The Gravity of Liberation

- An analysis of Hong Kong’s trade flows

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Abstract

June 1 1997. After 155 years under British rule, Hong Kong was reunited with its ancient roots, China. The administrative power shifted. What happened then? In this paper we analyze how Hong Kong’s trade flows changed after the liberation. We conduct our analysis with main focus on the trade predicting factors of Gravity, Institutional quality and Hong Kong’s relationship to China. We have found that trade flows did not significantly change much, however, Hong Kong’s attitude towards its trade partners’ institutional quality seem to have. Further, Hong Kong seem to have embraced the reunification with China and is now more dependent of its new ruler, in terms of trade, than before.

Key words; Hong Kong, China, Trade, Gravity, Institutions, Contract Intensity
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1. Introduction

June 1, 1997, Hong Kong was liberated from its colonizer Great Britain and reunited with China after 155 years under Britain rule. The administrative power of Hong Kong was thereby transferred from London to Beijing and Hong Kong’s time as a British crone colony came to an end (Larsson, 1997). With a new ruler many things must have change, but what? In one point of view one can think of the liberation as a power change from one culture to another. Further, in an economic point of view one wonders what implications this had on economic policies and patterns. A new ruler, with a different culture, and a different way of ruling must have implications on economic matters. As Hong Kong became liberated it lost a part of its national connection to Great Britain and gained a closer one to China. Hong Kong has for long figured as a “door to China” and a big share of Chinese exports has gone through the country (Larsson, 1997). As bilateral ties with China was enlarged due to the liberation, we can expect a change in trade flow patterns due to even more Chinese trade shipped through Hong Kong and an increased trade with China, which is the Hong Kong’s largest trading partner (Feenstra and Hanson, 2000).

There are multiple matters to investigate regarding the liberation of Hong Kong, however in this paper we will focus on trade.

Trade is a rather general term in economics and contains multiple sub components. In this paper we are specifically interested in the choice, made by Hong Kong, with whom it decides to trade with. To do this we will investigate Hong Kong’s trade flows, both imports and exports with the use of the Gravity model of trade. The Gravity model is a common tool economist’s use while investigating trade and it predicts the volume of traded goods between two countries based on their economic sizes and the distance between them. One assumption that needs to hold for the Gravity model to predict properly is the assumption of free trade.
One can, from estimated Gravity model results, see how free a country is trading. If Gravity does not predict trade correctly, one can assume that other factors initiates trade than the main components of the Gravity model.

Hence, we will start off with investigating the gravity model’s prediction of trade flows, both on a general, aggregated, level and on industry level, and compare results from before the liberation with the corresponding results after the liberation. In this way, we can identify changes. Further, as the liberation transferred the administrative power of Hong Kong to China, we are motivated to investigate the china specific factors of the Gravity model as well.

Another interesting fact about the liberation is that Great Britain relative to China has more developed institutions. This can be concluded by comparing the indexed ranking in institutional quality of the two different rulers of Hong Kong in the year of 1995, which is the earliest year in our investigation, and 2010, which is the latest year in our investigation. The index is constructed by the Economic Freedom Network (Economic Freedom Network, 2016) and is a summation of various institutional parameters. Further, the index ranges from 0, with is the lowest level of institutional quality, to 10, which is the highest. China had the score 5,07 in 1995 and 6,26 in 2010. Great Britain had the score 8,21 in 1995 and 7,8 in 2010. Hence, the liberation initiated a downgrade in terms of the Hong Kong ruler’s institutional quality.

Further, many times has the relationship between trade and good institutions been proven positive (North, 1990). We are therefore interested in analyzing how Hong Kong’s choice of trade partner based on trade partner’s institutional quality has changed. Is Hong Kong after the liberation downgrading its preferences on partners’ institutions or are the preferences unchanged?

To summarize, in this paper, we will analyze Hong Kong’s gravity model of trade first on an aggregated trade flow level and later on industry level. Later, we will include Hong Kong’s institutional preferences. All these investigations will include a separate China-parameter to
identify Hong Kong’s new relationship to China. All for the purpose of observing the liberation had on Hong Kong’s trade.

Hence, our problem is; as Hong Kong was liberated, did its Trade, specifically Trade in different industries, become more dependent on the factors of the gravity model? Did Hong Kong also reduce its preferences on trade partners’ institutional quality? Also, did Hong Kong became more dependent on Chinese factors in all the above matters?

To answer these three questions we will start off with a simple estimation of the Gravity model where we estimate whether Hong Kong’s import and export trade flow gravity prediction changed. Second, we will estimate the gravity model on different industries, with a separate China specific gravity interaction variable, in order to investigate changes on industry level before and after the liberation. Third, we will investigate whether Hong Kong changed its preferences in trade partners’ institutions by including institutional variables in the gravity equation. Fourthly, we will estimate the “China effect” in the institutional model’s variables by including China specific interaction variables.

2. Hong Kong; a brief background

20 January 1841, Hong Kong, a Chinese archipelago mainly inhabited by fishers and smugglers, was occupied by the British Empire during the first opium war against the Chinese Qing Empire. On 29 August 1842 the war ended with the Treaty of Nanjing, which included an obligation that China approved the island of Hong Kong as a crown colony of Great Britain. Further conflicts escalated into the second opium war, which resulted in peace in 1860 with the signing of the Convention of Beijing. One of the paragraphs in the convention included that the peninsula of Kowloon also became a part of the Crown colony. In 1898 the Qing dynasty agreed to a 99-year lease to Great Britain of the Lantau Island and another
around small 200 islands around Hong Kong. After 1898, the full area we today call Hong Kong was included into the Crown colony. (Yui-Sang Tsang, 2007)

In the late 1970’s, the question of transferring the sovereignty of Hong Kong from Britain to China was raised. It concluded in the Sino-British Joint Declaration in 1984 and included that Hong Kong should be handed over to China 1 30 June 1997. The Declaration included among other things that Hong Kong would remain independent as a Special Administrative Region, keep its free market model and represent itself in international organizations. (Yui-Sang Tsang, 2007)

Hong Kong remained a Colony for 155 years. During the years of colonization, Hong Kong grew from being an Island of only 5000 inhabitants to becoming the world’s 8th largest trade nation, 8th largest stock market, 5th largest banking center and one of the world’s busiest ports (Larsson, 1997).

Many argue that this astonishing achievement is due to Hong Kong’s laissez-faire approach to economic policies with low taxes, low customs duties, free trade, free capital movements and a fairly liberal immigration policy. Many wondered how Hong Kong could ever be able to be ruled by China again, a country with a considered completely different approach to economic policies. Over the years, Hong Kong has been considered the “door to China”, meaning that many goods and services targeted to the mainland Chinese market was traded via Hong Kong (Larsson, 1997). Would Hong Kong’s role as a door to China strengthen with the liberation? Would the closer ties to the Chinese communist party have a bad influence on Hong Kong’s laissez-faire-concept? These where some of the big questions before the liberation. How did it end up? We are in this paper about to investigate some of the details.
3. Literature Review

In this section I will lead the reader through some previous research published on the field of Hong Kong, the Gravity model and Institutions in trade, separately. The objective of this section is to give the reader important knowledge of the different components this research paper will discuss before further reading.

3.1 Hong Kong and its relation to China

Feenstra and Hanson conducted a study in 2000 about the re-exports of Chinese goods in Hong Kong. They found that China exports goods to Hong Kong and that Hong Kong later exports them again. The markup for differentiated goods, goods with a large variance in export prices, products sent to China for processing and exports to countries with less direct trade with China are higher, net customs, insurance and freight charges. Further, they acknowledge that Hong Kong acts as an Entrepôt economy, a match maker between buyers and sellers. One can from these conclusions identify Hong Kong’s role as the “door to China” and that Hong Kong via its neutrality has performed profitable business (Feenstra and Hanson, 2000). These evidences strengthens our motivation to investigate Hong Kong’s relation to China in our research, to identify if the boundary between the two countries has strengthened with the liberation.

3.2 The Gravity Model

The most important contribution on the gravity model was made by Jan Tinberger in 1962 where he concluded that the Gravity equation in physics also could be used in economics in order to predict trade between two countries (Tinberger, 1962). The specifics of this model will be presented in the theory section of this paper. The gravity model has been estimated on many cases by many researchers over the years. It has also been proven to describe reality fairly well. However, Feenstra, Markusen and Rose (2001) raised a few objections on the
model and argued that it lacked some important factors in order to predict trade completely. One can elaborate around their reasoning without naming what objections they had by argue that all factors that predicts trade except the main factors of the model is included in the estimated error term. Hence, we will in this research investigate the quality of institutions’ impact on Hong Kong’s trade flows, i.e. lift these issues out of the error term.

3.3 Institutions and Trade

Institutions is explained by North (1990) in his book “Institutions, Institutional change and Economic Performance” as follows; “The major role of institutions in a society is to reduce uncertainty by establishing a stable (but not necessary efficient) structure to human interaction”. He argues that institutions reduces the amount of uncertainty in an economy. Hence, better institution lays the ground of the playing field between two agents. The first agent knows at a higher level of certainty what the second agent will do. This initiates more business. And, as we will see in our next example, more trade.

