



JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL  
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# **Economic Growth in China**

During the Period of 1980-2003

Bachelor's thesis within ECONOMICS

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<b>Titel:</b>	<b>Ekonomisk Tillväxt i Kina: Under Perioden 1980-2003</b>
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## Sammanfattning

Innan Kina öppnade dörrarna för omvärlden, ansågs de inneha en av världens mest slutna marknader. Detta har dock förändrats då Kina tillät marknaden styra istället för central styre, samt att de beslöt för en utåtriktad utvecklings strategi. Detta tyder på att Kina tillät utländsk handel att spela en betydelsefull roll i deras ekonomiska utveckling.

Uppsatsen, med hjälp av inkomst benämner av handel och BNP per capita, har som syfte att studera relationen mellan handel och ekonomisk tillväxt i Kina under perioden 1980-2003. Syftet är att man med hjälp av det ekonometriska verktyget, tidserie, kunna finna en positiv relation emellan dessa variabler. Inkomst benämner av handel inkluderar värden av både export och import. Det är därför teorin används för denna uppsats, eftersom teorin anser att export ensam inte kan orsaka ekonomisk tillväxt om inte import är inkluderad.

Undersökningen, tidserie, innebar en enheten rotar problem, cointegration, samt Granger causalitets test. Värdena givna visar på att undersökningen har statistisk signifikanta värden, vilket tyder på att handel är av relevans för den ekonomisk tillväxt i China under 1980-2003.

## **Bachelor's Thesis in ECONOMICS**

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### **Abstract**

Prior to China's open-door policy, China was considered among one of the worlds' most isolated economies. However, that changed when they allowed the market force to go before central planning, and decided on an outward orientation for their development strategy. This was a sign indicating that China allowed foreign trade to play a leading role in its economic development.

This thesis, with the help of income terms of trade (ITT) and GDP per capita, aim to study if there is any relation between trade and growth in China during 1980-2003. The purpose is with help of the econometric tool, time series, to find a positive correlation between these variables. ITT include both the value of exports and imports. That is why the theory ITT is being used for this thesis, since the theory indicates that exports alone cannot explain growth if imports is not considered as well.

The test, time series, was performed by doing a unit root problem, co-integration, and a Granger causality test. The result given when doing these tests show of statistically significant result, which indicates that trade is of relevance for growth in China during 1980-2003.

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## 1 Introduction – China

In 1997, the 15<sup>th</sup> Communist Party Congress introduced a new phase for China and its economy. Two-third of China's small and medium-sized enterprises was suggested to be freed on the open market (Zhiqin, 2000). Prior to 1978, China's total trade amounted to less than one per cent of the world trade, making them among one of the most isolated economies. Pursuing the opening, China's foreign trade grew with an average of 15 per cent a year, indicating a growth twice as fast as the world trade. This, therefore, caused the volume of total trade to increase from US \$21 to US \$325 billion (Zhang, 2000, p. 5).

By 1997, China was the world's 10<sup>th</sup> largest trading nation. The expansion was due to reformed adaptations that were made in the late 1970s, which caused two major shifts. Two major shifts such as: **1)** *“resource-allocation mechanisms from central planning to market forces”*, and **2)** *“development strategies from an inward to an outward orientation”* (Zhang, 2000, p. 5). Therefore, indicating that China had given foreign trade a leading role in their economic development (Zhang, 2000).

The main goal was for China to base their exchange and trade system on foreign exchange and trade system. Doing so, they would base their exchange and trading system so that it would regulate *“the allocation of foreign exchange as well as exports and imports”* (Zhiqin, 2000, p. 571). The purpose was to import capital goods and raw materials that China had shortfall in. The imported goods were then used to produce goods that were exported. By doing so, China would pay for their imports and, hence, generate a moderated surplus in their trade balance (Zhiqin, 2000).

China's open-door policy caused a rapid expansion in foreign direct investment (FDI) inflows. The government would lure FDI to invest in factories that would boost consumer goods that were to be later exported. Indicating that the factories would import components needed for exports production (Zhiqin, 2000). Prior to 1978, FDI was less than one per cent of China's total fixed investment; by 1994, it reached nearly US \$100 billion, which was 18 per cent of their total fixed investment (Hu & Khan, 1997, p. 5). FDI in China has contributed to certain improvements; improvements such as new factories, job opportunities, import transfer of technology, and linked China with the international market (Hu & Khan, 1997).

China initially was one of the original members of General Agreement on Tariffs and Trade (GATT). However, the Chinese government was overthrown by the communists who claimed to be the legitimate government of China. The government change seemed to have the nation's approval. Therefore, when they notified the UN Secretary General in 1950 their withdrawal from GATT, their authority went unchallenged. Conversely, China had the observing status for two years, when they showed interest in re-entering GATT in 1980. Not until 1986, did the government formally request continuation of China's contracting party status in GATT. However, by not coming to terms with China's re-enter, GATT brought down China's hopes in becoming a full member of World Trade Organisation (WTO). Not only would they benefit from trade agreement, but it would so they thought, bring political recognition to their status as a major economic power. Nevertheless, three major nations such as EU, USA and Japan with whom China had to negotiate, insisted that China's action was not an act of political recognition, but of commercially viable terms (Strange, 1998).

