Dutch Offshoring to and Trade with China: A Quantitative Analysis

Author	:	Raphie Hayat[♣]
Student Number	:	1253913
Supervisor	:	Dr. F.A.G. den Butter
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University	:	Free University, Amsterdam

Abstract
Trade between China and the Netherlands has been growing prodigiously for the past ten years. Using a time series based gravity model, this paper investigates whether part of this growth can be explained by Dutch offshoring to China, which has recently been a popular subject of debate in the Netherlands. The results indicate that next to GDP growth, Dutch in-house offshoring to China can explain the main part of Dutch import growth from China, followed by the Dutch distribution function and to a small extent declining tariff rates in the EU. Dutch exports to China however seem to be driven mostly by GDP growth and declining tariff rates in China. In addition, the results indicate that Dutch FDI to China mainly has a vertical rather than a horizontal character. Furthermore, after controlling for product types according to the classification of Rauch (1999), the results indicate that Dutch firms tend to offshore production in-house when the asset specificity of the traded inputs is high and offshore via the market when this asset specificity is low. Controlling for these product types also reveals that transport costs mainly influence homogeneous and reference priced goods rather than differentiated goods. Moreover, the results call for policy measures to strengthen the Dutch comparative advantage in reducing transaction costs and underline that the notion of transaction costs is indispensable in explaining contemporary trade and corporate governance structures.

[♣] email: raphie.hayat@hotmail.com

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I. Introduction

"Subcontracting as many non-core activities is a central element of the new economy".
Financial Times, 31 July 2001, p.10.

After the gradual departure in the late seventies from a centrally planned economy and the economic reforms in the late eighties, China's economy has been growing 10% per annum on average for the past twenty years. In fact China is the only country in the world that has grown so fast for such an extended period of time. Currently, China is the forth-largest economy in the world with incomes per capita that are not near western standards yet, but are rising fast (CPB, 2006).

China's prodigious growth has sparked a huge amount of debate among economists about its cause and its effects on the world economy. In the Netherlands this debate has even been more intensive since Dutch trade with China has been growing even faster than the Chinese economy for the past 10 years or so. Nowadays, China is the Netherlands' fifth biggest trading partner, with 8% of total Dutch imports coming from China (CPB, 2006). These numbers have provoked fear about China's posed threat to Netherlands' competitive position and consequently its employment. This has led to several reports written to describe the effects of China's growth on the Dutch economy. Suyker and De Groot (2006) and CPB (2006) for example, conclude that Chinese export products are more complements than substitutes for Dutch export products and that China's growth has had relatively little impact on Dutch employment. Furthermore Suyker and De Groot (2006) and CPB (2006) conclude that China's growth has mainly had a positive effect on the Dutch economy, for example through lower inflation.[1]

This literature however has paid relatively little attention to backing the explanation of the surging growth in trade between the Netherlands and China with empirical analysis. More specifically, the claims made on Dutch offshoring and its affects on trade growth between the Netherlands and China lack adequate statistical backing.[2] This is troublesome since there is no consensus in literature regarding the amount of offshoring in the Netherlands or its effects on the Dutch economy. On the one hand, evidence suggests that quite some activities are or soon will be outsourced to countries like China (e.g., Deloitte & Touche, 2002 and Ernst & Young, 2004), while the other view is that this type of outsourcing is present but marginal (e.g., Gorter *et al*., 2005; Suyker and De Groot, 2006) and has little effect on employment.[3] This paper aims to add to the debate by providing a statistically sound model explaining the growth in trade between the Netherlands and China for the past ten years. The main question this paper will try to answer is: *"Did Dutch offshoring to China have a significant effect on the trade growth between these two countries over the past ten years"*?

Another important and related question this paper attempts to answer is whether this offshoring has occurred through the market (outsourced offshoring) or through hierarchy (in-house offshoring) and if this decision has been influenced by the asset specificity of the

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[1] Another example is Gorter, Tang and Toet (2005) who reach similar conclusions and state that massive reallocation of Dutch economic activities abroad is not likely and that the fear for a sharp rise in Dutch unemployment is thus unwarranted.

[2] Offshoring is the term used for the moving of economic activities abroad.

[3] It must be said though that the quality of research of the former view is quite low compared to the latter. The surveys conducted by Deloitte and Ernst&Young are for example quite prone to sample bias and certain conclusions are exaggerated (Poort *et. al.*, 2003).

traded goods. This is important since increasing (international) fragmentation of production processes has made the decision to offshore in-house or via the market an important question for firms nowadays and has become a popular topic in contemporary economic literature (e.g. Spencer, 2005 and Grossman and Helpman, 2003).

In addition this paper aims to give statistical backing to some common explanantia of trade growth found in literature like GDP growth, tariff reduction and declining transport costs (e.g., Baier and Bergstrand, 2001). Since it is a known fact that a large part of Dutch imports are re-exports, the importance of the Dutch distribution function is also empirically tested in explaining the trade growth between the Netherlands and China.[4] Although literature suggests that trade between countries is significantly affected by other (not directly observable) variables like institutions, cultural familiarity and trust (e.g., Den Butter and Mosch, 2003; Deardorff, 2004 and Linders, 2006), this is beyond the scope of this paper. Next to the fact that these variables are quite difficult to measure and disentangle from another (institutions for example also have an affect on trade through trust), they are often unavailable on a sufficiently detailed level over time. Furthermore this paper will focus exclusively on trade in goods as opposed to services. The latter have different dynamics and are only a small part of total Dutch trade.[5]

The empirical testing in this paper is based on a time series version of the gravity model of trade, which in economic literature has become a standard model for explaining trade patterns (see for example Frankel and Rose, 2002; Den Butter and Mosch, 2003; Guo, 2004 and Linders, 2006).

The remainder of this research is structured as follows:

Section II provides a contextual setting in which the main economic differences between China and the Netherlands and their historical trade relation is described. Section III discusses theoretical considerations and provides a literature review. Section IV explains and discusses the data, model and methodology. Section V presents and discusses the results. Section VI concludes and discusses possible improvements, policy implications and suggestions for further research.

[4] Re-Exports are defined by Roos and Exel (2006) as: Exported goods, which were previously imported, that leave the exporting country without a change in their Harmonized System six digit classification code. In addition, these goods have to (temporarily) become legal property of a resident of the re-exporting country to be classified as re-exports. Thus, re-exports are not the same as transit trade. The reason is that goods in transit do not at any time become legal property of the re-exporting country.

[5] Data from CBS Statline indicates that trade in services between China and the Netherlands was only 7.5% of trade in goods between these two countries in 2005.

II. Contextual Overview

To provide the reader with some background information, the following section will give an overview of the recent history of China's opening up and describe the basic economic characteristics of China and the Netherlands. This will be useful to put the trade relationship of these two countries in perspective. In addition, this section will describe the composition of trade between the Netherlands and China trade and how it has evolved over recent years.

II.1 China After 1978

The story of China's opening up is quite different from that of the Netherlands. For the latter, trade has always played an important role in its economy. Ever since the 17th century, when the VOC (Vereenigde Oost-Indische Compagnie) traded goods on and around the Eastern Sea, the Dutch have had a dominant position in the world as a trading nation (WRR, 2003).

China's opening up and economic growth on the other hand has only lifted off in the past 30 years. After being a centrally planned economy since 1949, the "opening up" policy introduced by part leader Deng Xiaoping in 1978 marked the beginning of a gradual transformation to a market based economy (Suyker and De Groot, 2006).

Prasad *et.al.* (2004), distinguish five phases through which this transformation occurred. In the first phase (1978-1984) the agricultural sector was decentralised to the household level. An important feature of this decentralization was that it allowed farmers to set their own prices.[6] Also, the communal system was abandoned and was replaced by a more incentive driven system, named the contract responsibility system. Under this system, farmers could rent a piece of land for a fixed price and keep whatever they produced above what was needed to pay the rent.

Furthermore, the first phase consisted of the inception of so called Special Economic Zones (SEZ) in 1980. These were geographical regions where several economic laws were more liberal than in the rest of China. SEZs were for example exempt from several taxes (to promote foreign investment), they had greater independence, their economies were more market oriented and their products more export driven.

The second phase (1984-1988) consisted of further reforms, which the Chinese authorities initiated after seeing the success of the rural reforms. The new reforms included the break up of the monobank system (state owned banking), the introduction of enterprise taxation and some liberalization of price and wage setting for private firms. Furthermore, fourteen other coastal areas were opened up for investment and foreign trade.

Although the third phase (1988-1991) also entailed further reforms, it was mainly characterised by a shortage of effective institutions and macroeconomic management. Inflation had increased sharply because of the price liberalization and the government was losing grip on the economy. The authorities acted by recentralizing certain price controls and by following a sharp contractionary policy. The result was a decline in inflation, but of course also a decline in economic growth.

[6] These were previously fixed by the government.

In the forth phase (1992-1997) expansionary policy returned, which led the economy back into a growth cycle. The more salient feature of this phase however was the acknowledgement of the Communist Party that the ideals of socialism were not incompatible with a market-based economy. The Communist Party called for China to become a socialist market economy. This acknowledgement did not have a direct effect, but it provided the political backing that was needed to speed up China's globalization process.

The most recent phase has been characterised by a broader and more general opening up of China's economy and its commitment to accessing the World Trade Organisation (WTO). The latter entails among others China's commitment to improving property right protection (which is still quite poor). China joined the WTO in 2001.

II.2 Basic Differences Between China and the Netherlands

A different economic history is not the only asymmetry between China and the Netherlands. Commonly known are the large cultural differences between Chinese and Dutch norms, values and business ethics.[7] In addition, table 1 shows that although China has come a long way, the Dutch and Chinese economies still differ quite a bit.

Notice that although the GDP of China is more than four times the size of Dutch GDP, the latter's per capita output is still much higher. As stated before, China is still regarded a developing country.

This is also apparent when looking at some of the human development statistics. Table 1 shows that 31% of Chinese people living in urban areas don't have access to adequate sanitation facilities. Furthermore the mortality rate of young children is five times as high as in the Netherlands. Internet usage is also very low in China compared to the Netherlands. Not even 10% of the Chinese population uses the Internet, while almost three quarters of the Dutch population does. Table 1 also shows that China is mainly and industry focused country, while the most value is added in the Netherlands through services. Furthermore, table 1 shows that although China has opened up a lot in the last few decades, the Dutch economy still trumps China in terms of openness. Note for example that trade exceeds GDP by 22% in the Netherlands and that FDI stocks are 94% of GDP, while the Chinese figures are nowhere near these numbers. This does not necessarily mean that China is not an open country, but it does illustrate that overall, the Dutch economy is much more open than the Chinese economy.[8]

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[7] See www.evd.nl/china and www.hollandinchina.org for examples.
[8] China for example holds a top 30 ranking regarding economic integration, based on AT Kearney's Globalization Index.

Table 1: Key statistics about China and the Netherlands (2005)

	China	Netherlands
Population (mln)	1300	16
Life expectancy at birth (years)	72	79
Mortality rate under-5 (per 1000)	27	5
Internet users (per 1000 people)	85	739
Improved sanitation facilities (% of urban population with access)	69	100
GDP (current €, bln)	2125	493
GDP per capita, (in $ at PPPs)	7204	30861
Agriculture, value added (% of GDP)	13	2
Industry, value added (% of GDP)	48	24
Services, value added (% of GDP)	40	74
Average Inflation (1990-2006, %)	5.08	2.43
Average real GDP growth (1990-2006, %)	6.41	4.05
Trade (€, bln)	1422	531
Trade as % of GDP	67	122
FDI stock (inward)	318	463
FDI stock (inward) as % of GDP	14	94

Sources: World Development Indicators Database 2007, Suyker and De Groot (2006), IMF

II.3 Dutch China Trade Evolution

Notwithstanding the large cultural differences between China and the Netherlands, their trade has grown remarkably fast over the past 10 years. This growth is remarkable not only in size but also relative to China's trade with its main partners. Table 2 shows the output of several t-ratio tests on the difference between China's trade growth with its main partners and China's trade growth with the Netherlands.

Table 2 shows that trade growth between the Netherlands and China has been significantly (t ratio 2.98, significant at 1%) greater than trade growth between China's trade with the rest of the world for the past ten years[9]. The second column shows that this growth was also economically significant, since on average trade between China and the Netherlands has grown 5.43 percentage points more than trade between China and the rest of the world.

Table 2 also shows that Dutch China trade (trade between the Netherlands and China) has grown significantly faster than China's trade with most of its main partners. Note that the t-ratios on seven out of eleven identified partners (63%) are significant and positive, implying that Dutch China trade has grown faster than China's trade with each of these seven partners for the past ten years. However, trade between China and India and between China and the Philippines has grown faster than Dutch China trade. The reason for this seems to be that India and the Philippines both have export baskets that are very compatible with China's needs. India for example is naturally well endowed with iron ore, which China needs for its production sector (53% of Indian exports to China comprised iron ore in 2000). The Philippines on the other hand is skilled in the production of several high tech components, which China uses to assemble other high tech goods (Lall and Albaladejo, 2004).

[9] These tests should however be interpreted with some caution. The results may vary somewhat depending on which countries are identified as China's main partners.

On average, Dutch China trade has grown 3.6 percentage points faster than China's trade with its main trading partners.[10] Especially important is the fact that for the past ten years, Dutch China trade has grown faster than USA China trade (5.66 percentage points higher), while the latter is often seen as one of China's most important trading partner. All in all, these numbers imply that the Dutch seem to have some advantage over most of China's trade partners. This makes the investigation into the determinants of Dutch China trade growth quite an interesting and relevant endeavour.

Table 2: The supremacy of Dutch China trade growth

Table 2 contains the output of 12 t-ratio tests on the difference between monthly trade growth between China and the Netherlands and China and its main partners. Trade growth between China and each of its main partners is calculated as $TRG_{it} = LN(TR_{it}/TR_{it-12})*100$. Here TRG_{it} is the trade growth (continuously compounded) between China and its partner i at time t, LN represents the natural logarithm, TR_{it} is the value of trade (import+export) between China and country i at time t, while TR_{it-12} is the same twelve months before. Growth rates thus compare the same month in two successive years. This mitigates any seasonal and monthly effects that might be present in the data. For each partner TRG_{it} is subtracted from TRG_{nt}, which is the trade growth between China and the Netherlands at time t, formally: $\Delta TRG_{it} = TRG_{nt} - TRG_{it}$. The T-ratio test (displayed in the second column) on ΔTRG_{it} for each country is performed in the usual manner by dividing this variable's average by its standard error (see Brooks, 2002 for a textbook explanation of the standard error and the use of t-ratio tests). Formally, for each country H_0: $\Delta TRG_{it} = 0$ is tested against the alternative hypothesis H_1: $\Delta TRG_{it} \neq 0$. The third column represents the (arithmetic) average of ΔTRG_{it} for each country ($\overline{\Delta TRG_{it}}$) in percentage points. The source of the data is CEIC, extracted through UBS Investment Bank, it is on a monthly base ranging from Jan 1996 – May 2006 (the choice of this period was based on availability) and thus has 113 data points for each country. Data for China's trade with the Netherlands was taken from CBS Statline. *, ** and *** represent significance at the 10%, 5% and 1% respectively.

