conclusion can be drawn that with China's income level such a sophisticated export bundle should not be possible (Rodrik 2006).

3.2 Sweden: Relationship, Trade Pattern and Chinese Influence

The European countries and China have through history been more concerned with their relationship with the United States than with that between them. The relationship between Sweden and China is seen as complementary and with better dynamics than the Sino-American relationship (Kim 1998). The diplomatic relations have been complicated due to the issue of Taiwan. China got trade preferences in the European market in 1978 (Möller 2002). In 1985 the trade agreement was replaced by an agreement on trade and economic cooperation which deepened the trade relationship (Algieri 2002). China is known for its poor human rights, however this has never had to collide with trade in the European markets since the discussion is delegated to the EU (Edmonds 2002). After 1985 China realized the European power and relations were strengthened, with the exception of Soviet. When the tragic Tiananmen Square massacre occurred Europe took a step back. However early interest was shown not to let the incident deteriorate the relationship (Möller 2002). This was also due to Chinese efforts, engaging in international political concerns. Two years after Tiananmen Chinese officials were yet again welcome to the European countries (Kim 1994).

It was not until the 1990s that the Swedish market felt the impact of the growing Chinese economy. As a response to the new competition EU created a program, "the Lisbon strategy", where emphasize was put on a more knowledge based growth (Schön 2007). China did not become a net exporter in trade with Sweden early in reforms. Even though China's exports to Sweden have increased steadily since 1997 Sweden remained a net exporter until 2000, mainly due to telecommunications. When the telecommunications exports decreased China gained market power and has since 2001 been a net exporter in trade (Kammerskollegium 2003). For all of the West European countries there is a common pattern in the increased trade with China and a deficit in the trade balance (Taube 2002).

Since 2003 China has been Sweden's largest Asian trading partner. From January to July 2008 Sweden exported goods to China for twelve billion Swedish Krona, which is an increase

of 20 % compared to the year before. However it is to be compared to the large impact China has on Sweden with an export of 43,5 billion Swedish Krona for the year of 2007. This is also an increase by 20 % compared to the year before. China has a 5 % share of the total exports to Sweden. Out of the total Swedish exports 3 % goes to China. Even though China is a large partner in trade there has been a negative growth of 4 % for the years of 2008 and 2009. However due to the economic crisis this is expected. Increases before the crisis in the Chinese exports are estimated to seven billion SEK annually (www.swedishtrade.se 2010-04-29).

3.3 The United States: Relationship, Trade Pattern and the dollar.

The Sino-American relationship has fluctuated through the years. In 1979 the diplomatic relationship was established. The relationship initially created a massive growth in every area the two countries interacted in. One of the reasons for the strengthening of the relationship was the common anti-Soviet spirit. However serious disagreements between the two countries, primarily concerning Taiwan, caused problems and a difficult relationship. When Deng Xiaoping travelled to the south and announced market-oriented reforms the relationship improved. However in 1989 when the Tiananmen massacre occurred the relationship deteriorated. The relationship experienced continuing difficulties, when Clinton took over the U.S. presidency in 1992 the U.S. continued to ignore China, as a consequence of the massacre (Kim 1998).

In May 1994 an important trade contract was signed where Clinton decided to separate the MFN (most favored nation) privilege and China's human rights policy. In 1996 China's trade surplus with the United States exceeded that of Japan's. However there were concerns about China, being accused for using dumping on the U.S. market. The United States pressured China to cut tariffs, eliminate the quotas and reduce import-licensing restrictions to the U.S. goods. By 1997 China had adjusted a bit and was ready to enter the WTO (Kim 1998). However in 1999 yet another crisis happened when China could not meet the agreements of the WTO accession (Lampton 2001).

Functioning trade relations were not established before China expressed its will to join the WTO. Therefore it was not until the year of 2000 that the two economies got a permanent trade relation, several years after the diplomatic relations were normalized. The United States being the world's largest economy has a large influence and therefore it was not until 2000 that China was seen as an equal partner in trade (Chow 2003).

As the United States today is the world's largest economy it is also China's biggest threat. However since the 1980s Chinese exports have grown tremendously in the U.S. market. The U.S. trade deficit with China has grown steadily since the exports began, illustrating a co-dependent relationship. The Chinese exports consist mainly of light manufacturing labor-intensive products whilst the exports from U.S. to China consist of capital-intensive products. China has been largely criticized for its dumping of goods under production prices. Also the illegal copying of software has affected U.S. profits within this area (Kim 1998).

As much as 30-40% of the Chinese exports go to the United States which further illustrates the co-dependent relationship. However even though this illustrates China's dependence on the United States it does not go straightly in the other direction. The United States is to a larger extent depending on the other 60-70% of imports. China has for a long time been dependent on the U.S. ability to provide oil, which is a necessity in the industrial production (Sutter 2006). However there is an interesting development occurring where China has started evaluating other sources of oil. China is today the second largest importer of oil from Africa. 30 % of China's imported oil in 2006 came from Africa. However the imports are very concentrated on particular countries of interest. These are the countries that attain oil and other natural endowments. In 2004 71,2 % of all the imports from Africa came from four countries: Angola, South Africa, Sudan and Congo-Brazzaville (Haglund 2008).

China's most important relationship continuous to be that to the United States, being the world's largest economy (Buzan & Foot 2004). The United States trade balance has deteriorated since 1991. The deficit has increased especially since 1997 onwards. The Yuan being pegged to the dollar means that a devaluation would decrease the deficit, having in mind that China has a lot of U.S. gilt-edged securities in possession. After the year of 2000 China has been the largest source of the U.S. trade deficit, even though U.S. has a free trade policy to North America and protectionism against Asia. In 2007 the trade deficit reached as much as US\$256.3 billion (Chiu, Lee & Sun 2010). The increased trade is partly due to the Yuan being overvalued.

According to Lyons in Financial Times (www.ft.com 2010-04-30) the dollar is possibly loosing its primary place in trade. The Chinese are becoming more skeptical about using the dollar as a medium of exchange and rather uses the Yuan. With the increased Chinese trade it is becoming natural to pay in Renminbi instead of in the U.S. dollar. The new Chinese net

reserves are not placed in the dollar, a clear sign of warning. The Yuan is pegged to the U.S. dollar which implies a fixed rate to the U.S. dollars. The Yuan has been increasingly criticized for not appreciating, something that will occur, although gradually so (www.ft.com 2010-04-30).

Although U.S. imports from China fell in 2008 imports from other countries decreased more. This means that China accounts for almost half of the U.S. trade deficit, moving up from one third of it in 2008. China's impact is growing, one of the reasons is due to the undervalued currency. Both Japan and the four Asian tigers lost market shares when appreciating their currencies. China being a larger country is not certain to face the same problems (www.economist.com 2010-04-30).