In 1999, China experienced a decrease in their GDP for the seventh time in row, due to weaknesses in their private domestic demand. However, it was expected to take off in

2000-2001, when China entered WTO (Zhiqin, 2000). After a 15-year long negotiation to gain membership in the WTO, the People's Republic China became the 143<sup>rd</sup> member in December 11, 2001 (Gertler, 2002). Upon entering WTO, the trade conditions changed not only for China but also for the rest of the world. China would experience a tariff reduction that would eliminate trade distortions and make it, therefore, more efficient to trade on the international market as well as promoting global economic growth (Yam, 2000).

## 1.1 The research problem

China has gone through changes since they opened up their doors to the world. From being an isolated economy to an open economy, tells us about the reformed adaptations that has taken place and still takes place since the late 1970s. The opening of the Chinese market shows that it required and still requires efforts behind the opening of their market. The reformed adaptations made in China have caused them to implement adjustment according to the international market.

China is, since the open-door policy, considered the sixth largest economy in the world, especially when its output is measured at market exchange rates. It is the fourth largest trading nation in the world (Eichengreen et al., 2004). Its growth policy shows that exports in China have grown faster than its economy. This has caused China's share of world trade to rise two decades later, from less than one per cent to six per cent (Eichengreen et al., 2004, p. 1).

Growth and trade relation, in what direction does the causality run. Regarding causality of growth and trade, will growth be causing trade in such way that advancement in the economy occurs through changes made in the endowments of either or both factors of production – capital or labour – or technological change. However, how these changes are affecting and are being affected depends on the country itself and the world. A small economy strong enough to influence the world price will benefit from trade, whereas, trade for a large economy will worsen. However, if trade is causing growth, a movement from an isolated to an open economy augments a country's aggregate real income or welfare. Growth refers, in this case, to a forceful process of income raise extended over time. This would indicate that growth would be increasing in its stock of capital and labour. Moreover, the shift from an isolated to an open economy would not be beneficial if the pre-trade price ratio of a country was the same as the world. Conversely, if they do differ, the intermediate sectors (importable) would cut its production, whereas, the other (exportable) would expand its production. Nevertheless, a fraction of the supplementary real income would be saved, indicating that the growth rate of capital would rise, for a while that is. A small economy reducing its trade barriers would have the same effect as if it changes its economy from an isolated to an open economy. A large economy would, however, be experiencing a comparative-static fall in their real income (Brenton et al., 1997).

The purpose of the thesis is to see if there is any relation between trade and growth in China during the period of 1980-2003.

The implication, according to theories regarding trade and growth, implies the more open a nation is the greater is its ability to import ideas from the world (Johansson, 2002). The claim is that imports are more important than exports in a nation's economy, this because imports bring new development (Johansson, 1993). The dilemma is that industrialise process in a developing nation is depended on imports of both intermediates and capital goods. Moreover, the purchasing power within a developing nation regarding export revenues is

somewhat low. Therefore, imports are considered relevant for economic growth, especially concerning knowledge and technology (Johansson, 2002). Consequently, the concept of ITT is being used for this thesis; to measure the impact trade has on growth. ITT is a measurement defined as a net barter terms of trade times the export volume; a measurement that consider both the volume and price effects and, hence, measures a country's imports ability. ITT is expected “*to cover the net effect of a trade expansion on real income*”; therefore, its measurements are relevant when studying trade-induced growth (Johansson, 2002, p. 1). With the help of the econometric tool, times series analysis, the purpose is to endorse a positive relation in-between growth in ITT and GDP per capita. Therefore, the expectation is to find a positive correlation that support the statement that ITT is of relevance for growth in GDP per capita (Johansson, 2002).

Moreover, this thesis will only include data regarding the Mainland China, People's Republic of China. Therefore, the following data regarding Hong Kong SAR, Macao SAR, and Taiwan Province of China will be excluded.

## 1.2 Outline of the thesis

The outline of the thesis is presented in the following way. In section two, the theoretical framework will be presented. The focus will be mainly on explaining the relationship between trade and growth, and growth and trade. The aim is provide an insight on whether trade is causing growth, or if growth is causing trade.

Section three elaborates the empirical study made. The intention is to provide a model formulation, which the empirical study is based on. The section will present a general view of what time series analysis is. Thereafter, the result will be provided and analysed according to the assumption underlying time series analysis. The purpose is to see if there is a relation between the variables ITT and GDP per capita, with the help of time series analysis. However, the empirical study made will be based on the ITT theory.

Thereafter, in section four, the conclusion will be drawn. Here the outcome will be provided and what the findings of the thesis are. Additionally, section five will provide with recommendation for further research to be made.

## 2 Theoretical framework

This section will mention theoretical frameworks, frameworks that explain how open trade liberalisation effects the growth of a country. Therefore, different views of economic growth theories have been brought up for this study. However, the emphasis will be made on income terms of trade (ITT).

### 2.1 Trade-induced investment-led growth

From early studies of the neoclassical growth model, it has come to our understanding that in order to improve growth in the economy there should be an increase in the capital accumulation.

