

Czech University of Life Sciences Prague

Faculty of Economics and Management

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Diploma Thesis

**The Analysis of Economic Performance and Foreign
Trade Development in the Republic of the Philippines**

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DIPLOMA THESIS ASSIGNMENT

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Economics and Management
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Thesis title

The analysis of economic performance and foreign trade development in the Republic of the Philippines

Objectives of thesis

The main aim of the present Master thesis is to identify the main determinants of foreign trade development in Philippines.

Since the Philippines is a newly industrialized country and its economy has been transitioning from one based on agriculture to an economy with more emphasis upon services and manufacturing, it becomes interesting to investigate how the content and structure of the Philippine foreign trade has been changing over the last 20 years.

On the basis of gathered data for the period from 1998 to 2018, the revealed comparative advantage (RCA) of the Philippines exports will also be evaluated, answering thus the question of whether the Republic has conquered its own niche in the world market.

Methodology

The synthesis of relevant information from various reliable resources represented by printed literature, scientific articles, surveys, web sources will be done and used then in the practical part of the Master thesis. Both theoretical and practical parts will rest on descriptive analysis and thematic synthesis. Own research work will be based on index and regression analysis along with comparative techniques and statistical inference.

The proposed extent of the thesis

60-80

Keywords

Philippines, Foreign trade, Balassa RCA, Vollrath index, Regression analysis

Recommended information sources

- ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE. INSTITUT TROPŮ A SUBTROPŮ, – JENÍČEK, V. – KREPL, V. *Foreign trade and development economics*. Prague: Czech University of Life Sciences, 2007. ISBN 978-80-213-1651-5.
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Declaration

I declare that I have worked on my diploma thesis titled "The Analysis of Economic Performance and Foreign Trade Development in the Republic of the Philippines" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 06 April 2020

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The Analysis of Economic Performance and Foreign Trade Development in the Republic of the Philippines

Abstract

The Republic of the Philippines is classified as a lower middle-income country in the region East-Asia and Pacific. This diploma thesis analyses the economic performance of the country and its foreign trade development. It is interesting to see the shift of the country's economy transitioning from an agriculture-based economy to an economy based on services and manufacturing. For the years 1998 to 2018, the different economic policies of the different administrations are taken into consideration and through the construction of a magic quadrangle, the most effective policies are identified. The thesis also delves into the Philippines' most dominant foreign trade sector – Machine and Electrical Equipment. For the same time period of 1998 to 2018, Balassa and Vollrath indices of all sectors of traded merchandise of the country, based on the HS 1988/92 product nomenclature, are computed. Resulting Balassa and Vollrath indices show that the country has revealed comparative advantage on its dominant sector Machine and Electrical Equipment, and other sectors with promising comparative advantage are also identified. A regression analysis is also performed to establish if there is a relationship among the endogenous variable Philippine GDP with the exogenous variables Exchange rate, Total Exports value, Balassa and Vollrath indices of Machine and Electrical Equipment. Resulting values show that the variable with the strongest effect on the Philippine GDP, in this case, is the Total Exports value.

Keywords: Philippines, Foreign trade, Economic performance, Revealed comparative advantage, Balassa RCA, Vollrath index, Regression analysis, Magic Quadrangle, Machine and Electrical Equipment

Analýza hospodářské výkonnosti a vývoje zahraničního obchodu na Filipínské republice

Abstrakt

Filipínská republika je v regionu východní Asie a Tichomoří klasifikována jako země se středním příjmem s nižšími příjmy. Tato diplomová práce analyzuje ekonomickou výkonnost země a její vývoj zahraničního obchodu. Je zajímavé sledovat přechod ekonomiky země z zemědělství na hospodářství založené na službách a výrobě. Pro roky 1998 až 2018 se berou v úvahu různé hospodářské politiky různých správních orgánů a prostřednictvím konstrukce magického čtyřúhelníku jsou identifikovány nejúčinnější politiky. Práce se také věnuje nejvýznamnějšímu odvětví zahraničního obchodu na Filipínách - strojním a elektrickým zařízením. Pro stejné období let 1998 až 2018 se počítají indexy Balassa a Vollrath všech odvětví obchodovaného zboží v zemi na základě nomenklatury produktů HS 1988/92. Výsledné indexy Balassy a Vollratha ukazují, že země odhalila komparativní výhodu ve svém dominantním sektoru Strojní a elektrická zařízení a jsou identifikována i další odvětví s nadějnou komparativní výhodou. Regresní analýza se také provádí, aby se zjistilo, zda existuje vztah mezi endogenní proměnnou filipínský HDP s exogenními proměnnými směnný kurz, hodnota celkového vývozu, Balassa a Vollrath indexy strojů a elektrických zařízení. Výsledné hodnoty ukazují, že proměnnou s nejsilnějším účinkem na filipínský HDP je v tomto případě hodnota Total Exports.