Feenstra, Hong, Ma and Spencer (2012) examined export patterns of different provinces in China with different standards of institutional quality. Their estimations showed that institutional quality was a significant estimator of the export volume. Provinces with better institutional quality had greater export volumes compared to provinces with less good institutional quality. Industries that require better contract enforceability where specifically attracted to provinces with better institutions. Further, Nathan Nunn (2007) investigated whether a good ability to enforce contracts is a source of comparative advantages. In his research he found that countries with good contract enforcement attracts industries where relationship specific investments are important. These industries are viewed as contract intense. He further proves in his estimations that good contract enforceability is a better predictor of trade than both the two classical predictors of trade; capital endowments and skilled labor. Hence, better contract environment should imply more trade, especially in
industries that are contract intense. This strengthens the conclusions related to institutional quality; good institutional quality in a country is a foundation for trade in differentiated products that requires good contract enforceability (Feenstra, Hong, Ma and Spencer, 2012). Hence, greater trade volume in highly contract intense industries should be observed from countries with better institutional quality.

4. Theoretical Background

In this segment, an introduction on the theoretical and empirical models used in this paper is presented. There will also be a discussion on which estimation model that is best suited for this kind of research.

4.1 The Gravity model of trade

The main tool used in this investigation is the Gravity Model of trade. The Gravity Model of trade origin from Newton’s law of gravity - in the field of physics - where it illustrates gravity between two physical objects. In 1962 the Physicist and Economist Jan Tinbergen combined his knowledge of physics with his knowledge of economics and modified Newton’s gravity model by exchanging gravity to trade and mass to economic mass, commonly measured by GDP. Jan Tinbergen concluded that the gravity model of trade should be constructed as the following equation;

\[
\text{trade}_{o,d,t} = G \times \frac{\text{GDP}_o}{\text{Distance}_{o,d}} \times \frac{\text{GDP}_d}{\text{Distance}_{o,d}}
\]

Where \text{trade} is the flow of trade from the country origin, \(o\), to the destination country, \(d\), at the specific time, \(t\). \(\text{GDP}\) measures the gross national product of the countries and \(\text{Distance}\) measures the distance between the two countries. \(G\) is a constant of gravity, measuring frictions of trade such as institutions and other trade affecting factors (Baldwin and Taglioni, 2006). As we can observe, according to Tinbergen, the amount of trade between the two
countries is a function of frictions in trade, $G$, gross national products and the distance between the two countries. Assuming free trade, no frictions; the larger the GDP obtained by the two countries and the smaller the distance between them, the more they will trade.

(Feenstra, Markusen and Rose, 2001)

The Gravity Model has been one of the most successful empirical models in economics (Anderson, 2011). However, it was not brought up in general economic textbooks until 2004 (Feenstra, 2004). On one hand, it is an established model that is generally considered a good estimator of trade. On the other hand it is a new model that is not introduced to economics students until later in their academic careers, even though its’ concept is rather simple (Anderson, 2011). With this in mind, one can conclude that the Gravity model is an old friend that has not gained recognition until recently. Many economist have used the model in their research, but for young economists studying for their bachelor’s degree; it is generally unknown. This may be due to the Models’ clarification problems in empirical estimations. General OLS-estimations of the model suffers from a variety of draw backs, which will be discussed later.

To conclude, the Gravity Model can be considered a good estimator of how a country would choose its trade partners if it was free to do so. Since the Gravity Model assumes free trade (Feenstra, Markusen and Rose, 2001), one can assume that a country’s trade flow that does not follow the gravity model is an indication that there are factors outside the main variables of gravity model that intervenes, frictions to trade, such as common cultures, common languages, common preferences, institutional quality and so forth. Hence, if trade flows are not predicted by the main gravity variables, one should look for other possible explaining factors in the estimated error term (Mátyás, 1998).
4.2 Empirical estimations of the Gravity Model

As mentioned earlier, the gravity model has been estimated empirically by many researchers since the theory was brought to light (Anderson, 2011). However, which way to estimate it has been an active debate. Santos Silva and Tenreyro (2006) breaks down the debate and estimates the gravity model in a “monte carlo”, randomized observations, example. Until this day it is generally considered that their proposed empirical model is the best estimator of Gravity models. Their arguments are summarized briefly below, curious readers are suggested to read their paper for even more details.

The most common way to estimate the gravity model has been to estimate through an ordinary least square, OLS, model in its linear-logarithmic form;

\[
\text{Ln(Trade}_{o,d}) = \text{Ln(}\alpha + \beta \text{Ln(GDP}_{o}) + \gamma \text{Ln(GDP}_{d}) + \delta \text{Ln(Distance}_{o,d}) + \varepsilon_{o,d}
\]

Where “Ln” stands for the natural logarithm of the function and \(\varepsilon\) is the error term, capturing the aspects of the dependent variable that is not described by the independent variables. By using natural logarithms the researcher attempt to easily interpret the results’ estimated coefficients as the relative contribution, or elasticity, the independent variable contribute with to the dependent variable (Santos Silva and Tenreyro, 2006). However, the use of OLS-estimations in log-linearized Gravity models has been dismissed by Santos Silva and Tenreyro. The first argument dismissing OLS-estimations of log-linearized gravity models is that it excludes zeros when the dependent variable’s data, its trade data, is converted to its logarithmic values. The intuition behind this issue can be derived by simple calculus; the natural logarithm of 1 equals 0 since e to the power of 0 is 1. Hence, e to the power of an unknown, x, should be 0, which cannot occur (Böiers and Person, 2010). By estimating the natural logarithm of a variable that contains zero-values is skewing the estimates if zero is
supposed to be zero. This is a problem since zero trade volumes do exist and they should definitely be accounted for if the estimated results are subjected to reflect reality.

Santos Silva and Tenreyro further question the interpretation of log-linearized models estimated by OLS to be viewed as elasticities, as described above, due to Jensen’s inequality; the expected value of the logarithm of a random variable is different from the logarithm of its expected value. They formulate the issue as follows;

“The basic problem is that log-linearization (or, indeed, any nonlinear transformation) of the empirical model in the presence of heteroskedasticity leads to inconsistent estimates. This is because the expected value of the logarithm of a random variable depends on higher-order moments of its distribution. Therefore, if the errors are heteroskedastic, the transformed errors will be generally correlated with the covariates.” - Santos Silva and Tenreyro (2006)

Hence, a serious bias occurs when the researcher can observe unequal variance in the error term, i.e. heteroscedasticity. Since data usually used in Gravity estimations often suffers from heteroscedasticity, OLS estimations of log-linearized gravity models becomes highly questionable. Hence, Santos Silva and Tenreyro argue that estimated elasticities obtained from log-linearized models via OLS under heteroscedasticity can be misleading and incorrect.

4.3 The Poisson Pseudo-Maximum-Likelihood Estimator

Santos Silva and Tenreyro (2006) tests and compares different empirical approaches to the log-linearized Gravity model in their paper “The Log of Gravity”. They conclude that the Poisson Pseudo-Maximum-Likelihood, PPML-estimator, yields the best results. The four main arguments for this stand are;

1. PPML treats the dependent variable as count data. Hence, no logarithmic trade variable, which rids the problem of excluded zeros.
2. PPML is robust against heteroscedasticity which rids the problem of misleading results in log-linearized estimates.
3. PPML does not require Poisson distribution.
4. PPML can handle over and under dispersion.

For more specific details I recommend the reader to read Santos Silva and Tenreyro’s paper. Hence, Santos Silva and Tenreyro conclude that PPML estimations lacks the drawbacks of log-linearized OLS estimations. Further, the estimations of PPML can be interpreted as elasticities since the independent variables are log-linearized. As mentioned above, the dependent variable is treated as count data, so a gravity estimation using PPML should have the following design:

\[ Trade_{o,d} = \ln(\alpha) + \beta \ln(GDP_o) + \gamma \ln(GDP_d) + \delta \ln(Distance_{o,d}) + \epsilon_{o,d} \]

Hence, for the purpose of estimating Gravity models, the PPML-model is the best choice. Mainly because that it estimates its results the way log-linearized OLS estimations intend to, but lacks the drawbacks of it. I am therefore convinced that PPML fits our purpose best and it will be used throughout the estimations in our research.

4.4 Institutions and Trade

Good institutions are considered important determinants of long lasting trade relationships (Kokko, Söderlund and Tingvall, 2014). Two fields of institutions argued to have direct implications on trade is property rights (Hart and Moore, 1990) and transaction cost economics (Williamsson, 1985). Property rights is argued to direct determinate trade and transaction cost economics is argued to affect trade via different enforcement-levels of contracts (Kokko, Söderlund and Tingvall, 2014). Kokko, Söderund and Tingvall further explains the necessity of Contract enforcement as “… a particularly severe challenge for international trade, where enforcement possibilities are weaker because the parties are located
in different countries with different jurisdictions”. Hence, good contract enforceability is an important factor that determinates trade in order to reduce risks related to initial investments. Further, Nunn (2007) argues that the level of contract enforceability is more important in industries that requires relationship specific investments, which is often related to more complex products such as high tech goods.

We will in this research make use of a general index of institutional quality and an index of contract intensity needed for different industries, both described under “variables”, in order to investigate the possible changes in institutional quality among different industries as a determination of Hong Kong’s trade.