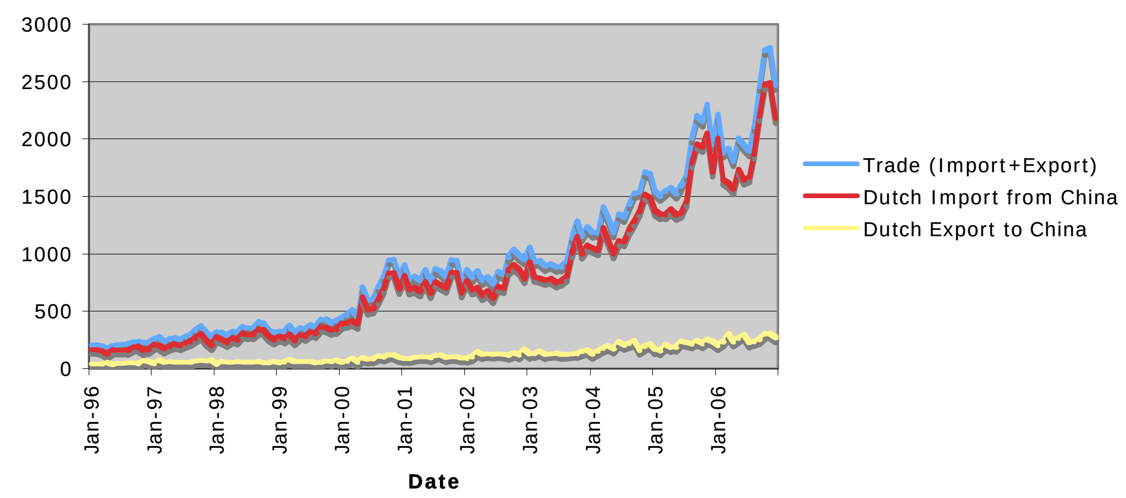
China's Trade Partners	T-ratio	Average of Difference ($\overline{\Delta TRG_{it}}$)
Australia	2.25**	5.15
India	-2.26**	-4.69
Indonesia	3.14***	7.50
Japan	6.19***	11.25
Korea	2.30**	4.54
Malaysia	0.06	0.13
Philippines	-1.80	-4.53
Singapore	3.11***	6.56
Taiwan	3.03***	6.02
Thailand	1.28	2.31
USA	3.08***	5.66
World (excl. Netherlands)	2.98***	5.43

To help visualize the trade growth between the Netherlands and China, figure 1 presents a graphical representation of it for some recent years (in real terms). The graph in figure 1 clearly shows that the growth in trade between China and the Netherlands has indeed been stellar. This trade has grown from a value of 229 million Euro in December 1996 to almost 2.5 billion in the same period ten years later. Which means that trade between China and the Netherlands is currently eleven times what it was ten years ago!

[10] 3.6 is the average of $\overline{\Delta TRG_{it}}$ for China's trade with its main trading partners, see Table 2.

Another salient feature of figure 1 is that most of the trade growth between the Netherlands and China has been through imports from China. This could partially be related to the distribution function that the Netherlands plays between Asia and Europe. According to Suyker and De Groot (2006), a large part of imports from China are re-exported again to the rest of Europe. These Re-Exports are defined as imports that have (temporarily) been the legal property of a Dutch resident and are exported again without undergoing any significant modification.

Figure 1: Real Monthly Trade between the Netherlands and China



Source: CBS Statline

Anecdotal evidence from the Dutch Central Agency for Statistics (CBS) suggests however that a considerable amount of import from China is not re-exported, but used as input for producing other goods, thus representing offshoring of Dutch production to China.[11] Trade growth between the Netherlands and China is furthermore likely to have been affected by China's accession to the WTO in 2001. Next to a direct affect via tariff and quota reductions, there might be an indirect affect via institutional quality and trust. The latter two are however beyond the scope of this research and will not be further investigated.

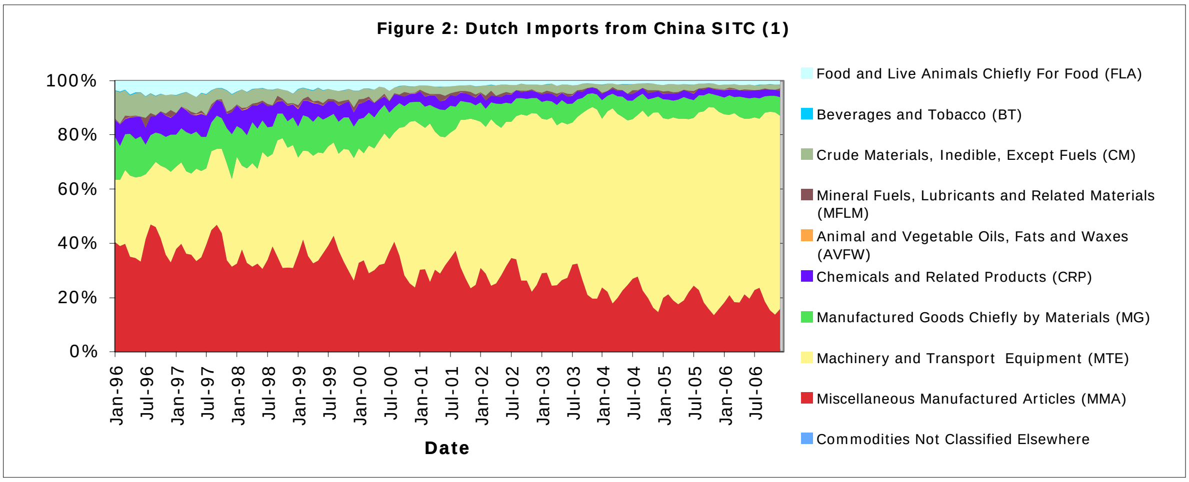
Notice furthermore that after a first rally, starting in 2000, Dutch China trade growth was depressed around 2001 and 2002. This probably reflects the bear market that followed after the September 11 attacks on the US in 2001.

II.4 Import Export Composition

This section describes the trade relation between China and the Netherlands in further detail. Figures 2 and 3 display the trade between the Netherlands and China for the past ten years broken down in the one digit Standard International Trade Classification (SITC) of traded goods.[12]

[11] This evidence is based on telephone and email contact with several employees of CBS.
[12] The SITC classification is a classification of traded goods upheld by the United Nations and one of the most widely used classifications for traded goods in economic literature. This classification can be broken down into

Figure 2 displays that the bulk (69%) of Dutch imports from China nowadays are goods classified as "Machinery and Transport Equipment" (MTE, SITC 7). Table A in the Appendix shows that a large part of these imported MTE goods are computers, telecommunication devices and components and parts of computers and office machinery.



Source: CBS Statline

Figure 2 and Table A in the Appendix also show that the composition of our imports from China has become more high-tech over the past ten years, since MTE has become a larger part of goods import from China than they were ten years ago and since within the MTE category, computers and telecommunication devices have gained share at the cost of *inter alia* electrical machinery and apparatus.[13] This is consistent with literature that has found that China's export basket is getting increasingly more high tech (e.g., Yue and Hua, 2002; Rodrik, 2006 and Schott, 2006). This may seem puzzling at first since China is (given its natural resources) expected to have a comparative advantage in mostly low skilled labour intensive products. But literature mainly relates this to the assembly in China of high-tech goods with the use of production from other Asian countries, rather Chinese "home made" production (e.g., Gaulier *et. al.*, 2006; Suyker and De Groot, 2006; Chen, 2005).[14] When disregarding MTE imports from China, a different picture emerges. Figure B in the Appendix shows that when disregarding MTE, Miscellaneous Manufacture Articles (MMA, SITC 8) dominate Dutch imports from China, followed by Manufactured Goods Chiefly by Materials (MG, SITC 6). These two categories include footwear, clothes, handbags (MMA) and rubber tyres, wood manufactures and household equipment of base metals (MG).

Moving on to figure 3 (below), it becomes clear that the composition of Dutch import from and export to China is rather asymmetric. Next to the difference in size (Dutch exports to China were only around 12% of total Dutch China trade in December 2006), the type of traded products is also quite different. Figure 3 shows that in 2006 the Dutch mainly exported MTE, inedible Crude Materials (CM, SITC 2) and Chemical and Related Products (CRP, SITC 5) to China. The MTE goods currently imported to the Netherlands are however not

six levels of detail. The one digit level is the most aggregate level of classification and divides goods in 10 classes, while the six digit classification is the most detailed division and distinguishes 2970 separate items.

[13] "Machinery and Apparatus" (SITC code 778) includes goods like batteries, drills, fire alarms etc.

[14] Rodrik (2006) proposes another view. He relates China's increased exports in technology intensive products *inter alia* to the size of the Chinese market, which (fostered by China's policy environment) allowed for entrepreneurial experimentation.

quite the same as the ones exported to China. The former include (among others) machinery and equipment specialized for particular industries, valves and industrial cooling and heating equipment (see Table C in the Appendix). CM exports to China currently include non-ferrous base metal waste, and crude vegetable materials, while CRP exports include for example hydrocarbons, alcohols and phenols. Figure 3 furthermore shows that the composition of Dutch exports to China has only changed modestly compared to the composition change of imports from China.

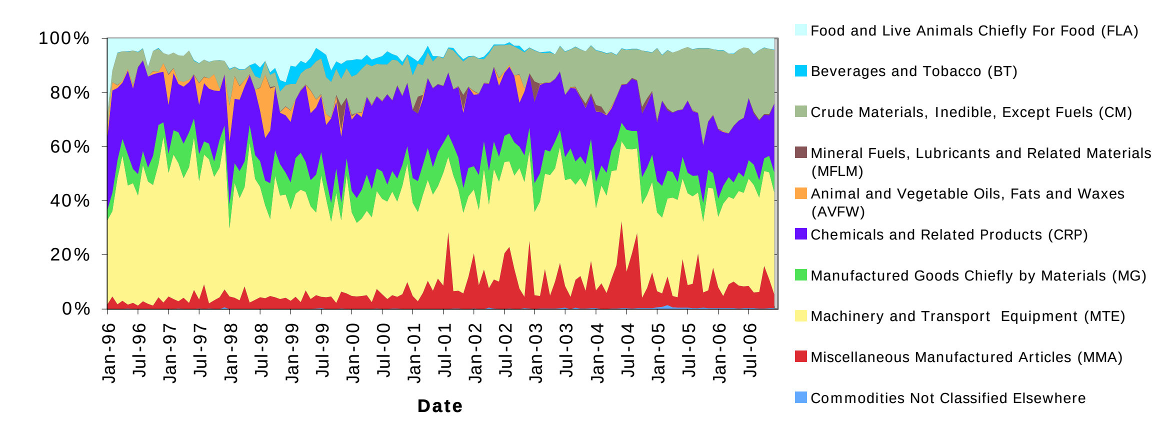


Figure 3: Dutch Exports to China SITC (1)

Source: CBS Statline

At first the graphs above seem to sharply contradict the notion of comparative advantage differences (at least the ones based on natural factor endowments) as the determinants of the Dutch China trade composition. When scrutinized further though, the results are somewhat more supportive. Suyker and De Groot (2006) found that 6 out of the top 10 products in which China has a comparative advantage are low skilled labour intensive (e.g. goods included in SITC 6 and 8), while all of the top 10 products in which the Netherlands have a comparative advantage are primary products (e.g. food and agricultural products). But China mainly exports high-tech MTE goods to the Netherlands, while the Netherlands's export of agricultural products and food to China is a very small share of total Dutch exports to China. As mentioned before though, China's large share in export of high-tech goods can be related to its skills in assembly, rather than production. When ignoring MTE, Dutch imports from China conform somewhat better to expectations from a comparative advantage view. Figure B in the Appendix for example shows that the comparative advantage that Suyker and De Groot report China to have in MMA and MG goods is quite apparent in Dutch imports from China. Also, the comparative advantage that according to Suyker and De Groot (2006) the Dutch have in the chemical sector (goods included in CRP) and in flowers and bulbs (goods included in CM) is apparent in Dutch exports to China (see figure 3).

Nonetheless, differences in comparative advantages based on natural factor endowments seem to be an unsatisfactory explanation for the Dutch China trade composition and evolution. China also seems to posses a comparative advantage in assembly, while the Netherlands seems adept in distribution. Section IV will therefore include the Dutch distribution function, outsourced and in-house offshoring and several trade barriers to explain the evolution of Dutch China trade. Before investigating the affect of these trade barriers and facilitators however, section III will explain the theoretical background of transaction costs in trade and give an overview of previous research.

III. Previous Literature

This section describes how transaction cost economics evolved as an answer to the restrictive assumption of traditional trade models that trade is frictionless. It also explains what the underlying causes of transaction costs are and describes empirical backing in economic literature on the impact of transaction costs on trade. Furthermore, this section describes how transaction costs affect a firm's choice to offshore in-house or through an external party.

III.1 Neo Classical Trade Theory

Traditional trade theory (based on Ricardo's seminal work in 1817) assigns the existence of international trade to differences in comparative advantage between countries. The source of these comparative advantages has been related to technological differences (Ricardo, 1817) and to differences in factor endowments (Heckscher, 1919 and Ohlin, 1933). Although the notion of comparative advantage is theoretically a strong argument for the existence of trade, empirically it has worked rather poorly (Davis *et.al.*, 1997).

Leontief (1953) for example finds that the US (which is one of the worlds most capital abundant countries) exported labour-intensive commodities while importing capital-intensive commodities, which is the opposite of the prediction made by the Heckscher Ohlin model. Furthermore, Trefler (1995) finds that trade should be much larger than it is based on the Heckscher Ohlin model. According to Trefler, the comparative advantages relating to the availability of production factors only predict the direction of bilateral trade correctly in 50% of the cases (in his study). Trefler also finds that in 90% of the cases trade is virtually absent while the model predicts a substantial trade volume. Trefler calls this the "mystery of missing trade". In addition, Yi (2003) finds that traditional trade models cannot explain the growth in world trade unless assuming unrealistic elasticities of substitution between domestic and foreign goods.

Many attempts have been made to augment traditional trade models to give a more realistic picture of reality (e.g., Myrdal, 1957 and Linder, 1961). One worth highlighting is the "New Trade Theory" (Krugman,1995 and Helpman, 1998) which states that increasing returns to scale can lead to comparative advantages which are not necessarily based on factor endowments. A country could arbitrarily happen to produce a certain product first and then through increasing returns to scale get a comparative advantage in that product. This implies that certain trade patterns are explained by mere coincidence, because some countries happened to produce a certain product first and then specialised in it, like for example Switzerland in watches (WRR 2003). Another example is the Dutch comparative advantage in distribution activities, which is based on an (arbitrary) advantageous costal location combined with rivers that go deep into Europe. This creates an ideal situation for a distribution hub. Although evidence on new trade theory is somewhat stronger than on traditional trade models, there is no univocal confirmation of the relevance of economies of scale in economic literature. Head and Ries (2001) for example don't find consistent results when testing their increasing returns to scale model over different periods in time.

III.2 Transaction Cost Economics

One of the main critiques of traditional trade theory is that it assumes that trade is frictionless and thus free. This assumption is part of a more general economic paradigm that the efficient allocation of production factors is self-enforcing and thus needs no coordination. A new stream of economic literature (New Institutional Economics) departs from this line of thought and proposes the view that production is also an organizational problem rather than just a technical one. New Institutional Economics thus sees a firm as on organizational structure rather than just a production function (Williamson, 1998).

