Explaining the trade relation between India and Sweden in the 21st century
A regression analysis

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Degree Programme in Industrial Engineering and Management
Date: May 24, 2023

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School of Industrial Engineering and Management
Swedish subtitle: En regressionsanalys
Abstract

The following bachelor thesis in Applied Mathematics at the school of Industrial Engineering and Management, aims to investigate which factors affect the trade relation between India and Sweden during the 21st century. This has been done by performing a multiple linear regression analysis. The selected response variable is India’s import from Sweden, and the regressor variables are India’s direct investments in Sweden, Sweden’s direct investment to India, Sweden’s import from India, the Swedish krona to Indian rupee exchange rate, as well as the Education level in India. Data is collected monthly and taken from various sources, namely the Central Bureau of Statistics (SCB) and the Swedish Central Bank. Using the OLS method to build and test our model, the results are that the Education level, Exchange rate, and Sweden’s import from India are all significant in describing India’s import from Sweden in the 21st century, specifically when considering a longer time span. Furthermore, this study found that education is negatively correlated, which could imply a reduced need for knowledge intensive imports as education level increases.

Keywords
Emerging country, Exchange rate, Foreign Direct Investments, Education level, Imports, Trade, Regression analysis
Sammanfattning


Nyckelord

Utvecklingsland, Valutakurs, Utlandsinvestering, Utbildningsnivå, Import, Handel, Regressionsanalys
Acknowledgments

We would like to express our sincere gratitude to our supervisor at the Royal Institute of Technology, Hans Lööf at the Unit of Accounting, Finance and Changes, as well as our examiner Camilla Johansson Landén at the Department of Mathematical Statistics, for their guidance and support throughout the process of writing this bachelor thesis.

Stockholm, May 2023
Leah Eriksson and Rebecka Ehn
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List of acronyms and abbreviations

FDI  Foreign Direct Investments
INR  Indian Rupee
MGC  More Globalized Country
OECD  Organization for Economic Cooperation and Development
SEIC  Swedish East India Company
SEK  Swedish Krona
List of acronyms and abbreviations
Chapter 1

Introduction

This paper investigates which factors drive the trade level between an Organization for Economic Cooperation and Development (OECD)-country and an emerging market economy. Following this first introductory part, Part 2 contains a description of the variables that will be considered, accompanied by previous research on the topic. Part 3 and 4 conceptually unites the methodology and necessary theory needed to complete the analysis which will be presented in Part 5. The learnings on how each variable contributes to India’s import levels from Sweden will be discussed in Part 6. Finally, Part 7 is dedicated to epitomize the discussion.

1.1 Background

The historic commerce relationship between Sweden and India begins with the Swedish East India Company (SEIC), which was established in the first half of the 18th century. During the following century, the shipping company would provide investment capital to businesses in Stockholm and Gothenburg, as well as make significant contributions to the scientific community. It should, however, be noted that Sweden’s engagement with India was obstructed by the British East India Company looking to protect its dominance in the area (Müller [2003]). It appears that the commerce relationship between India and Sweden is as well rooted in history as it is viable today.

Over the past decades, global imports of Swedish goods have skyrocketed and almost tripled in value. This is far from an isolated development as the global economy plays an essential part in trade between countries (SCB [2023a]). During the same time period India has experienced similar growth trends within their trade and economic development (The World Bank [2023]).
Today, India is within the top 30 trading partners of Swedish export, and Sweden’s 3rd largest trading partner in Asia (Embassy of India [2022b]). Their trade increased by 27% compared to the same period the previous year (SCB [2023b]). India’s most imported commodities from Sweden include items such as machinery, iron and steel, electrical equipment, paper as well as vehicles or parts thereof (Trading Economics [2023]).

Figure 1.1: The logarithmic development of import levels in India, generally as well as imports only from Sweden.