According to the Heckscher-Ohlin model on trade, global trade liberalisation should raise return on investment in countries exporting capital-intensive goods, but lower investment for countries importing capital-intensive goods. The model implies that trade liberalisation should stimulate investments in some countries and depress in others. Economists such as Barro (1991), Levine and Renelt (1992) and Baldwin and Seghezza (1996) do not agree. They imply that the model contradict empirical evidence, evidence showing that openness to trade increases investment rates in a wide range of countries. Indicating that empirical evidence do not confirm the predictions, which the model is build on. Predictions that trade encourages investment in nations that export capital-intensive goods (rich country), and discourage nations that imports such goods (poor country). This is due to three grounds; **1)** it predicts that most of the world's trade is among rich countries, **2)** that it consists of intra-industry trade, and **3)** the fact that Heckscher-Ohlin model uses the net trade date, trade data in which intra-industry trade has been cancelled out because it cannot cope with such trade. Moreover, 1/3 of the intra-industry trade that occurs between Western European nations, North America nations and Japan, confirms the idea behind Heckscher-Ohlin model (Baldwin & Seghezza, 1996a).

As mentioned above, the Heckscher-Ohlin model predicts empirical evidence. Tobin's  $q$  approach to trade, investment and growth that has been elaborated by Baldwin and Forslid (1996), Baldwin, and Seghezza (1996a) can explain this.  $q$  is defined as a ratio of the market value of a unit of capital to its replacement cost gives us:

$$q = J / F$$

where  $J$  denotes the market value of a unit of capital, and  $F$  denotes the marginal cost of capital.  $J$  depends on the rate of return to capital, the rate of depreciation as well as the rate of returns to savings.  $F$  is, as well as  $J$  depends on the labour unit requirement and the wage rate in the capital-producing sector. If perfect competition is assumed, the price of capital should equal  $F$ . A firm would increase their capital stock if  $q > 1$ , decrease it if  $q < 1$ , and it would be in a steady-state-situation if  $q = 1$ .  $q$  determines the steady-state capital-labour ratio in the exogenous model. While it in the endogenous model determines the level of real investment, since endogenous growth model predict that a constant level of real investment yields constant growth (Baldwin & Forslid, 1996).

Tobin's  $q$  approach to investment-led growth is based on the assumption that traded goods, in general, are more capital-intensive in production than non-traded goods. This would cause a price reduction that would improve the situation for the capital-intensive

countries compare to the non-traded goods, an improvement that would boost the derived demand for capital. An investment-led growth occurs when trade liberalisation reduces the cost of capital-intensive production, which in turn raises a country's  $q$  in capital accumulation until Tobin's  $q$  reaches a new steady-state-situation (Baldwin & Forslid, 1996).

Baldwin and Seghezza (1996) presented a paper that tested for trade-induced investment-led growth. The paper emphasises on the role of traded intermediate employed in capital formation sector and the capital intensity in traded and non-traded sector. Trade-induced investment led growth is said to occur if barriers at home were to be higher than foreign trade barrier, meaning that it should stimulate demand for capital at home. However, the result show that domestic barriers depressed investment and growth more than what foreign trade barriers did (Baldwin & Seghezza, 1996b).

## 2.2 The effects of growth on trade

The world consists of perfect competition and free trade, and each country has two given endowments, capital and labour. To explore the effect of growth, A is a single country and B the rest of the world that are trading with one another. Growth takes form in two ways: **1)** it can result from a rise in country A's endowments. In either one of the endowments or both together, or **2)** it can take the form of an advanced technology, confined in one of country A's industries, or in both on them (Brenton et al., 1997).

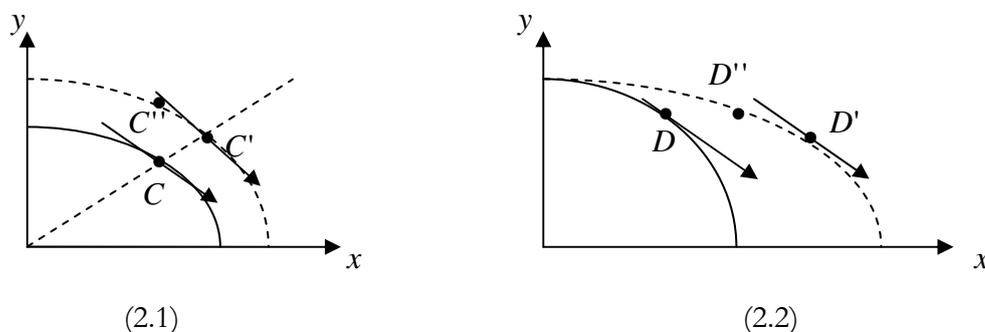
We ought to look at it through factor accumulation. What would the outcome look like given the two different economic situations, one small and one large economy? What if these two economic situations takes form in the two ways mentioned above. What if we stated that: **1)** prices are fixed, demand unchanged, and doubles the input in the endowments, and **2)** if the labour factor was raised and the capital factor was held fixed (Brenton et al., 1997).

What would the outcome look like given the two economic situations portrayed earlier? A small economy with fixed prices and unchanged preferences would double their exports and imports because of doubled input made. The trading situation would worsen for a large economy. Meaning that A's world price of exports falls in terms of its imports. If this occurs, producers in both nations would switch production away from the cheaper good toward the new-dearer one. Both would experience a rise in the real reward to the factor used intensively in A's importable industry, since this is the good that becomes scarcer. This means that A's export volume would go up. However, whether the imports volume would rise or fall depends on B's decision. If B's offer curve is elastic imports would rise, and fall if it is inelastic (Brenton et al., 1997).