III.2A *Theory of the Firm*

Coase (1937) was the first to point out that if the market mechanism freely coordinated the efficient allocation of production factors, firms would not exist. From this he deduced that market allocation apparently brings about costs, which he called "marketing costs". This reasoning can be turned around of course by asking: "If firms exist (because they eliminate marketing costs), why are there markets"? Coase answered this question with the argument that an increase in firm size (through internalization of another production process) could raise the cost of management and reduce efficiency since another activity had to be managed and since the firm did not specialize in a particular activity.[15] Consequently, a firm would keep growing (internalizing production processes) until it reached its optimal size when the marginal cost of allocation through the market would equal the marginal cost of allocation within the hierarchy. In essence, Coase was describing what is known as the "make or buy" decision in contemporary economics.[16]

The term "transaction costs" was first used by Arrow (1969), who agreed with Coase by stating that the existence of vertical integration implied that there are costs involved in operating competitive markets. Much like Coase's definition, Arrow defined transaction costs as "costs of running the economic system" (Arrow, 1969: 1).

Although it is difficult to give a univocal definition of transaction costs, this paper follows the more general and practical definition given by Den Butter and Wit (2006) namely "*all costs market participants make in exchanging goods, services and ideas*" (Den Butter and Wit, 2006: 5). This definition thus encompasses direct costs like tariffs and transportation costs as well as indirect costs like search, contracting and monitoring costs.

III.2B *Types and Sources of Transaction Costs*

Transaction costs have been categorised in various ways. Williamson (1985) for example divides them in *ex-post* and *ex-ante* transaction costs, while Den Butter and Mosch (2003) break this down a little further by distinguishing three stages in every transaction, namely the *contact*, *contract* and *control* stage.[17] Linders (2006) on the other hand categorizes transaction costs into costs arising from tangible and intangible barriers to trade. Tangible barriers to trade (e.g. transport and trade policy barriers) lead for example to transportation costs and tariffs. Intangible barriers (e.g. informational, cultural and institutional barriers) lead to more indirect costs, like the ones discussed by Williamson (1985, 1998). According to Linders, intangible barriers are more important for trade than tangible barriers. The WRR

[15] Williamson (1998) adds that markets are more incentive driven than firms and thus that firms loose some efficiency when an activity is governed within hierarchy instead of the market.

[16] It was actually Williamson (1975) who dubbed the decision of firms to keep an activity in-house or to purchase it from an external party the "make or buy" decision.

[17] Note that the three stage breakdown is essentially the same as the two way breakdown, since transaction costs made during the contact and contract can be seen as *ex-ante* transaction costs, while the costs made during the control stage can be seen as *ex-post* transaction costs.

(2003) furthermore notes that intangible barriers have become relatively more important over the years as tangible barriers have continued to fall.

Den Butter and Mosch (2003) give a lucid description of how these intangible frictions induce costs to arise during a transaction. They argue that before a transaction can take place, supply and demand must meet each other, i.e. buyers and sellers of a certain product/service must find each other. This happens during the *contact* stage, in which the buyer is looking for a reliable party that is selling the product he needs (or is willing to invent it) for his preferred price to quality ratio. The seller on the other hand is trying to find a reliable party to sell his product/service to for his preferred price. Since the information both parties need is not free, easily accessible or complete, both parties must invest in search (make transaction costs) to find each other.

The second stage of a transaction (*contract*) commences right after the buyers and sellers have found each other and consists of negotiating the terms of the transaction. Transaction costs arise here because time and money have to be spent on: Deciding how the profit of the transaction is to be split up between the transacting parties, what the specific rights and obligations of the parties are towards each other and what actions need to be taken in case of unfavourable outcomes or contingencies.

The final stage of a transaction (*control*) starts after an agreement between the trading parties has been reached. Here, costs must be made to ensure that both parties live up to their part of the agreement. These costs include monitoring costs and enforcement costs. Monitoring costs are the costs made to ensure that the other party is acting in accordance with the agreement. When this is not the case, enforcement costs arise because the shirking party is forced to comply with the agreement (i.e., a legal procedure is started).

The costs that arise in these three stages are intimately linked with incomplete information and relationship specificity, which can lead to uncertainty and opportunistic behaviour. As stated by Nunn (2006), a well-established insight from the theory of the firm is that underinvestment will occur when investments are relationship specific and contracts cannot be enforced. Investments are considered to be relationship-specific when their value outside of a buyer-seller relationship is significantly lower than within it. Nunn gives the example of an investment made by an input supplier (the seller) that produces a customized good for a final good producer (the buyer). When the customization calls for relationship-specific investments, the buyer can "hold up" the seller when contract enforcement is imperfect. Namely, the buyer can go back on the initial agreement by paying a lower price for the customized good after the relationship specific investment has been made.[18] Of course the seller foresees this and consequently under-invests in the necessary relationship specific investment. This underinvestment then leads to sub optimal level of trade.[19] Consequently, firms invest time, effort and money in: finding a partner that is trustworthy (*contact*), establishing sound contracts (*contract*) and implement monitoring (*control*). All these investments are thus to reduce the probability and extent of opportunistic behaviour by a potential partner.

Den Butter and Mosch (2003) also note that the costs made during all three stages of a transaction are exacerbated in an international context. Seeking and gathering information

[18] More specifically, the buyer will pay the price that prevails outside the relationship.
[19] Although in this particular example it is the seller that has to make the relationship-specific investment, the argument naturally holds equally well if the buyer has to make the relationship-specific investment.

about potential partners in another country is for example more difficult because of geographical distance, differences in (business) culture, language and the way information is distributed. These differences also make contracting, monitoring and enforcing more difficult.

III.2C *Transaction Costs and the Governance Structure of Firms*

One of the most prominently researched problems in transaction cost economics is the make or buy decision that firms face. Grossman and Helpman (2003) extend this question to an international context. They state that the classical dichotomy to make or buy is too simplistic to explain current patterns in international trade. Helpman (2006) argues that this decision is actually two-dimensional. These two dimensions are geographical location and ownership structure. Firms must simultaneously choose whether to outsource (the ownership dimension) and whether to offshore (the geographical dimension). This leads to four possibilities; in-house production in the home country (insourcing), subcontracting input production to an external party in the home country (outsourcing), producing the inputs in-house through a subsidiary in a foreign country (in-house offshoring) or subcontracting input production to an external party in a foreign country (outsourced offshoring). Since the simultaneous choice is quite complex and beyond the scope of this research, the focus will be on the latter two possibilities.

Given that a firm decides to move production (or parts thereof) to a foreign country. It then has to decide whether to keep this production in-house or to outsource to an external party. From a transaction cost perspective, this decision depends vitally on the asset specificity of the traded inputs. As assets become more relationship specific, the risk of opportunistic behaviour increases, which means that the costs of contracting increase more than the costs of vertical integration (Klein, Crawford and Alchian, 1978). In such a situation one should (*Ceteris Paribus*) expect vertical integration to occur as opposed to outsourcing.

An interesting way to distinguish between goods that require relatively large relationship specific investments and goods that do not is given by Rauch (1999). Rauch proposes a network/search view of trade and argues that there is an essential difference between homogeneous goods and differentiated goods. He defines three types of goods, namely goods that are sold on an organised exchange, goods that are reference priced (meaning that their prices are quoted regularly in trade publications) and goods that are neither of these. Rauch calls the latter type of goods differentiated goods. He states that these goods are too heterogeneous to be compared on price alone since their price has to be adjusted to multidimensional differences in characteristics. Consequently, trade in these goods entails a lot more (relationship specific) search costs than goods sold on an organised exchange. Trade in differentiated goods is thus more prone to opportunistic behaviour.

Nunn (2006) also states that trade in differentiated products is more exposed to opportunistic behaviour than trade in homogeneous goods. According to Nunn, homogeneous goods are less prone to this opportunistic behaviour since less relationship specific search costs have to be made to match buyers and sellers. Homogeneous goods furthermore have values that do not differ much within or outside a trade relationship because their market is thick (i.e. has many buyers and sellers). Exposure to opportunistic behaviour is also increased because differentiated goods are more prone to the verifiability problem. Their quality cannot be perfectly assessed by third parties because of their heterogeneity. This has an impeding effect on monitoring and enforcement. In addition, contracts for differentiated goods are more incomplete since more factors than price alone have to be considered. All in all, differentiated goods are more prone to the hold up problem because of asset specificity and incomplete contracts and thus transaction costs are higher for this type of goods.

Note that the additional transaction costs arising from trade in differentiated goods instead of homogeneous goods can also be seen throughout the previously described three stage process. For trade in differentiated goods: firms have to invest more in search costs (*contact*), contracting is arduous and takes longer (*contract*) and monitoring and enforcing (*control*) is more difficult.

III.3 Empirics

Notwithstanding the fact that transaction cost economics is a relatively new field of research, it has had a remarkably strong empirical backing. After Trefler (1995) and Davis *et.al.* (1997) suggested the inability of traditional trade models to sufficiently explain international trade, a surge of research has emerged explaining trade patterns and volumes from a transaction cost perspective.

Many studies for example find that distance negatively affects trade (e.g., Frankel and Rose, 2002 and Linders *et.al*., 2005). Here, distance is often viewed to be a proxy for intangible barriers to trade like for example cultural unfamiliarity and incomplete information, rather than just transport costs (Linders, 2006). As Linders (2006) points out though, the effect of distance on trade does vary quite a bit across literature. Furthermore, the WRR (2003) points out that it is not clear what type of barriers distance is a proxy for.

Baier and Bergstrand (2001) find that direct trade costs cost explain a significant part of trade growth. More specifically, they find that declining tariffs and transportation costs explain 25% and 8% respectively of trade growth in several OECD countries between 1950 and 1980. Their model however only explains 40% of the variation in trade flow growth in their sample and their results cover a period in which tariffs and transportation costs are likely to have declined more than in recent years. In this vein, Anderson (1999) states that current tariffs and transportation costs cannot sufficiently explain the resistance to trade.

Trade has recently also been related to increased vertical specialization (outsourcing). Hummels, Ishii and Yi (2001) for example find that increased vertical specialization can account for a third of growth in trade between 1970 and 1990 of the countries in their sample. Yi (2003) furthermore finds that vertical specialization increases the sensitivity of trade to tariff reductions, since goods that are produced in several countries, pass multiple borders and are thus subject to multiple tariffs. This is in contrast to the view expressed by Anderson (1999) since it implies that although tariffs have not gone down as much in recent years as for example 20 years ago, the effect of tariff changes on trade is still significantly strong.

An increasingly popular question in transaction cost economics is the choice firms face to offshore via hierarchy or via the market. Grossman and Helpman (2003) model this choice between in-house offshoring and outsourced offshoring. Their model shows that this choice depends *inter alia* on the thickness of the market and on the verifiability of investment tasks. Both these variables (when increased) reduce relationship specificity and thus are likely to induce outsourced offshoring as opposed to in-house offshoring.

Lieberman (1991) uses a logit model tot test whether asset specificity increases chances of US chemical producers to vertically integrate backwards. He finds that both his measures of asset specificity have a positively significant effect on firms' decision to integrate backwards in his sample. Lieberman's research however is only confined to the chemical industry.

Maltz (1994) extends his analysis throughout multiple industries. He uses a logit model to find out if transaction specific assets are associated with a lower likelihood of the outsourcing of logistical activities. He finds results consistent with the transaction cost hypothesis, since the coefficient on his proxy for asset specificity is significantly negative. This implies that asset specificity negatively affects the likelihood of outsourcing.

Kvaloy (2003) on the other hand discusses a model in which the inefficiency resulting from a hierarchical structure (due to weaker incentives) is positively related to asset specificity. Hence, in Kvaloy's model, firms would not have the incentive to internalize production even when the transaction is characterised by relationship specific investments. The reason is that the gain in transaction costs would be equally offset by the loss in efficiency of a hierarchical structure. The model that Kvaloy proposes however is an algebraic one and he provides no empirical backing to it.

More recently, Nunn (2006) proposes that a country's contracting environment might be an important determinant of its comparative advantage because of asset specificity. He finds that countries with good contracting environment specialize in industries that require large relationship specific investments.

Furthermore, literature indicates a significantly strong influence of institutional quality (Dixit, 2004; Linders, 2006), trust (Den Butter and Mosch, 2003) and cultural differences (Guo, 2004) on trade. These variables are however beyond the ambit of this research, thus their empirics are not discussed further.

Overall, it can be concluded that although there is no consensus regarding which type of transaction costs affect trade the most, the notion that transaction costs matter is widely supported. Furthermore, literature seems to support the view that asset specificity is an important determinant of firms' decision to make or buy.

IV. Data and Methodology

Trade growth between the Netherlands and China is explained in this paper as a function of the growth in the economic size of these two countries, Dutch FDI stocks in China, outsourced offshoring in the Netherlands, Dutch re-exports, average tariff rates in the Netherlands and China and transportation costs. This section rationalizes the use of the gravity model as the method of analysis and the choice of the independent variables. It furthermore explains how these variables are estimated. Afterwards, a concise description of the empirical model is given.

IV.1 The Gravity Model

The method of analysis used in this paper is the gravity model of trade. This model was first mentioned by Tinbergen (1962) and is one of the most commonly used models for quantitative analysis of trade in contemporary economic research (Guo, 2004). The functional form of the gravity model is based on Newton's gravity equation in physics. The economic gravity model expresses bilateral trade between countries as a function of their economic sizes and the physical distance between them. More specifically, it relates trade proportionally to economic size and inversely to distance in the absence of frictions. The frictions and facilitators of trade are then often added to this benchmark version of the gravity model. The same procedure is followed in this paper, albeit using time-series data instead of a cross section.

The gravity model has often been criticized to lack a solid theoretical foundation, since its classic form is only based on an intuitive analogy between spatial interaction in physics and economics (Linders, 2006). However, literature has found the model to work well empirically, producing sensible parameter estimates (Rose, 2005). The WRR (2003) furthermore notices the large explanatory power gravity based models have, being able to explain 60% to 80% of the variance in bilateral trade.

In addition, the gravity model no longer suffers from lack of theoretical underpinning. The gravity equation has mostly been derived from models of imperfect competition and product differentiation (e.g., Helpman and Krugman, 1985; Anderson and Van Wincoop, 2004). Deardorff (1998) however shows that the gravity equation is also consistent with Heckscher Ohlin theory under perfect competition. As Linders (2006) points out, the gravity equation can be derived from both neo-classical and new trade models as a reduced form equation that explains bilateral trade patterns. Linders derives that the model (assuming frictionless trade, identical and homothetic preferences across countries) algebraically looks like:

$$T_{ij} = Y_i \frac{Y_j}{Y_w} \tag{1}$$

Where T_{ij} is export from country i to j, Y_i, Y_j and Y_w are the economic size of country i, j and the world respectively.

Following the gravity model's assumption that trade between two countries is proportional to their economic size, this paper uses the Gross Domestic Product (GDP) of China and the Netherlands as an explanatory variable for Dutch China trade growth. The variables for economic size are denoted as GDP_{ct} and GDP_{nt}, where the subscript t stands for time and c and n stand for China and the Netherlands respectively. The variable of world economic size is not explicitly included in the regression model, but is assumed to be present in the constant. Note that since world GDP appears in equation (1) as a denominator, after logarithmic transformation it becomes negative (thus the constant of the regression model is assumed to be negative). Furthermore, since causality runs both ways between trade and GDP, these variables are lagged one period to mitigate simultaneous equation bias.[20] The other variables that are assumed to be facilitators of and impediments to trade are described in the following paragraphs.

IV.2 FDI, Outsourced Offshoring and Dutch Re-Exports

In-house offshoring to China is measured by the stock of Foreign Direct Investment (FDI) done by the Netherlands in China.[21] This variable is denoted by FDI_t, where the subscript t stands for time.