As reflected in Figure 1.1, the development of India’s imports from Sweden is aligned with the general development of the import over the past two decades, thereby making Sweden a good representative trading partner to suit the scope of the thesis. Furthermore, Sweden and India have a longstanding relationship heavily based on Research and Development linkages and investment activities. Multiple prominent Swedish companies such as ABB and Ericsson have establishments in India dating over 60 years back. They have more recently been accompanied by modern technology companies such as Truecaller and Spotify. The growth of Swedish companies’ presence across India over the past 5 years has increased by approximately 70% (Embassy of India [2022b]). The rationale for expanding operations to India varies, however, one reason may be connected to labor-cost arbitrage. This is defined as exports from one country with a GDP per capita of less than a fifth of the respective GDP per capita of the importing country. This means that the importing country leverage the low-wage environment of the exporting country (Lund, Manyika, Woetzel, Bughin, Krishnan, Seong, and
Muir [2019]). In 2021 India’s GDP per capita is estimated at about 1/27-part of the Swedish GDP per capita (The World Bank [2021]).

1.1.1 Emerging market economies

The terms which describe a country undergoing significant development are many; developing countries, emerging market economies, more or less globalized countries. India, specifically, can be classified within the More Globalized Country (MGC) category, where the distinction between more or less globalized is determined based on a measure of trade dynamics. Moreover, the reformation of the Indian economy is dependent on state interventions, such as application of various trade policies and the much prioritized monetary policy. With careful policy-moderation and exchange rate control, India is considered a leader in the MGC group (G.W [2002]).

Generally, in order for the economy to develop, certain requirements need to be met. Firstly, G.W [2002] mentions that one of the essentials is technological progression, such as new production or manufacturing methods; this, however, is enabled by scientific advancements and an appropriate level of education in order to supply high-quality human capital. Secondly, to leverage technological development an efficient market economy needs to be established. This means that the economic conditions and institutional directions must be aligned with the prospective technological growth. With this, emerging markets have the potential to reach a sustainable economic development.

1.2 Purpose and Problem statement

The objective of this research thesis is to investigate and quantify the impact of the macroeconomic variables Exchange rate, Education level, and Foreign Direct Investment, on import levels using multiple linear regression. This will be done by creating two models. Model (1) will include all variables, but will, however, use data from a shorter time period. Put into comparison with Model (2), which will consider less variables, however, with data from a longer time period. It is understood that there are many factors at play when it comes to international trade, which this thesis is well aware of. The following analysis of India’s import of Swedish goods and services aims to find whether import patterns can be explained using domestic, social, and macroeconomic variables in isolation from external forces.
India has been selected for this analysis due to the country’s significant development lately, and can be considered a booming economy over the time period that this thesis investigates. Moreover, Sweden is used as a case example of an industrialized country characterized by trade openness. The research area of international trade is wide and continuously growing, hence the aim of this thesis is to contribute to this field of research and further explain patterns in global trade. Other areas of usage for this thesis could be for economists, politicians, entrepreneurs and businesses to use the results found here in order to make qualitative decisions regarding investments and trade with emerging market economies.

1.3 Research question

The research questions for this thesis are the following:

- Which macroeconomic factors are important in explaining India’s import levels from Sweden, historically?

- What is the impact of education level on commerce in emerging market economies?

1.4 Scope and Delimitations

Firstly, this thesis uses historical data and does not aim to draw any conclusions regarding trends outside the set time frame. Model (1) has data ranging from 2013:M1-2020:M3, while Model (2) will have data covering 2000:M1-2020:M3. The limitation follows from lacking data for the FDI variables in Model (1).

Secondly, the countries in focus are India and Sweden, however, they do not solely trade with each other or exist in a detached space from the rest of the world. Hence, this paper will reserve its findings to only relate to Sweden and India, even though it is established that there might be outside factors affecting the trends that cannot be explained without considering the world economy, and world involvement.