What would the situation be like if there was no increase in its endowments of factor of production, but an advanced technology that translates inputs into output for one or both of A's industries? Advanced technology can be characterised in two ways: **1)** it could be exogenous, as a result of an accidental finding of a new, finer method of production, or **2)** it could be through invention or innovation. This is shown by Hicks-neutral technological progress graphs that explain the situation for A as a small and large economy (Brenton et al., 1997).

Figure 2.1, below, informs that the pattern of production will change from  $C$  to  $C'$  when country A is small. However, the change will go from  $C$  to  $C''$ , if A is sufficiently large to affect its terms of trade and, hence, cause the price of  $x$  to decline if  $x$  is its exports. Fig-

Figure 2.2, below, exposes Hicks-neutral technological advancement restrained to industry  $x$ . The PPF of  $y$ 's intercept will not change, but  $x$ 's intercept increases substantially. From a small economy's point, as a term-of-trade taker, the new pattern shows that production will be  $D'$ . Comparing  $D'$  and  $D$  we see that the output for  $x$  has risen but fallen for  $y$ . If  $A$  is a large economy, the world price of  $x$  would fall, causing a movement from  $D'$  to  $D''$ , which indicates a fall in  $x$  but a rise in  $y$  (Brenton et al., 1997).



**Figure 2.1** Hicks-neutral technological progress at the same rate in both sectors: output effects

**Figure 2.2** Hicks-neutral technological progress in sector  $x$  only: output effects

Source: Brenton et al., 1997, p. 251.

Mahadevan indicated in his empirical study of Singapore that the Total Factor Productivity (TFP) growth showed negative results. This was mainly because of poor usage of technology, even though Singapore did enjoy a positive and increased technological progress. It was not the lack of technology that caused the negative result, but the inefficient usage of technology that caused the negative result (Mahadevan, 2002).

### 2.3 The income terms of trade

In income terms of trade (ITT), export cannot alone be regarded as an engine of growth, if ignoring the import capacity. ITT imply that export expansion might lead to a deterioration of the terms of trade and leave an export promoting country worse off. However, as long as ITT for a country grows, the change in net barter terms of trade is less important for long-run growth in GDP. The benefit from trade indicates at a long-run development and growth, as long as it is in terms of increased productivity and high capital formation. This in turn is based on dynamic comparative advantages, rather than on initial trade pattern (Ekholm & Södersten, 2002).

As known, imitation costs are lower than the cost of innovation. This means that international diffusion of knowledge and technology transforms countries' competitive positions. Indicating that countries with low capacity to import cannot fully exploit benefits from trade and are, therefore, forced to act at given country-specific constraints. On the contrary, countries that have good import capacity can gain from foreign technological progresses that would improve their utilisation of domestic resources (Ekholm & Södersten, 2002). Heckscher claims that import brings news from the world, indicating that information regarding development, new technology, and investments are transferred across borders. Heckscher emphasises, therefore, that import has a more important role in the structure changes in the economy than what the export has (Johansson, 1993).

However, as mentioned above, export in itself cannot be considered as the engine of growth, ignoring the import capacity. Meaning that, in order to analyse the impact trade has on growth the import capacity has to be taken into account, using the income terms of trade as a measurement. The definition of income terms of trade is:

$$ITT = P_X Q_X / P_M$$

where  $Q_X$  denotes export volume, and  $P_X (P_M)$  denotes price indices of export (import). The definition of *ITT* consist of two factors: export volume and net barter terms of trade. *ITT* might either rise through a fall in import prices, or through an increase in the export earnings ( $P_X Q_X$ ). If export prices were held constant, a fall in import prices would lead to a rise in the net barter terms of trade, implying at a rise in the relative price of exports in terms of imports. Even though export volumes were held constant, a rise in the net barter terms of trade would increase the *ITT*. Accordingly, *ITT* is negatively related to the import price index and positively related to the total export value. The equation measures, therefore, the import capacity since an increase in *ITT* would improve the purchasing power of a country's export revenues. This would imply that if trade works as a trigger to growth, the development of *ITT* and growth in GDP would be closely correlated (Ekholm & Södersten, 2002).

Ekholm and Södersten's empirical study showed that Asian countries have been able to improve their *ITT* in a remarkable steady trend. They managed to improve their export volumes without an offsetting fall in their *ITT*. This implies that quality improvements have been made within sectors, or they have either specialised in sectors that are of favourable development with respect to world market prices (Ekholm & Södersten, 2002).

## 2.4 Summary

The theoretical frameworks mentioned, show in their own way that growth – in a country – can be implemented in a various way. Trade-induced investment-led growth, talks about the importance of investment. The Heckscher-Ohlin model implies that an increase in investment depends on whether a country export or import capital-intensive goods. If it exports, the investment will increase, whereas, if it imports the tendency for investment will decline. However, there are disagreements to the model; some Economists imply that world trade is among rich countries, that it has an intra-industry trade, and that the Heckscher-Ohlin model in its calculation cancels out intra-industry trade.