FDI can have either a vertical or horizontal nature. This dichotomy is based on two different views on the multinational activities of firms. The proximity concentration hypothesis states that multinational activity of firms is led by the trade off between being close to customers and suppliers and the loss of scale economies at the plant level. The factor proportion hypothesis on the other hand states that multinational activity is mainly motivated by production efficiency reasons (Markusen and Maskus, 2001). This implies that vertical FDI takes place when firms internationally fragmentise production via subsidiaries (i.e. in-house), while horizontal FDI occurs when firms undertake the same activities in multiple countries. Consequently, when FDI is found to have a positive affect on trade it can be assumed to have a vertical nature (since the FDI leads to import of intermediate goods), while a negative relationship implies a horizontal nature (since exports are substituted by sales through foreign branches).

The question whether FDI is horizontal or vertical has been heavily debated in economic literature (e.g, Markusen and Maskus, 2001). Although consensus has not been reached yet, evidence seems to suggest that FDI between economically similar countries is horizontal while FDI between very dissimilar countries is vertical (e.g., Gorter, Tang and Toet, 2005).

Several models have rejected the vertical model in favour of the horizontal model (e.g, Blonigen *et.al.*, 2003). As Waldkirch (2003) notices though, these studies are biased because they all use data on FDI originating in and going to developed countries. This makes it more likely to find results conforming that most FDI is horizontal. When data on substantially dissimilar countries is considered, the results indicate that vertical FDI dominates horizontal FDI (e.g., Waldkirch, 2003).[22] Suyker and De Groot (2006) on the other hand find data that suggests that FDI flows from the Netherlands to China have a horizontal rather than a vertical

[20] Lagging variables is a commonly used econometric technique to help alleviate problems of reverse causality (See Brooks, 2002 for a textbook explanation).

[21] Foreign Direct Investment comprises “capital provided by a foreign direct investor (the parent company) to an affiliate enterprise, to obtain a lasting interest and influence in that enterprise” (Suyker and de Groot, 2006: 41). Actually, FDI flows are more commonly used than stocks in economic research. Most of these papers however use cross sectional data. This paper uses time series data, hence the growth in FDI stocks is analogous to FDI flows.

[22] It is furthermore noteworthy that a clear distinction between horizontal and vertical FDI is fading since firms are increasingly engaging in more complex strategies that have both a vertical and a horizontal character Helpman (2006). Nonetheless, the production of inputs is still an important function of foreign subsidiaries (Grossman and Helpman 2003).

character. Their analysis however is based on reviewing a few Dutch company annual reports and interpreting FDI data without statistical analysis.

Reverse causality might also exist between trade and FDI. Vernon's (1966) product cycle hypothesis for example suggests that trade can cause FDI because multinational firms trading with foreign markets get to know the foreign country's economic, political and social situation better and become less uncertain to invest in it. Hence, the FDI variable is lagged with one period to mitigate this problem.

To estimate outsourced offshoring, a measure based on the import of intermediate goods is constructed. This measures follows from Hummels *et.al.* (2001) and Yi (2003). Hummels *et.al.*(2001) propose that there is a difference between outsourcing and vertical specialization, with the latter being a subset of the former. According to Hummels *et.al.*, vertical specialization does not just entail international fragmentation of the production process. It further requires the export of the goods that are partly produced in foreign countries.[23] Thus only goods that require foreign inputs and after finishing are exported account for vertical specialization. Hence, according to this definition goods that use imported intermediate inputs but are not exported are not counted in vertical specialization. Hummels *et.al.* measure vertical specialization in a certain country as the ratio of imported intermediates to output multiplied by exports, algebraically:

$$VS_t = \left(\frac{IIG_t}{OP_t}\right) * TEX_t \tag{2}$$

Where OP_{kt} is defined as:

$$OP_t = VA_t + I_t \tag{3}$$

Here, the subscript t represents time, VS_t stands for Dutch vertical specialization, IIG_t is the total Dutch import of intermediate goods, OP_t represents Dutch output (which is defined as the sum of intermediate input (I_t) and valued added (VA_t)) and TEX_t in this case stands for total Dutch exports, excluding re-exports.[24] This measure effectively gives the value of imported input content in the exports of the Netherlands at time t. Note that this proxy thus represents overall vertical specialization in the Netherlands and not specifically relating to China since IIG_t represents total import of intermediate goods and not solely from China. However, anecdotal evidence suggests that a substantial part of Dutch imports of intermediate goods are from China.[25]

The approach to use intermediate goods to measure international outsourcing is frequently seen in economic literature (e.g., Feenstra and Hanson, 1996 and Hummels *et. al.*, 2001). There are however several caveats of using this measure. One is the subjective nature of the classification of goods as "intermediate". As noted by Hummels *et.al.* (2001), which goods are treated as "intermediate" is rather arbitrary. Tyres for example could be classified as intermediate goods (since they are used as inputs in the production of a final good, namely

[23] More specifically, for vertical specialization as defined by Hummels *et.al.* (2001) to occur three conditions must be fulfilled; (1) goods must be produced in two or more sequential stages, (2) two or more countries must provide value added in the production of the good and (3) at least one country must use imported inputs in its stage of the production process and some of the resulting output must be exported.

[24] Re-exports are extracted from Dutch total exports because they are likely to bias the VS measure upwards. Increased re-exports can namely induce total exports to rise without influencing output much (since the margin on re-exports is low), thus VS goes up even when there is essentially no increase in vertical specialization.

[25] This anecdotal evidence is based on telephone and email contact with associates of CBS.

automobiles) as well as final goods (since they are also bought by households). Furthermore, in this case, another vexation is that import of intermediate goods represents in-house offshoring as well as outsourced offshoring. The assumption made here, is that the effect of outsourced offshoring is big enough to give different results than the effect of FDI, which solely measures in-house offshoring. In addition, imported intermediates that are used as inputs for final goods that are not exported are not counted by this proxy as part of vertical specialization.[26]

Since the Netherlands has been know to be an important distribution hub for Europe, the importance of the Dutch distribution function is also likely to have a significant effect on Dutch China trade. Dutch Re-Exports are a good measure to proxy this distribution function. But re-export is not just a distributive process though. Value is also added to products in various ways, ranging from, storage and bulk breaking to slight modification (for example the mixing/thinning of certain chemicals)[27]. The Dutch distribution function is measured as the ratio of Dutch Re-Exports to total Dutch trade, algebraically:

$$D_t = \frac{RE_t}{TR_t} \tag{4}$$

Where TR_t is defined as:

$$TR_t = TIM_t + TEX_t \tag{5}$$

Again the subscript t represents time, D_t represents the Dutch distribution function, RE_t represents total Dutch re-exports and TR_t is total Dutch trade (which is defined as the sum of total Dutch import and export, represented by TIM_t and TEX_t respectively). This measure thus represents the importance of the Dutch distribution function to its trade. Dividing re-exports by total trade furthermore mitigates the effect of inflation and relieves an endogeneity problem that would occur if just re-exports were used as an explanatory variable.[28]

IV.3 Transport Costs and Tariffs

The proxy for transport costs is the Cost Insurance and Freight to Free On Board ratio (CIF/FOB) of the trade between the Netherlands and China. This ratio has often been used in economic research to give a proxy of transportation costs (e.g., Hummels, 1999 and Baier and Bergstrand, 2001). It is defined in this paper as:

$$TC_t = \left[\left(\frac{IM_t}{EX_{ct}} \right) - 1 \right] \tag{6}$$

Here TC_t represents transport costs, IM_t represents the value of Dutch imports from China (which are registered including insurance and freight costs, i.e. CIF), EX_{ct} represents Chinese

[26] When omitting the final part of (1), namely TEX_t, the problem of excluding offshoring that does not entail export of the final good is mitigated. The use of this alternative measure however produced results that are very similar to the results found when using the original proxy. Thus only the results that use the original proxy are presented and discussed.

[27] Re-Exports to a certain extent also proxy an intermediating function Dutch firms play between finding and contacting potential buyers of the Re-Exports (Ernst & Young, 2002). This is part of the value added of Re-Exports is trivial though.

[28] Since Dutch import from China is a subset of total Dutch re-export (assuming that part of Chinese imports are exported) while Dutch import from China is also the dependent variable, this creates simultaneous equation bias because essentially Dutch import from China appears on both sides of the regression equation.

exports to the Netherlands (which are registered excluding cost, insurance and freight, i.e. FOB) and the subscript t represents time, while the subscript c indicates that the exports are from China. The basic idea behind the proxy is that without transport costs, the value of exports from China to the Netherlands should be the same as the value of Dutch imports from China. Since customs register exports on an FOB base (i.e. excluding insurance and freight costs) while imports are registered CIF (i.e. including insurance and freight costs), there is a difference. This difference can be seen as a measure of transportation costs. TC_t thus expresses these transportation costs in *ad-valorem* equivalent terms.

This measure, although useful, also has several shortcomings. First of all, it is a relatively aggregated measure, so it does not distinguish which transportation costs matter most, nor does it reveal which goods are most sensitive to transportation costs. Secondly, when using CIF/FOB ratios, the effect of transportation costs is contaminated with the effect of insurance costs. Thirdly and more importantly, the use of CIF/FOB ratios in this case is troubled by the fact that the registration of transit trade from China to other countries is usually flawed.[29] Namely, transit trade is reported as going to the Netherlands, while it only passes through Netherlands on its way to another country. Since these goods never become legal property of a Dutch citizen, Dutch customs do not register these goods in transit. Thus, more goods are registered to have left China to go the Netherlands than are registered to have arrived in the Netherlands. This leads to the unintuitive situation that the value of goods exported to the Netherlands from China is consistently higher than the Dutch import value of Chinese goods.

Fortunately, Eurostat and the China Statistical Yearbook report data on the quantities (in 100 kg) of goods traded between the Netherlands and China. The data reveals that not only the value but also the quantity of goods exported from China to the Netherlands is below the quantity of goods arriving in the Netherlands from China. This seems to confirm the suggestion that goods that are shipped from China *through* the Netherlands are registered in China as going *to* the Netherlands. This notion can be used to extract the flow of goods between the Netherlands and China that are merely in transit from the actual trade.[30] To do this, the following procedure is used:

The euro value of exports from China to the Netherlands is divided by their quantity in kg. This gives a Euro value per 100 kg of Chinese goods exported to the Netherlands. The ratio is then multiplied by the difference between the quantities of Chinese exports to the Netherlands and the quantities of Dutch imports from China. This effectively gives the value of the goods that are shipped *through* but not *to* the Netherlands but are registered as such. This value is than subtracted from the original value of Chinese goods exported to the Netherlands (EX_{ct}), which gives the transit corrected value of Chinese goods exported to the Netherlands (CEX_{ct}).

[29] This statement is based on email contact and telephone conversations with an associate of the National Bureau of Statistics of China.

[30] Note that only goods in transit are extracted from the trade, Re-Exports temporarily become property of a Dutch citizen and thus are registered by the Dutch customs.

Consequently, the corrected measure for transaction costs becomes:

$$CTC_t = \left[\left(\frac{IM_t}{CEX_{ct}} \right) - 1 \right] \tag{7}$$

Where CEX_{ct} is defined as:

$$CEX_{ct} = EX_{ct} - \left[\left(\frac{EX_{ct}}{Q_{ct}} \right) * \left(Q_{ct} - Q_{nt} \right) \right] \tag{8}$$

Here, t represents time, CTC_t is the corrected measure of transport costs, CEX_{ct} is the transit trade corrected value of Chinese exports to the Netherlands, Q_{ct} is the quantity (in 100 kg) of Chinese goods exported the Netherlands, Q_{nt} is the quantity (in 100 kg) of Dutch goods imported from China and IM_t and EX_{ct} are as defined in (6). This transit trade corrected measure for transport costs is an improvement of the standard CIF/FOB ratio and has not been used before in economic literature.

The effect of tariffs on trade is quite difficult to measure since there is a large variation in tariffs imposed between different goods. Countries also discriminate between trading partners by applying different tariffs on the same type of good. Nevertheless, an attempt is made to measure the affect of tariffs on Dutch China trade with the use of "average applied import tariff rates on non- agricultural and non-fuel products" in China and the European Union.[31] This variable is denoted by TA_{eut} and TA_{ct}, where t is time and n and c denote the Netherlands and China respectively. The downside of this measure is of course that agricultural and fuel products are excluded. This problem is not likely to be very large though, since section II has shown that agricultural and food products are not a large part of Dutch China trade. Also, the use of this specific measure for tariffs is not so much motivated by literature, but more by its availability and comparability.[32]

IV.4 The Empirical Model

After the data has been converted to a common currency, corrected for inflation and seasonal effects and converted into growth rates[33], the coefficients of the regressors are estimated with Ordinary Least Squares (OLS). First, the frictionless specification of the gravity model is estimated for Dutch imports from and exports to China. This model is stated as[34]:

$$\dot{IM}_t = \beta_0 + \beta_1 G\dot{D}P_{ct-1} + \beta_2 G\dot{D}P_{nt-1} + \varepsilon_t \tag{9}$$

$$\dot{EX}_t = \beta_0 + \beta_1 G\dot{D}P_{ct-1} + \beta_2 G\dot{D}P_{nt-1} + \varepsilon_t \tag{10}$$

Here, the subscript t represents time, the dot above the variables indicates growth rates, IM_t and EX_t are the Dutch imports from and exports to China respectively, β_0 represents the intercept of the model, ε_t is the error term and GDP_{ct-1} and GDP_{nt-1} are the lagged GDPs of China and the Netherlands respectively. Since logs appear on both sides of the equation the

[31] Data taken from UNCTAD, see table H in the Appendix for the exact source.
[32] This was the only measure of average tariff rates which could be found that is comparable between China and the Netherlands and which was available on a quarterly base.
[33] See section 1 in the Appendix for the detailed data preparation procedure.
[34] Geographical distance between the Netherlands and China is excluded from the model since it is constant over time.

coefficients of these models can be interpreted as elasticities. After estimating (9) and (10), the full model is estimated as:

$$\dot{IM}_t = \beta_0 + \beta_1 G\dot{D}P_{ct-1} + \beta_2 G\dot{D}P_{nt-1} + \beta_3 F\dot{D}I_{t-1} + \beta_4 V\dot{S}_t + \beta_5 \dot{D}_t + \beta_6 C\dot{T}C_t + \beta_7 T\dot{A}_{eut} + \varepsilon_t \quad (11)$$

$$E\dot{X}_t = \beta_0 + \beta_1 G\dot{D}P_{ct-1} + \beta_2 G\dot{D}P_{nt-1} + \beta_3 F\dot{D}I_{t-1} + \beta_4 \dot{D}_t + \beta_5 C\dot{T}C_t + \beta_6 T\dot{A}_{ct} + \varepsilon_t \quad (12)$$

Again the dot indicates growth rates, β_0 represents the intercept of the model, ε_t is the error term and IM_t, EX_t, GDP_{ct-1} and GDP_{nt-1} are as in (9) and (10). FDI_{t-1} is the lagged value of Dutch FDI stocks in China, VS_t is a measure of Dutch outsourced offshoring, D_t is the importance of the Dutch distribution, CTC_t is a measure for transportation costs and TA_{eut} and TA_{ct} are the average tariff rates in the European Union and China respectively. Note that the variable VS is not included in (12). The reason is that there is no *a priori* justification for Dutch offshore outsourcing to affect exports to China. Including this variable would only make model (12) less efficient since another degree of freedom is lost whilst no explanatory power is added to the model. The coefficients of the models can again be interpreted as elasticities.