Furthermore, the variables; two-way Import, two-way FDI, Education level and Exchange rate, while selected as potential drivers of trade patterns, are not sufficient to fully explain them. The limitations lie in both the limited number of variables considered, as well as the amount of information they can provide.
Lastly, there are limitations to the selected method of research which is ordinary least squares in multiple linear regression. The main limits of OLS are the many assumptions which include linearity assumption as well as independence assumption, all of which will be addressed later in the report.
Chapter 2
Economic Theory

2.1 Imports
Importing represents the action of acquiring products from abroad, theoretically in order to satisfy unfulfilled domestic needs (Djalo M.U [2023]). This explanation of import levels has been widely discussed, and addresses multiple factors, yet concludes somewhat ambiguous results. During the 1990’s, the improving market access in South Asian Countries, including India, halted due to major reforms. This makes the area interesting in terms of economic studies on trade (United Nations [2005]). Following a general exogenous rise in world demand over the past years, more specifically in India, India’s import from Sweden, as a representative for an OECD country, is chosen as the response variable for this thesis. Moreover, Sweden’s import levels from India are included to provide a relationship aspect.

2.2 Foreign Direct Investment
Foreign Direct Investments (FDI) is described as the value of cross-border transactions associated with the acquisition of equity or reinvestment of earnings in a foreign enterprise, without the regular purchase of shares. Accordingly, FDI creates steady and enduring relationships between economies (OEC [2008]). FDI has played an increasingly important role in the Swedish economy since the 1980’s with a large share of investments directed to manufacturing MNCs (OEC [1993]).

The consensus regarding the theoretical relationship between FDI and import is to be determined. Theoretical arguments regarding a substitutionary or complementary relation between the variables of interest are ambiguous,
yet the majority of reports point to a complementary relationship (Kapor K. [2022]). Nonetheless, many more recent studies (e.g. Majeed M.T. [2007], Egger P. [2004]) find positive and significant effects of FDI on export. In this thesis the FDI will be represented two-way in order to examine which direction explains the trade, both the Swedish FDI to India, and the Indian FDI to Sweden are included in Model (1).

### 2.3 Exchange rate (SEK/INR)

The exchange rate is explained as the price of one currency in terms of a foreign currency. The rates can either be floating and rely on supply and demand, or fixed and be determined by the country’s Central Bank (Dornbusch [2018]). A weak currency will stimulate exports and reduce imports, as the weak currency means that it has a lower value relative to other currencies. Hence, the exports become cheaper for foreign buyers while imports become more expensive for domestic buyers. Consequently, the currency in which prices are set has significant implications for trade flow and many exporting companies use EURO- or USD-pricing to be less affected by the local currency’s fluctuations (Dornbusch [2018]).

![Figure 2.1: Development of the (SEK/100 INR) Exchange rate](image)

Additionally, multiple studies show that uncertainty amongst traders as a result of exchange rate volatility will reduce the trading volumes as the traders become more risk-averse (W. [1973]). The variable in this thesis will be a measure of Swedish Krona (SEK) per 100 Indian Rupee (INR). As Figure 2.1 shows, the exchange rate has varied over the past 20 years whilst displaying an overall negative progression of INR, or in simpler terms, it has weakened.
2.4 Education level

In this thesis, Education level considers the gross enrollment in secondary school. Dias [2015] concluded that an intermediate education level (9-11 years) benefits from incentives promoting imports as imports increasingly demand certain skills, suggesting that availability of human capital with a secondary degree favors imports. Thus, considering Sweden’s growing advanced tech industry, Education level has been determined as interesting in describing import levels.

_Poor countries and poor people differ from rich ones not only because they have less capital but because they have less knowledge_  
— Wolfensohn [2000]

As the president of The World Bank Group, Wolfensohn highlights that knowledge creation often comes at a cost and is therefore more easily generated in industrialized countries. Whereas developing countries rely more on acquiring knowledge through trade relationships. It should, however, be noted that knowledge as used here addresses technical and information-knowledge and does not regard culture or religion.

2.5 Literature Review

2.5.1 Bilateral trade

As the main topic of this thesis is trade between India and Sweden this literary review starts by examining the existing literature regarding bilateral trade, before moving into the literature of the regressor variables.

Bilateral trade is explained as trade solely between two specified countries (Global Negotiator [2023]). Specifically Sweden and India have a bilateral trade agreement in place (Embassy of India [2022a]).