The effect of growth on trade, talks about factor endowments. Here, the impact of factor endowments – capital and labour – depends on the country in question. How large the market is, and whether there is an incentive to technological innovation. The theory explains how the market acts, and how these acts taken are affected by other countries actions to economic growth.

*ITT* informs that growth is not only explained by exports, but that imports play an important part in the development. When dealing with trade, there is an awareness that knowledge spillover and technology imitation can contribute to growth. Heckscher claims that imports are important for growth since information causes to be transferred across borders. Therefore, trade cannot be explained by exports alone, but imports capacity has to be taken into consideration as well.

### 3 Empirical study – China

This section will elaborate the model formulation, as well as the result provided during the empirical study. The aim is to give the reader a general view of time series, allowing the reader to understand what time series is. For each step taken in this time series study made, a perceptive view to why and what the steps are hinting at are to be provided.

#### 3.1 Model formulation – Time series

Time series is by definition “*a set of observations on the values that a variable takes at different times*” (Gujarati, 2003, p. 25). This means that data collected is at regular time intervals, i.e. daily, monthly, quarterly and annually. Empirical work using time series econometrics assumes that the time series is stationary. Stationary, in this case, indicates that the mean and variance do not differ systematically over time. Hence, nonstationary time series is considered a problem since mean and variance individually fluctuates over time or both together (Gujarati, 2003).

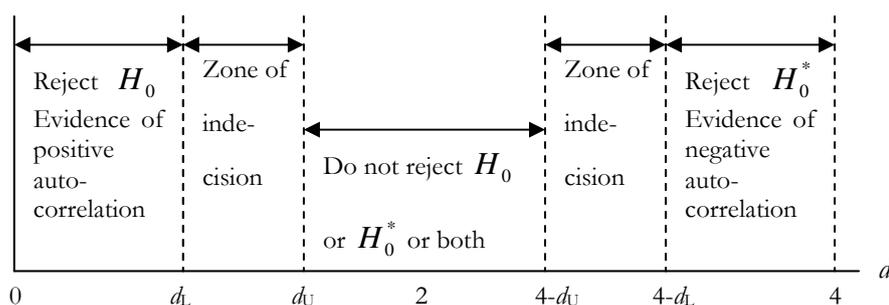
As emphasised, the assumption implies that the underlying time series is stationary. Therefore, certain obstacles whereabouts are to be considered. If the underlying time series is nonstationary, beware of autocorrelation. Autocorrelation results due to nonstationary time series (Gujarati, 2003). Autocorrelation by definition is a “*correlation between members of series of observations ordered in times [as in times series data] or space [as in cross-sectional data]*” (Gujarati, 2003, p. 442). A further hindrance to beware of is high  $R^2$ , high  $R^2$  can occur although there is no correlation between two variables. These hindrances can be problem of nonsense, or spurious, regression (Gujarati, 2003). Be, therefore, precautionary while testing for time series.

Stationarity is important, because nonstationarity can only be measured for each set of time series data under a particular episode and is, therefore, not forecast able. This means that the possibility to generalise it to other time periods is not possible. It is, therefore, important that the underlying assumption in a regression models is stationary. The random walk model such as pure random walk and random walk with drift are both distinguished as nonstationary. Consequently, first difference has to be taken in order to obtain stationarity in both models; nonstationarity indicates a unit root problem. Nonstationarity, random walk model and unit root problem are treated as identical. So in order to distinguish a unit root problem, nonstationarity has to be spotted. Unit root is due to  $\rho = 1$ , however, if it is  $|\rho| \leq 1$ , it is considered stationary (Gujarati, 2003).

Whether the process is stationary or not has an essential part in verifying whether the trend is of a deterministic or stochastic process. A deterministic trend is considered to be predictable and not variable, whereas, a stochastic trend is not predictable. Therefore, the random walk model with or without drift is considered a difference stationary process (DSP). This indicates that DSP is not predictable in time series, the so-called stochastic trend. A trend stationary process (TSP), on the other hand, is a deterministic trend, indicating that it is predictable and not variable. To obtain stationarity in a deterministic trend, the mean of  $Y_t$  has to be subtracted from  $Y_t$ . This procedure in obtaining stationarity is called detrending. Recall that stationarity, in random walk model, was obtained by taking the first difference. This step shows an integrated process depending on how many times the data is being differenced tell us what order it is, denoted as  $Y_t \sim I(d)$  (Gujarati, 2003).

Once stationarity has been settled by the unit root test, we need to know what order it is, denoted as  $Y_t \sim I(d)$ , where  $d$  indicates the order. When the integration of the order  $d$  has been established, the following test – co-integration – will be tested for in order to see whether the variables are co-integrated or not. Assuming that both of the variables are of  $I(1)$ , the residuals are assumed to be  $I(0)$ . Although the variables have stochastic trends of  $I(1)$ , their linear regression is  $I(0)$ . This indicates that the stochastic trends cancel each other out and, hence, is said to be co-integrated. The aim of these tests – unit root test, co-integration test – is made to help us solve the problem of nonstationarity. By solving for nonstationarity, we find us avoiding spurious regression. A third test to mention is the Granger causality test; here the aim is to tell what direction the causality is going. Is  $Y_t$  being affected by  $X_t$ , or is  $X_t$  being affected by  $Y_t$  (Gujarati, 2003).