Klíčová slova: Filipíny, Zahraniční obchod, Ekonomický výkon, Odhalená komparativní výhoda, Balassa RCA, Vollrathův index, Regresní analýza, Kouzelná čtyřúhelník, Strojní a elektrická zařízení

Table of contents

| | | |
|----------|--|-----------|
| 1 | Introduction | 11 |
| 2 | Objectives and Methodology | 13 |
| 2.1 | Objectives | 13 |
| 2.2 | Methodology | 13 |
| 3 | Literature Review | 15 |
| 3.1 | Overview of Foreign Trade | 15 |
| 3.1.1 | International Organisations Influencing Foreign Trade | 16 |
| 3.2 | Magic Quadrangle of the Economy | 17 |
| 3.2.1 | Components of the Magic Quadrangle | 18 |
| 3.3 | Comparative Advantage and its Indices | 22 |
| 3.3.1 | Balassa Index (RCA) | 22 |
| 3.3.2 | Vollrath's Index of Revealed Competitiveness | 24 |
| 3.4 | Econometric Analysis | 24 |
| 3.4.1 | The Classical Linear Regression Model | 25 |
| 3.4.2 | Model Verification | 28 |
| 4 | Practical Part | 32 |
| 4.1 | The Philippine Economy | 32 |
| 4.2 | Magic Quadrangle of the Philippines in Selected Years | 37 |
| 4.2.1 | Inflation in the Philippines | 39 |
| 4.2.2 | Philippine Current Account Balance | 41 |
| 4.2.3 | Philippine GDP | 42 |
| 4.2.4 | Unemployment in the Philippines | 43 |
| 4.3 | The Philippines in International Trade | 44 |
| 4.4 | Revealed Comparative Advantage of Philippine Commodities | 45 |
| 4.4.1 | Recent Trade data | 45 |
| 4.4.2 | Balassa Index of Selected Philippine Commodities | 48 |
| 4.4.3 | Vollrath Index of Selected Philippine Commodities | 49 |
| 4.4.4 | Machine and Electrical Equipment – The Philippines' Major Traded Sector | 50 |
| 4.4.5 | The world market for Machine and Electrical Equipment and revealed comparative indices of China, United States and Germany | 51 |
| 4.5 | Econometric Analysis | 56 |
| 4.5.1 | Economic model | 56 |
| 4.5.2 | Econometric model | 57 |
| 4.5.3 | Data set | 57 |
| 4.5.4 | Estimation of parameters | 59 |

| | | |
|----------|---|-----------|
| 4.5.5 | Economic verification..... | 60 |
| 4.5.6 | Statistical verification..... | 61 |
| 4.5.7 | Econometric verification..... | 63 |
| 4.5.8 | Mathematical verification..... | 63 |
| 5 | Results and Discussion..... | 65 |
| 6 | Conclusion and Recommendation..... | 68 |
| 7 | References..... | 70 |
| 8 | Appendices..... | 73 |