Following the estimation of (9)-(12), detailed trade data (3 digit SITC) between the Netherlands and China is extracted from CBS Statline and sorted in three groups, namely differentiated goods, reference priced goods and homogeneous goods. The sorting procedure is based on the classification of Rauch (1999).[35] The 3 digit SITC codes belonging to the three types of goods are downloaded from John Haveman's website.[36] After the sorting, the models (9)-(12) are estimated again for each of the three types of goods. Thus 12 more regressions are run, where all the independent variables are as in (9)-(12), but the dependent variables are $\dot{IM}_{dt}$, $E\dot{X}_{dt}$, $\dot{IM}_{rt}$, $E\dot{X}_{rt}$, $\dot{IM}_{ht}$ and $E\dot{X}_{ht}$. Here the subscripts d, r, and h indicate differentiated, reference priced and homogeneous goods respectively. These models are numbered (9a)-(12a), (9b-12b) and (9c-12c), with a, b and c representing that the dependent variable consists of differentiated, reference priced and homogeneous goods respectively. So model (9a) for example is the same as (9) except the dependent variable is $\dot{IM}_{dt}$, while model (12a) is the same as (12) except the dependent variable is $E\dot{X}_{dt}$.

Following the regular analysis, a robustness check is performed. The residuals of the models are tested for serial correlation and heteroscadasticity and the models are tested for parameter stability using Chow tests. The procedure and results of the robustness analysis are displayed in section 2 of the Appendix. The results of the gravity model regressions are discussed in the next section.

[35] Rauch (1999) specifies two versions of his classification, namely a liberal one and a conservative one. The conservative classification is stricter than the liberal classification in defining goods as homogeneous or reference priced. This paper makes use of the conservative classification.

[36] www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html#classification

V. Results

This section displays and describes the results of the models estimated in this paper. Section V.1 presents the results of models (9)-(12) and derives conclusions regarding the extent to which the explanatory variables can explain Dutch China trade over the past ten years. Section V.2 then displays the results of estimating models (9c)-(12c) and derives conclusions about the affect of asset specificity on the governance structure of Dutch firms offshoring to China.

V.1 Basic Results

Table 3 shows the output of regressing the growth in several trade enhancing and several trade impeding variables on import and export growth between China and the Netherlands.
The second and third column (specification 1) display the coefficient estimates of the benchmark gravity models (9) and (10) discussed in the previous section. Note that the adjusted R^2 in these two columns is 0.67 and 0.66 respectively. This indicates that more than half of the growth in trade between the Netherlands and China can be explained by the growth of their economies. In addition the F statistics (40.55 and 39.16) indicate that the null hypothesis that all the coefficients of the explanatory variables are 0 is rejected at the 1% level.[37] The results of specification 1 also indicate that imports from China are a little more sensitive to (Dutch) demand growth while the exports growth to China are more sensitive to (Dutch) supply growth. The difference between these demand and supply elasticities is small though, for imports as well as exports.

The explanatory power of the first two models is in line with most estimations of the standard frictionless gravity model equation. Linders (2006) for example, finds an adjusted R^2 of 0,67 on his benchmark gravity model equation. Furthermore the coefficients of the GDP variables are statistically significant, positive and close to unity, implying that an increase in (lagged) GDP growth (approximately) leads to a proportional increase in trade growth. The intercept, of models model (9) and (10) are positive though, while the intercept is found to be negative in most gravity models. Still, this result is intuitive since the significantly positive intercept implies that even if the growth of Dutch and Chinese GDP is zero, there is still trade growth between these two countries. It seems that there is some decay in friction (i.e. reduction in transaction costs) over time causing trade between China and the Netherlands to grow above their GDP growth.

When the full model is estimated, some interesting results arise. The last two columns of table 3 display that the explanatory power of the benchmark model rises substantially after the trade barriers and trade facilitators are added as explanatory variables. The models now explain 77% of Dutch import growth from China and 71% of Dutch export growth to China. Although, the F statistics go down somewhat, they are still high enough to strongly reject the null hypothesis that all coefficients are zero. Note that the coefficients on GDP growth become somewhat less for imports as well as exports (although they still stay close to one).

[37] The critical values of the F-statistic at the 1% level are 5.18 for the models (9) and (10), 3.30 for model (11) and 3.47 for model (12).

Table 3: Growth in Trade between the Netherlands and China

Independent Variables	Specification 1: Dependent Variable: $\dot{IM}_t$	Specification 1: Dependent Variable: $\dot{EX}_t$	Specification 2: Dependent Variable: $\dot{IM}_t$	Specification 2: Dependent Variable: $\dot{EX}_t$
Constant	1.58^{***} (3.39)	0.26^{***} (3.72)	-0.77^{**} (-2.15)	-0.92^{**} (-2.27)
$G\dot{D}P_{ct-1}$	0.91^{***} (4.99)	0.91^{***} (5.03)	0.71^{***} (4.11)	0.88^{***} (3.96)
$G\dot{D}P_{nt-1}$	0.98^{***} (6.94)	0.99^{***} (6.25)	0.81^{***} (2.99)	0.91^{***} (4.08)
$F\dot{D}I_{t-1}$			0.60^{***} (3.77)	0.23 (0.77)
$V\dot{S}_t$			0.33 (1.44)	
$\dot{D}_t$			1.78^{***} (6.12)	0.28 (1.05)
$C\dot{T}C_t$			-0.14 (-1.05)	-0.24^{**} (-2.09)
$T\dot{A}_{eut}$			-0.33^{*} (-1.76)	
$T\dot{A}_{ct}$				-0.29^{***} (-3.31)
Observations	38	38	38	38
Adjusted R^2	0.67	0.66	0.77	0.71
F-statistic	40.55	39.16	29.02	31.27

Notes: t-statistics in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%.

To test if the coefficients of GDP growth are significantly different from unity, a Wald test is conducted on models (11) and (12) restricting the coefficients of GDP to 1. The resulting F-statistics are 1.14 and 1.53 for models (11) and (12) respectively. Thus for each model the null hypothesis that the coefficients on Dutch and China GDP growth are 1 cannot be rejected at conventional levels. Also note that the intercepts of the models are negative and significant, congruent with the theoretical expectations of the gravity model. The intercepts of the models can be interpreted as the average quarterly growth rates of world GDP over the sample period. These intercepts are indeed quite close to the real quarterly growth of world output, which was a little below 1% during the sample period.

Another interesting result is that growth of Dutch FDI stocks in China has a positive influence on Dutch imports from China. This effect is significant at the 1% level, while the influence of FDI on Dutch exports to China is insignificant (although positive). According to the model, a 1% increase in Dutch FDI stocks in China, leads to an increase in Dutch imports from China of 0.60%. This seems to corroborate the idea that FDI flows are complements instead of substitutes for trade, which is in accordance with the factor proportion hypothesis. Thus FDIs from the Netherlands to China seem to be of a vertical character, rather than a horizontal character as suggested by Suyker and De Groot (2006). If the latter was true, the model should have indicated a significantly negative relationship between the FDI variable and Dutch exports to China.

The fact that the FDI variable is significantly positive implies, that Dutch China trade growth has indeed been affected by Dutch offshoring to China. This offshoring is likely to be in-house since the FDI variable is significant, while the outsourced offshoring variable (VS) remains insignificant. These results are somewhat congruent with Liu *et.al.*(2001) who also find a positive relationship between lagged growth of FDI and import growth. Liu *et.al.*(2001) however find larger coefficients for FDI and also find that the relationship between FDI and import grows stronger when FDI is lagged more periods. The latter could for example be because it takes some time to set up a plant in a foreign country or to integrate two firms after an acquisition. It might thus take some time before the foreign subsidiary is ready to supply intermediate goods to the "home" country. This notion seems to be supported when model (11) is estimated without lagging FDI. Namely, the coefficient on FDI is lower, although still significant and positive.[38] Alternatively, the stronger effect of lagged FDI growth on import growth could also be related though to increased trust between the trading parties.

As expected, the increasing importance of the Dutch distribution function has had an important positive effect on Dutch imports from China over the past ten years. In fact, the coefficient on this variable (1.78) is the highest among all coefficients of model (12). This suggests that Dutch imports from China are most sensitive to the growth in the distribution function of the Netherlands compared to the other variables. This does not necessarily mean though that the growth of this variable can explain the largest part of Dutch China import growth (the end of this section explains why). The effect of the increasing distribution function of the Netherlands on export to China however is insignificant. Dutch export growth to China seems to be mainly sensitive to the GDP growth of China and the Netherlands. This is also as expected, since Dutch re-exports mainly get distributed to the rest of Europe instead of Asia.

The estimated effect of the transportation cost variable is somewhat troubling. Although the signs of the coefficients on this variable are both correct (i.e. negative), the coefficient remains insignificant for import, while it is significant for export. A possible reason for the apparent insignificance of transportation costs for import could be that the composition of imports between the Netherlands and China has become more high-tech. As Baier and Bergstrand (2001) note, one of the assumptions when using CIF/FOB ratios to proxy transportation costs is that the composition of trade doesn't change much. Since CIF/FOB ratios also include insurance costs, the changing composition of Dutch trade with China could have offset the effect of declining transportation costs. The reason behind this is that, as trade becomes more high tech, the insurance costs of these goods go up, which tempers the effect of decline in actual transportation costs. Another reason that transportation costs seem to have significantly affected Dutch exports to China but not imports from China could be related to differences in size between import and export goods. Exports to China might have a lower value to weight ratio (i.e. they are bigger in size) than imports from China, which means that they are more sensitive to transportation cost changes. Table D in the Appendix shows that a large part of exports to China comprise reference priced and homogeneous goods, while the bulk of imports from China consists of differentiated goods. The latter are

[38] See Table G in the appendix for the exact output of this model.

more likely to have a high value to weight ratio and are thus likely to be less sensitive to transportation cost changes.

The decline in average tariff rates seems (as expected) to have a significantly negative impact on imports as well as exports between the Netherlands and China. Furthermore, imports from China seem to be more sensitive of tariff declines than exports to China. The difference between the two sensitivities is rather small though. The sensitivities of trade to tariff rates are much smaller than found by Yi (2003). But the variation in Yi's findings is quite large. Yi's estimates of the effect of tariff reductions of 1% lead to an increase in export growth from 1.7% to 42%, depending on the specification of the model.

To interpret the results from a growth accounting perspective (using the methodology of Baier and Bergstrand, 2001), consider table 4. This table shows the total (logarithmic) growth of the independent and dependent variables of models (11) and (12) between 1996 and 2006.

Table 4: Growth of selected variables between 1996-2006

Variable	$\dot{IM}$	$\dot{EX}$	$\dot{GDP}_c$	$\dot{GDP}_n$	$\dot{FDI}$
Growth	249.95	150.74	116.45	23.83	158.19
Variable	$\dot{VS}$	$\dot{D}$	$\dot{CTC}$	$\dot{TA}_{eu}$	$\dot{TA}_c$
Growth	72.10	35.46	-7.00	-25.08	-109.46

Note: Growth rates are corrected for inflation, on a logarithmic base and are calculated as $LN(X_{2006}/X_{1996})*100$.

Note that Dutch imports from China grew 250% over the past 10 years.[39] Model (11) can account for 237 percentage points of this growth (approximately 95%). This is built up as follows: the growth of Dutch and China GDP led to 102 percentage points of Dutch import growth from China, FDI accounts for 95 points, the Dutch distribution function accounts for 63 points, European tariff declines account for 8 points and the coefficient on world GDP implies a negative effect of 31 points.[40] This result is interesting since it implies that only a third (28%) of the growth in Dutch imports from China over the past ten years can be attributed to overall GDP growth (including the negative affect of world GDP growth), the other half is mainly explained by in-house offshoring to China (38%), the increased distribution activities of the Netherlands (25%) and only 3% by declining EU tariff rates. Thus, in-house offshoring of Dutch production activities to China seems to have contributed more to Dutch China import growth than overall GDP growth or increased Dutch distribution activities, even though imports are more sensitive to changes in the latter two variables.[41] Furthermore the contribution of tariff declines is statistically, but not economically significant.

[39] Note that the 249.95% growth is on a logarithmic scale though, thus equivalent to a normal growth of $e^{2.4995}$=12.18-1*100=1118%.

[40] The contribution of the significant variables to Dutch China import growth is calculated by multiplying the significant coefficients of model (11) by the growth of these variables. Thus the contribution of Dutch and China GDP growth is calculated as 0.81*23.83+0.71*116.45=102, the contribution of FDI is 0.60*158.19=95, the Dutch distribution function contributes 1.78*35.46=63 points and tariff declines contribute -0.33*-25.08=8. Furthermore, the constant (which is assumed to represent the negative of world GDP growth) is -0.77, implying an affect of world GDP growth during the total sample period of -0.77*4*10=-31 percentage points.

[41] When excluding the model's implied growth of world GDP, the GDP growth of China and the Netherlands explains 41% (102/250) of the growth in Dutch imports from China.

For Dutch exports to China, the result is somewhat different. Again, the model can explain a large part of the 151% growth of Dutch exports to China, namely 122 points (approximately 81%). But the main part of this, is contributed by GDP growth, namely 88 points (approximately 58%). The rest is mainly explained by declines in Chinese tariff rates (32 points, 21%) and declining transport costs only explain only 1.7 points (approximately 1%).[42] Thus the contribution of declining tariff rates is larger for exports to China than for imports from China, even though the sensitivity of the latter is higher. The reason is of course that China has declined its tariff rates more rigorously than Europe, which already had quite low average tariff rates. Since the tariffs and transportation costs are expressed on a comparable basis, it can also be concluded that tariff rate changes have mattered more for Dutch China trade than transportation costs changes. This supremacy of the effect of tariff rates on trade over the effect of transport costs seems in line with previous findings in economic literature (e.g., Baier and Bergstrand, 2001).

All in all, it seems that next to GDP growth, the trade growth between the Netherlands and China seems to be positively and significantly affected by Dutch offshoring to China. It seems likely that over the past ten years, Dutch companies have indeed offshored parts of the production process to China and have subsequently been importing intermediate goods from China via subsidiaries. Furthermore the increased importance of re-exports in Dutch trade has had a strong positive effect on growth of imports from China, although this variable has contributed less to import growth from China than in-house offshoring. Tariffs still seem to be important impediments to Dutch exports to China, but are economically modest for imports from China. Transport costs and outsourced offshoring seem to have mattered less for Dutch China trade for the past ten years.

V.2 Results After Controlling for Product Type

The results in section V.1 showed that Dutch offshoring to China has had a significant effect on their trade relation and that this offshoring has mainly been in-house. This section investigates whether the governance structure of Dutch firms offshoring to China has depended on the asset specificity of the traded inputs. To answer this question, goods are sorted into three levels of asset specificity, namely differentiated products (high level of asset specificity), reference priced goods (medium/low level of asset specificity) and homogeneous goods (low level of asset specificity). Tables 5,6 and 7 show the results of estimating models (9a)-(12c) using differentiated, reference priced and homogeneous goods as dependent variables respectively.

V.2A *Differentiated Goods*

When looking at the second and third column of table 5 (specification 1), it becomes clear that the results are quite the same as in table 3. Models (9a) and (10a) explain 69% and 67% respectively of the variation in the data, the F statistics reject the null hypothesis that all of the coefficients are zero. The coefficients on the Dutch and Chinese GDP growth are also still close to unity, positive and significant at 1%, while the intercept is also positive and significant.