When analysing the tests – unit root test, co-integration test – look upon the t-statistic and Durbin-Watson statistic. These statistics are to provide and strengthen the support to the probability value given. The t-statistic show that values within the critical level  $-2 < t < 2$  is not statistically significant, indicating that the hypothesis is to be rejected, hence indicating that values that that are not within the range are to be statistically significant. The Durbin-Watson statistic provides support to the p-value as well as the t-statistic. For better understanding look at figure 3.1 below, there a better view of when and when not to reject the hypothesis is given. Values being close to the Durbin-Watson statistic value 2 are not to be rejected, since they are statistically significant.



**Figure 3.1** Durbin-Watson  $d$  statistic

Source: Gujarati, 2003, p. 469.

The regression model will have the following model formulation:

$$\ln GDP_{CAP_t} = \alpha + \beta \ln ITT_t + \varepsilon_t$$

Where the equation for  $ITT$  is computed as  $ITT = P_X Q_X / P_M$ . Where,  $Q_X$  denotes export volume, and  $P_X (P_M)$  denotes price indices of export (import).  $ITT$  is, in the regression model a measurement used for the purpose of explaining the impact trade has on growth. Growth, in this case, cannot solemnly be explained by exports, imports have an important substance in explaining growth as well (Ekholm & Södersten, 2002). That is why  $ITT$  is used in this thesis, for the purpose stated in the introduction of this thesis; that is, is there any relation between trade and growth in China during the period of 1980-2003. The expectation is, therefore, in this empirical testing to find a positive correlation that support the statement that  $ITT$  is of relevance for growth in GDP per capita. Therefore, the regression model stated above is being used for the purpose of explaining the relation between trade and growth, hence,  $ITT$  and GDP per capita. Since, this in best way can explain the relationship between the two variables used.

## 3.2 Empirical result

A regression model has been used to approximate the impact of ITT on GDP per capita in China during 1980-2003. GDP per capita is the dependent variable, which is to be explained by the independent variable ITT. As previously stated, the underlying assumption in time series is stationary. To know if the data provided is stationary or not, a unit root test was made. The data collected came from IMF International Financial Statistics, UNCTAD handbook of statistics, and National Bureau of Statistic of China. These sources have been used since they are considering being most reliable in providing true data. Why the base year 1980 has been the starting point for this thesis, is due to availability of data. The data collection could at most be found to begin from 1980 and onward.

The result indicates that a unit root problem exists, where  $\rho = 1$ . To exclude nonstationarity, a unit root test, with the augmented Dicker-Fuller test, was done on the raw data obtained. The test showed that the raw data collected was nonstationary; therefore, first difference on the raw data was taken. However, this still proved to contain a unit root problem. The data had, therefore, to be transformed into logarithm. Although transformed there still was a unit root problem. That is why first difference was taken and tested for on the transformed data. The result provided in table 3.1, at a five per cent significant level, proved to be statistically significant and, hence, stationary.

**Table 3.1** Augmented Dicker-Fuller test for  $\ln GDP_{CAP}$  and  $\ln ITT$

Variables	Prob.	t-Statistic	Durbin-Watson statistic
$\Delta \ln GDP_{CAP}$	0.0031	-3.407429	2.003811
$\Delta \ln ITT$	0.0043	-3.260844	1.969428

Once the unit root problem was solved, the following step was to see if the variables were co-integrated or not. The variables were found to be integrated of order one – when tested for the unit root problem – that is,  $\ln GDP_{CAP} \sim I(1)$  since  $\Delta \ln GDP_{CAP} \sim I(0)$ , and  $\ln ITT \sim I(1)$  since  $\Delta \ln ITT \sim I(0)$ . This is, however, not a sufficient condition for co-integration, spurious regression might still exist although integrated of the same order. If the variables are integrated of  $I(1)$ , the residuals ( $e_t$ ) are assumed to be  $I(0)$ . This indicates that the stochastic trends of the variables cancel each other out and, hence, are co-integrated. The result given in table 3.2 show the values provided when running the original regression model without first difference.

**Table 3.2** Least square regression model

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	1.966687	0.243370	8.081072	0.0000
$\ln ITT$	0.512184	0.029826	17.17236	0.0000

Dependent Variable:  $\ln GDP$  per capita

Independent Variable:  $\ln ITT$

Number of observations: 24

Durbin-Watson Statistic: 0.809525

R square: .0930575

As seen in table 3.2, the values for constant (C) and lnITT coefficient are both statistically significance. The t-statistic shows values above the critical value  $-2 < t < 2$ . As stated before, values close to two or two indicates that the Durbin-Watson statistic cannot be rejected. However, the Durbin-Watson statistic in this case show a  $d$ -value of  $d = 0.809525$ . When studying the Durbin-Watson table, the  $d_L$  and  $d_U$ -value at 24 observations and one explanatory variable are  $d_L = 1.037$  and  $d_U = 1.199$ . Indicating that the null hypothesis can be rejected but “*we cannot reject the hypothesis that there is a positive autocorrelation in the residuals*” since  $d < d_L$  at a five per cent significant level (Gujarati, 2003, p. 470).