List of pictures

| | | |
|-----------|---|----|
| Figure 1 | Magic Quadrangle of the Philippine Economy in Selected Years..... | 38 |
| Figure 2 | Philippine Peso Inflation Rate 1998 to 2018..... | 40 |
| Figure 3 | Philippine Consumer Price Index (CPI) Weights by Commodity Group..... | 40 |
| Figure 4 | Philippine Current Account Balance as % of GDP 1998 to 2018..... | 41 |
| Figure 5 | Philippine GDP in Billions US\$ 1998 to 2018..... | 42 |
| Figure 6 | Philippine GDP Growth Rate 1998 to 2018..... | 43 |
| Figure 7 | Philippine Unemployment Rate 1998 to 2018..... | 44 |
| Figure 8 | Share of Philippines in World Trade 1998 to 2018..... | 45 |
| Figure 9 | Product Share of Philippine Exports 1998, 2008 and 2018..... | 46 |
| Figure 10 | Product Share of Philippine Imports 1998, 2008 and 2018..... | 47 |
| Figure 11 | Machine and Electrical Equipment Export, Import and Trade balance 1998 to 2018..... | 50 |
| Figure 12 | Product Share of Machine and Electrical Equipment in Philippine Exports and Imports 1998 to 2018..... | 51 |
| Figure 13 | Product Share of Machine and Electrical Equipment in World Trade 1998 to 2018..... | 52 |
| Figure 14 | Machine and Electrical Equipment Export Share by Country..... | 53 |
| Figure 15 | Machine and Electrical Equipment Imports Share by Country 1998 to 2018..... | 54 |

List of tables

| | | |
|----------|--|----|
| Table 1 | Philippine Global Economic Policy as Contrasted with Local Policy..... | 33 |
| Table 2 | Data Set for Magic Quadrangle of Philippine Economy..... | 38 |
| Table 3 | Balassa indices of Philippine Traded Commodities..... | 48 |
| Table 4 | Vollrath Indices of Philippine Traded Commodities..... | 49 |
| Table 5 | Philippine Sectors that possess Revealed Comparative Advantage..... | 50 |
| Table 6 | Balassa and Vollrath Indices for Machine and Electrical Equipment (PHL, CHN, USA and DEU)..... | 55 |
| Table 7 | Data Set for Regression Analysis..... | 58 |
| Table 8 | Multicollinearity of original data set..... | 59 |
| Table 9 | Multicollinearity of data with natural logarithm..... | 59 |
| Table 10 | Estimated Parameters..... | 59 |
| Table 11 | T-test..... | 61 |
| Table 12 | Confidence Interval..... | 62 |
| Table 13 | Mathematical Verification..... | 64 |

List of abbreviations

| | |
|-------|---|
| APEC | Asia Pacific Economic Cooperation |
| ASEAN | Association of Southeast Asian Nations |
| CHN | China |
| CMDP | Capital Market Development Plan |
| DEU | Germany |
| FAO | Food & Agriculture Organization of the United Nations |
| GATT | General Agreement on Tariffs and Trade |
| MNLF | Moro National Liberation Front |
| ODA | Official Development Assistance |
| OECD | Organisation for Economic Cooperation and Development |
| RCA | Revealed Comparative Advantage |
| PHL | Republic of the Philippines |
| RPDEV | Ramos Peace and Development Foundation |
| SEC | Securities and Exchange Commission |
| USA | United States of America |
| WITS | World Integrated Trade Solutions |
| WTO | World Trade Organization |

1 Introduction

Foreign trade is an important factor in a country's economic growth and development, but this is also restricted by the diversity of the commodities in a specific country. This paper focuses on the analysis of the economic performance of the Republic of the Philippines as well as the development of foreign trade in the country. The Republic of the Philippines is a lower middle-income country in the region East-Asia and Pacific. In 2018, the country registered a growth rate of 6.2%, becoming a strongest performer among countries in East Asia and Pacific region according to the World bank.

This paper will first discuss some basics of foreign trade and some institutions that affect or monitor trade in different parts of the world. There is also a discussion on the four components of the magic quadrangle - a graphical representation of a country's economic situation which visualizes how effective are the economic policies imposed in the given time period. The theoretical part will also include the comparative indices of Balassa and Vollrath, how to compute them and the difference between the two. The basics of a regression analysis using Least Squares Method is also included in the theoretical part of this thesis.

The practical part of this thesis showcases the current state of the Philippine economy and how it came to such. A brief history of the Philippine economy will be synthesized based on the different eras before 1992 and based on the different political leaders during the years after that. The economic policies of the five Presidents of the Philippines from 1992 to 2019 will be given into view. Magic quadrangles will be constructed based on each presidential term to see whose policies prove to be more beneficial for the country.