4. Method

4.1 The Engle-Granger Approach

To test if the groups of variables are cointegrated Engle-Granger's approach will be used, described below. However before being able to test for cointegration the non-stationarity of the variables must be certain. To test for non-stationarity the Augmented Dickey Fuller-test is used. The reason why the ADF-test is superior to the Dickey-Fuller test is because it allows for testing of higher-order processes than the AR(1), used in the DF-test. Also it allows for the error term to be autocorrelated. In the simple setting an AR(p) process is considered:

$$\Delta Y_t = \delta + \pi Y_{t-1} + c_1 \Delta Y_{t-1} + \dots + c_{p-1} \Delta Y_{t-p+1} + \varepsilon_t \quad (1)$$

Where $\pi = \theta_1 + \dots + \theta_p - 1$. This responds to $\theta(1)$ being zero when π is zero. Therefore the hypothesis $H_0: \pi=0$ responds to a unit root.

Since the t-distribution is skewed to the left critical values are smaller than those of the normal distribution and the specific Dickey-Fuller critical values must be used (Verbeek 2008). After having made certain via the ADF-test that the variables are non-stationary, cointegrating relationships can be found via Engle-Granger estimation, described below.

If a series must be differenced d times before being considered stationary it contains d unit roots. If y_t and x_t are both $I(d)$ and the disturbance term from a vector, $(1, -\beta)$, is of a lower order of integration, $I(d-b)$ where $b > 0$ then y_t and x_t are cointegrated of order (d, b) .

Cointegration can be illustrated by two non-stationary processes that moves closely together

where the error term is I(0), creating a constant distance between the two I(1) processes (Harris & Solis 2003).

When cointegration is found in a group an error-correction model must be used to present the data. It is not possible to have cointegrated series without an ECM representation (Harris & Sollis 2003). The idea for the error-correction model is that disequilibrium from one period is corrected in the next period (Engle & Granger 1987). The error-correction term in the model identifies to what extent the long-run equilibrium is not met. In other words it represents a current error in achieving the long-run equilibrium (Kennedy 2008).

The error-correction model is developed from a multivariate stationary model. The long-run relationship of the model looks like the following:

$$Y_t = \beta_1 + \beta_2 x_t + \varepsilon_t \quad (2)$$

In this representation ε_t is not I(0), because of the short-run dynamics captured in the parameter.

The error-correction model is developed by taking the first difference of the short run of (2).

A vector, y_t , with an error-correction presentation is presented below:

$$\Delta y_t = \beta_1 + \beta_2 \Delta x_t + \alpha_1 (\hat{\varepsilon}_{t-1}) + u_t \quad (3)$$

Δx_t contains the error correction specification where the lagged value brings out the dynamic pattern of the data. The lagged error term responds to at what speed the variables are moving towards the long-run equilibrium. All of the terms in the error-correction presentation are I(0). (2) can be estimated using OLS if y_t and x_t are I(0). OLS can also be used if y_t and x_t are I(1) but the first difference, Δy_t and Δx_t and the error term are all I(1) (Verbeek 2006). The error-correction representation has advantages over the level short run since the ECM incorporates both the long-and short-run effects. Since the ECM is I(1) standard regression techniques are valid (Harris & Solis 2003).

5. Empirical Analysis

5.1. Model

The models to be estimated are based on a Cobb-Douglas setting:

$$Y_t = AK^\alpha L^\beta \quad (4)$$

Where α and β are the output elasticities of labor and capital, A is the total factor productivity, K is the capital input and L is the labor input.

The reason why the Cobb-Douglas model is chosen is because it is a production function where the relationship between output and input is estimated (Kennedy 2008). Therefore it functions well with the industrial production. The Cobb-Douglas function will be estimated as a linear function, wherefore it is logged. The logged presentation is:

$$\ln(Y_t) = \beta_1 + \alpha \ln(k) + \beta \ln(l) \quad (5)$$

Where $\ln(k)$ and $\ln(l)$ are the natural logarithms of capital and labor. α and β are the output elasticities of labor and capital and β_1 is the Chinese impact, presented by either exports from China or imports from China. A is not used in the logged model since the productivity of the countries is captured in the dependent variable.

5.2. Data

The regressions performed are based on equation 2 and 3. All of the data is collected from Thompson Financial DataStream Advanced. For the industrial production an index with base year 2005 is used. Since parts of the Swedish data are in SEK currency it is transformed into U.S. dollars when necessary, as to be able to make the regressions as similar as possible. The specific country series found are the same in matters of measuring them and has the same identification numbers, except for the labor categories.

5.2.1. Dependent Variables

For all of the regressions the industrial production of each country is used as the dependent variable. For Sweden the industrial production in only manufacturing and manufacturing are added for the purpose of later robustness checks. For the United States the industrial production in manufacturing is added, however not the manufacturing and mining since it was not to be found. There is a lack in the data present since the alternative parts of the industrial production are not the same for both of the countries. Another disadvantage of the data is the limitation of labor, where only the labor responding to the parts of respective country's production was found.

The total industrial production is used as the main variable for both countries for several reasons. Since what is relevant for this thesis is to see the total effect on the countries from China's increased exports it is important to investigate the total production. If only using the industrial production in textiles or light manufacturing it would be hard to interpret the impact on the countries as a whole. However it could have provided more distinct results. Since both of the countries are capital-intensive, hence has a decreased production of light manufacturing, these types of results could however be misleading.

All of the dependent variables will be described in the figures below.

Sweden's industrial production is seen to be affected negatively by the OPEC 2 crisis of 1979 (www.opec.org 2010-05-28), seen in the decreased production around 1980. The production fluctuates between 1983 and 1989. The financial crisis of 1992 (Dougherty 2008) is seen in the negative annual change over the years close to 1992. From 1995 until 2007 the production has an annual increase on a lower level than after the financial crisis of 1992. In 2008 the production decreases massively on an annual basis, due to the current financial crisis. As seen in Figure 1 the industrial production has fluctuated a bit but it is not until recent years that it has started decreasing, increasingly so.

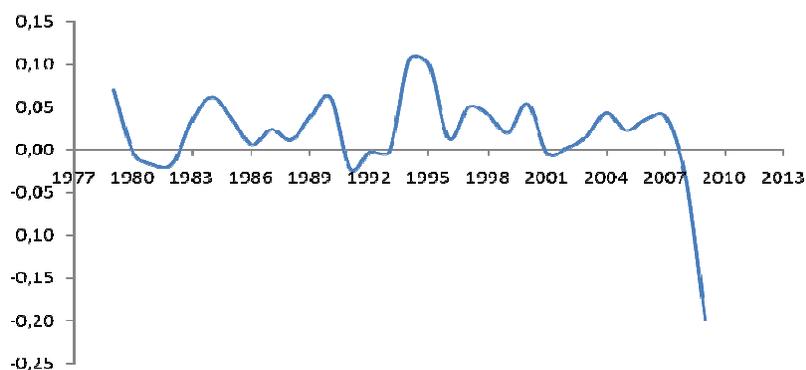


Figure 1: Average annual change in Sweden's total industrial production

When separating the manufacturing and mining production from the total industrial production the results are almost the same as in Figure 1, seen in Figure 2. It is clear that the manufacturing and mining production has been impacted of the financial crises as much as the total industrial production.