However, whether the regression model is co-integrated or not, a unit root test on  $e_t$  was made. Since  $e_t$  is assumed to be  $I(0)$ , it will amount to zero, consequently a constant or trend cannot be included in the unit root test. The result, table 3.3, show sign of co-integration since t-statistic -2.050232 is less than the five per cent critical value -1.9574 for 24 observations,  $-2.050232 < -1.9574$ . This signifies that  $e_t$  contains no unit root problem, indicating that we have  $e_t \sim I(0)$ , which means that  $\ln\text{GDP}_{\text{CAP}}$  and  $\ln\text{ITT}$  are co-integrated of order (1,1). As mentioned in the model formulation, high  $R^2$  is to beware of, since this can be a hindrance for stationarity. As seen, table 3.2, show that  $R^2$  has a high value of 0.930575,  $R^2$  is initially “*measuring the proportion or percentage of the total variation in Y explained by the regression model*” (Gujarati, 2003, p. 84). Since the regression model in table 3.2 show value of high  $R^2$ , this would indicate the existence of spurious regression. If nonstationarity exists, the mean and variance would differ over time and, hence, cannot be forecast able. That is because nonstationarity can only measure for each set of time series data under a particular period. Nonstationarity indicates the existence of autocorrelation problem. Therefore, it is important to be precautious when testing for time series. When running a unit root test on  $e_t$ , the result given informed that there was a co-integration between IIT and GDP per capita. This indicated that the variables are co-integrated of order one. Therefore, high  $R^2$  and autocorrelation has no essential part in this test, since the existence of co-integration showed no sign of a unit root problem.

**Table 3.3** Augmented Dicker-Fuller test for  $e_t$

Variable	5% Critical Value*	t-Statistic	p-value	Durbin-Watson statistic
E(-1)	-1.9574	-2.050232	0.0537	2.076688

Previously mentioned, in stochastic trends the variables are supposable cancelling each other out and, therefore, co-integrate with one another. Consequently, the regression model is possible to estimate in the long-run and, hence, show no sign of spurious regression. The empirical study made so far show no sign of unit root problem and the variables are co-integrated with one another. A third test mentioned, the Granger causality test, will tell in what direction the causality is going. The causality test question whether  $\ln\text{GDP}_{\text{CAP}}$  is causing  $\ln\text{ITT}$ , or whether  $\ln\text{ITT}$  is causing  $\ln\text{GDP}_{\text{CAP}}$ . Due to the two variables involved, the causality test was bilateral. The aim was to come across the nature of causality between  $\ln\text{GDP}_{\text{CAP}}$  and  $\ln\text{ITT}$  for China for the period 1980-2003.

**Table 3.4** Causality between  $\ln\text{GDP}_{\text{CAP}}$  and  $\ln\text{ITT}$ 

Direction of causality	Numbers of lags	F-value	Decision
$\ln\text{ITT} \rightarrow \ln\text{GDP}_{\text{CAP}}$	4	5.17232	Reject
$\ln\text{GDP}_{\text{CAP}} \rightarrow \ln\text{ITT}$	4	0.71660	Do not reject

The estimation that the F-value will be statistically significant at five per cent level when the critical value of F is 2.87. The critical value was obtained with four numerator degrees of freedom and 20 denominator degrees of freedom. At a five per cent significance level, the causality test show a relation going from  $\ln\text{ITT}$  to  $\ln\text{GDP}_{\text{CAP}}$ , since  $0.71660 < 2.87$ . This resulted in a rejection from  $\ln\text{GDP}_{\text{CAP}}$  to  $\ln\text{ITT}$ , since  $5.17232 > 2.87$ .

The last test, Granger's causality test, informs if and in what way the variables are influencing each other. That is, did  $\ln\text{ITT}$  cause  $\ln\text{GDP}_{\text{CAP}}$  or did  $\ln\text{GDP}_{\text{CAP}}$  cause  $\ln\text{ITT}$ . The result provided show a one-way causation, where  $\ln\text{ITT}$  cause  $\ln\text{GDP}_{\text{CAP}}$ . This confirms with the hypothesis stated, that there is a positive relation between trade and growth in China during 1980-2003. Therefore, the purpose stated cannot be rejected, since tests made established the statement that  $\text{ITT}$  is of relevance for growth in GDP per capita.

As seen, the tests made have shown in varies way that there is a relationship between  $\text{ITT}$  and GDP per capita. Moreover, the causality test showed that  $\text{ITT}$  was Granger-causing GDP per capita. Therefore, the tests indicate that we cannot reject the null hypothesis saying we have statistically significant result when checking for stationarity, co-integration, and causality in the regression model.

## 4 Conclusion

There are various ways of explaining growth and trade, and trade and growth relationship. However, the statement was such that this thesis is to be based on the IIT theory, although various theories were mentioned. IIT is used because the implication is such that export alone cannot have an impact on growth if import is left out. Import has an essential impact; some even consider it to explain growth, since import causes knowledge spillover and technology transfers.

The purpose of this thesis was to see if trade was of relevance for growth. This was possible to evaluate with the help of the econometric tool time series. As mentioned, the underlying assumption in time series is stationarity. The study made, was based on the variables GDP per capita (dependent variable) that is explained by IIT (independent variable). GDP per capita is used as a measure because it shows a country's growth economically as the real income changes. IIT in contrast measures the impact trade has on growth, since export volume and price affects are being taken into consideration. IIT is expected to coat the net effect of trade growth on real income. Therefore, the impact IIT has on GDP per capita is an essential way of seeing the relation between trade and growth.