Further analysis will be focused in the foreign trade of the country with focus on Machine and Electrical Equipment – the country's most dominant traded good. Comparative indices namely the Balassa and Vollrath indices will be calculated for the different trade product categories not only to find out if the country has revealed comparative advantage for its major trade product but also to identify other categories where the Philippines has revealed comparative advantage. In addition, the Balassa and Vollrath indices of the Machine and Electrical Equipment category of the Philippines will be compared side by side with that of China, United States and Germany, the three main players in the world for this category.

The paper will delve deeper into how these indices of Machine and Electrical equipment, along with the real exchange rate from US dollar to Philippine Peso, and total export value of the Philippines, affect the Philippine GDP. Regression analysis will be used to establish the relationship, if any, among these variables.

2 Objectives and Methodology

2.1 Objectives

The main aim of this diploma thesis is to analyse the performance of the Philippine economy in terms of its foreign trade activities and its competitiveness in its dominantly traded goods for the period 1998 to 2018. In order to achieve this goal, the following questions will be answered:

- What years in the selected period does the Republic of the Philippines exhibit an ideal economic status? What economic policies were applied on those specific years?
- Does the Republic of the Philippines have revealed comparative advantage for its dominantly traded goods? What other categories could the country focus on to improve its foreign trade performance?
- Does an interrelation/causality exist among the Philippines' GDP, real exchange rate, total exports, Balassa index and Vollrath index of main traded commodity? If it does, to what degrees do these variables affect the Philippines' GDP?

2.2 Methodology

This thesis will first present the current situation of foreign trade in the Philippines, touching slightly on how the economy shifted from an agriculture based to industry based international trade. It is interesting to know how the country's economy changed over the years and with the use of a magic quadrangle, five selected years from the time period 1998 to 2018 will be presented and compared. The following years are chosen for the reason that these are the years when presidential elections were held and therefore marks the end of the presidential terms and 2018 as the end of the selected periods in focus: 1998, 2004, 2010, 2016, 2018.

The current Philippine foreign trade is highly dominated by Machineries and Electrical equipment accounting for 63% of its exports in 2018. On the other hand, this category shares 35.6% of the country's imports on the same year (World Bank, 2020). Through the use of comparative advantage indices Balassa Index, and Vollrath index, this paper will determine if the Philippines possesses a revealed comparative advantage on this category with reference to the whole world. Other possible categories where the country have revealed comparative advantage will also be identified.

Using econometric regression analysis, the effects of real exchange rate, total exports, Balassa index and Vollrath index of main traded commodity on the Philippines' GDP, will be measured. It will also be identified whether these variables are statistically significant to the country's economic performance. All computations will be done using the Gretl software.

Data are gathered from various printed and online sources with most quantitative data (covering the period of 1998 to 2018) coming mainly from online platforms of organisations such as the Organization for Economic Cooperation and Development (OECD), the World Bank's World Integrated Trade Solutions (WITS) and the United Nations Comtrade Database.

3 Literature Review

This part will discuss literature gathered from printed and online materials, firstly giving a short overview of foreign trade. Then, there will be a discussion of the magic quadrangle and its components, followed by literature on Balassa and Vollrath indices. Lastly will be the literature for a simple regression analysis.

3.1 Overview of Foreign Trade

Foreign trade is a very important driver of economic growth and with the onset of globalisation is becoming more so. Trading is important in the sense that it allows countries to benefit not only in economic terms but also in social terms. By engaging in trade, a country is able to procure raw materials, finished goods and even services that it cannot produce for itself. Trading enables a country to fulfil its supply requirements even if it does not have the means, capacity or raw materials to produce these things by itself. As long as they have the financial capability, this activity supplies the needs of the people both necessities and luxuries, which otherwise cannot be supported if trading is not done. It makes products never known before to be available in many parts of the world. International trade does not only allow flow of goods but flow of money and capital as well. Trading also stimulates economic growth and elevates the standard of living in a country.