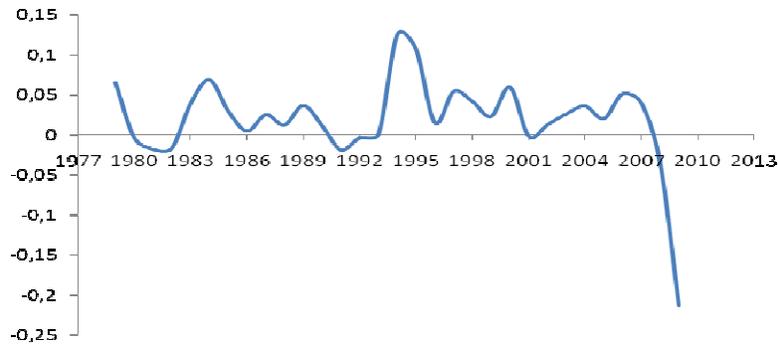


Figure 2: Average annual change in Sweden's total manufacturing and mining production

The United States' industrial production is also seen to be affected by the OPEC 2 crisis, and the financial crisis of 1992. The U.S. being a larger economy naturally has larger annual increases in production, over the timeline, than Sweden has. After 2008 a decrease in production is illustrated, however not to the same extent as in Sweden.

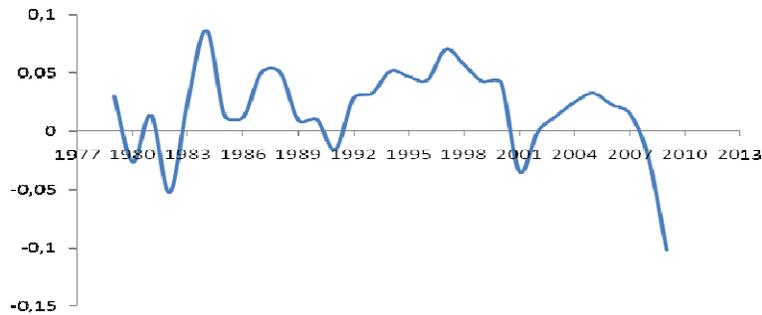


Figure 3: Average annual change in the United States' total industrial production

The manufacturing part of the production follows the same pattern as for the total industrial production, probably due to the large share attained of the total industrial production.

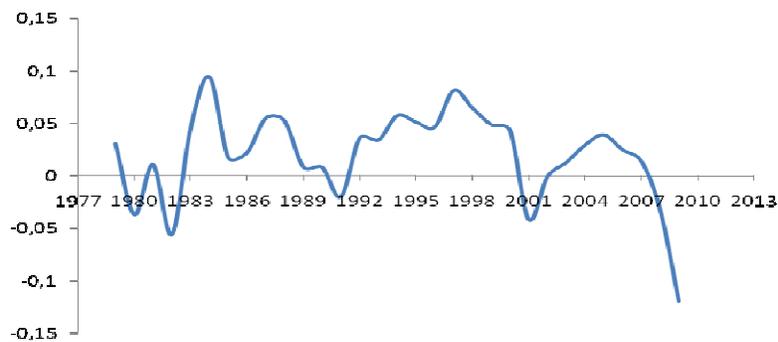


Figure 4: Average annual change in the United States' total manufacturing production

5.2.2. Independent Variables

China's export to Sweden and the United States is used as a measurement of the Chinese impact on the two countries. Since China's exports have grown more than the GDP exports capture China's trade influence well. An alternative measurement, the respective countries' imports from China is used for robustness checks. The variables are measured in U.S. dollars.

In Figure 5 China's average annual change in exports to Sweden is illustrated. The exports did not start off until 1984, and increased on a large scale until 1994. Influence from the financial crisis of 1992 might be the reason of a later coming decrease in 1995. From 1996 to 2001 exports fluctuated, however around a positive annual average change. After China's joining of the WTO exports yield increases every year, although having a decreasing pattern. After 2008 the exports were naturally affected by the current financial crisis, however there is still an annual increase present.

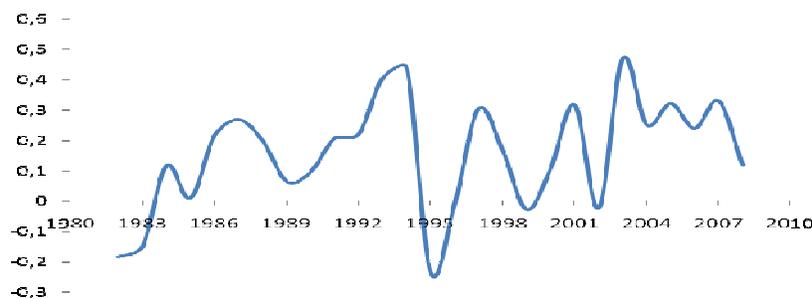


Figure 5: Average annual change in China's exports to Sweden

The Swedish imports from China have naturally a similar pattern as the Chinese exports in Figure 5. However the imports are based on the Chinese mainland only, where Hong Kong and Macau are not included in the data material. The data follows the same pattern, but has a lower level in the increases.

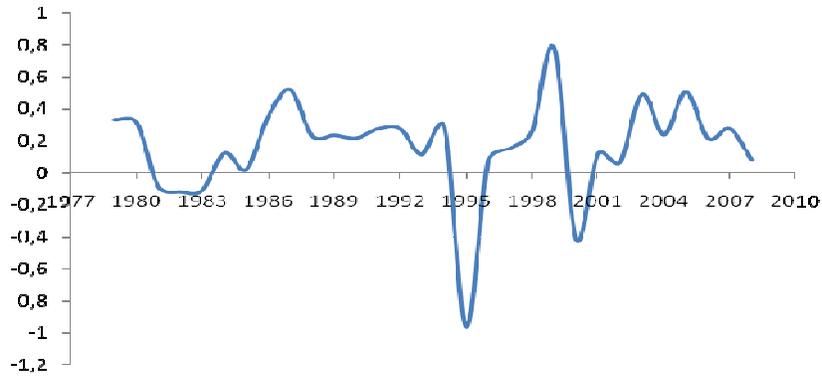


Figure 6: Average annual change in Sweden's imports from China

As seen in Figure 7 the United States has not been affected much by the Chinese exports. The average annual change is close to zero until the year of 2003. The increase in 2003 is a cause of China's entry into WTO which according to theory caused the trade relationship to grow. The Chinese exports stagnated after 2005 and decreased before the financial crisis happened. This is probably because the crisis affected the U.S. before the rest of the world, since this is where it originated. An interesting pattern is seen in the increase in exports after 2008, when the financial crisis occurred.