5. Data and Models

In this section I am about to describe the data used in our model estimation. I will also describe the different models in order to give the reader good background knowledge of how and why we conduct our estimations.

5.1 Dataset

The panel dataset used in this paper contains data from three different sources; UNCTAD, Quality of institutions and Nunn. It includes bilateral trade data from 226 different countries between the years of 1995 to 2010. The time span is carefully chosen to include years before and after the liberation of Hong Kong in 1997. To investigate two years before the liberation is considered a good starting point under the assumption that the pre-liberation economic setting is well established. These two years are included in our data subjected to be compared with the after-liberation period which ranges from 1998 to 2010. The after-liberation time span is substantially larger compared to the pre-liberation time span. This is because of that our interest in this paper lays with how the trade patterns of Hong Kong changed after the liberation, hence we need to use as much data as we can receive on this specific period.
Further, the dataset includes data on trade flows from 11 different industry technology levels, which we have assembled into 3 different major required technology-industry levels; low-level-technology, mid-level technology and high-level-technology. The dataset also includes variables with institutional data on all the included countries and contract intensity rankings on all industry technology levels.

5.2 Data sources

The dataset used for our estimation is a combined dataset assembled from three different sources. These three sources are described below.

*United Nations Conference on Trade and Development Statistics*, or UNCTADStat, is a department of the United Nations that collects data from almost all economies in the world and assembles it. They have made it open to the public to use in any research from their website. UNCTADStat contributes with data on trade flow volumes, both on country and industry level, and GDP to our research. (UNCTADStat, 2016)

*Economic freedom of the world* – Every year the Economic freedom network releases a report that discusses trends in institutional variables. This is subjected to promote transparency and democracy by monitoring trends and key index-numbers in different institutional matters assembled on country level. The data used for these reports are released together with the reports so that anybody can use it. From this data source we have collected our institutional data to our dataset. (Economic Freedom Network, 2016)

*Nunn’s index of Contract Intensity* – Nathan Nunn is in his article “Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade” (2007) investigating the variation of contract enforcement among different industry groups subjected to see if higher contact intensity-levels imply comparative advantages in trade. To accomplish this, Nunn created an index that
measures contract enforcement on industry level. Nunn later concluded in his study that countries with a high ability to enforce contracts specialize in production that requires relationship specific investments. The index is included in the dataset of this paper as a variable named “Nunn-index” and is described below under “Variables”.

5.3 Variables

5.3.1 Dependent variables

The dependent variables in our investigation is chosen based on the theory of gravity. Hence, trade flow is our dependent variable. Trade flow is the bilateral trade volume in goods, services not included, between the country of origin and the destination country and is in our data measured in thousands of 2005 US dollars. However, depending on the purpose of the model, there will be a difference in how trade flow volume is categorized. In the simpler first models, total trade volume serves as the correct measurement, denoted as “Total trade”. In later models, total trade in various tech-level-industries will serve as a better measurement, denoted as “Trade in industry”. What categorization that is used in the different model will be described together with the corresponding models later. The bilateral trade volume variables covers the years 1995 to 2010.

5.3.2 Independent variables

The first main independent variables are two GDP-variables measuring the gross domestic product in the importing country and the exporting country. Both these variables will be included in all models subjected to measure “economic mass” in the gravity of trade. These gross domestic product-variables will be denoted \(Y_o\) and \(Y_d\), where “d” denotes country of origin and “d” denotes destination country and “Y” denotes GDP. GDP is in our data measured in thousands of 2005 dollars, hence constant prices. According to the theory of the gravity model, larger economic mass implies larger amount of trade. Hence, we expect these
variables to display statistically significant positive coefficients. These two variables will also be in a natural logarithmic shape so that the coefficients can be interpreted as elasticities.

In later models, a measurement for institutional quality will be included among the independent variables. In this analysis we have chosen a general measurement of institutional quality subjected to capture a general view of the institutional situation in every country included in the models. Economic Freedom Summary Index, denoted “EFSI”, is such variable. EFSI summarizes the institutional quality and gives every country an average score every year based on multiple contributing factors related to institutional quality. The EFSI score ranges from 1 to 10 where 10 is the best score, indicating the best possible institutional quality. EFSI is present in the year of 1995, and 2000 to 2010.

The Nunn index will also be included among our independent variables in some models. The Nunn-index, denoted “Nunn”, measures Contract intensity among industries and is created by Nathan Nunn (2007). We are motivated to use this in order to investigate what kind of institutional characteristics Hong Kong prefer in trade partners in different industries with different level of contract intensity and if these preferences changed after the liberation. The Nunn index ranges from 0 to 1 where 1 is the most contract intense score an industry can receive. The Nunn index is ordered to the corresponding tech-level-industry in our dataset and is assumed to be time independent. Good contract intensity is considered to be more important in industries that requires more relationship specific investments, such as high tech industries, and will determine the trade volume in these since it makes it easier to trade partners to make sure that contracts are being obeyed, it can be considered a guarantee that goods ordered will be delivered and reduce the amount of unpleasant surprises in business. Hence, this variable is expected to show significant positive coefficients the higher the technology level is in the investigated industry.
5.3.3 Dummy variables

The models in this thesis contain multiple dummy variables in order to separate the objectives of every model. First of all we have created a time dummy that indicates whether the model is investigating the time before the liberation, which corresponds to the years of 1995 to 1996, or after the liberation, which corresponds to the years of 1998 to 2010. In the model descriptions this model will be denoted as “L_b,a” where “L” denotes “liberation”, “b” denotes “before” and “a” denotes a “after”. In the estimated results this will be indicated as a notion in the model name.

In order to make more specific investigations we have to make a distinction between Hong Kong’s exports and imports. To accomplish this a second dummy variable is created denoted “W_x,m” where “W” shall be pronounced “way”, indicating which way the trade flow is heading, where “x” corresponds to “exports” which includes solely trade from Hong Kong to the destination country and where “m” corresponds to “imports” which includes solely trade from the country of origin to Hong Kong. In the estimated results this will be indicated as a notion in the model name.

Since the liberation shifted the administrative power of Hong Kong from Great Britain to China we are motivated to isolate Hong Kong’s trade with China and compare it to Hong Kong’s trade with all other countries excluding China. Therefore we have created one more dummy variable subjected to be building stones included in specific interaction variables. The dummy variable is called “China”, denoted “C”, and as it goes from 0 to 1 it excludes all other countries but China alone. With the help of this variable we are able to investigate whether the effect of the Chinese GDP and Institutions alone have any specific effect on Hong Kong’s trade flow.
Many economists argue that the use of dummies to control for fixed effects is crucial for reducing the possibility of obtaining skewed results origin in either undesired country specific characteristics or time specific characteristics (Gujarati, 2011). We are therefore motivated to include three different kinds of fixed effect dummies to our framework. The first one is time dummies; we create a dummy for every year investigated in the model subjected to reduce yearly fixed effects. Secondly, we include specific dummies for every country included in the estimation subjected to reduce country fixed effects. Since we intend to investigate both import trade flows and export trade flows separately, we create both importer country specific dummies and exporter specific dummies. In the result tables we will include a row each for every fixed effect used and later denote it with “Yes” or “No” under each model whether the specific fixed effect is controlled for or not.

5.4 Empirical Models

In this section all models investigated in this research will be presented and explained subjected to give the reader all substantial knowledge of how the models are constructed, motivated and what purpose they serve with our objective in mind. Due to the convincing results estimated by Santos Silva and Tenreyro (2006), all models will be estimated by PPML, and are therefore design to fit the properties of that estimator.

5.4.1 Model 1; The basic gravity model

Model 1 is a simple gravity model estimation. This model starts of our investigation of Hong Kong’s trade flow and is subjected to investigate whether the trade flow of Hong Kong has been predicted by the gravity model both before and after the liberation;

$$Total\ \text{Trade}_{o,d,t} = \alpha_{10} + \alpha_{11} \ln Y_{o,t} + \alpha_{12} \ln Y_{d,t} + \alpha_{13} W_{x,m} + \epsilon_t$$

As dependent variable “Total Trade” serves as the estimator in this model. Total Trade measures the total trade from the country of origin, the export country, to the country of
destination, the import country, at any given year measured in 2005 US dollars. As independent variables we set GDP, “Y”, of both the exporting countries, country of origin, “o”, and the importing countries, destination country, “d”. The GDP variables measures the gross domestic product of any specific country in all bilateral trade relationships investigated, measured in 2005 US dollars. As observed, a distance variable is not included in this model. The distance between our investigated countries is not expected to change over our investigated time period, hence by controlling for both country and yearly, time, fixed effects, there is no motivation left to include such a variable in this model. The same argument holds for all models below. We have also included the superscript, “L”, subjected to distinguish whether we are investigating the time period before, “b”, or after, “a”, the liberation. To make it simple for the reader to understand the results of these models, we set the superscript to either strictly b, before the liberation, or a, after the liberation. All estimations of all models in this paper will either display results where L is strictly a or b, after or before the liberation, in order to make the comparison easy.