Improvements in the production, communication and transportation infrastructures in most parts of the world also make trade easier and therefore more inevitable. At first glance, international trade might be all positive, however, it also has its own pitfalls. First of which is the alienation of local brands. Big multinational companies take a big chunk of the market share leaving smaller local entrepreneurs in shambles. Second, international trade may inadvertently increase income inequality, making the disparity between low and high-income earners more visible (Hill, 2014).

3.1.1 International Organisations Influencing Foreign Trade

As international trade involves coordination with various countries, it is expected that there would be organizations helping to make trading flows easier and put some control over it. Some of the organizations are listed below:

World Trade Organization (WTO)

Established in 1995 and headquartered in Geneva, Switzerland, the main aim of the WTO is to facilitate the General Agreement on Tariffs and Trade (GATT). GATT is an international agreement promoting free international trade in goods. On its website, WTO identifies itself as “the only international organization dealing with the rules of trade between nations” (WTO, 2019). As of February 2020, the organization has 164 member countries and 625 secretariat staff. The organization claims that all major decisions are made by the membership as a whole. The WTO operates on a one-nation one-vote ideology meaning that each member has equal standing in the organization. However, one of the criticisms for WTO is the existence of smaller groups where the real negotiations take place and least powerful member countries are left out in informal discussions which influences overall decision-making (Collins, 2015).

International Monetary Fund (IMF)

The International Monetary Fund, as evident in its name, deals with international monetary cooperation by ensuring the stability of the international monetary system (IMF, 2006). By keeping track of global economies and economies of member countries, financial lending to countries with balance of payments difficulties and giving practical help to members, the organization keeps its activities aligned with its purpose. IMF was established in 1945 and has 189 members as of February 2020 (IMF, 2019). Its creation was sought to serve as a future prevention of the repetition of disastrous economic policies which led to the Great Depression in the 1930s (IMF, 2006).

Association of Southeast Asian Nations (ASEAN)

The Association of Southeast Asian Nations was established in August 1967 with the Bangkok ASEAN Declaration with five members namely Indonesia, Malaysia, Philippines, Singapore and Thailand with the pursuit of regional peace, stability and economic prosperity (Weatherbee, 2019). As of February 2020, ASEAN is composed of ten member countries with the addition of Brunei Darussalam, Viet Nam, LAO PDR, Myanmar and Cambodia. The purposes of ASEAN is more all-encompassing compared to that of WTO or IMF but one of it's main aims and purposes includes a more effective collaboration for better utilization of agriculture and industries and trade expansion which covers international commodity trade, improvement in transportation and communication facilities and rising the people's living standards (ASEAN, 2019).

Asia-Pacific Economic Cooperation (APEC)

Asia-Pacific Economic Cooperation was established in 1989 with twelve founding members with the aim to support sustainable economic growth and prosperity in the Asia Pacific region. The purpose of the forum lies on “championing free and open trade and investment, promoting and accelerating regional economic integration, encouraging economic and technical cooperation, enhancing human security, and facilitating a favourable and sustainable business environment (APEC, 2019).”

3.2 Magic Quadrangle of the Economy

The magic quadrangle is a graphical representation of the four main goals of economic policy namely economic growth, full employment, price stability and balanced trade. These main goals can be measured through the following indicators all expressed in percentage: GDP growth, unemployment rate, inflation rate and current account balance as percent of

GDP. The values of these indicators are then plotted, and by connecting their points on the axis a quadrangle is formed, the larger the quadrangle the better (Kaldor, 1987).

This idea was introduced by Germany in 1967 through the Act to Promote Economic Stability and Growth. The law aims for an overall economic equilibrium and outlined four factors to enable such: “price stability, high level of employment, external equilibrium and steady and adequate economic growth (Anon, 2006)”. In 1971, Nicholas Kaldor conceptualized the graphical representation of the magic quadrangle where the improvement of one indicator will lead to the deterioration of another.

OECD defines the optimum for the four indicators as 3% GDP growth rate, 5% unemployment rate, 2% inflation rate and 0% share of current account balance to GDP (Majerova, 2014). This quadrangle is a good graphical representation of the effectivity of a country’s economic policy measured through the above-mentioned indicators. However, there has been some critics on this magic quadrangle in the sense that it is only focused on GDP and economic growth. In 2013, discussions in Germany are calling for a modified magic quadrangle which will also be inclusive of other factors such as “innovation, social justice, environmental sustainability and stable state finances (Willy Brandt School of Public Policy, 2013).”