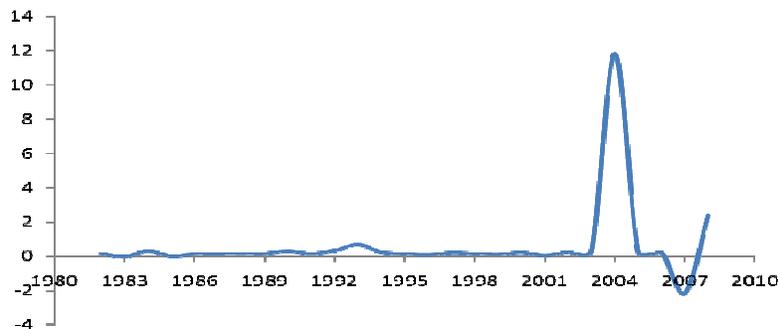


Figure 7: Average annual change in China's exports to the United States

Imports from China naturally follows the same pattern as that of the exports from China. However there is no increase after the financial crisis happened, rather a stagnation. Since the imports does not contain Hong Kong and Macau this could imply that the U.S. traded more intensively with these regions after 2008.

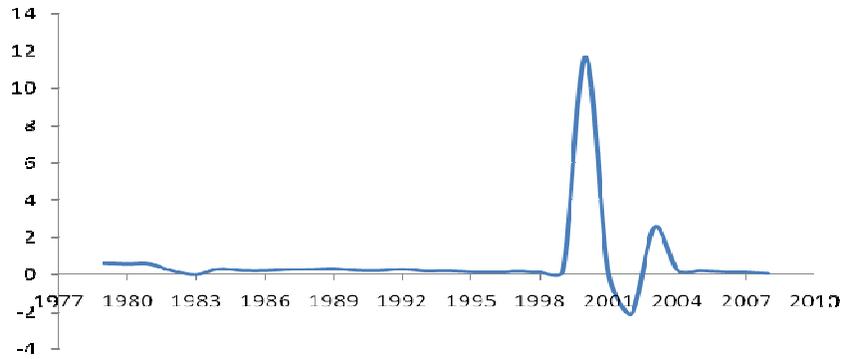


Figure 8: Average annual change in the United States' imports from China

The Swedish capital follows the same pattern as the industrial production in Figure 1. Measured in terms of GDP per capita it naturally has decreased around the OPEC 2 crisis, the financial crisis of 1992 and during the current financial crisis, seen in the decrease from 2008 onwards. The reason for using GDP as a measurement is because it is a good measure of the pure wealth of a country. It is naturally divided by the population size since the economies are not of the same size. The industrial production is also a good measurement of capital, however since this is the measure of the dependent variable it will not be used.

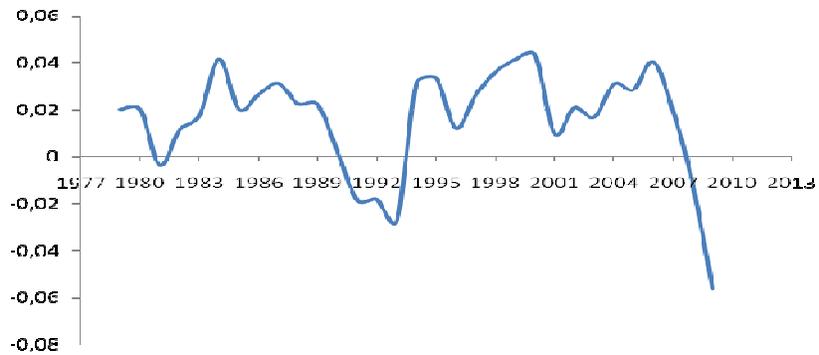


Figure 9: Average annual change in Sweden's capital

The U.S. GDP per capita also follows the crises, seen in the decrease in capital during these years.

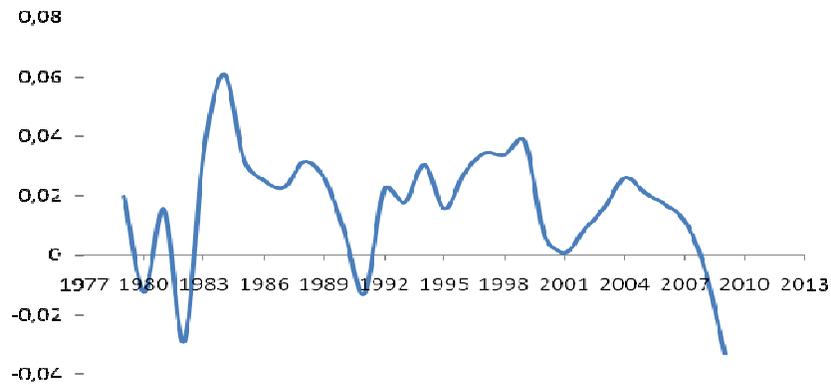


Figure 10: Average annual change in the United States' capital

Sweden is a country capital-intensive in production. This is clearly illustrated in Figure 11 where the average annual change in the total industrial labor is decreasing. Increases are seen after the crises, in 1983 and 1994.

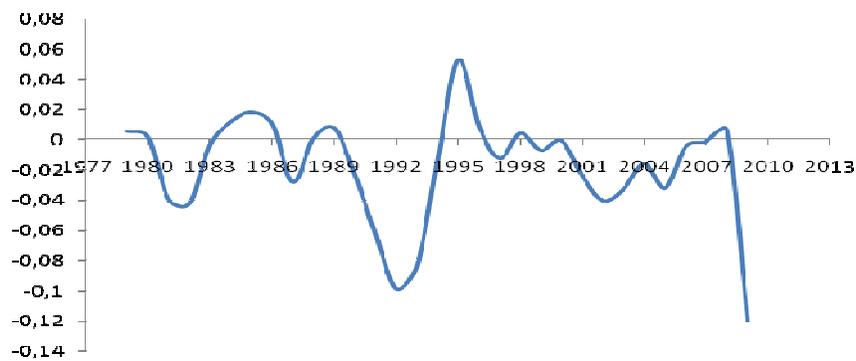


Figure 11: Average annual change in Sweden's total industrial labor

In Figure 12 the same pattern can be seen as in Figure 11. However it is clear that the mining and manufacturing sector has been more impacted of decreases in labor. This is due to the labor-intensive character of the production in this part of the industry.