We will in this model also distinguish whether Hong Kong is the exporter or the importer in the bilateral trade relationship. We do this by simply just adding our Way-dummy, W. The Way-dummy, described earlier, distinguish whether Hong Kong is the exporter, “x”, or the importer “m”. To make it easy to grasp and interpret the results we set the Way-dummy strictly to either 1; Hong Kong is the exporter, or 0; Hong Kong is the importer. Later, we will present the results in Table 1 in four columns; two of which Hong Kong is the exporter where the time before, “b”, liberation is illustrated in one and the time after, “a”, liberation is presented in the second. The same principle is applied on imports. The results from Model 1 is presented in Table 1.1 through 1.4.
5.4.2 Model 2; Industry characteristics

Model 2 starts off where Model 1 ended but includes a modification of the dependent variable; the trade flows are divided into each tech-level industry, “i”. The industries are divided into either low-, mid or high-technology. We construct this model to investigate how the components of the gravity model have changed their predictability on trade due to the liberation in every individual tech-level-industry.

\[ \text{Trade}_{o,d,i,t}^L = \alpha_{20}^L + \alpha_{21}^L \ln Y_{o,t}^L + \alpha_{22}^L \ln Y_{d,t}^L + \alpha_{23}^L C^L + \alpha_{24}^L (C^L + \ln Y_{o,d}^L) + \alpha_{25}^L W_{x,m}^L + \epsilon_t \]

We have labeled every industry in the data into either low, mid or high tech, depending on which level of technology each industry require to produce their goods. Further, we set each technology labeled industry’s trade flow, “Trade”, as the dependent variable. Since we attempt to estimate each technology level labeled industry’s gravity prediction, we include both the log of GDP, “lnY”, of the exporter, country of origin, “o”, and the importer, destination country, “d”, as two independent variables. Again, we do not include any specific distance variable due to redundancy after fixed effects controls.

Further, we are interested in investigating Hong Kong’s relationship to China within every industry, hence we include a china dummy, “C”, to construct the Chinese GDP interaction variable, “C × lnY_{o,d}”, in order to estimate the effect of the Chinese GDP on total trade within the tech-level-industry alone. The estimated coefficient from the above interaction variable will indicate the difference in impact the Chinese GDP has on trade compared to Hong Kong’s other trade partners.

We will with this model again investigate the effects on exports and imports separately, separated by the Way-Dummy, “W”, and every tech-level-industry will be investigated both before and after the liberation separately, separated by the Liberation subscript, “L”. Hence,
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the estimated results with respect to Hong Kong’s exports are displayed in Table 2 and the estimated results with respect to Hong Kong’s imports are displayed in Table 3.

5.4.3 Model 3; The general impact of institutions and contract intensity

We have now investigated the general and the industry-specific gravity of Hong Kong’s trade flows in Model 1 and 2. To continue we add variables measuring institutional quality, “EFSI”, and contract intensity, Nunn index or “Nunn”, to our model.

\[
\begin{align*}
\text{Trade}_{o,d,t} &= \alpha_{30} + \alpha_{31} \ln Y_{o,t} + \alpha_{32} \ln Y_{d,t} + \alpha_{33} EFSI_{o,d,t} + \alpha_{34} Nunn_{t} \\
& \quad + \alpha_{35} (EFSI_{o,d,t} \times Nunn_{t}) + \alpha_{36} W_{x,m} + \epsilon_t
\end{align*}
\]

We are motivated to do this since we have reason to suspect that there has been a change in the importance of institutional quality regarding Hong Kong’s trade partner decisions due to the shift of administrative power from one ruler with high institutional quality to another with lower institutional quality. Further, we are motivated to investigate the level of contract intensity among Hong Kong’s trade partners and its implications on trade. We are also interested in investigating the combined effect of these two variables, hence we include an interaction variable, “EFSI \times Nunn”, where the EFSI is multiplied with the Nunn index. The coefficient of the estimated interaction variable, \(\alpha_{35}\), should be interpreted as the change in the effect of institutional quality on trade as the Nunn index increases with one unit.

All these additional variables are added to the framework of the Gravity model and is expected to have a statistically significant positive impact on trade (Nunn, 2007), hence we expect significant positive coefficients attached to these variables in the results. Another difference from Model 1 and 2 is that Model 3’s dependent variable has another categorization of Hong Kong’s trade flows, it is now measuring trade flow in the different tech level industries, but we do not separate the industries. This is due to that the Nunn index is categorized with respect to these different industries. Hence, one can conclude that the
dependent variable measures total trade, divided into trade in all industries. The results from Model 3 are presented in Table 4 and are divided into four columns where the first two illustrate exports, one before the liberation and one after. The last two columns illustrate before and after the liberation with respect to imports.

One aspect, described before, that motivates us to include variables measuring institutional quality and contract intensity is to fetch some of the determinants of trade that is not included among the main variables of the Gravity model. It is understood that both good institutions and good contract enforcement generally reduces the relative opportunity cost of trade compared to agents with lower levels of the two included variables (Feenstra, 2011).

5.4.4 Model 4; Chinese characteristics

As we now have investigated the general effect of institutional quality and contract intensity in Model 3, we are now interested in investigating Hong Kong’s relationship to China. Or rather the effect Chinese institutional quality and contract intensity has on Hong Kong’s imports and exports compared to the same effect from other countries different than China.

The model is designed as follows:

\[
\text{Trade}^{L}_{o,d,t} = \alpha_{40}^{L} + \alpha_{41}^{L} \ln Y^{L}_{o,d,t} + \alpha_{42}^{L} \ln Y^{L}_{d,t} + \alpha_{43}^{L} \text{EFSI}^{L}_{o,d,t} + \alpha_{44}^{L} \text{Nunn}^{L}_{i} + \alpha_{45}^{L} C^{L} \\
+ \alpha_{46}^{L} (C^{L} \times \ln Y^{L}_{o,d,t}) + \alpha_{47}^{L} (C^{L} \times \text{EFSI}^{L}_{o,d,t}) + \alpha_{48}^{L} (C^{L} \times \text{Nunn}^{L}_{i}) \\
+ \alpha_{49}^{L} (\text{EFSI}^{L}_{o,d,t} \times \text{Nunn}^{L}_{i}) + \alpha_{50}^{L} (C^{L} \times (\text{EFSI}^{L}_{o,d,t} \times \text{Nunn}^{L}_{i})) \\
+ \alpha_{51}^{L} W^{L}_{x,m} + \varepsilon_{t}
\]

Model 3 steps of from Model 2 and adds a few interaction variables. These interaction variables are constructed with a China dummy, “C”, that fetches the individual effect of China on the multiplied variable. The variables that is multiplied with this dummy variable are GDP, EFSI, Nunn Index, and the EFSI-Nunn index-interaction variable.
The China-interactions will illustrate how the china part of the multiplied variable differs from other countries. The estimated coefficients of the Chinese interaction variables should be interpreted as the difference in effect the multiplied variables of interest have on trade compared to other countries.

We will divide this model again into one before liberation column and one after liberation column. Further, we will distinguish these two models between the effects on Hong Kong’s exports and imports, hence we will end up with a total of four columns. The first two columns displaying the results of the estimated effects on Hong Kong’s exports are illustrated in Table 5.1 and 5.2 and the last two columns displaying the results of the estimated effects on Hong Kong’s imports are illustrated in Table 5.3 and 5.4.

We are motivated to investigate the China-effect on Hong Kong’s trade flow under the assumption that China gained comparative advantages in terms of common language and common culture. Further, after the liberation, another comparative advantage was added to China with respect to Hong Kong; a common ruler, and the fact that China considers Hong Kong as a domestic administrate region. Hence, the Chinese impact on Hong Kong’s trade should have increased after the liberation, which should be reflected in the estimated results from both Model 2 and 4.
6. Results

In this section all the estimated results from the models described in previous section are presented, interpreted and discussed. We will start with Table 1, which illustrates the estimated results from Model 1.

6.1 Estimations of Model 1; The basic gravity model

Table 1 (1.1) (1.2) (1.3) (1.4)
Dependent Variables Total Export Volume, Before Liberation Total Export Volume, After Liberation Total Import Volume, Before Liberation Total Import Volume, After Liberation
Log of exporter GDP Omitted. Omitted. .933*** .337***
Log of importer GDP .432*** .987*** Omitted. Omitted.
Fixed Yearly effects Yes. Yes. Yes. Yes.
Fixed Exporter country effects No. No. Yes. Yes.
Fixed Importer country effects Yes. Yes. No. No.

No. Of observations 3872 27060 3718 27060
R-Squared .999 .997 .999 .998

* = significant at the 10%-level. ** = significant at the 5%-level. *** = significant at the 1%-level.

Model 1 illustrates the general gravity model of Hong Kong’s total trade before its liberation divided into exports (column 1.1 and 1.2, and) imports (column 1.3 and 1.4). Before discussing these estimations, we should examine the export side of Hong Kong’s trade in Fig 1.
Fig 1 illustrates the export volume of Hong Kong over our years of interest divided up into two receiving groups; China, the darker line, and all other countries excluding China, the brighter line. The Y-axis indicates trade volume in thousands of US-dollars. The X-axis illustrates time and ranges from the year 1995 to 2010. The vertical line indicates the time of the liberation.