Three tests were made – unit root test, co-integration test, and Granger causality test – to see if there was a relation between IIT and GDP per capita in China's case. As known, the raw data collected had to be logged, since logarithm smoothen trend in the variables. The significant level for each test made was set at a five per cent. For each test made the outcome showed of statistically significant values. This would indicate that the probability value was equal to or less than five per cent, when testing for unit root test and co-integration test. The basis was to solve for nonstationarity when running the regression model used. Since nonstationarity would indicate the existence of autocorrelation and high  $R^2$ . Therefore, first difference was taken to solve for nonstationarity. The outcome of first difference did prove to solve for nonstationarity. Consequently, a co-integration test was made to tie up and exclude the existence of nonstationarity. The finding did show that there was a co-integration between the variables used and, hence, nonstationarity was solved. This indicates that autocorrelation and high  $R^2$  has no essential part in this test, since the existence of co-integration showed no sign of a unit root problem. However, to learn in what direction the variables are integrated with one another a Granger causality test was made. The result informed that IIT was causing GDP per capita, hence, the result provided showed a one-way causation.

As mentioned in the introduction, China's main goal was to base their exchange and trade system on foreign exchange and trade system, indicating that they would regulate trade between China and the international market. By doing so, they would benefit from trade in such that they would import components needed for their own export production. Due to China's open-door policy, there has been a rapid expansion in their trade on the international market, which has caused FDI inflows to increase in China. However, Liu et al. (2001), points out two possible ways to how FDI is causing international trade; **1)** FDI is considered a complement to, or a substitute for international trade, or **2)** it could be that FDI is not causing international trade, but international trade is causing FDI. Liu et al. (2001) indicates that China today hosts a large inflow of FDI, since they implemented an open-door policy. Study made by Liu et al. (2001) showed that imports, FDI, and exports are closely correlated, when a study was made between FDI and trade in China. The study made indicated the more China imports, the more FDI will there be, and that in it will lead to more exports in China and, hence, promote growth.

## Conclusion

The attained result was possible due to reformed adaptations made in the late 1970s; reforms that allowed for a market planning and an outward orientation, which showed that foreign trade was allowed to take a leading role in their economical development. This would imply that improvements were made within sectors, or specialised sectors that were of favourable expansion with respect to world market prices. Gang (1994) indicated that the Communist party had, as their goal of system reform, adopted a socialist market economy. This was a reflection showing that the Chinese government had after an extensive time changed from a planned economy to a socialist market economy. Changes were made once the government saw that the planned economy was not working in favour of promoting economic growth. This indicated that the people of China had become aware of the efficiency of the market and, therefore, become less resistance to changes and, hence, given the market a leading role in their economic development. Changes made in China's economy came gradually, a so-called gradualism. Gradualism was adopted and approved by China since a radical reform package would be to haste, consider their economic situation in late 1970s was too good for radical changes. This indicated that gradualism allowed for experiment of different programs to promote growth on their economy while still implementing their old economic system, a so-called dual-track system. People became aware and understood that the market cannot be planned or fashioned in planned ways. What seemed to be in need of planning was how to abolish restrictions that hindered economic growth. The dual-track system allowed for a parallel economy, an old economy running along the new economy. This was a way to reform the economy without taking action against the old system implemented. Indicating that as the new system was adopted and approved of, the old system was gradually diminishing and eventually eliminated without any resistance from the people.

Reforms made have proven to be of advantage for China. This has enlightened the government and the people of China that planned economy was not in favour of promoting growth. It has also proven to support my purpose of this thesis, which indicated to see if there is any relation between trade and growth in China during the period of 1980-2003. As seen, tests made have shown in varies way that there is a relationship between ITT and GDP per capita. Moreover, the causality test showed that ITT was Granger-causing GDP per capita. Therefore, the tests indicate that we cannot reject the hypothesis saying we have statistically significant result when checking for stationarity, co-integration, and causality in the regression model. Tests made indicate that the regression model used was successful in explaining the relationship between trade and growth in China's case and, hence, the hypothesis has proven to be fulfilled.

## 5 Recommendation for further research

When writing this paper I discovered how large influence the government has in China. How well they organised themselves to reach the goals set to be reached. As well as how they organised themselves to lure investors to invest in China. However, knowing that trade in this case does have relevance for growth in China. It would be interesting to know how essential experiments such as export processing zones (EPZs) have for their growth. Moreover, if these areas do contribute to spillover to local companies', and if these companies' has advanced due to the spillover effect.

A host country can, according to Johansson and Nilsson (1997), gain knowledge and capital that can be used to build their own export base which they can stand on. By studying some local companies' that are located within these zones, maybe a study can tell how well they have developed.

Multinational companies (MNCs) are considered a type of foreign direct investment (FDI). They locate themselves within a certain location where the incentive to profit maximisation is risk-adjusted. However, to lure investors to invest, a host country has to have an infrastructure, a labour market, and that there is a possibility to continuous economic growth. Therefore, recommendation for further research is to see how large influence FDI in EPZs has on the local companies' development. To see if this has contributed to the start of China's export base which they can stand on.

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