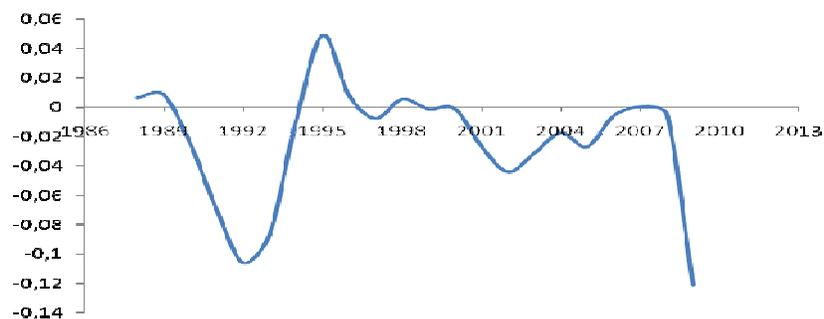


Figure 12: Average annual change in Sweden's total manufacturing & mining labor

The U.S. industrial labor has fluctuated over the years since 1979. Decreases are responding to financial crises. However the U.S. labor is not as stagnated as the Swedish labor since there are periods to be found with positive average annual increases.

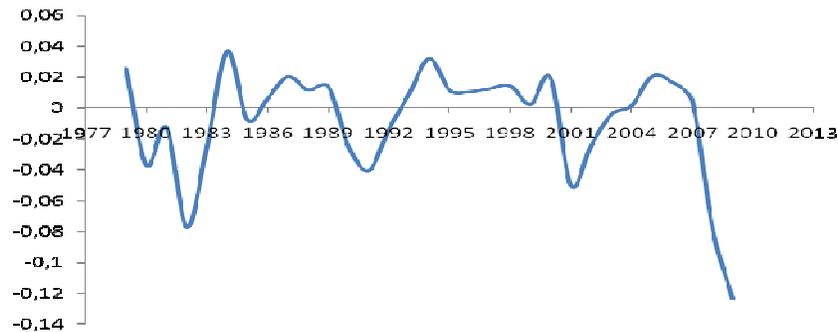


Figure 13: Average annual change in the United States' total industrial labor

Figure 14 contains the same fluctuations as Figure 13, describing the similarity in the total industrial labor force and the manufacturing labor force.

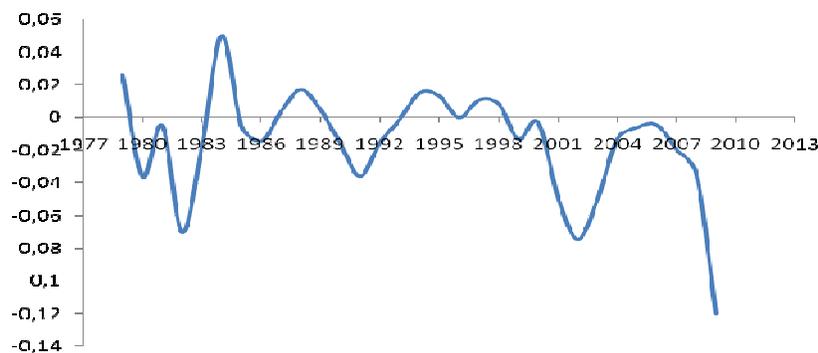


Figure 14: Average annual change in the United States' total manufacturing labor

5.3. ADF-test

Before testing for cointegration and estimating the long- and short-run models it must be certain that the data is non-stationary. If not, no cointegration can be found between the variables. To test for unit root several ADF tests are performed, both for the level, the first and the second difference series. To determine the number of lags needed Schwarz information criterion is used. Akaike's information criteria is also performed but is not presented in Tables 1 and 2 due to the similarities in the results.

As seen in Table 1 most of the variables are I(1). However the industrial data is only I(1) if including no intercept or trend. Therefore the second difference is taken, which proves that the industrial data is non-stationary. This is illustrated in Table 2. When estimating cointegrated relationships all of the variables must be I(1). This is a requirement since I(2) variables will be cointegrated with both y_{t-1} and y_t . However there are certain circumstances that makes the industrial data seem like I(2), but it is not. Since the data sample is annual from 1978 to 2008 the sample is rather small. This will give the wrong indication of the data being I(2). Since the variables are logged they cannot be I(2) since that would implicate that the growth rate is I(1). That in itself is impossible. Therefore the industrial data will be treated as the other I(1) variables.

As seen in Table 1 two of the variables are found to be stationary in the level series. China's exports to Sweden are stationary on the 1 % level when including no intercept and trend. However since always including an intercept and a trend this will not cause problems in the regressions. The labor in the Swedish manufacturing and mining sector is stationary on the 10 % level when including an intercept and trend. However because of the low significance level, and the other two test groups being non-stationary, the conclusion is drawn that this will not cause problems in the regressions.

Variable s	Level series			First difference series		
	With intercep t	With intercept and trend	None	With intercep t	With intercept and trend	None
	Log of Sweden's ind.prod	-1.33	-1.60	0.20	-1.70	-1.70
Log of Sweden's ind.prod(man&min)	-1.44	-1.95	-0.03	-1.41	-1.34	-1.74*
Log of U.S. ind.prod	-1.16	-1.49	0.88	-2.56	-2.53	-2.47**
Log of U.S. ind prod(man)	-1.24	-1.43	0.72	-2.37	-2.36	-2.33**
Log of China's export to Sweden	1.47	-3.08	4.58** *	-4.57***	-4.74***	2.77** *
Log of China's export to U.S.	-0.05	-1.61	1.34	-5.11***	-5.29***	4.85** *
Log of Sweden's imports from China	-0.11	-2.12	2.83	-5.30***	-5.29***	4.41** *
Log of the U.S. imports	-0.45	-2.08	1.38	-5.67***	-5.64***	-

from China						5.33** *
Log of industrial labor Sweden	0.56	-3.20	-2.43	-3.67**	-3.70**	-2.02**
Log of man&min ind. Labor Sweden	-0.29	-3.27*	-2.45	-3.24**	-3.01	-1.25
Log of industrial labor U.S.	-2.52	-2.77	-1.16	-2.20	-1.96	-2.09**
Log of man. Industrial labor U.S:	2.49	0.08	-1.89	-2.28	-2.77	-2.08**
Log of Sweden's capital	-1.54	-2.92	0.63	-1.66	-1.54	-1.70*
Log of U.S. capital	-1.12	-1.93	1.92	-3.20**	-3.23*	-2.47**

***, **, * responds to rejecting the null hypothesis about non-stationary variables at the 1,5 and 10% level respectively.