Between any trading partners it is essential that there is a certain amount of trust in the other partner. This trust-trade relationship was empirically shown to have positive significant correlation by researchers Xing and Zhou [2018]. Applying their results one could state that improving bilateral trust can foster bilateral trade. However, if there is not trust between two nations they may use plurilateral trade agreements and involve several countries, as doing this may be a safer option. Historically, the number of bilateral as well as plurilateral trade agreements have increased, yet their impact on trade differs
according to researchers Chafer and Llorca-Vivero [2022]. The findings from their study show that plurilateral agreements increase trade, while the bilateral agreements have no significant effect on trade.

Another important aspect of bilateral trade is geographical proximity and logistics. Research conducted by Hausman and Subramanian [2005] observed the large impact of the logistics metrics on the operational performance, where they suggest that optimizing the logistic operations will increase international trade in the long run. Considering the distance perspective, Disdier and Head [2008] found that the decrease in bilateral trade as geographical distance increases grew in the middle of the century and has since remained high. Supporting the common understanding that trade is more frequent with neighboring countries than those far away.

Research conducted in Malaysia by Yusoff [2010] highlights that bilateral trade balance is responsive to macroeconomic variables such as real exchange rate and domestic and foreign income rates. However, it is more responsive to certain trading countries and not others. The general recommendation of the research was for Malaysia to use undervalued exchange rate strategies to improve their trade balances.

### 2.5.2 Exchange rate

As trade transactions between two regions typically require the action of currency conversion, the consideration of exchange rates when discussing imports appear well supported. Research conducted by Genc [2014] about the effect of exchange rates on imports in emerging countries show a significant result, and they conclude that exchange rate indexes have an effect on imports long term. On the other hand, Morrison W. [2011] raised the notion that in the case of a depreciation in currency on the importer's end, the exporter may reduce his price level. Thus, eliminating the possible correlation. However, this would be in an attempt to retain market share, and the strategy proposed is both industry and product specific (Genc [2014]).

Similar findings were presented by Ng et al. [2008] based on their research in Malaysia; a positive relationship between trade balance and exchange rate in the long term, however, a negative relationship between foreign income and trade balance. The researchers suggest that in the long term devaluation would improve trade balance. In contrast Onafowora [2003] found that there exists a co-integration relationship between trade balance, real exchange rate as well as domestic and foreign income in the long run.

Further, one study by Khim-Sen Liew and Hussain explores other explaining
variables as they find that the effect of exchange rates on changes in trade is exaggerated. They instead suggest using real money, rather than nominal exchange rate, as they find that real money can affect the trade balance. They encourage a shift of policy measures to focus more on the variable of real money rather than exchange rates.

2.5.3 FDI

FDI has a complex relation to trade, as according to Wei [2013] increased FDI can in the short term lead to increased import, and although this in itself does not fuel the economy, the FDI will in the long term increase exports. Another study done in India by Viswanadh N. [1974] found a positive linkage between trade and inward FDI, suggesting that the variables are complementary to each other. The same conclusion was drawn by Mariam C. [2004] after analysing the demand for exports and imports of manufactured goods in the EU, US and Japan. The result of capital inflows does, however, raise concerns as it may increase the risk of rising inflation and cause currency appreciation which in turn could have implications on trade levels (Ahmed S. [2014]).

2.5.4 Education level

It is widely accepted that education is a public good as it aids the development of a country, since the citizens are able to perform higher level tasks and grow businesses via trade. However, not all citizens are in favor of the increase in trade, in an article by Hainmueller [2006] it is established that the highest support for trade restriction is found in groups of low level education. These results indicate that with higher education trade is favored and further development and globalization is anticipated. Hainmueller and Hiscox results imply that education strongly affects the individual trade preferences, highlighting that there are more factors at play other than those linked to job skills.

Interestingly, the relationship between trade and education is a two-way relationship, and it feeds a positive loop. Researchers Kim S.J. [2000] found that global trade in combination with education leads to worker flexibility and the possibility for workers to specialize in certain industries. Hence granting the individual a chance to further personal development.