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[42] The calculations are as follows: the contribution of China GDP is 0.88*116.5=103, the contribution of Dutch GDP is 0.91*23.83=22 and the implied affect of world GDP growth is -0.92*4*10= -37, which leads to a total affect of GDP of 103+22-37=88 points, which is 58% of 150.74. The contribution of tariff rates is -109.46*-0.29=32, which is 21% of 150.74 and the contribution of declining transport costs is -0.24*-7=1.7 (1% of 151).

Table 5: Trade between the Netherlands and China of Differentiated Goods

Independent Variables	Specification 1: Dependent Variable: $\dot{IM}_{dt}$	Specification 1: Dependent Variable: $\dot{EX}_{dt}$	Specification 2: Dependent Variable: $\dot{IM}_{dt}$	Specification 2: Dependent Variable: $\dot{EX}_{dt}$
Constant	2.43^{***} (5.05)	0.29^{***} (4.22)	-0.76^{**} (-2.21)	-0.88^{**} (-2.44)
$\dot{GDP}_{ct-1}$	0.90^{***} (5.01)	0.91^{***} (4.36)	0.74^{***} (3.07)	0.84^{***} (3.46)
$\dot{GDP}_{nt-1}$	0.95^{***} (4.96)	0.99^{***} (5.22)	0.83^{***} (4.51)	0.90^{***} (3.71)
$\dot{FDI}_{t-1}$			0.65^{***} (6.67)	0.37 (0.49)
$\dot{VS}_{t}$			0.25 (0.98)	
$\dot{D}_{t}$			1.81^{***} (7.58)	0.32 (1.05)
$\dot{CTC}_{t}$			-0.13 (-1.35)	-0.14 (-1.05)
$\dot{TA}_{eut}$			-0.35^{*} (-1.84)	
$\dot{TA}_{ct}$				-0.32^{***} (-3.72)
Observations	38	38	38	38
Adjusted R^2	0.69	0.67	0.78	0.73
F-statistic	42.99	40.51	33.15	34.16

Notes: t-statistics in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%.

Interestingly, the result that imports from China are slightly more demand elastic, while exports to China are slightly more supply elastic also holds, even when the other variables are added to models (specification 2). This result might possibly be because the Dutch innovate more than China and thus their exports are more supply driven. Since China is known to be an assembler rather than an innovator, it seems likely that Dutch imports from China are somewhat more demand driven than supply driven. This conclusion however is quite tentative as the difference between the two elasticities is rather small.

The results in specification 2 are also quite similar to ones found in table 3. Models (11a) and (12a) are able to explain 78% of Dutch imports from China and 73% of Dutch exports to China. Also the F statistics still reject the null hypotheses that all coefficients are zero. The elasticities of GDP with respect to import and export also go down somewhat after the full model is estimated, although remaining close to one. The intercept is negative and significant for models (11a) and (12a) and close to the actual quarterly growth of world output. Furthermore, the Wald test still does not produce F-statistics that can reject the null

hypothesis that the coefficients on lagged GDP growth are 1.[43] Also note that export still seems more a little supply driven import seems a little more demand driven.
The effect of Dutch FDI in China becomes stronger when exclusively regarding differentiated goods. Here, an increase in Dutch FDI stocks in China of 1% is estimated to increase Dutch imports from China by 0.65%. The coefficient of the outsourced offshoring proxy though is still insignificant. Also, Dutch FDI stocks in China do not seem to significantly effect Dutch exports to China. The coefficient on this variable furthermore is positive and thus does not seem to imply that Dutch FDIs to China mainly have a horizontal character.

The strong effect of the Dutch distribution function on imports from China also seems to hold and even becomes somewhat stronger. An increase in the Dutch re-export to total trade ratio of 1% leads to an estimated growth of imports from China of 1.81%. This is in accordance with the findings of Mellens *et. al.* (2007) that a large part of Dutch re-exports are computers and other electronic devices (which are classified by Rauch (1999) as differentiated goods).

The coefficient on the proxy for transportation costs has the correct sign, but is not significant at the conventional levels. Thus transportation costs do not seem to have significantly affected Dutch China trade of differentiated goods.

The effect of tariff changes is similar to the results found in table 3. Declines in the tariff rates of China and the EU seem to have a significantly negative effect on trade between the Netherlands and China. The effect of tariff rate declines is again greater for imports from China, than for exports to China.

The fact that these results are similar to the results found in table 3 seems to imply that the trade between China and the Netherlands is dominated by trade in differentiated products. This is notion is confirmed when looking at table E in the Appendix. This table shows that the trade between the Netherlands and China has mainly comprised differentiated products and that the importance of differentiated goods in this trade relation has increased over the past ten years. Namely, the share of differentiated goods in Dutch China trade has increased from 77% in 1996 to 89% in 2006. This is congruent with Nunn's (2006) proposition that countries with good contract environment specialize in industries that rely heavily on relationship specific investments. Nunn shows that the Netherlands has a top 10 position in the world based on the quality of contractual environment, thus it can be expected that the Dutch specialize in goods characterized with high asset specificity.

V.2B *Reference Priced Goods*

The results displayed in the second and third column of table 6 (specification 1) show similar results as in table 3 and 5. The effects of GDP growth on trade growth between the Netherlands and China remain positive, significant and close to unity, while the intercept is also positive and significant in specification 1 and becomes negative in specification 2. In addition, the models still explain a large part of the variation in the data. The third and fourth column of table 6 show that the effect of GDP growth and tariff rate changes is also similar to the results shown in specification 2 of tables 3 and 5.

[43] The F-statistics of the Wald tests are: 1.07 for model (11a) and 1.23 for model (12a).

Table 6: Trade between the Netherlands and China of Reference Priced Goods

	Specification 1		Specification 2	
Independent Variables	Dependent Variable: $\dot{IM}_{rt}$	Dependent Variable: $\dot{EX}_{rt}$	Dependent Variable: $\dot{IM}_{rt}$	Dependent Variable: $\dot{EX}_{rt}$
Constant	0.74*** (4.07)	0.84*** (4.05)	-0.88* (-1.91)	-0.79** (-2.33)
$G\dot{D}P_{ct-1}$	0.94*** (4.71)	0.93*** (3.75)	0.80*** (3.54)	0.92*** (4.22)
$G\dot{D}P_{nt-1}$	0.99*** (3.87)	0.98*** (5.67)	0.87*** (3.97)	0.97*** (5.19)
$F\dot{D}I_{t-1}$			0.42 (1.07)	0.53 (1.17)
$V\dot{S}_t$			0.43** (2.09)	
$\dot{D}_t$			1.03*** (4.08)	0.48 (0.52)
$C\dot{T}C_t$			-0.61** (2.24)	-0.63* (-1.80)
$T\dot{A}_{eut}$			-0.38* (-1.92)	
$T\dot{A}_{ct}$				-0.35*** (-4.72)
Observations	38	38	38	38
Adjusted R^2	0.68	0.66	0.71	0.68
F-statistic	37.67	39.97	30.24	28.95

Notes: t-statistics in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%.

The effect of the Dutch distribution function is still positive and significant for imports, although the effect is weaker than displayed in tables 3 and 5. This indicates that Dutch import of differentiated goods is more sensitive to Dutch distribution activities than import of reference priced goods.

More interesting though, is the result that FDI is no longer found to significantly affect Dutch imports from China. Outsourced offshoring however is found to positively affect these imports with the coefficient on this variable being statistically significant at 5%. This seems to corroborate the view that the decision of firms to internationally fragmentise production via the hierarchy of via the market depends on the transaction costs resulting from the asset specificity of the traded inputs. Thus it seems likely that Dutch firms have tended to offshore production to China via subsidiaries when the traded inputs had a high level of asset specificity, while this offshoring has been via the market in case the concerned products had a medium/low level of asset specificity.

Transport costs furthermore seem to adversely affect imports as well as exports, with this effect being significant at the 5% and 10% level respectively. Note that the coefficients on this variable are also substantially higher than the ones found in tables 3 and 5. This seems consistent with Rauch's (1999) findings that transportation costs matter most for reference priced and homogeneous goods as opposed to differentiated goods.

V.2C *Homogeneous Goods*

The results shown in table 7 further strengthen the results already found in table 6. The average R^2 of the models displayed in table 7 is 0.68, meaning that the models on average can explain 68% of the variation in the data. All F statistics reject (at the 1% level) the null hypothesis that none of the coefficients have explanatory power. The coefficients of the GDP variables are somewhat lower, but still not significantly different from one.[44] The sensitivity of imports with respect to Dutch distribution activities goes down to 0.38, but remains significant at the 5% level. This strengthens the belief that Dutch distribution function mainly matters for differentiated goods and less for homogeneous goods.

The salient result displayed in table 7 is that the coefficient on VS is significant and positive for imports while the coefficient on FDI is not significant. The outsourced offshoring variable even becomes larger (0.51 from 0.43 in table 6) and gains significance from 5% in table 6 to 1% in table 7. In fact, this variable accounts for 28% of the growth in Dutch imports from China of homogeneous goods during the past ten years, which is similar to Yi's (2003) findings that vertical specialization has accounted for around a third of world trade growth.[45] So it seems that Dutch outsourced offshoring has led to growth in imports from China of homogeneous goods, while the growth of Dutch FDI stocks in China does not seem to have had a significant impact on either imports or exports of this type of goods. It is furthermore noteworthy that the coefficient on FDI has consistently been positive in all estimations, which suggests that Dutch FDIs to China do not mainly have a horizontal character. If the latter were the case, it would be expected that the coefficient on FDI would be negative, since direct sales in China via a subsidiary would replace Dutch exports to China.

Note furthermore that the effects of tariffs and transportation costs consistently keep the correct (negative) sign implicating that these variables indeed have an impeding effect on Dutch China trade. It is also interesting to see that the coefficient on the transportation cost variable is greater and more significant than in table 5. This seems to be congruent with the previously stated notion that transportation costs matter most for homogeneous and reference priced goods and less for differentiated goods. As noticed before, the reason behind this is likely to be that reference priced and homogeneous goods are larger in size and thus more sensitive to transportation costs. The coefficients on tariff rate changes furthermore does not seem to differ much from the previous tables, they are namely still negative, significant and larger for Dutch imports from China than for Dutch exports to China.

When assessing the results of this section, the overall conclusion seems to be that Dutch offshoring to China has indeed significantly and positively affected trade growth between these two countries, namely through imports. Dutch firms furthermore seem to have offshored in-house when the concerning goods were asset specific and have offshored via the market when the concerning goods were homogeneous (i.e. not asset specific).

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[44] The Wald F-statistics for models (11c) and (12c) restricting the coefficients of the GDP variables to 1 are 2.17 and 2.03 respectively.

[45] The total logarithmic growth of Dutch imports from China of homogeneous goods was 129.98 during the sample period. The coefficient of variable VS is 0.51, which multiplied by the growth of this variable during the sample period (72.10, see table 4) becomes 36.78. This is 28% of 129.98.

Table 7: Trade between the Netherlands and China of Homogeneous Goods

	Specification 1		Specification 2	
Independent Variables	Dependent Variable: $\dot{IM}_{ht}$	Dependent Variable: $\dot{EX}_{ht}$	Dependent Variable: $\dot{IM}_{ht}$	Dependent Variable: $\dot{EX}_{ht}$
Constant	0.12** (2.51)	0.20*** (3.03)	-0.95* (-1.83)	-0.91** (-2.21)
$\dot{GDP}_{ct-1}$	0.82*** (3.84)	0.85*** (3.74)	0.71*** (3.60)	0.80*** (4.92)
$\dot{GDP}_{nt-1}$	0.87*** (4.03)	0.91*** (4.56)	0.76*** (4.64)	0.88*** (6.01)
$\dot{FDI}_{t-1}$			0.22 (0.76)	0.31 (0.86)
$\dot{VS}_{t}$			0.51*** (3.04)	
$\dot{D}_{t}$			0.38** (2.17)	0.42 (0.62)
$\dot{CTC}_{t}$			-0.70*** (3.24)	-0.72*** (-2.97)
$\dot{TA}_{eut}$			-0.29* (-1.97)	
$\dot{TA}_{ct}$				-0.23*** (-3.88)
Observations	38	38	38	38
Adjusted R^2	0.64	0.64	0.73	0.68
F-statistic	37.56	38.82	37.25	35.56

Notes: t-statistics in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%.

Furthermore, Dutch FDIs to China seem to have a vertical as opposed to horizontal character and thus have been motivated mainly by production efficiency reasons rather than market proximity reasons. Tariffs seem to have been significant impediments to Dutch exports to China as well as to imports from China, although their contribution to the latter is economically modest.

The effect of declining transportation costs seems to have statistically significantly mattered for reference priced and homogeneous goods, but not for differentiated goods. Since transport costs have only declined 7% over the past ten years, their effect is economically not meaningful though. In addition, Dutch and Chinese GDP growth has also been important in explaining trade between these two countries. Overall the elasticity between Dutch and Chinese GDP growth to import and export growth has been close to unity, congruent with theoretical expectations. Furthermore, the increased importance of Dutch re-exports has been found to have a significantly positive effect on growth of Dutch imports from China but not for Dutch exports to China. Finally, the parameters of the estimated models seem to be stable over time and their standard errors are robust against heteroscedasticity and autocorrelation.[46]

[46] See Section 2 in the Appendix for a detailed robustness analysis.

VI. Conclusion

This section summarises the main findings of this research, provides conclusions, discusses policy implications and suggests further research topics.

VI.1 Main Findings

After rural and economic reforms during the late seventies and the eighties, China's economy has increasingly opened up to the rest of the world. Consequently, China's economy and its trade with the rest of the world have risen exceptionally fast. Trade between the Netherlands and China however, has grown even faster for the past ten years (on average 26% per annum). In fact, Dutch China trade on average has grown 5 percentage points faster (annually) than China's trade with the rest of the world and 4 percentage points faster than China's trade with its main partners.

Currently, China is Netherlands' fifth largest trading partner and accounts for approximately 8% of total Dutch imports. These imports mainly comprise goods like computers, telecommunication devices and parts and components of computers and office machinery. The export to China looks different and comprises goods like valves, industrial cooling and heating equipment, non-ferrous base metal waste, and chemicals like hydrocarbons, alcohols and phenols.

The stellar growth in trade between the Netherlands and China naturally evokes questions about its cause and effects. These questions are related to the recent outsourcing and offshoring debate that has been going on in the Netherlands (and indeed in most Western economies). Recently, fear has evoked among some policymakers about the moving of Dutch production activities abroad (offshoring) to countries like China and its effects on for example employment. The paucity of statistically adequate analysis of Dutch offshoring to China however limits policymakers to properly assess the situation. This paper has aimed to add understanding to the affect of Dutch offshoring to China on the trade growth between these two countries. Thus the main question this paper has tried to answer is: *Did Dutch offshoring to China have a significant effect on the trade growth between these two countries over the past ten years?"* Furthermore, this paper has investigated whether Dutch offshoring to China has been through hierarchy or via the market and if this decision has been influenced by the asset specificity of the traded inputs. The paper has in addition tried to quantify the effects of several other commonly accepted determinants of trade on Dutch China trade growth.

With the use of a time series version of the gravity model of trade, several regression analyses were conducted explaining import and export growth between the Netherlands and China as a function of the economic size of these countries, Dutch in-house and outsourced offshoring to China, Dutch re-export activities, transportation costs and Dutch and Chinese tariff rates.

The results indicate that 39% of the import growth between China and the Netherlands can be attributed to the growth of Dutch FDI stock in China, while 34% is attributable to GDP growth (including the negative effect of world GDP growth), 25% is accounted for by Dutch distribution activities and only 3% is attributable to EU tariff rate declines.