In column 1.1 and 1.2 we have set Hong Kong’s total exports as dependent variable. By doing this we omit Hong Kong’s GDP in the importer GDP variable and investigates only the effect of other countries’ GDP on Hong Kong’s exports. Exporter GDP, i.e. the GDP of Hong Kong, is omitted. Model 1.1 illustrates the gravity model on Hong Kong’s exports before the liberation and Model 1.2 illustrates its exports after the liberation. In Model 1.1, the coefficient of importer GDP is estimated to .432 and is statistically significant. In Model 1.2 it is estimated to .987 and is statistically significant. We can observe that changes in Hong Kong’s trade partner’s GDP has a greater impact on Hong Kong’s total exports volume after the liberation compared to before.

Why is there a difference in coefficients? One possible explanation is that as Hong Kong was liberated from its colonizer it became freer in choosing which countries it wished to do business with, since it does not have to trade according to its colonizers wishes anymore.
Hence, Hong Kong’s exporting trade flows are more aligned with the theory of the Gravity model after the liberation compared to before. Another possible explanation may be that after the liberation, Hong Kong’s ties to China became greater, which may imply more trade with China. Hence, the exponential growth of the Chinese GDP raises the average GDP size of Hong Kong’s export partners. Hence, China grows towards becoming the largest economy in the world simultaneously as Hong Kong is increasing its exports to it. Also, a third possible explanation may be that Hong Kong has increased its exports in high tech goods. High tech goods are generally more expensive compared to goods of a lower technology level, hence Hong Kong’s overall trade is somewhat redirected towards richer countries.

We are now moving on to discuss the Gravity model of the import side of Hong Kong’s trade. First we examine Hong Kong’s total import volume, illustrated in Fig 2.

Fig 2 illustrates the import volume of Hong Kong over our years of interest divided up into two groups of origin; China, the darker line, and all other countries excluding China, the brighter line. The Y-axis indicates trade volume in thousands of US-dollars. The X-axis illustrates time and ranges from the year 1995 to 2010. The vertical line indicates the time of the liberation.
In column, 1.3 and 1.4 we use Hong Kong’s total imports as dependent variable. In these models, importer GDP, i.e. Hong Kong’s GDP, is omitted from the model due to low variance, after controlling for yearly fixed effects. Model 1.3 illustrates the gravity model on Hong Kong’s imports before the liberation, Model 1.4 illustrates it after the liberation. The coefficients of the exporter GDP-variables are observed as statistically significant at .933 before the liberation in Model 1.3 and at .337 after the liberation in Model 1.4. Hence, Hong Kong’s import partners GDP have on average a smaller impact on Hong Kong’s total import volume after the liberation compared to before.

One possible explanation may be that Hong Kong’s import trade flows may well be driven more by other factors than the main variables of the Gravity model after the liberation compared to before. Hence, the possible explanation of these results is found in the error term. For instance, Hong Kong may be importing from countries with lower opportunity costs of trade or better institutions. We may find an answer to why these estimations yield such patterns in some of our estimations below.
6.2 Estimations of Model 2; Industry characteristics

Below, in Table 2, the estimated results from Hong Kong’s exports in Model 2 is illustrated.

As observed, there are three pairs if columns individually illustrating a specific level of industry technology. The first column in every pair illustrates the before liberation estimations and the second column illustrates the after liberation estimations.

<table>
<thead>
<tr>
<th>Table 2 (2.1)</th>
<th>(2.2)</th>
<th>(2.3)</th>
<th>(2.4)</th>
<th>(2.5)</th>
<th>(2.6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable: Exports trade volume per tech-level industry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Low tech,</strong></td>
<td>Low tech,</td>
<td>Mid tech,</td>
<td>Mid tech,</td>
<td>High tech,</td>
<td>High tech,</td>
</tr>
<tr>
<td>Before Liberation</td>
<td>After</td>
<td>Liberation</td>
<td>After</td>
<td>Liberation</td>
<td>Liberation</td>
</tr>
<tr>
<td>Log of exporter GDP</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
</tr>
<tr>
<td>Log of importer GDP</td>
<td>-.968</td>
<td>1.018</td>
<td>-.172</td>
<td>.982*</td>
<td>-1.086</td>
</tr>
<tr>
<td>China Dummy</td>
<td>-21.49758</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
</tr>
<tr>
<td>China*Log of importer GDP</td>
<td>1.562</td>
<td>-1.364***</td>
<td>.070</td>
<td>-.307</td>
<td>1.259</td>
</tr>
<tr>
<td>Fixed yearly effects</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
<tr>
<td>Fixed importer country effects</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
<tr>
<td>No. of obs.</td>
<td>1392</td>
<td>9840</td>
<td>1026</td>
<td>7380</td>
<td>700</td>
</tr>
<tr>
<td>R-Squared</td>
<td>.831</td>
<td>.694</td>
<td>.664</td>
<td>.625</td>
<td>.608</td>
</tr>
</tbody>
</table>

* = significant at the 10%-level. ** = significant at the 5%-level. *** = significant at the 1%-level.

In Table 2, we have estimated Model 2 subjected to conclude if the parameters of the model have any impact on the export volume of the three different degrees of technological standard.
We have also included an interaction variable subjected to investigate the impact of the Chinese gravity specific characteristics, Chinese gross domestic product.

Every tech-level industry will be illustrated with a Graph in order to provide more information to complement the estimated results in Table 2. We will first examine and discuss the results in column 2.1 and 2.2 which corresponds to Hong Kong’s low-tech industry exports. Below, in Fig 3, the trade volume of Hong Kong’s exports in this industry is illustrated between our years of interest.

Fig 3 illustrates the volume of exports in low tech industries (y-axis) divided up by the share of exports subjected for China and the share subjected for countries other than China, Rest of the World, “Row”, over our time of interest (x-axis). We can observe that the shares have not changed specifically since the start of our study. The vertical line indicates the time of the liberation. This indicates that no changes occurred in how Hong Kong redirected its trade flows in this sector after the liberation. Alternatively, the changes did occur earlier since the liberation has been known to occur already in 1984.
We can from the estimation of Model 2.1 and 2.2 observe that there is no statistical significance in the general GDP explanatory variables, neither before nor after the liberation. When it comes to the Chinese GDP interaction variable we can observe a statistical significant result in Model 5.2, i.e. after the liberation. By observing the Chinese GDP variable we gain reason to suspect that China is affecting Hong Kong’s export gravity model in the low tech industry.

The Chinese gross domestic product variable is statistically significant with a negative coefficient. This can be interpreted as when Hong Kong exports low tech industry goods, the effect of the receiving countries’ gross domestic product on trade is lower when it comes to China compared to countries other than China. If the Chinese GDP grows by 1 percent, it affects the amount of trade 1.36 percent less than the same growth in other countries’ GDP would. However, since the general impact of GDP on exports in this sector is insignificant, no more concrete conclusions can be drawn from these results.

However, the fact that the China specific GDP variable is significant after the liberation and not before give me reason to suspect that there has been a change with the liberation in this particular industry. Hong Kong’s exports in this industry is partly explained by the Chinese GDP. Hence, Hong Kong’s closer ties to China seem to affect Hong Kong’s trade in this particular industry relative to other countries GDP.
Fig 4 illustrates the volume, in thousands of 2005 US dollars, of exports in mid tech industries (y-axis) divided up by the share of exports subjected for China and the share subjected for countries other than China, Rest of the World, “Row”, over our time period of interest (x-axis). The vertical line indicates the time of the liberation. We can observe that the shares have changed specifically since the start of our study and that the shares have a 50-50 relationship by the year of 2006. This indicates that Hong Kong has redirected its trade flows in this sector more towards China, however if this is due to the liberation or China’s exponential economic growth, we cannot tell.

Exports in the segment of products that requires a medium level of technology are illustrated in Model 2.3 and 2.4. The results from these do differ from the results in the low tech sector; the after liberation, the general GDP variable displays statistically significant results with a coefficient at 0.982, and the results of the after liberation Chinese GDP variable is insignificant. None of the pre liberation explanatory variables show significant results. Again, there seem to be a difference between the before- and after liberation Gravity Models.
The significant result in the after liberation general GDP variable indicates that Hong Kong’s exports in this industry is driven more by the gravity model after the liberation than before. The coefficient is positive and indicates that for every percent of growth in GDP the receiving country achieves, it increases its imports from Hong Kong in the mid tech industry with 0.98 percent. However, significance is only at the 10 percent level in this variable’s estimation, which is the weakest level of significance, hence this result should be interpreted with caution.

The variables that measures the effect of the Chinese GDP is insignificant. Hence, we cannot distinguish any difference between China and other countries in the gravity model in the mid tech industry.

![Fig 5: High Tech Exports](image)

Fig 5 illustrates the volume of exports in high tech industries (y-axis) divided up by the share of exports subjected for China and the share subjected for countries other than China, Rest of the World, “Row”, over our time period of interest (x-axis). The vertical line indicates the time of the liberation. Further, in 2002, the share of high tech exports to China reached 50 percent. After 2002, this share has been growing and reached 65 percent of total exports in this industry in 2010. China is clearly continuously increasing its share of Hong Kong’s total trade flow in this industry. China is growing and require more and more high tech good
imports. Since Hong Kong is geographically and culturally close to China, one can assume that Hong Kong is a natural supplier of Chinese imports. The liberation drew Hong Kong even closer to China, which may have increased this perception.