Moreover, new technologies demand new skills, which translates to a need for rapid adaptation of technology advancements. In accordance with this,
J.W. [2001] brings light to the importance of adequate education in developing countries and argues that the educational levels have a complementary effect on machinery imports. In all, he continues to prove that secondary education is vital in order to facilitate foreign technologies. A similar conclusion is also supported by Bartel A. [1987] as well as Nelson R.R. [1966] who confirms the advantage of more highly educated workers in innovation and technological-change dominated industries.
Chapter 3

Mathematical theory

3.1 Multiple Linear Regression Analysis

The use of a multiple regression model is to showcase the relationship between \( k > 1 \) regressors and one dependent variable. The independent variables \( x \), with the corresponding regression coefficients \( \beta \), and a response variable \( y \). The relationship can be expressed as:

\[
y_i = \sum_{j=0}^{k} x_{ij} \beta_j + \epsilon_i, \quad i = 1, \ldots, n.
\]  

(3.1)

The analysis conducted in this thesis will apply a confidence interval of 95%, yielding a significance level of 5% (Montgomery et al. 2021).

3.1.1 Assumptions

Montgomery et al. (2021) explains that the multiple regressions model relies on five assumptions. These should be taken into account in order to examine the model adequacy.

1. The relationship between the dependent variable and the independent variables is approximately linear.
2. The mean of the error term is equal to zero. \( \text{E}(\epsilon_i) = 0 \quad i = 1, \ldots, n. \)
3. The errors have constant variance, i.e. homoscedasticity.
4. The errors are uncorrelated.
5. The errors are normally distributed. \( \epsilon \sim \mathcal{N}(0, \sigma^2 I_n) \)
Chapter 4

Methodology

4.1 Literature study

The book *Macroeconomics* written by Dornbusch [2018] is the main reference literature for the economic theory. In addition, to review previous studies and existing literature Google Scholar, Ulm University Economics database, and the Library of the Royal Institute of Technology will be used as research sources. The selection criteria for the articles included are title, abstract, publication date, and journal. In addition, keywords such as “imports”, “multiple linear regression”, “emerging market economies” and “trade” were used to find adequate sources.

Furthermore, the underlying mathematical theory supporting the multiple linear regression analysis is drawn from *Introduction to Linear Regression* (Montgomery D.C. [2012]) and *Modern Multivariate Statistical Techniques* (A.J. [2008]).

4.2 Data Collection

The sample of data to be used in the multiple linear regression analysis comprises 243 observations and 87 observations respectively. The accumulated data sets are in parts collected from public sources such as the Central Bureau of Statistics (Statistiska Centralbyrån), Sweden’s Central Bank (Riksbanken), and The World Bank. The period in scope is two-parted and concerns 2013:M1-2020:M3 and 2000:M1-2020:M3. A detailed description of the sources is cataloged below.
• India’s imports from Sweden: Central Bureau of Statistics (SCB)
• Sweden’s imports from India: Central Bureau of Statistics (SCB)
• India’s Direct Investments in Sweden: Central Bureau of Statistics (SCB)
• Sweden’s Direct Investments in India: Central Bureau of Statistics (SCB)
• Exchange rate: Sweden’s Central Bank
• Education level: The World Bank

4.3 Data Processing

Firstly, all individual dataset corresponding to the different variables were processed to arrive at a comparable series of data points. The Exchange rate and Import levels are reported on a monthly scale, which is used as the base frequency for this analysis. However, Education level is detailed on an annual level, as well as FDI on a quarterly basis and their respective frequencies were adjusted to the established base frequency. The underlying assumption which allows for the frequency processing is that Education level and FDI are constant during their reported periods. The processing operations were conducted in Excel from which the final dataset was constructed and later read into R for analysis.

4.4 Model

Following limited data-availability our analysis will be comprised of two regression models, where Model (1) includes five variables, FDI (SWE to IND), FDI (IND to SWE), Indian Education level, Exchange rate (SEK/100 INR), and Sweden’s import from India and spans over 2013:M1-2020:M3. Model (2) includes three variables, Indian Education level, Exchange rate (SEK/100 INR), and Sweden’s Import from India and accounts for the period 2000:M1-2020:M3.
Model (1)

\[ \ln(y_i) = \beta_0 + x_{i1}\beta_1 + x_{i2}\beta_2 + x_{i3}\beta_3 + x_{i4}\beta_4 + \ln(x_{i5}\beta_5) + \epsilon_i. \]