On the other hand, Dutch export growth to China can be mainly accounted for by GDP growth (58%), Chinese tariff rate declines (21%) and to a trivial extent by declining transportation costs (1%).

Thus the growth of Dutch FDI in China has had a positive and significant impact on the growth of Dutch imports from China. This implies that Dutch offshoring to China has indeed had a significant affect on Dutch China trade growth. The affect of FDI on exports is also positive (although not significant), so it can furthermore be concluded that the FDI from the Netherlands to China has had a vertical rather than a horizontal character and is thus mainly motivated by cost advantages rather than market proximity. So Dutch firms seem to have moved parts of their production to China and have subsequently been importing intermediate inputs from China. Since the affect of FDI is significant while the affect of outsourced offshoring in insignificant, it seems likely that Dutch offshoring to China has been mainly in-house rather than via the market. The results are furthermore similar to the findings Liu *et.al.*(2001) who also find a positive influence of FDI on trade, but are in contrast with Suyker and De Groot (2006) who state that most Dutch FDIs to China have a horizontal character.

The results also indicate that the elasticity of Dutch and China GDP growth with respect to trade growth is close to unity (thus an increase of Dutch or China GDP of 1% also increases Dutch China trade with 1%) and that the affect of world GDP growth to trade growth is negative. These findings are in accordance with the theoretical expectations of the gravity model and are commonly found in economic literature on trade.

Imports between the Netherlands and China furthermore seems to be most sensitive to the Dutch distribution function, with a rise in the ratio of Dutch re-exports to total exports of 1% leading to a rise of Dutch imports from China by 1.78%. Still, the contribution of the re-export function is not the most important factor explaining the growth in Dutch China trade. The reason is that the share of Dutch distribution activities in total Dutch export has not risen fast enough for the past ten years to explain a large part of Dutch China trade growth. Furthermore, the affect of Dutch re-exports is insignificant in explaining exports to China, which reflects the fact that most Dutch re-exports are to Europe instead of Asia.

The affect of transport costs seems to be statistically insignificant for imports and economically insignificant for exports, although it consistently has the correct (i.e. negative) sign. This seems to be somewhat in accordance with the view of for example Anderson (1999) who states that traditional trade barriers cannot account for the recent growth in world trade.

Tariff rates seem to be significantly negative impediments to Dutch China trade, with their effect on imports being larger than their effect on exports. These elasticities however are much smaller than found by Yi (2003) and thus do not seem to corroborate the notion that trade responses to tariff reductions are very high.

The second part of the analysis has tested whether the decision of Dutch firms to offshore to China in-house or via the market has been significantly influenced by the asset specificity (and thus by the transaction costs resulting from it) of the traded inputs. To do this Dutch imports from and exports to China were separated in three groups according to the classification of Rauch (1999).

These three groups are homogeneous, reference priced and differentiated goods and control for low, medium and high levels of asset specificity respectively. The same independent variables were then regressed on these six dependent variables.

The output of these models indicates that the decision of Dutch firms to offshore production to China in-house or via the market has indeed been affected by the asset specificity of the traded inputs. More specifically, the results show that FDI (representing in-house offshoring) has a positive and significant influence on the imports of differentiated goods while outsourced offshoring has a positive and significant influence on the imports of reference priced and homogeneous goods. The results also indicate that outsourced offshoring can explain 28% of the growth of Dutch imports from China of homogeneous goods. Thus Dutch firms offshore parts of production via subsidiaries (i.e. in-house) when the asset specificity of the concerning goods is high and (internationally) outsource production to an external party (i.e. via market) when the asset specificity of the concerning goods is low.

Dutch trade with China furthermore mainly comprises differentiated goods, which is in accordance with the proposition of Nunn (2006) that countries with good contract environment specialize in goods with high asset specificity. This indeed indicates that the Netherlands seem to have a comparative advantage in "reducing transaction costs" as proposed by for example WRR (2003) and Den Butter (2006). The Netherlands seems to have specialized in goods that are characterized with high transaction costs since they have the comparatively better tools to reduce these transaction costs.

In addition, the results indicate that differentiated goods are more sensitive to increases in Dutch re-export activities than homogeneous and reference priced goods, which reflects the fact that most re-exports comprise differentiated goods.

The controlling for product types also reveals that transport costs seem to be (statistically) significant impediments to Dutch China trade in reference priced and homogeneous goods, while the effect on differentiated goods is insignificant. This is probably because reference priced and homogeneous goods are likely to have larger volumes than differentiated goods and are thus more sensitive to transportation costs. These results are similar to Rauch (1999) who states that transport costs matter more for reference priced and homogeneous goods than for differentiated goods. The affect of tariff rate declines on the other hand does not seem to differ much between differentiated, reference priced and homogeneous goods.

The results displayed in this research are furthermore robust against residual autocorrelation and heteroscedasticity and 75% of the estimated models have stable parameters over time. This does not mean that these results can be extrapolated through time or be extended to different countries without caution though. The trade relation of the Netherlands and China is one between two economically and politically dissimilar countries. This relation is likely to have different dynamics than trade between countries that are similar in these dimensions. Also, the comparative advantages of China and the Netherlands are different than conventional advantages in for example high or low skilled labour intensive goods. China for example is (next to low skilled labour intensive goods) adept in assembly while the Netherlands seems to be strong in reducing transaction costs. Nonetheless, the results strongly indicate that transaction costs matter (especially for trading nations) and are indispensable in understanding trade growth and the governance structures of multinational firms.

VI.2 Policy Implications

The offshoring debate in the Netherlands has been characterised by two views, namely the view that offshoring is significantly affecting the Dutch economy and the view that it is marginal and thus has no substantial effect. This paper finds results that are in accordance with the first view. However, the fear for a massive loss of Dutch employment and a strong detriment to the Dutch competitive position seems unwarranted. Suyker and De Groot (2006) and the CPB (2006) for example note that Chinese export products are more complements than substitutes for Dutch export products and that the Dutch economy has benefited from trade with China *inter alia* through cheaper products (leading to lower inflation). Increased trade with China does however increase Dutch exposure to Chinese inflation. Although Chinese inflation has been low in recent years, an increasing number of economists agree that Chinese inflation could peak in (recent) coming years, which implies upward pressure on Dutch inflation. This effect should be kept in mind when evaluating the pros and cons of the Dutch China trade relationship.

Baeten and Den Butter (2006) furthermore argue that moving abroad parts of actual production, while keeping the coordination and trade function at home can be a good productivity and welfare enhancing strategy for a trading country like the Netherlands. They state that the relative efficiency of the Dutch to reduce transaction costs is an important source of Dutch comparative advantage and thus advocate investments in innovations that improve this efficiency. These so-called trade innovations are not the same as innovations in traditional production (resulting for example from Research and Development (R&D) activities) but are innovations in activities that link the different parts of a production process. This contrasts with the current government focus on R&D as set out in for example the Lisbon Strategy.

Baeten and Den Butter (2006) give some explicit recommendations in this respect. They propose investments in knowledge and infrastructure that reduce transaction costs (which they call trade capital). Government action is needed to promote these investments since trade capital partly has the characteristics of a public good (since it is non-rival and non-excludable).

According to Baeten and Den Butter, government policy in this respect should focus *inter alia* on increasing trust between Dutch and foreign companies[47], a more efficient use of knowledge on international trade and promoting the establishment of multinational enterprise headquarters in the Netherlands. For the first and last measure, the relative quality of Dutch institutions is particularly important. Table F in the Appendix shows that the Dutch institutional quality (although quite high) has deteriorated over the past 10 years compared to its main competitors. Thus the Netherlands is having difficulty keeping its comparative advantage in reducing transaction costs, at least the part of this advantage that is based on relative institutional quality. This is quite troublesome and policy measures should be taken to put the Netherlands in at least the top 5 of countries with the highest institutional quality.

[47] With respect to the Dutch China trade relationship, the trade missions organized by the economic agency EVD to and from China are applauded, since they increase bilateral trust.

VI.3 Further Research

Although the research in this paper is done with care for statistical and theoretical adequacy, there is still scope for further improvement. First of all, the results are difficult to generalize since only trade between the Netherlands and China is discussed. Secondly, the effect of transportation costs could be more accurately measured by specifying different transportation costs per product group since they are likely to differ substantially (the same can be said for tariff rates). Thirdly, the proxy measuring outsourced offshoring could be improved if it would be possible to extract the part of this proxy that represents in-house offshoring. This would give a more accurate estimate of the affect of outsourced offshoring on trade. Fourthly, more detailed data is needed on the trade of intermediate inputs between the Netherlands and China to give a more precise description of Dutch offshoring and outsourcing to and from China. Finally, the amount of data points used in this research is modest (although enough for adequate statistical analysis). Most of the above stated problems were not dealt with because of lacking data.

On a more general level, additional research is needed on the dynamic effect of institutional quality and trust on the trade growth between the Netherlands and China and trade in general. The lack of sufficient time series data on institutions however is a serious impediment to this type of research. This paper thus proposes more effort into detailed and time series oriented data collection of trust and institutional quality indicators.

More research on Dutch re-exports is also needed. To adequately assess the added value of re-exports to the Dutch economy, additional data is needed on the costs of the Dutch distribution function. As noted by the WRR (2003), these costs are crucial in understanding if Dutch focus on re-exports should be increased or resources should be allocated to activities with better cost benefit ratios. However, the costs of re-exports are often neglected in literature, leading to wrong inferences about the economic attractiveness of the Dutch distribution function. Suyker and De Groot (2006) for example note that de margin on re-export is quite low (10%) compared to the margin on domestically produced goods (60%). But the resources used for re-export activities are likely to be modest compared to the resources used for domestic production. Thus the cost benefit ratio of re-exports might be higher than that of domestically produced goods.

In addition, more research is needed on the affect of the Dutch coordination function on productivity growth. Again, the crux here is the availability of data. For example, productivity gains that are achieved by a switch from actual production to the coordination of (globally sourced) production is often not registered in statistics or enters statistics incorrectly as being the sole result of R&D activities (Den Butter, 2006). The alleviation of this problem requires a more sophisticated definition of innovation and thus also a more sophisticated method of data collection on this subject.

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Appendix

1. Data Preparation

The data used in this thesis comes from a variety of sources, table H (end of the Appendix) gives an overview of each variable, its source and the original currency and frequency it was stated in. This section describes the preparation of the data used for the regression analysis.

The time range of the data is the first quarter (Q1) of 1996 to the last quarter (Q4) of 2006, resulting in a maximum of 40 data points per variable, which is well above the minimum 30 data points required for adequate statistical analysis.[48] All variables that are not expressed in Euro are converted to it using the appropriate exchange rate.[49] Table H displays the original currencies of each variable.

The main explanatory variables in this paper are the import and export between the Netherlands and China, which are denoted by IM_t and EX_t respectively and where the subscripts t indicates time. Here, only trade in goods is considered, thus the import and export of services is excluded.

All data are on a quarterly base. The reason for this specific amount of detail is that some of the variables used in the analysis are not available in more detail than on a quarterly base (e.g., GDP data). Hence, all data that was originally more detailed was converted into quarterly figures. Table H displays the original frequency of the data for each variable.

After converting the data to a quarterly frequency, the logarithmic growth rates of the variables are calculated in the conventional way:

$$\dot{X}_t = LN\left(\frac{X_t}{X_{t-4}}\right) * 100 \tag{13}$$

Here, the dot over X represents the logarithmic growth rate of variable X, LN is the natural logarithm, X represents the concerning variable and t represents time, which in this case is expressed in quarters per year. Note that the growth rate is calculated by comparing the same quarter between two sequential years, rather than between two sequential quarters. The reason for this is that it eliminates the seasonal effects that the conversion into quarters makes the data prone to. Gravity model analysis often uses log levels rather than growth rates. Growth rates are used here to mitigate the effect of trend correlation, which the data is likely to suffer from.

The data is corrected for inflation by subtracting the quarterly growth in the Dutch and Chinese Consumer Price Index (CPI) from the growth rate of the appropriate variables. More specifically, for each quarter, Chinese inflation is subtracted from growth in IM_t, GDP_{ct} and

[48] Four data points are lost when calculating growth rates. In addition, two data points are lost because of the lagging of certain variables.

[49] Luckily, all data was available in either USD or EUR. Quarterly USD/EUR exchange rates were extracted from Data Stream and used to convert the data from USD to EUR in each quarter. This admittedly contaminates the data somewhat with exchange rate effects, this is not likely to be a big problem since on average USD has been depreciating only about 0.11% per quarter against EUR during the sample period.

FDI_t, while Dutch inflation is subtracted from growth in EX_t, GDP_{nt} and VS_t. For the other variables (D_t and CTC_t), the inflation correction is not necessary, since these "correct themselves" because they are fractions and the inflation component appears in the nominator as well as the denominator. Tariffs furthermore are not assumed to be affected much by inflation.

It might be argued that in this case an inflation correction is redundant. During the sample period, the average annual inflation in the Netherlands and China has only been 2.27% and 2.89% respectively (which is not likely to affect the results severely). Nevertheless, the inflation free dataset is assumed to give a better representation of the underlying relationships investigated in this paper.

2. Robustness Analysis

Although the results presented section V seem strong and intuitive, they should be interpreted with caution. Since the data has a time series character, part of the strong result could be due to autocorrelation (even after using growth rates instead of log levels). Also, the results might only be representative for a specific time frame (i.e. the parameters of the model might not be stable). This section attempts to mitigate some of these problems to improve the reliability of the previously found results. First the model will be tested for parameter stability and then tests for residual autocorrelation will be run, followed by estimation of the models with heteroscedasticity and autocorrelation robust standard errors.

2.1 Are The Estimated Parameters Stable Over Time?

To test if the estimated coefficients of the models are stable over time a Chow test is used. The Chow procedure is actually just an application of the standard F-test formula. Namely, the Chow test is an F-test to check if the residual sum of squares (RSS) of a model estimated over the entire sample period significantly differs from the sum of the RSSs of two sub periods of the entire sample period (Brooks, 2002). The null hypothesis is that the estimated coefficients are stable over time, while the alternative hypothesis is that they are not. The null hypothesis is rejected if the calculated F-statistic of the Chow test is greater than the critical value of the F-statistic from its distribution under the null hypothesis.[50] To divide the time frame of the sample in two sub periods a break point is required. The most obvious break point would seem to be the quarter in which the September 11 attacks on the US took place in 2001. If the relationships between the dependent and independent variables have changed significantly within the sample period, it seems most likely that they would have changed after 9/11. A look back at figure 1 underlines this. Notice that the growth in trade between the Netherlands and China has been steeper and more volatile before 2001 than after 2001.

Table 8 displays the results of 8 Chow tests applied to the models (11)-(12c). This table clearly shows that most of the F-statistics cannot reject the null hypothesis that the estimated coefficients are stable over time. The null hypotheses is only rejected at the 5% level for the model explaining reference priced goods. This means that 75% (6 out of 8) of the models have stable parameters over time and thus the relationships between the dependent and independent variables of these models have not been altered significantly after the 9/11

[50] The upper 10% critical values of the F-statistic in this case are 1.97 for models (11)-(11c) and 2.01 for models (12)-(12c). The upper 5% critical values are 2.40 for model (11)-(11c) and 2.46 for model (12)-(12c) and the upper 1% critical values are 3.45 for model (11)-(11c) and 3.59 for model (12)-(12c).

attacks on the US. Of course these results may vary after choosing a different break point, but a good theoretical reason for a different break point seems to be absent. The only candidate that comes to mind is the accession of China to the WTO, but that happened on 11-12-2001 (Q4 2001), which is very close to the breakpoint already chosen and is not likely to strongly affect the results of the Chow tests.