Fig 5 also suggest that Hong Kong’s largest export sector is within the high tech industry. Model 2.5 and 2.6 illustrates the estimated gravity models of Hong Kong’s exports in this industry, before respectively after the liberation. None of the explanatory variables show significant results, which indicates that trade in this industry is not predicted by the gravity model.

The perception of Hong Kong being a “door to China” is being strengthen by examining Fig 5. It may be so that Hong Kong’s high tech industry exports is not driven by its own gravity model, but by the Chinese gravity model of imports in this industry. We suggest further research on this matter; could one observe that high tech imports to Hong Kong is later exported to China?

To conclude our analysis of Hong Kong’s different export sectors we can observe that no dramatically changes in the gravity model’s explanatory factors has occurred within the specific industries. Further, we can see that exports in the high tech sector has increased to become Hong Kong’s largest. Further, we can see that the share of exports in this sector subjected for China has increased the most and reached 65%.
Below, in Table 3, the estimated results of Hong Kong’s imports in Model 2 is illustrated. As observed, there are three pairs of columns individually illustrating a specific level of industry technology. The first column in every pair illustrates the before liberation estimations and the second column illustrates the after liberation estimations.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>(3.1)</th>
<th>(3.2)</th>
<th>(3.3)</th>
<th>(3.4)</th>
<th>(3.5)</th>
<th>(3.6)</th>
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<tbody>
<tr>
<td>Dependent Variable; Imports trade volume per tech-level industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low tech, before liberation</td>
<td>Log of exporter GDP</td>
<td>2.434</td>
<td>.760</td>
<td>-1.116</td>
<td>-.0125</td>
<td>2.418</td>
</tr>
<tr>
<td>Low tech, after liberation</td>
<td>Log of importer GDP</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
</tr>
<tr>
<td>Mid tech, before liberation</td>
<td>China Dummy</td>
<td>28.013</td>
<td>8.332</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
</tr>
<tr>
<td>Mid tech, after liberation</td>
<td>China*Log of importer GDP</td>
<td>-1.608</td>
<td>-.419</td>
<td>1.142</td>
<td>.395</td>
<td>.116</td>
</tr>
<tr>
<td>High tech, before liberation</td>
<td>Fixed yearly effects</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
<tr>
<td>High tech, after liberation</td>
<td>Fixed exporter country effects</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
<tr>
<td>No. of obs.</td>
<td></td>
<td>1312</td>
<td>9840</td>
<td>696</td>
<td>6639</td>
<td>420</td>
</tr>
<tr>
<td>R-Squared</td>
<td></td>
<td>.690</td>
<td>.584</td>
<td>.575</td>
<td>.455</td>
<td>.590</td>
</tr>
</tbody>
</table>

* = significant at the 10%-level. ** = significant at the 5%-level. *** = significant at the 1%-level.

In Table 3 we investigate if the parameters of the gravity model have any impact on Hong Kong’s import trade flow in the three different tech level industries. We have again included an interaction variable subjected to investigate the impact of the Chinese characteristics.

Every tech-level industry will be illustrated with a figure in order to provide more information to complement the estimated results in Table 3.
Below, in Graph 6 and 7, the trade volume of Hong Kong’s imports within these industries are illustrated between our years of interest.

Fig 6, 7 and 8 illustrates the trade volume in 2005 US Dollars (y-axis) over our time period of interest (x-axis) in the corresponding industry segment. The vertical line indicates the time of the liberation. We can observe from Fig 6 that imports in low tech industries has been volatile over our years of investigation. The Chinese share has been hovering around 50%. Further, due to the volatility shown, we cannot conclude if the higher levels in the end of our time periods is a due to big fluctuations or a positive trend. Fig 7 illustrates mid tech industry imports and indicates that the volume is increasing, however modestly. The Chinese share has been rather stable since 1999 after the rather dramatically drop in imports from countries other than China.

We will first examine and discuss the results in column 3.1-4 which corresponds to Hong Kong’s low- and mid-tech industry imports. None of the gravity related variables in these estimated models show any statistical significance. Hence, one can suspect that the import side of the low- and mid-tech industry is not predicted by the gravity model, neither before nor
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after the liberation. Neither does the Chinese GDP variable display any significance. Hence, China does not seem to affect Hong Kong’s import trade flows in these industries different from other countries. This indicates that Hong Kong’s imports in these two industries are motivated by factors different from the main components in the Gravity model. From this investigation, we cannot draw any further conclusions.

However, the high tech industry side of Hong Kong’s imports display significant results. We shall discuss this further, but first we should observe Fig 8 which illustrates Hong Kong’s total trade volume in this industry (y-axis) with China and countries different from China between the years of 1995 and 2010 (x-axis).

As we can see in Fig 8, the largest share of imports in the high tech industry origin from other countries than China. However, the Chinese share is large and has been gaining ground over the years from having less than 25% of the total share in 1995 to just above 47% in 2010.

Model 6.5 illustrates Hong Kong’s imports in the high tech industry before the liberation. No significant results is observed among the variables. However, Model 6.6, which illustrates the gravity model of this industry after the liberation, does include one variable with significant results; the exporter GDP-variable. This variable is significant at the 10 percent level, which is the weakest level of significance, and shows a coefficient at 1.88. This indicates that Hong Kong’s imports in this industry is driven by a main factors of the gravity model and that for every percent of additional gross domestic product, trade flows to Hong Kong increases by 1.88%.

High tech industry imports has grown over our years of interest to become Hong Kong’s largest import sector. This is, in combination with the fact that this industry also is the greatest on the export side, and that 65% of Hong Kong’s exports in this industry is subjected for China, worth discussing. It may be so that Hong Kong actually serves as the “door to China”
in this industry. The hypothesis would be that Hong Kong is importing high tech goods according to the factors of the gravity model and later export them to China. That would explain why exports in the high tech industry is not predicted by the gravity model, since China is buying these goods via Hong Kong and the trade flow is already predicted by the Gravity model via Hong Kong’s imports. China is ordering goods, Hong Kong supply China, hence gravity prediction on imports and no gravity prediction on exports. This would be in line with the study earlier discussed by Feenstra and Hanson (2000).

To conclude our analysis of Hong Kong’s imports in different industries; no significant changes has occurred within explanatory gravity factors. However, high tech industry imports has grown to become the largest import sector over our years of interest. Further, the Chinese share of Hong Kong’s imports in this industry has grown significantly. This indicates a closer tie to China in high tech imports that is not explained by the main components of the gravity model.
6.3 Estimations of Model 3; The general impact of institutions and contract intensity

We continue to analyze the trade flows of Hong Kong by adding institutional quality and contract intensity to the models. The estimations of Model 3 is illustrated in Table 4 below.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>(4.1)</th>
<th>(4.2)</th>
<th>(4.3)</th>
<th>(4.4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable; Trade volume in all tech-level industries.</td>
<td>Exports, before liberation</td>
<td>Exports, after liberation</td>
<td>Imports, before liberation</td>
<td>Imports, after liberation</td>
</tr>
<tr>
<td>Log of exporter GDP</td>
<td>Omitted</td>
<td>Omitted</td>
<td>1.049***</td>
<td>.275</td>
</tr>
<tr>
<td>Log of importer GDP</td>
<td>.089***</td>
<td>.603</td>
<td>Omitted</td>
<td>Omitted</td>
</tr>
<tr>
<td>EFSI</td>
<td>.315</td>
<td>.948***</td>
<td>.071</td>
<td>.099</td>
</tr>
<tr>
<td>Nunn Index</td>
<td>-1.975</td>
<td>8.614***</td>
<td>-.745</td>
<td>2.813</td>
</tr>
<tr>
<td>Nunn Index*EFSI</td>
<td>.447</td>
<td>-.779**</td>
<td>.285</td>
<td>-.059</td>
</tr>
<tr>
<td>Fixed Yearly effects</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
<tr>
<td>Fixed exporter country effects</td>
<td>No.</td>
<td>No.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
<tr>
<td>Fixed importer country effects</td>
<td>Yes.</td>
<td>Yes.</td>
<td>No.</td>
<td>No.</td>
</tr>
<tr>
<td>No. of observations</td>
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<td>12340</td>
<td>970</td>
<td>12340</td>
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<tr>
<td>R-Squared</td>
<td>.554</td>
<td>.380</td>
<td>.453</td>
<td>.441</td>
</tr>
</tbody>
</table>

* = significant at the 10%-level. ** = significant at the 5%-level. *** = significant at the 1%-level.

Table 4 illustrates an extended gravity model subjected to investigate the impact of institutions and contract intensity on Hong Kong’s exports and imports before and after the liberation. In Model 4.1 we analyze the effect of institutions and contract intensities on Hong Kong’s exports before liberation and in Model 4.2 we analyze its effect on Hong Kong’s exports after liberation. Further, in Model 4.3 we analyze the effect of institutions and contract intensities on Hong Kong’s imports before liberation and Model 4.4 analyzes its effect on imports after liberation. To measure institutional quality we use the Economic freedom summary index, EFSI, and to measure contract intensity we use the Nunn Index. We
also include an interaction variable in which we combine the EFSI and the Nunn index subjected to investigate a combined effect of institutional quality and Contract intensity. As we can observe in the results of Model 4.1, there are no statistically significant results among our variables measuring institutional quality or contract intensity, nor is the result from our interaction variable statistically significant. This suggests that Hong Kong did not choose its export partners based on institutional quality nor contract intensity before its liberation. In Model 4.2 we can observe contrasting results; EFSI has a statistically significant coefficient at .948 and the Nunn Index has a statistically significant coefficient at 8.614. This indicates that for every additional increase of one percent in institutional ranking a country gains its imports from Hong Kong with 0.95%. Further, the difference in the Nunn index from its worst rank at 0 to its best rank at 1, trade increases by 8.6%.