Table 4.1: Explanation of Variables of Model (1)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>(y_i)</td>
<td>India’s import from Sweden</td>
<td>SEK</td>
</tr>
<tr>
<td>(x_{i1})</td>
<td>FDI (SWE to IND)</td>
<td>SEK</td>
</tr>
<tr>
<td>(x_{i2})</td>
<td>FDI (IND to SWE)</td>
<td>SEK</td>
</tr>
<tr>
<td>(x_{i3})</td>
<td>Indian Education level</td>
<td>% gross</td>
</tr>
<tr>
<td>(x_{i4})</td>
<td>Exchange rate (SEK/100 INR)</td>
<td>SEK</td>
</tr>
<tr>
<td>(x_{i5})</td>
<td>Sweden’s import from India</td>
<td>SEK</td>
</tr>
<tr>
<td>(\epsilon_i)</td>
<td>Error term</td>
<td>Scalar</td>
</tr>
</tbody>
</table>

Model (2)

\[ \ln(y_i) = \beta_0 + x_{i1}\beta_1 + x_{i2}\beta_2 + \ln(x_{i3}\beta_3) + \epsilon_i. \]

Table 4.2: Explanation of Variables of Model (2)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>(y_i)</td>
<td>India’s import from Sweden</td>
<td>SEK</td>
</tr>
<tr>
<td>(x_{i1})</td>
<td>Indian Education level</td>
<td>% gross</td>
</tr>
<tr>
<td>(x_{i2})</td>
<td>Exchange rate (SEK/100 INR)</td>
<td>SEK</td>
</tr>
<tr>
<td>(x_{i3})</td>
<td>Sweden’s import from India</td>
<td>SEK</td>
</tr>
<tr>
<td>(\epsilon_i)</td>
<td>Error term</td>
<td>Scalar</td>
</tr>
</tbody>
</table>
Chapter 5

Results

5.1 Final Model

Model (1)

As shown in Table 5.1 none of the explanatory variables display a p-value below 0.05, leading us to dismiss this regression model as it is not statistically significant on a 95% confidence level. Accordingly, the adjusted R-squared value of 0.1391 indicates that little of the variance in India’s import level of Swedish goods is explained by the proposed model. The F-statistic for the full model as well as the individual covariates confirms the lack of a significant relationship.

Table 5.1: Model (1) Properties

|                     | Estimate | Std. Error | t value | Pr(>|t|) | F value |
|---------------------|----------|------------|---------|----------|---------|
| (Intercept)         | 1.094e+01| 2.073e+00  | 5.279   | 1.07e-06 | ***     |
| Swedish FDI         | 2.199e-03| 3.256e-03  | 0.675   | 0.501    | 2.6912  |
| Indian FDI          | -1.069e-04| 7.557e-05 | 1.415   | 0.161    | 1.8013  |
| Education           | -1.709e+00| 1.354e+00 | -1.263  | 0.210    | 0.6898  |
| Exchange rate       | 4.111e-02| 2.997e-02  | 1.372   | 0.174    | 5.7511  |
| Log(Sweden imports) | 2.677e-01| 1.823e-01  | 1.469   | 0.146    | 2.1575  |

Signif. codes 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’

F-statistic 2.618 p-value: <0.03023

Multiple R-squared 0.1391

Adjusted R-squared 0.08599
Model (2)

The second regression model shows a much better fit, and has higher validity than Model (1). From Table 5.2 it can be noted that the adjusted R-squared has a value of 0.5431 meaning that the slight majority of the variance in import levels is explained by the model. The results on the F-statistic show that all variables have a significant relationship to the response variable on a 95% confidence level, this also supported by the F-statistic for the full model.

| Model (2) Properties
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>Std. Error</td>
<td>t value</td>
<td>Pr(</td>
<td>t</td>
</tr>
<tr>
<td>(Intercept)</td>
<td>7.53506</td>
<td>1.0006</td>
<td>6.850</td>
<td>6.22e-11</td>
<td>***</td>
</tr>
<tr>
<td>Education</td>
<td>-2.37643</td>
<td>0.69722</td>
<td>-3.408</td>
<td>0.000767</td>
<td>5.3805</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>-0.09776</td>
<td>0.01696</td>
<td>-5.763</td>
<td>2.53e-08</td>
<td>240.4708</td>
</tr>
<tr>
<td>Log(Sweden imports)</td>
<td>0.70338</td>
<td>0.10502</td>
<td>6.698</td>
<td>1.50e-10</td>
<td>44.8589</td>
</tr>
</tbody>
</table>