Table 1: Results of ADF unit root test

Variables	Second difference series		
	With intercept	With intercept and trend	None
Log of Sweden's ind.prod	-4.12***	-4.26**	-4.12***
Log of Sweden's ind.prod(man&min)	-3.76***	-3.92**	-3.75***
Log of U.S. ind.prod	-6.37***	-6.60***	-6.45***
Log of U.S. ind prod(man)	-6.42***	-6.72***	-6.50***

Table 2: Results of ADF unit root test

5.4. Cointegration

The Engle-Granger estimation of cointegration requires the variables to be I(1), which is made certain in the earlier ADF Tests. The second step of the test requires the residuals to be stationary, in that case cointegration exists in the groups.

The data is arranged in groups since there are different variables to be tested and different annual periods. Sweden and U.S data will naturally be separated since there is no point in finding cointegrating relationships in the data between the two countries. Sweden's data yields sixteen groups. Due to robustness tests groups are included which measures China's impact in terms of both the export from China and the import from respective country. Also the labor for both Sweden and the United States is measured in both the total industrial labor and the manufacturing and mining/manufacturing labor. This is to make certain that the results are applicable to other parts of the industry, hence can be used to draw conclusions. The different groupings of the variables are shown in Table 3.

Group number	Variables	Sample range
1	Lnsweindprod, Lnchinaexporttoswe, Lnswecapital, Lnindlaborswe	1978-2008
2	Lnsweindprod, Lnswecapital, Lnindlaborswe	1978-2008
3	Lnsweindprod, Lnchinaxporttoswe, Lnswecapital, Lnindlaborswe	1994-2008
4	Lnsweindprod, Lnswecapital, Lnindlaborswe	1994-2008
5	Lnsweindprodmanmin, Lnchinaexporttoswe, Lnswecapital, Lnminmanlaborswe	1978-2008
6	Lnsweindprodmanmin, Lnswecapital, Lnminmanlaborswe	1978-2008
7	Lnsweindprodmanmin, Lnchinaexporttoswe, Lnswecapital, Lnminmanlaborswe	1994-2008
8	Lnsweindprodmanmin, Lnswecapital, Lnminmanlaborswe	1994-2008
9	Lnsweindprod, Lnsweimportfromchina, Lnswecapital, Lnindlaborswe	1978-2008
10	Lnsweindprod, Lnswecapital, Lnindlaborswe	1978-2008
11	Lnsweindprod, Lnsweimportfromchina, Lnswecapital, Lnindlaborswe	1994-2008
12	Lnsweindprod, Lnswecapital, Lnindlaborswe	1994-2008
13	Lnsweindprodmanmin, Lnsweimportfromchina, Lnswecapital, Lnminmanlaborswe	1978-2008
14	Lnsweindprodmanmin, Lnswecapital, Lnminmanlaborswe	1978-2008
15	Lnsweindprodmanmin, Lnsweimportfromchina, Lnswecapital, Lnminmanlaborswe	1994-2008
16	Lnsweindprodmanmin, Lnswecapital, Lnminmanlaborswe	1994-2008
17	Lnusindprod, Lnchinaexporttous, Lnuscapiatal, Lnindlabourus	1978-2008
18	Lnusindprod, Lnuscapiatal, Lnindlaborus	1978-2008
19	Lnusindprod, Lnchinaexporttous, Lnuscapiatal, Lnindlabourus	1994-2008
20	Lnusindprod, Lnuscapiatal, Lnindlaborus	1994-2008
21	Lnusindprodman, Lnchinaexporttous, Lnuscapiatal, Lnmanlaborus	1978-2008
22	Lnusindprodman, Lnuscapiatal, Lnmanlaborus	1978-2008
23	Lnusindprodman, Lnchinaexporttous, Lnuscapiatal, Lnmanlaborus	1994-2008
24	Lnusindprodman, Lnuscapiatal, Lnmanlaborus	1994-2008
25	Lnusindprod, Lnusimportfromchina, Lnuscapiatal, Lnindlaborus	1978-2008
26	Lnusindprod, Lnuscapiatal, Lnindlaborus	1978-2008
27	Lnusindprod, Lnusimportfromchina, Lnuscapiatal, Lnindlaborus	1994-2008
28	Lnusindprod, Lnuscapiatal, Lnindlaborus	1994-2008
29	Lnusindprodman, Lnusimportfromchina, Lnuscapiatal, Lnmanlaborus	1978-2008
30	Lnusindprodman, Lnuscapiatal, Lnmanlaborus	1978-2008
31	Lnusindprodman, Lnusimportfromchina, Lnuscapiatal, Lnmanlaborus	1994-2008
32	Lnusindprodman, Lnuscapiatal, Lnmanlaborus	1994-2008

Table 3: Variable groupings

The cointegration found in the different groups is presented in Table 4. None of the groups of the annual periods 1978 to 2008 generates cointegration, seen in the insignificance of the variables. Since this makes the estimation of an error-correction model impossible these groups will not be further analyzed. The groups including data from 1994 to 2008 will therefore be the foundation for further estimation. The reason why these samples start from 1994 is because of the trade contract implemented between China and the U.S. in this year,

which is described in the background section. The reason for letting the Swedish sample be restricted to these years as well is because the trade did not increase until the 1990s in Sweden. The year of 1994 was therefore chosen for Sweden as well as to make a comparison possible between the countries. A dummy for this restriction, and a trend, will be implemented in the regressions.

Since some of the groups including the Chinese impact were found not to be cointegrated an additional group without the Chinese impact is added to all of the different group settings. However they are all found to not have cointegration, and the impact of the Chinese exports is therefore secured. Groups 3, 7, 11, 15 and 31 will be estimated. The Swedish data is found to be more robust than the U.S. data, since the U.S. data only yields one group. Critical values for Engle Granger's test were used to determine the stationarity of the error terms.

Groups Sweden	Level series	Groups U.S.	Level series
residual series	With intercept and trend	residual series	With intercept and trend
1	-2.27	17	-2.31
2	-0.15	18	-2.19
3	-4.92**	19	-3.46
4	-1.57	20	-2.19
5	-2.15	21	-1.79
6	0.92	22	-1.76
7	-4.56**	23	-3.37
8	-3.27	24	-3.28
9	-2.36	25	-2.17
10	-0.15	26	-2.19
11	-4.76**	27	-3.74
12	-1.57	28	-3.12
13	-3.10	29	-2.44
14	0.92	30	-1.76
15	-4.72**	31	-4.68**
16	-3.27	32	-1.76

Table 4: Cointegration

5.5. Long-run Equilibrium

Estimating the small sample requires a robust model wherefore OLS is used. As seen in model three in Table 5 the coefficient of China's export to Sweden is positive and significant. However with a coefficient of 0.006 it is a small impact. But since already being aware of that

the variable cannot be dropped from the group, because of generating no cointegration in the group, the impact still matters. The positive coefficient implies that the Chinese exports have a positive effect on the Swedish industrial production. This implies that the Chinese exports are value-adding for the Swedish production. Meaning that the commodities from China are something Sweden use in its production, illustrating comparative advantages present. This indicates that China produces labor-intensively and Sweden capital-intensive products. The conclusion can be drawn that China is not a threat to Sweden's industrial production, seen as a total. However estimating only the labor-intensive part of the Swedish production might yield a result in China's favor.