We can from the comparison of the significance levels of the coefficients in Model 4.1 and 4.2 conclude that a shift seems to have occurred. The coefficient of the EFSI variable is positive after the liberation, hence Hong Kong seem to export more to countries the higher their levels of EFSI are. Hence, Hong Kong do, intentionally or unintentionally, choose export partners with better institutional quality. This is in line with the theory of institutional quality and trade and with previous research (Feenstra, Hong, Ma and Spencer, 2012). The same conclusion can be drawn by analyzing and comparing the significance levels and the estimated slope of the coefficient of the Nunn index variable. It is insignificant before the liberation, positive and significant after the liberation. Hence, Hong Kong seem to export more within industries with higher levels of contract intensity. This is in line with the results from Model 2 which suggested that Hong Kong has increased its exports in high tech goods, which requires higher contract intensity (Nunn, 2007).

The surprising part of this model is in the comparison of the interaction variable before and after the liberation. It is insignificant before the liberation and statistically significant with a
coefficient at -0.779 after the liberation. The unexpected part of these results is that the coefficient is negative. Both institutional quality and contract intensity do independently seem to have positive effects on Hong Kong’s exports. It should be interpreted as when the level of contract intensity increases by one percent, the effect institutional quality has on trade is decreased by 0.779 percent. Hence, better contract enforcement among the industries decreases the positive effect good institutions have on Hong Kong’s export trade flow. This is against earlier research and the theory (Nunn, 2007). It seems like Hong Kong is a special case and it requires some reasoning in order to conclude how this can be the case.

As assumed; the higher the tech level is in an industry, the higher the required contract intensity. Hong Kong’s largest and fastest growing export industry is in the high tech segment. It may be the case that countries importing products from Hong Kong’s higher tech level industries are not able to produce these high tech level industry products by themselves due to poor levels in contract enforcement ability and institutional quality in combination. Their institutional environment may not attract high tech producers. Hence, these countries need to import high tech goods, and that may explain why the coefficient is negative. Low scores in institutional quality forces countries to import high tech goods rather than to produce them themselves. We will discuss this matter more in the discussion-part of this paper.

In Model 4.3 and 4.4 we investigate the effect of Hong Kong’s trade partners’ characteristics in institutional quality and contract intensity on Hong Kong’s imports. We can observe that neither of the variables display statistically significant results. This indicates that institutional quality and contract intensity do not impact the import side of Hong Kong’s trade flows. We can suspect from these results that Hong Kong’s decision on which country to import from is not based on these two variable measures. This is against the predictions of both Nunn (2007) and North (1990).
To conclude, Hong Kong’s imports in different industries is so far estimated to neither be explained by the main factors of the gravity model nor institutional quality. Hong Kong’s exports seem so far to be explained by institutional quality after the liberation but not by the main factors of the gravity model. Further, Hong Kong’s increasing trade volume in high tech industries seem to have impact on our results.

We continue our analysis by observing Chinese specific institutional quality in order to further investigate China’s impact on Hong Kong’s trade.
6.4 Estimations of Model 4; Chinese characteristics

In order to introduce the reader to the estimated results of Model 4 where the impact of China’s characteristics on Hong Kong’s exports and imports are investigated. Below, in Table 5, the results from Model 4 illustrated.

Table 5 (5.1) (5.2) (5.3) (5.4)

<table>
<thead>
<tr>
<th>Dependent Variable; Hong Kong’s trade volume in all tech-level industries.</th>
<th>Exports, Before Liberation</th>
<th>Exports, After Liberation</th>
<th>Imports, Before Liberation</th>
<th>Imports, After Liberation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log of exporter GDP</td>
<td>Omitted</td>
<td>Omitted</td>
<td>1.042***</td>
<td>1.203</td>
</tr>
<tr>
<td>Log of Importer GDP</td>
<td>.892***</td>
<td>.818</td>
<td>Omitted</td>
<td>Omitted</td>
</tr>
<tr>
<td>China Dummy</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
<td>Omitted</td>
</tr>
<tr>
<td>Nunn Index</td>
<td>-.347</td>
<td>-2.021</td>
<td>-6.315</td>
<td>-11.203**</td>
</tr>
<tr>
<td>EFSI</td>
<td>.455</td>
<td>-.045</td>
<td>-.400</td>
<td>-1.246</td>
</tr>
<tr>
<td>Nunn Index*EFSI</td>
<td>.246</td>
<td>.543</td>
<td>.991</td>
<td>1.690***</td>
</tr>
<tr>
<td>Log of importer GDP*China</td>
<td>.373***</td>
<td>-.149</td>
<td>Not included</td>
<td>Not included</td>
</tr>
<tr>
<td>Log of Exporter GDP*China</td>
<td>Not included</td>
<td>Not included</td>
<td>.248</td>
<td>-.811</td>
</tr>
<tr>
<td>China*EFSI</td>
<td>Omitted</td>
<td>-.478</td>
<td>Omitted</td>
<td>-.401</td>
</tr>
<tr>
<td>China*(Nunn Index*EFSI)</td>
<td>-.138</td>
<td>.475**</td>
<td>.438</td>
<td>.634***</td>
</tr>
<tr>
<td>Fixed yearly effects</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
<tr>
<td>Fixed importer country effects</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
<tr>
<td>No. of obsevartions</td>
<td>1010</td>
<td>12340</td>
<td>970</td>
<td>12340</td>
</tr>
<tr>
<td>R-Squared</td>
<td>.554</td>
<td>.368</td>
<td>.449</td>
<td>.436</td>
</tr>
</tbody>
</table>

* = significant at the 10%-level. ** = significant at the 5%-level. *** = significant at the 1%-level.

Table 5 illustrates the results of an extended version of the Model 3 where we distinguish the institutional effects on Hong Kong’s export and imports whether the institutional effect is from China, illustrated by the dummy “China”. We are motivated by Fig 1 and Fig 2 to pursue
with this extension due to the big share of Hong Kong’s exports and imports subjected for China.

Further, in Table 5 we also include an extended version of Model 1; we have added an interaction variable subjected to distinguish a difference in the estimated effect GDP has on trade from China or other countries. These estimations suggests that, before liberation, if Chinese GDP is increased by 1%, Hong Kong exports increased 0.37% more compared to if the same GDP increase would have occurred in another country.

Model 5.1 is also subjected to investigate the difference in how institutional quality and contract intensity affects trade between China and the rest of the world in pre-liberation Hong Kong exports. As we can observe in the results, the variables investigating this matter does not show any sign of statistical significance. Hence we cannot conclude any difference in the pre-liberation exports between these two origin groups in terms of institutions or contract intensity. This is in line with the estimated results illustrated in Table 4 and it strengthens the suggested conclusion that Hong Kong pre-liberation did not base its choice of export partner on institutional quality. The results from Table 5 even illustrates that this suggested conclusion holds when we divide up the receivers into China and other countries.

Model 5.2 illustrates the extended version of Model 4.2; Hong Kong’s after liberation exports. We can observe that the only statistically significant result lays with our Chinese institutional quality and contract intensity interaction variable, China*(EFSI*Nunn). This variable should be interpreted such as when the China dummy goes from 0 to 1, the effect of institutional quality and contract intensity combined is raised with 0.47. In other words, when the effect of this interaction variable is from China compared to other countries excluding China, the effect is 0.47 percent greater.
Hence, as observed in Table 4, the effect institutional quality has on trade is reduced in industries with higher levels of contract intensity. Further, if this occurs in China, the effect is increased by 0.475, hence, 0.475% larger. However, if the same effect occurs in a country different from China, the effect is changes by -0.475, meaning that the effect is smaller in other countries compared to China.

A shift seems to have occurred in how influenced Hong Kong seems to be by Chinese institutional characteristics; by comparing the levels of statistical significance between the estimated results of the Chinese institutional interaction variables of Model 5.1 and Model 5.2 we can observe that Hong Kong’s exports seems to have gone from not being influenced to being influenced by these. This is in line with our hypothesis that Hong Kong probably would be influenced more by China after the liberation compared to before.

One possible explanation of this result can be seen in the shares of Hong Kong’s exports in Fig 1. We can see that after the liberation in 1997, the share of Hong Kong’s exports ending up in China is increasing to the extent that it reaches 50 percent in 2009 and keeps growing above that percentage level after 2010. The general perception is that the more a producing country is selling to a buying country, the more dependent they become of each other. Hence, as Hong Kong is exporting more to China, Hong Kong’s trade becomes more influenced by Chinese characteristics. Whether this is due to Hong Kong’s closer ties to China after the liberation or a combined effect of China’s growing economy and Hong Kong’s geographical closeness to the mainland, or a combination of them both, cannot be concluded based on these results.