Signif. codes 0 ‘****’ 0.001 ‘***’ 0.01 ‘**’ 0.05 ‘*’ 0.1 ‘.’
F-statistic 96.9 p-value: « 2.2e-16
Multiple R-squared 0.5488
Adjusted R-squared 0.5431

5.1.1 Residual Analysis

Through visual inspection of the normal Q-Q plots in Figure 5.1, it is determined that the normality assumption holds for Model (2) despite being slightly skewed. Nonetheless, the normality plot is slightly left-skewed and light-tailed for Model (1); however, the normality assumption is still assumed to hold normality considering the statement by Montgomery D.C. [2012] that modest deviations do not gainsay the assumption.
Figure 5.1: Normal Q-Q plots (Model (1) to the left, Model (2) on the right)

Regarding the residual vs. regressor value plots, Model (1) show no severe violations against the assumption. However, Model (2) tends slightly to a double bow but is also presumed not to violate the assumptions.

Figure 5.2: Standardized Residuals vs. Fitted Values

5.1.2 Multicollinearity Analysis

The introduction of the variance inflation factor (VIF) as a measure of multicollinearity, as well as the corresponding cut-off value 10 (Dornbusch [2018]) are established. Accordingly, it is noted that none of the regressors exceed the cut-off value for Model (1), see Table 5.3. For Model (2), Table 5.4 shows that the covariate Education just exceeds the cutoff value. Consistently,
eigen system analysis confirm the lack of multicollinearity with condition number well below cut-off value of 100 (Dornbusch [2018]).

Table 5.3: VIF factor Model (1)

<table>
<thead>
<tr>
<th>Swedish FDI</th>
<th>Indian FDI</th>
<th>Education</th>
<th>Exchange rate</th>
<th>Log(Swedish imports)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.270648</td>
<td>1.081647</td>
<td>1.530494</td>
<td>1.886022</td>
<td>2.004896</td>
</tr>
</tbody>
</table>

Table 5.4: VIF factor Model (2)

<table>
<thead>
<tr>
<th>Education</th>
<th>Exchange Rate</th>
<th>Log(Sweden Imports)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.308474</td>
<td>5.787051</td>
<td>5.685964</td>
</tr>
</tbody>
</table>

Due to the above-cutoff value in Model (2) the analysis continues with further investigation of the multicollinearity using a heatmap. Following the results in Figure 5.3, Education level is only slightly positively correlated with both Swedish import levels of Indian goods, as well as the Exchange rate (SEK/INR). However, the correlation is not severe. The Exchange rate is more strongly correlated to the Swedish import levels of Indian goods. The last conclusion is anticipated by the same reasoning as for including Exchange rate in our studies of what affects Indian imports of Swedish goods. Moving forward the multicollinearity is disregard in favor of the relationship-based nature of our studies.
5.1.3 Model conclusions

We conclude that Model (2), with a considerable time-span yields plausible results. That is, significance of all included variables, in comparison to Model (1), where no variables were significant in describing India’s import levels of Swedish goods. The adequacy of Model (2) is also considered higher in terms of normally distributed error terms. For this reason, we can conclude that macroeconomic variables are important in explaining India’s import of Swedish goods when considering a longer time period. This prompts us to favor the model that concerns a longer time span.
Chapter 6

Discussion

The final model derived from our analysis shows that all variables, Education, Exchange rate (SEK/100 INR) and Sweden’s import from India considered over a 20 year time-span are constructive in explaining India’s import from Sweden. This is anticipated, since they all have an impact on the economy, as established by previous research, which will reflect in the trade. Multicollinearity is considered negligible, however, it may be suitable to introduce a lag of one to two periods in further studies.