Both the Swedish capital and the total industrial labor are positive, implying a positive affect on the industrial production. The capital has a coefficient of 0.020 which is a small affect, whereas the labor has an effect of 0.221. It would have been expected that the capital should have a larger impact on the industrial production. However since the estimated sample is the total industrial production it can be that there are parts of the production more dependent on labor than capital.

For model 7 the coefficient of China's export to Sweden is of a positive 0.008. Even though being small it has an impact, based on the argument above. Model 7 is based on one part of the industrial production, the manufacturing and mining. Since the coefficients of model 3 and for model 7 are almost the same for the Chinese exports it illustrates the robustness of the results. The capital has a positive impact of 0.487 and the labor in the specific sector has an impact of 0.044. The pattern in model 7 shows that capital affects the industrial production more than labor, which should be the case according to Sweden's capital-intensive comparative advantage.

Model 11 is based on the alternative measurement of Chinese impact; the Swedish imports from China. The variable affects the industrial production with a positive coefficient of 0.008. This result is similar for the exports from China measurement, showing that the Swedish model is robust. The coefficient of capital is 0.070 whereas the industrial labor has a coefficient of 0.183. This is also the same result as for model 3 which further shows the robustness of the results.

Model 15 is as model 11 based on the manufacturing and mining parts of the industrial production. However model 15 uses the Swedish imports from China, which in this regression

yields a coefficient of 0.007. The conclusion can therefore be drawn that for all of the four Swedish models this variable is quite similar, implying robustness and the value-adding affect China has on the Swedish production. The capital has nearly the same affect as in model 7, with a coefficient of 0.591. However there is a disadvantage to this model when it comes to the labor in the sector. The labor has a negative coefficient of -0.072, which does not respond to the expected results. It might be that the smaller sample that the manufacturing and mining sector yields does not respond as well to the Swedish imports from China as it does to the exports from China. The Swedish imports from China are restricted to mainland China, wherefore the sample from this measurement is smaller than that of the exports from China.

The United States' groups resulted in no cointegration except for group 31. This indicates that China has a larger affect on Sweden, being a smaller country. However group 31 will still be analyzed, even though there is no possibility for robustness checks which means that no conclusions can be drawn from the model. Model 31 is based on the United States' manufacturing part of the total industrial production. The U.S. imports from China have a positive effect of 0.04, illustrating the value-adding affect on the manufacturing production. The positive coefficient of 1.495 for the U.S. capital illustrates that the manufacturing sector is dependent on capital. With a coefficient of labor of 0.233 the conclusion can be drawn that labor does not affect the manufacturing production to the same positive extent that capital does.

All of the models are tested for autocorrelation and heteroskedasticity, where none of the models are affected. When estimating OLS models it is important to test for these issues, since having these properties of the data implies that the error terms are no longer i.i.d. This means that OLS no longer is the best estimator, since it is inefficient and no longer BLUE (It does not have the lowest variance of all estimators). Even though having the same consequences for the data the two problems have different implications for the data. Heteroskedasticity implies that the variance over the observations differ, whereas autocorrelation means that the covariances between the different error terms are not all equal to zero (Verbeek 2008). The models are also tested for normality. Even though not all of the errors of the models are perfectly normally distributed this is the least important condition in the OLS model. Estimation can continue without putting any emphasize on this matter since it does not affect the results.

Dependent variables	Log of Sweden's industrial production	Log of Sweden's total man&min production	Log of Sweden's total industrial production	Log of Sweden's total man&min production	Log of U.S. manufacturing production
Models	(3)	(7)	(11)	(15)	(31)
	1994-2008	1994-2008	1994-2008	1994-2008	1994-2008
C	0.739	-2.253	0.175	-0.962	-15.218
Log of Sweden's capital	0.020	0.487	0.070	0.591	
Log of Sweden's total industrial labor	0.221		0.183		
Log of Swedens man&min labor		0.044		-0.072	
Log of China's export to Sweden	0.006	0.008			
Log of Sweden's import from China			0.008	0.007	
Log of U.S. capital					1.495
Log of U.S. total industrial labour					
Log of U.S. manufacturing labor					0.233
Log of China's export to U.S.					
Lof of U.S. imports from China					0.004
Adjusted R-squared	0.994	0.992	0.993	0.991	0.997

Table 5: Long-run equilibrium relationships from OLS

5.6. Robustness Check

The Swedish models 3, 7, 11 and 15 are all robust in matters of the measuring of the Chinese impact. Even though exports from China were alternated with the imports from Sweden the coefficients are still quite similar. When using the manufacturing and mining production as a proxy for the total industrial production the results for the Swedish impact are still the same. The Swedish models can therefore be used to draw conclusions.

Since only one of the U.S. groups was found to be cointegrated no conclusions can be drawn concerning robustness. Hence the U.S. model cannot be determined to be accurate or not. The reason for the U.S. data not performing as well might be that the U.S. is a larger economy where other economies might have had a larger impact than China. Sweden being a small

economy is naturally more affected by a growing economy, as discussed in the background section.

5.7. Short-run Dynamics (ECM)

To see how the short-run dynamics impacts the industrial production in the two countries, error-correction models are estimated by OLS. The results can be seen in Table 6. What the short-run adjustments add to the long-run regressions is that they gradually correct for deviations from the long-run equilibrium. The short-run terms pushes the equilibrium error back towards zero. This is done by a series of partial short-run adjustments. The short-run adjustments entail information about deviations from the current state from the long-run equilibrium (Verbeek 2008).

As seen in Table 6 model 3 adjusts the capital positively, with a coefficient of 1.945, and the labor negatively, with a coefficient of -0.872, illustrating the capital-intensive nature of the Swedish economy. When it comes to China's export to Sweden the coefficient is of a positive 0.03, however it is not significant. Non-significance means that it cannot be analyzed, but it is noteworthy that it is a positive term. This means that the short-run dynamics of the variable is similar to that of the long-run, implying that the Chinese exports are value-adding for the Swedish production. Model 7, 11 and 15 have the same positive coefficients of capital and negative coefficients of labor. Also the Chinese exports/imports from China have small, positive and insignificant coefficients. The lagged error term for all of the four models is negative and insignificant, hence it cannot be analyzed. However it is noteworthy that it is negative, implying that the variables are moving at a negative speed to their long-run equilibrium.