To conclude, estimations of Hong Kong’s export dependence on China shows that trade was before the liberation to a higher extent explained by Chinese GDP – in line with the gravity model – and after the liberation it was more explained by Chinese institutional quality. This should be discussed with the different export industry segments in mind; before the liberation
Hong Kong’s main export industry was in low tech goods, Fig 3, and in the end of our investigated time period; exports in the high tech segment dominate, Fig 5. Low tech exports are less dependent on institutional quality compared to High tech exports (Nunn, 2007). Hence, the estimated shift in explanatory trade factors are in line with Hong Kong’s shift in tech level industry exports.

Due to the big share of Hong Kong’s imports origin from China illustrated in Fig 2, we are motivated of running Model 4 on Hong Kong’s imports in order to analyze the impact of Chinese characteristics on these trade flows. Table 5.3 and 5.4 illustrates the results of this estimation and can be viewed as an extended version of Model 4.3 and 4.4.

As we can observe; the estimation subjected to analyze pre-liberation imports, column 5.3, do not display any statistical significance among the independent variables. Hence, we cannot conclude that institutions had any impact on imports at that time period. However, in column 5.4 we can observe a different story. Column 5.4 is subjected to investigate after-liberation-imports, and as we can observe, both interaction variables including the Nunn Index, EFSI and origin dummies do have statistically significant results. The Nunn Index-EFSI-China variable shows a positive coefficient at 0.634. This is interpreted as when imports comes from China, the effect on trade from institutional quality by an increase in contract intensity levels is greater, more positive, compared to if the effect occurred in another country. On the contrary, this indicates that the combined effect of institutional quality and contract intensity does have a smaller, negative, impact on Hong Kong’s imports when the effect origin from a country different from China.

Hong Kong’s imports is highly connected to China and as we can observe in Fig 2, imports from china is increasing over time. So are the Chinese score in terms of institutional quality. We have reason to suspect that the results in column 5.4 is spurious; both Hong Kong’s
imports from China and Chinese scores in the combined institutional quality and contract intensity variable may be increasing independently of each other.

However, we may also discuss the increase in Chinese institutional quality from 1995 to 2010. As we discussed in the results in Table 4; Hong Kong export high tech goods, which require higher levels of contract intensity, to countries with lower institutional quality since they cannot produce them by themselves. With this in mind, Hong Kong’s imports in industries requiring higher levels of contract intensity should mainly come from countries with higher institutional quality, otherwise Hong Kong could produce these high tech goods itself. As China is increasing its institutional quality, its exports in this sector is increasing. Hence, Hong Kong is buying these goods now more from China compared to before.

One thing that differs the estimated results in column 5.4 from its simpler version, 4.4, is that the EFSI*Nunn variable is statistically significant with a positive coefficient. This indicates that the combined effect of institutional quality and contract intensity do have a positive effect on Hong Kong’s imports. If this is the case, the better institutional quality a country have, the more it tends to export to Hong Kong. This can be explained by the high growth in Hong Kong’s high-tech-industry imports that took place after the liberation. High-tech-industries generally require high quality institutions and high contract intensity, hence Hong Kong is naturally importing more and more from countries with high scores in this combined interaction variable.

To conclude, Hong Kong is importing more from China in industries that require higher contract intensity due to the Chinese increase in institutional quality, which is consistent with the proposals of Nunn (2007). Further, Hong Kong seem to value higher levels in institutional quality more if they are Chinese than if they were from another origin, hence Hong Kong’s connection to China is well established. Further, due to the high share of Hong Kong’s total imports origin from China, this may not be too surprising.
7. Discussion

After investigating trade flows, institutions and the connection to China in various formations and model, what can we conclude about the liberation of Hong Kong? This section is subjected to summarize and discuss the most important results from our estimations within our three main areas of interest; Gravity, institutions and closeness to China. Every area will be discussed separately.

7.1 Gravity

Hong Kong’s total trade flows seem to be more dependent on the factors of the Gravity model on the export side, and less dependent on the import side after the liberation compared to before. One possible explanation may be that Hong Kong became freer in choosing export partners after the liberation, hence it follows the free market approach and gravity to a higher extent. Another possible explanation may be that after the liberation Hong Kong’s ties to China became greater, which may imply more trade with China. Hence, the exponential growth of the Chinese GDP raises the average GDP size of Hong Kong’s export partners. A third possible explanation may be that Hong Kong has increased its exports in high tech goods. High tech goods are generally more expensive compared to goods of a lower technology level, hence Hong Kong’s overall trade is somewhat redirected towards richer countries. Further, other factors outside of the main variables of the gravity model seems to determine trade flows on the import side.

Second, regarding trade flows in specific technology level specific industries we can conclude that the Gravity model has a low rate of prediction, both before and after the liberation. The results found on industry level are merely statistically significant in either imports or exports. While investigating these specific industry segments one can only conclude that other factors outside the gravity model is predicting trade flows. Hence, one can conclude that Hong Kong,
on industry level, probably was well prepared for the shift of power and did adjust itself much earlier than 1995. Further, one can conclude that on industry level other factors outside the gravity model’s main variables may impact trade more.

7.2 Institutions

When it comes to the quality of institution among Hong Kong’s trade partners one can distinguish from the results that at least the export side of trade flows is affected. Both better institutions and better contract enforcement are estimated to increase trade. However, the effect of how much institutional quality affects trade reduces when the level of contract intensity increases. This is inconsistent with the predictions made by Nunn (2007).

One can break this phenomenon down to a discussion on the different tech level industry groups; industries that require high contract intensity are the ones with higher technology requirements. This argument is based on that more complex technology requires better immaterial protection; a good contract environment is a ground stone for the protection of high tech ideas. Further, countries with lower levels of institutional quality can be considered not to have the ground stones of producing their own product in the high technology segment, they need to import it. Hence, Hong Kong is exporting goods from industries that require higher levels of contract intensity to countries that have lower levels of institutional quality. This makes the case of Hong Kong different from the general perception where trade in industries requiring high contract intensity generally is attracted to countries with higher institutional quality. One explanation may be that Hong Kong is a high tech producer in a generally lower tech level environment. Hong Kong’s neighbors do not have high institutional quality and is therefore not attractive to produce high tech goods in. Hence, Hong Kong is a regional producer of high tech goods, due to its good institutions, and exports it to its neighbors. We may suspect that the effect of short distance transportation offsets the effects of bad institutions in Hong Kong’s trade relationships.
If this phenomenon is due to the change in ruler institutional quality Hong Kong experienced with the liberation, or if it erupted due to the rapid increase in Hong Kong’s high tech exports, cannot be concluded.

### 7.3 Closeness to China

The investigation of Chinese institutions did also indicate some changes with the liberation. Both the export and the import sector did show statistically significant result in the combined variable including institutions and contract intensity. The export side showed results that indicated that the effect on trade by institutions after an increase in contract intensity is larger from China than other countries. Hence, Hong Kong’s exports within highly contract intense industries is affected more by Chinese institutions than others’. Further, before the liberation, this effect did not exist. We can assume that this occurs due to a combination of Hong Kong increasing its exports in high tech, highly contract intense, industries, and China dramatically increasing its institutional quality, from 5.07 to 6.26 over our investigated period of time. Since Hong Kong is assumed to have close relations to China both culturally and geographically, these changes are stronger with these two countries. This is consistent with the conclusions of Nunn (2007).

The estimated results on the import side indicate that as China is increasing its institutional quality, its exports in highly contract intense industries is increasing. This is shown by the level of determination Chinese institutions has on Hong Kong’s import trade flows in more contract intense industries. Also, Hong Kong’s imports in high tech industries from China is soaring. Hence, Hong Kong is buying high tech goods from China more now compared to before due to China’s increased production in these industries due to its increase in institutional quality. This is also consistent with the conclusions of Nunn (2007).
If our suggested explanations above is true, one can conclude that the conclusion about Hong Kong being an Entrepôt of China made by Feenstra and Hanson in 2000 is not just still valid; it may be even stronger.

8. Concluding remarks

To conclude, we started a quest to find how different specifics related to Hong Kong’s trade did change with its liberation in 1997. We did not find any specific changes in trade flows on industry level or changes in the explaining value of the different specifics of the Gravity model in any industry. However, we have found changes when it comes to Hong Kong’s attitude towards its trade partners’ institutional quality.

Over all, Hong Kong seem to have been well prepared for its liberation and companies had probably already changed their business plans. However, the fact that Hong Kong’s former colonizer, the United Kingdom, has on an average better institutional quality compared to China may have had some impact on Hong Kong’s trade flows.

However, the main changes in Hong Kong’s trade seem to have erupted internally. Hong Kong seems to have specialized in goods that require high levels of technology. These goods are later sold to countries which cannot produce these kinds of products themselves. I.e. countries with lower levels of institutional quality. Further, the rapid Chinese growth in both economic size and institutional quality seems to have initiated more benefits for Hong Kong and strengthen its role of being the “door to China”.
9. References

9.1 Books and articles


9.2 Databases

Economic Freedom Network, Accessed 2016-03-05
(http://www.freetheworld.com/release.html)