3.2.1 Components of the Magic Quadrangle

The four components of the Magic Quadrangle to maintain economic equilibrium are discussed below:

Inflation rate

Inflation can be defined as “a process of continuously rising prices, or equivalently, of continuously falling value of money (Laidler and Parkin, 1975)”. Laidler and Parkin also discusses that compared to changes in the value or prices of specific products which affects only those directly related to those products, changes in the value of money is more

significant in the sense that this phenomenon affects everyone. Inflation is also perceived as a monetary phenomenon because it happens when there is a rapid increase in the quantity of money rather than in actual output.

It is argued that inflation has re-distributional effects in the sense that because of inflation, wealth would be redistributed to those sectors who would use it more wisely and productively (Curwen, 1976). As businesses reacts to the aggregate demand stimulated by deficit financing, through creation of new investments, mild inflation will eventually result in economic growth. Although, there was no clear evidence to support such, there was no doubt that double figures inflation will have adverse effects on the economy as a whole.

The rate of inflation can be calculated as:

$$\text{Rate of inflation} = \frac{CPI_{x+1} - CPI_x}{CPI_x} \quad (1)$$

Where: CPI = Initial Consumer Price Index

Current account balance

Balance on current account is simply the difference between a country's exports and imports. Policy makers regard current account as an important macroeconomic variable because it is not only intertwined with but also gives us information about the actions and expectations of all the participants in an open economy (Scacciavillani and Knight, 1998). The current account balance exhibits the residents of a particular country's total transactions with foreigners in the current market and it also determines the development of a country's net claims of liabilities to the its trading partners and to the rest of the world.

Current account balance as percent of GDP can be calculated as:

$$CA \text{ as } \% \text{ of } GDP = \frac{(X-M)+NI+NT}{GDP} \quad (2)$$

Where:

X = exports

M = imports

NI = net factor income

NT = net cash transfers

Gross domestic product and growth

Gross Domestic Product or GDP is defined as “the market value of the goods and services produced by labour and property located in a country” (Van Marrewijk, Ottens and Schueller, 2012). A modified measure of the GDP is PPP GDP which according to the World Bank is “GDP converted to international dollars using purchasing power parity rates“. One challenge in GDP reporting is the reality that countries will have different practices in terms of acquiring statistics and thus will result to discrepancies. This is significant in most developing countries where there still lack resources, time, training and budget that are required in processing a comprehensive and accurate statistics.

GDP formula is shown below:

$$GDP = C + I + G + (X - M) \quad (3)$$

Where:

C = private consumption

I = gross investment

G = government investment and spending

X = exports

M = imports

One important related statistic to GDP is the GDP growth measured by comparing the current year and the previous year's GDP. This statistic answers the question of how fast the economy is growing in terms of percentage (Brezina, 2011).

The rate of growth of GDP can be computed using the following formula:

$$GDP \text{ Growth Rate} = ((Y_t - Y_{t-1})/Y_{t-1}) * 100 \quad (4)$$

Where:

Y_t = current GDP

Y_{t-1} = last period's GDP

A significant issue of using GDP as an economic indicator is that by measuring only market transactions, it fails to capture other aspects such as social costs, environmental impacts and income inequality (Costanza, Robert et al, 2014)

Unemployment

Unemployment is another important economic indicator of the economy's overall well-being as it measures the capacity of the economy to provide jobs for its citizens that want them, these are the people that are available for and seeking employment, thereby reflecting the country's utilisation of labour (Hughes and Perlman, 1984). High unemployment can sometimes be present in developed countries especially if they have unemployment or welfare benefits and the unemployed can afford to take time to find a new suitable job. On the other hand, it is also possible to have low unemployment as a disguise to poverty because, although employed, some workers do not necessarily get the benefits that they are supposed to and are living in a vulnerable working environment. Even though the unemployment rate is a very useful tool in the labour market, it fails to convey information on the quality of employment of those who do have a job, whether they are satisfied with their job or being underpaid or overworked; on the other hand, it also does not say about the situations of the person outside the workforce or their quality of life.