For model 31 the U.S. data has the same pattern as the four Swedish models with a positive coefficient of capital of 1.585, a negative coefficient of labor of -0.725 and an insignificant value of the imports from the U.S. of 0.002. The lagged error term is of a negative -0.248, however insignificant. Because of the insignificance of both the lagged error term and the variables for Chinese impact no conclusions can be drawn regarding deviations from the long-run equilibrium and how fast the model is moving towards the long-run.

Dependent Variables Models	Log of Sweden's industrial production	Log of Sweden's total man&min production	Log of Sweden's total industrial production	Log of Sweden's total man&min production	Log of U.S. manufacturing production
	(3)	(7)	(11)	(15)	(31)
	1994-2008	1994-2008	1994-2008	1994-2008	1994-2008
C	0.017 (0.027)	0.038 (0.038)	-0.007 (0.022)	0.040 (0.040)	0.003 (0.022)
ΔLog of Sweden's capital	1.945** (0.716)	3.676*** (1.102)	2.101*** (0.662)	3.285*** (1.005)	
ΔLog of Sweden's total industrial labor	-0.872** (0.406)		-1.073** (0.398)		
ΔLog of Swedens man&min labor		-1.247** (0.525)		-1.243** (0.528)	
ΔLog of China's export to Sweden	0.003 (0.003)	0.004 (0.004)			
ΔLog of Sweden's import from China			0.004 (0.003)	0.006 (0.006)	
ΔLog of U.S. capital					1.585** (0.705)
ΔLog of U.S. manufacturing labor					-0.725 (0.481)
ΔLof of U.S. imports from China					0.002 (0.002)
ΔLag of error term	-0.345 (0.615)	-1.361 (1.021)	-0.350 (0.452)	-1.256 (1.065)	-0.248 (0.001)
Adjusted R-squared	0.461	0.608	0.415	0.568	0.273

Table 6: Short-run adjustments from error-correction models

6. Conclusion

The significant results of the long-run regressions prove that China's exports are value-adding for both Sweden and the United States' industrial production. Both Sweden and the United States can only be seen to have been impacted since the trade contract of 1994. Since the results of the U.S. regressions were not robust they will not be further analyzed. China has indeed had a larger impact on Sweden, which should be the case for a smaller country. That Chinese exports are value-adding to the Swedish production is a sign of comparative advantages present. It shows that the countries are considering their comparative advantages and producing thereafter. Therefore the regressions prove that China is a possibility in trade for the Swedish economy, where advantages can be taken of one another's production. This

means that Sweden should continue specializing in capital-intensive production, whereas China should continue its labor-intensive production.

China should however not be undermined in terms of a threat. The regressions illustrate no need for concern at this point of time. There are clear comparative advantages present in the Chinese-Swedish relationship. By importing labor-intensive products Sweden can focus on the more advanced, capital-intensive goods. Even though China can be a threat to the capital-intensive production in the future it can cause Sweden to move to even more knowledge-based production. However, as of right now China clearly still produces labor-intensively. This is why China emerges as a larger threat in developing countries with the same production pattern. Even though China has moved into producing high-tech products in the 21st century there are no signs of a significant change in comparative advantage. The new high-tech products are produced labor-intensively, hence does not reach the quality of Swedish commodities.

As of right now China is not the big threat that it might seem. However as for the future the trade pattern is hard to foresee. There are disadvantages to the Chinese economy and potential obstacles to the miraculous growth. These hinders will conclude this thesis.

6.1. China Revisited: Obstacles to the Miraculous Growth

There are several drawbacks and possible limits to the Chinese growth. Three challenges are pointed out as the largest hinder for continued growth. Firstly, the increased energy demand needs to be met by supply. Over the last couple of years the energy demand has increased 70 % every five years. Since China is not self-sufficient in energy prices has increased which mainly has affected the third world. But this is something that might backfire on China itself. As a substitute for good energy coal is used which is environmentally degrading. Sooner or later this is something that China must take responsibility for, also due to the estimated decrease in China's annual growth rate by 2-10 %.

Increasing inequalities in the country can possibly affect in many ways. With a Gini coefficient of 46.9 the inequalities are worse than in the United States (40.8). Being a clear problem for growth it also is an obstacle to the ideology which the political party is built on.

The one-party rule in itself is also an obstacle to growth. Primarily because the growth has been focused on production and not on the welfare of the people. An increased dissatisfaction will affect the political party sooner or later (Paus, Prime & Western 2009).

Since the Yuan is undervalued an appreciation could possibly change China's position in the world economy. This situation occurred for both Japan and the four Asian tigers when the currencies were appreciated. When the Yuan goes up the U.S. trade deficit will be worth more, creating a deeper co-dependence between the countries. Also the price of exports will increase which can cause enterprises to move to new low labor-cost countries (www.economist.com 2010-04-30).

China needs to focus on the domestic consumption. If not sooner or later there will be an overcapacity in the industry production, caused by the combination of overinvestment and underconsumption. Since the 1950s the Chinese state has focused primarily on a rapid growth, leaving the consumer market underdeveloped. One of the reasons why the domestic consumption is low is because of the high savings ratios in China. The high savings rates are due to an uncertainty when it comes to medical care, pensions and education. Since the social welfare system is underdeveloped there is a higher propensity to save, causing the consumption to decrease (Hung 2008).

A threat to the Chinese growth is the United States, being the world's largest economy. Even though the Chinese GDP has grown from 13 % of the U.S. GDP in 2001 to 20 % of the U.S. GDP in 2006 this is not the same as being a threat to the economy. Because during the same period the U.S. GDP grew 20 %. Most of the calculations today are based on that China will continue its tremendous growth rate, in that case China will fall behind the United States until 2014. However if one were to calculate it with a lower growth rate, which is more likely, several years are added (Chestnut & Johnston 2009).

Some institutions have still to be modernized, the legal system's infant character is indeed an obstacle. For foreign firms China is yet today a tough market to conquer because of the poor legal system. Since the 1980s new market oriented laws have been implemented concerning banks, financial institutions and corporate behavior. However the problem in China is not that there is a lack of law rather that the sentences in court are not enforced (Chow 2003).

Even though China still is a dictatorship there was already in 2001 stated a goal to become a democracy. However it is not for certain that this is something heart-felt, rather it might be something spoken for the west and continued relationships. The political institutions and the will of being a democratic country have not had much progress since 1978. Rather China focuses on implementing market institutions as mentioned (Chow 2003). While the party keeps encouraging market institutions this might be what decreases their power in the end. The obstacles presented might be what decreases growth. However the Chinese growth pattern has not been easy to foreseen and will probably not be in the future either.

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