The Education level in India is negatively correlated with India’s Imports from Sweden in both models. However, the result is only significant when considering a longer time period. Admittedly, Education level is the variable that is the least significant despite inclusion of more historical data. The reviewed research is contradictory to the recorded results, and the negative nature may be related to a reduced need of advanced/technological imported goods and services as the knowledge and education level increase across India. This is most related to Kim S.J. [2000] research which states that increased trade and globalization allows for workers to specialize in certain industries, and thus potentially retain the knowledge within country-borders. In this light, our results also underpin the studies of G.W [2002] about human capital in emerging market economies and India as an MGC. The increasing level of education and improved technological skills in India support the establishment of a sustainable and efficient economy, with less need to import knowledge.

In conformity with the Education level, the Exchange rate (SEK/100 INR) is negatively related to India’s imports from Sweden. Economic theory opposes this conclusion, suggesting that imports should increase with a stronger currency. Conversely, Ng et al. [2008] imply that a long term currency devaluation should improve trade balances, meaning that the export level
should progress more strongly than imports, or that imports decline. In a similar manner, W. [1973] concludes that exchange rate volatility may reduce trading volumes, which is aligned with the trend of the SEK/100 INR exchange rate over the past 20 years. Another explanation could be related to pricing strategies such as dollar pricing at which the SEK/100 INR exchange rate would not be a significantly contributing factor. Nonetheless, the significance of the variable is related to Yusoff [2010] research about macroeconomic variables effect on trade.

In contrast, Sweden’s imports of Indian goods display a positive relation, and is the most significant in explaining India’s Imports from Sweden. As considered in the economic theory section, a trust-trade relationship between two trading parties is expected to have a positive and significant correlation. And the purchase of the opposing party’s goods may be considered foundational conditions for trust establishments.

Due to the insignificant results on Foreign Direct Investments, it is not possible to draw any conclusions regarding its relation to India’s imports from Sweden. Further, the general results indicate that the short-term model is too general, and in order to find what it is that explains Sweden’s trade with India it might be necessary to look at more variables. Depending on the investment incentives, the results may be considered discouraging.
Chapter 7

Concluding Remarks

7.1 Conclusions

In conclusion, when describing India’s import from Sweden in the 21st century it is essential to include the variables Indian education, Exchange rate (SEK/100 INR) and Sweden’s import from India, yet no results could be drawn when accounting for a more short term perspective. Further, the most significant variable in explaining Sweden’s export levels in the 21st century is Sweden’s imports from India.

From our study, the Indian education level has a negative relationship to India’s imports from Sweden. Correspondingly, we raise the notion that a higher education level reduces the need to import advanced technologies and machinery from OECD countries such as Sweden.

In order to answer our research questions, a literature review was conducted and two OLS models were built. The long-term model, showing significant results, was then improved using tests for multicollinearity.

To this end, the results from our study prove valuable when considering what factors to put a premium on in order to stimulate trade between an OECD country and an emerging market economy. However, the sentiment of our results remains indefinite as the action of importing goods and services creates a dependence that evidently can be disrupted. For example the Covid-19 pandemic supply chain issues, or the 2021 Suez Canal blockage and their implications on trade and the world economy.
7.2 Future work

If this study were to be expanded it is recommended to perform a Granger Causality Test, in order to see if there is causality and if predictions regarding the future of trade can be made. Moreover, using the Gravity Model of Trade the research can be explained in more detail to find what relationship Sweden and India have in regards to their international trade.

To widen the research field of trade and education it is highly recommended to look into the effects of gender discrimination and its consequences on the trade. Since it is established that India is a highly unequal society where a lot of stigmas and old traditions circulate, such as that the female children are expected to become wives and family caretakers rather than working professionals.

7.2.1 What has been left undone?

The empirical exercises of this thesis fails to account for several additional relevant factors such as nationality, trade barriers, tariff rates, the quality of infrastructure. Due to limited data availability on foreign direct investments, the years included in the analysis were cut short. Resulting in a short-term model of a 7-year time-span which limited the quality of the analysis. Subsequently, an analysis including a long term perspective on the effects of foreign direct investments would have been preferred.
Bibliography