Table 8: Chow Breakpoint Tests: 2001:Q1

Dependent Variable (model #)	F-statistic
$\dot{IM}_{ct}$ (11)	1.51
$\dot{EX}_{ct}$ (12)	1.15
$\dot{IM}_{dct}$ (11a)	1.06
$\dot{EX}_{dct}$ (12a)	0.97
$\dot{IM}_{rct}$ (11b)	2.99**
$\dot{EX}_{rct}$ (12b)	2.57**
$\dot{IM}_{hct}$ (11c)	1.32
$\dot{EX}_{hct}$ (12c)	1.25

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%.

2.2 Autocorrelation and Heteroscedasticity

This section tests and if needed corrects the models for residual autocorrelation and heteroscedasticity. If the residuals of the models are serially correlated, heteroscedastic or both, the OLS estimator is still unbiased and consistent, but no longer efficient. The standard errors in such a case can be wrong, leading to over or underestimated t values (Brooks, 2002). To test whether autocorrelation of the residuals is present in the models the Breusch-Godfrey test is used to test for autocorrelation up to 4 lags. This means that this test checks if the residuals are correlated not only to their immediately previous values, but also tests for correlation between the residual and its longer lagged values (for example correlation between ε_t and ε_{t-2}). The null hypothesis of the Breusch-Godfrey test is that there is no residual autocorrelation, while the alternative hypothesis is that there is residual autocorrelation of the first, second, third *or* forth order. To test if the variance of the residuals is constant, White's general test for heteroscedasticity is used. The null hypothesis of this test is that the variance of the error term is constant, while the alternative hypothesis is that the variance of the error term is heteroscedastic of unknown form. Both tests follow a chi-square (χ^2) distribution under the null hypothesis and are thus assessed by evaluating their χ^2 probability. If the χ^2 probability is below 0.05 (5%) the null hypothesis is rejected. Table 9 shows the results of 8 Breusch-Godfrey tests and 8 White tests, testing for autocorrelation and heteroscedasticity respectively.

Table 9 shows that the most of the estimated models do not suffer from residual autocorrelation. For all models except (11c) and (12c), the χ^2 probability is above 0.05 and the null hypothesis of no autocorrelation cannot be rejected. This is as expected since the transformation of the data into logarithmic growth rates was partly to mitigate this problem. Unfortunately though, the residuals of the models do seem to suffer from heteroscedasticity.

For all models except (12), (12a) and (12c), the χ^2 probability is below 0.05 and thus the null hypothesis of homoscedastic residuals is rejected. So only models (12) and (12a) do not seem to suffer from either residual autocorrelation or heteroscedasticity.

Table 9: Residual Tests

Concerning Model	Breusch-Godfrey (χ^2 prob.)	White (χ^2 prob.)
$\dot{IM}_{ct}$ (11)	0.1207	0.0276
$\dot{EX}_{ct}$ (12)	0.0841	0.1125
$\dot{IM}_{dct}$ (11a)	0.1062	0.0179
$\dot{EX}_{dct}$ (12a)	0.0745	0.0938
$\dot{IM}_{rct}$ (11b)	0.3867	0.0000
$\dot{EX}_{rct}$ (12b)	0.1564	0.0182
$\dot{IM}_{hct}$ (11c)	0.0394	0.0453
$\dot{EX}_{hct}$ (12c)	0.0006	0.0912

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%.

To mitigate these problems, models (11)-(12c) are estimated again, using Newey-West heteroscedasticity- and autocorrelation-consistent standard errors.[51] This correction is often used in econometric analysis since it corrects heteroscedasticity as well as autocorrelation (Stock and Watson, 2003). The results are presented in table 10. This table shows that the results are quite robust against correction for residual autocorrelation and heteroscedasticity. Although most of the t statistics of the new output are lower, all the inferences made prior to the correction hold. Note that all GDP coefficients are still significant at 1%, the coefficients on FDI are also still significant at 1% for models (11) and (11a).

The coefficient on VS stays significant in models (11b) and (11c) although the level of significance in the former model decreases from 5% to 10%. The Dutch distribution function stays significant at the 1% level in models (11), (11a) and (11b) while it's significance decreases from 5% to 10% in model (11c). The effect of transportation costs decreases in significance level somewhat in models (12) and (11b), but stays significant at the 1% level in models (11c) and (12c) as in the previous estimations. The inferences made regarding the effect of tariff also do not change much. The coefficients on Chinese tariff changes are found to be significant at 1% in models (12), (12b) and (12c), which is the same as in the previous estimations. The effect of EU tariff rates also stays significant at 10% in models (11b) and (11c), the same as in the previous estimations. Note furthermore that (as theoretically expected) the intercept is consistently negative, significant and close to the average quarterly real growth of world GDP.

[51] Although models (12) and (12a) do not seem to suffer from either autocorrelation of heteroscadasticity, they are still estimated using the Newey-West correction for comparability.

Table 10: Results Including Newey-West Correction

Independent Variables (model #)	Dependent Variables $\dot{IM}_t$ (11)	$\dot{EX}_t$ (12)	$\dot{IM}_{dt}$ (11a)	$\dot{EX}_{dt}$ (12a)	$\dot{IM}_{rt}$ (11b)	$\dot{EX}_{rt}$ (12b)	$\dot{IM}_{ht}$ (11c)	$\dot{EX}_{ht}$ (12c)
Constant	-0.77*	-0.92**	-0.76**	-0.88**	-0.88*	-0.79**	-0.95*	-0.91**
	(-1.96)	(-2.16)	(-2.13)	(-2.27)	(-1.83)	(-2.19)	(-1.73)	(-2.09)
$\dot{GDP}_{ct-1}$	0.71***	0.88***	0.74***	0.84***	0.80***	0.92***	0.71***	0.80***
	(3.97)	(3.90)	(4.45)	(3.11)	(2.98)	(4.01)	(3.29)	(4.81)
$\dot{GDP}_{nt-1}$	0.81***	0.91***	0.83***	0.90***	0.87***	0.97***	0.76***	0.88***
	(2.75)	(3.99)	(2.94)	(3.03)	(3.09)	(4.77)	(4.28)	(5.05)
$\dot{FDI}_{t-1}$	0.60***	0.23	0.65***	0.37	0.42	0.53	0.22	0.31
	(3.27)	(0.83)	(5.23)	(0.56)	(0.87)	(1.05)	(0.63)	(0.73)
$\dot{VS}_t$	0.33		0.25		0.43*		0.51***	
	(1.14)		(0.83)		(1.96)		(2.97)	
$\dot{D}_t$	1.78***	0.28	1.81***	0.32	1.03***	0.48	0.38*	0.42
	(5.98)	(0.92)	(5.82)	(1.25)	(3.96)	(0.37)	(1.93)	(0.62)
$\dot{CTC}_t$	-0.14	-0.24*	-0.13	-0.14	-0.61*	-0.63*	-0.70***	-0.72***
	(-0.97)	(-1.89)	(-1.21)	(-1.15)	(2.01)	(-1.71)	(3.29)	(-3.02)
$\dot{TA}_{eut}$	-0.33*		-0.35*		-0.38*		-0.29*	
	(-1.70)		(-1.79)		(-1.78)		(-1.74)	
$\dot{TA}_{ct}$		-0.29***		-0.32**		-0.35***		-0.23***
		(-3.31)		(-3.57)		(-4.50)		(-3.19)
Observations	38	38	38	38	38	38	38	38
Adjusted R^2	0.77	0.71	0.78	0.73	0.71	0.68	0.73	0.68
F-statistic	29.02	31.27	33.15	34.16	30.24	28.95	37.25	35.56

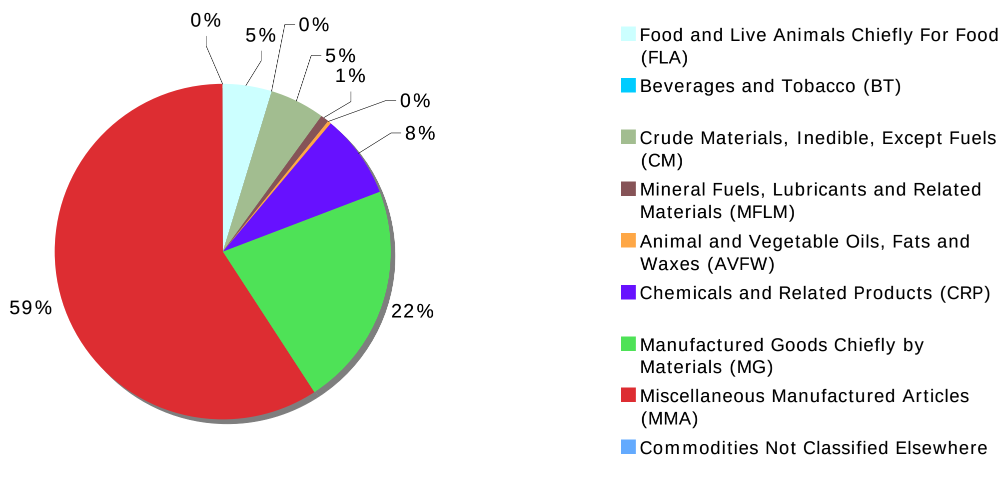
Notes: t-statistics in parentheses; * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A: Top 10 Dutch MTE Imports from China

1996			2006		
Goods (SITC code)	**Rank**	**% of MTE**	**Goods (SITC code)**	**Rank**	**% of MTE**
Electrical Machinery and Apparatus, n.e.s. (778)	1	32.36	Automatic Data Processing Machines and Units Thereof (752)	1	32.95
Automatic Data Processing Machines and Units Thereof (752)	2	19.64	Telecommunications Equipment n.e.s. (764)	2	23.25
Household Type Electrical and Non-Electrical Equipment, n.e.s. (775)	3	9.77	Parts and Accessories of 751 and 752 (759)	3	19.79
Telecommunications Equipment n.e.s. (764)	4	7.15	Sound/Video Recording or Reproducing Apparatus (763)	4	6.89
Parts and Accessories of 751 and 752 (759)	5	6.79	Valves, Tubes and Similar Semiconductor Devices (776)	5	3.01
Office Machines (751)	6	5.61	Electrical Machinery and Apparatus, n.e.s. (778)	6	2.99
Pumps, Air/Gas Compressors and Fans (743)	7	2.96	Office Machines (751)	7	2.23
Sound/Video Recording or Reproducing Apparatus (763)	8	1.94	Household Type Electrical and Non-Electrical Equipment, n.e.s. (775)	8	1.93
Electric Power Machinery (771)	9	1.91	Electric Power Machinery (771)	9	1.14
Valves, Tubes and Similar Semiconductor Devices (776)	10	1.80	Electrical Circuit Equipment (772)	10	1.08

Notes: n.e.s. (not elsewhere specified), source: CBS Statline

Figure B: Dutch Imports from China 2006 Excl. MTE



Source: CBS Statline

Table C: Top 10 Dutch MTE Exports to China 2006

Goods (SITC code)	Rank	% of MTE
Machinery and Equipment Specialized for Particular Industries (728)	1	10.58
Valves, Tubes and Similar Semiconductor Devices (776)	2	9.73
Heating and Cooling Equipment (741)	3	6.75
Parts and Accessories of 751 and 752 (759)	4	6.21
Pumps for Liquids and Liquid Elevators (742)	5	5.94
Electrodiagnostic Apparatus for Medical Purposes (774)	6	5.43
Electrical Circuit Equipment (772)	7	5.32
Automatic Data Processing Machines and Units Thereof (752)	8	4.63
Electrical Machinery and Apparatus, n.e.s. (778)	9	4.38
Pumps, Air/Gas Compressors and Fans (743)	10	4.19

Source: CBS Statline

Table D: Product Type Composition of Dutch China Trade 2006

	Percentage Share	
Product Type	Import	Export
Differentiated Goods	90%	53%
Reference Priced and Homogeneous Goods	10%	47%

Source: CBS Statline

Table E: Change in Product Type Composition of Dutch China Trade

	Percentage Share of total Trade	
Product Type	1996	2006
Differentiated Goods	77%	89%
Reference Priced and Homogeneous Goods	23%	11%

Source: CBS Statline

Table F: Dutch Ranking on World Bank Governance Indicators

	Rank in 1998	Rank in 2005
Voice and Accountability	9	4
Political Stability	2	59
Government Effectiveness	2	7
Regulatory Quality	6	8
Rule of Law	7	13
Control of Corruption	8	10

Note: Data taken from Kaufmann *et. al.* (2006), www.worldbank.org/wbi/governance

Table G: Dutch Imports from China

Independent Variables	**Dependent Variable:** $\dot{IM}_t$
Constant	-0.78**
	(-2.21)
$G\dot{D}P_{ct-1}$	0.73***
	(3.13)
$G\dot{D}P_{nt-1}$	0.80***
	(3.07)
$F\dot{D}I_t$	0.56***
	(3.39)
$V\dot{S}_t$	0.32
	(1.25)
$\dot{D}_t$	1.75***
	(5.52)
$C\dot{T}C_t$	-0.16
	(-1.14)
$T\dot{A}_{eut}$	-0.31*
	(-1.79)
Observations	38
Adjusted R^2	0.76
F-statistic	27.06

Notes: t-statistics in parentheses; *,** and *** represent significance at 10%, 5% and 1% respectively.

Table H: Data Sources

Variable	**Source**	**Original Currency**	**Original Frequency**
Dutch FDI Stocks in China, *FDI*	Bloomberg (the data was gathered from a Bloomberg terminal situated at SNS Securities)	Euro	Quarterly
Dutch Exports to China (detail level: 3 digit SITC), *EX*	CBS Statline www.statline.nl	Euro	Monthly
Dutch Imports from China (detail level: 3 digit SITC), *IM*		Euro	Monthly
Total Dutch Exports, *TEX*		Euro	Monthly
Total Dutch Imports, *TIM*		Euro	Monthly

Table H: Data Sources

Variable	Source	Original Currency	Original Frequency
Dutch Imported Intermediate Goods, *IIG*	CBS, the data represents yet unreleased CBS estimates, obtained via Jan van Laanen at CBS, email jvlnn@cbs.nl	Euro	Quarterly
Dutch Intermediary Input, *I*		Euro	Quarterly
Dutch Output, *VA*		Euro	Quarterly
Dutch Re-Exports, *RE*		Euro	Quarterly
Chinese CPI	China Statistical Yearbook 2006 (CD ROM)	Not Applicable	Quarterly
Chinese Export Quantities to the Netherlands (in 100 kg), Q_{ct}		Not Applicable	Monthly
Chinese Exports to the Netherlands, EX_{ct}		USD	Monthly
China GDP, GDP_c		USD	Quarterly
Dutch CPI	Eurostat www.epp.eurostat.ec.europa.eu	Not Applicable	Monthly
Dutch GDP, GDP_n		Euro	Quarterly
Dutch Import Quantities from China (in 100 kg), Q_{nt}		Not Applicable	Monthly
EUR/USD Exchange Rate	Thomson Financial Datastream	Not Applicable	Quarterly
Chinese Average Import Tariffs, *TA*	UNCTAD (www.unctad.org), the data is based on quarterly estimates used for calculating the annual figures in the UNCTAD Handbook of Statistics and was obtained from an associate at UNCTAD, email handbook@unctad.org	Not Applicable	Quarterly
EU Average Import Tariffs, TA_{eu}		Not Applicable	Quarterly