The unemployment rate can be computed as follows:

$$Unemployment\ rate = \frac{Unemployment}{Labour\ force} \times 100 = \frac{Unemployment}{Employment + Unemployment} \times 100 \quad (5)$$

3.3 Comparative Advantage and its Indices

It is argued that even though countries' reason for trading may be attributed to economies of scale and comparative advantage, the main theoretical explanation is the latter (FAO, 2010). The concept of comparative advantage was introduced by David Ricardo recognizing that even though countries engage in international trade because of their productivity – that is, in their differences in the ability to produce goods – it is not the absolute differences, but actually, the relative differences that matter. (OECD, 2011)

Analysis of comparative advantage can be a very useful tool in comparing relative costs of production and identifying commodities that would be most efficient for trading. One approach to assess comparative advantage is the Domestic Resource Cost, however, the data required for this approach proves to be difficult to obtain as it utilizes data on production costs. Another approach, which has less predictive potential and is more descriptive is the Relative Comparative Advantage. This approach uses data evidenced by actual trade flows which is more readily available compared to production costs (FAO, 2010).

3.3.1 Balassa Index (RCA)

The Revealed Comparative Advantage is based on the Ricardian comparative advantage concept where the relative competitiveness of a country is calculated based on actual trade flows (IGI Global, 2019).

Balassa index was introduced by Bela Balassa and Mark Noland in 1965. As a measure of relative comparative advantage, the Balassa index is the ratio of the share of the

commodity in the country's total exports compared to the share of the same commodity to the total exports of the world or a certain group of countries (IGI Global, 2019). There is a revealed comparative advantage when the ratio is greater than one, which means that the country is getting more than its fair share of trade in the commodity.

The Balassa index for revealed comparative advantage is computed as below:

$$RCA_{ij} = \frac{\frac{X_{ij}}{X_{it}}}{\frac{X_{nj}}{X_{nt}}} \quad (6)$$

Where:

X_{ij} = exports of j – commodity from i-country

n_j = a set of countries

nt = a set of commodities

If the resulting figure $RCA > 1$, then the country has comparative advantage for that commodity and if it $RCA < 1$, then the country has a comparative disadvantage.

However, one limit to the use of RCA is that since it uses post-trade data, any distortions caused by various trade policies may also be reflected in the results. More so, the Balassa index gives an asymmetric value where the Balassa index ranges from 1 to infinity if a country has revealed comparative advantage and only from 0 to 1 in case of disadvantage, which may result in the overestimation of the sector's relative weight.

Gnidchenko and Salnikov (2015) enumerated other disadvantages of the Balassa index. One of which is that it is sensitive to the number of categories of goods that a country exports. That is, if country A is exporting only 10 categories, the Balassa indices will be higher compared to country B which exports 20 categories and therefore more diversified. Moreover, it is incorrect to compare heterogeneous countries and comparison by Balassa index is applicable only to countries with comparable level of development and participation in international trade.

Even so, RCA can still be useful in identifying which commodities a country exports more or less than average. Together with other data, it can also be used in identifying trade

patterns whether or not they are driven by comparative advantage. RCA can also be used to gauge whether trade patterns are correlated to trade policies being imposed.

3.3.2 Vollrath's Index of Revealed Competitiveness

To answer to the limitations of the Balassa index, Vollrath's index of revealed competitiveness considers the difference between the logarithms of a country's export and import indices (Jambor and Babu, 2016).

The Vollrath index is computed as follows:

$$RC_{ij} = \ln RXA_{ij} - \ln RMA_{ij} \quad (7)$$

Where:

RXA = export index and computed the same as RCA

RMA = import index; a value of <1 means import is of revealed comparative advantage

A Vollrath index of greater than 0 indicates revealed competitiveness.

3.4 Econometric Analysis

Econometrics may be simply defined as “the quantitative analysis of actual economic phenomena based on the concurrent development of theory and observation, related by appropriate methods of inference” (Samuelson, Koopmans and Stone, 1954). An econometrician, therefore, in this sense, should be “competent mathematician and statistician and an economist by training” (Baltagi, 2007) An econometric analysis is finding the right set of assumptions which are both realistic and sufficiently specific to make full use of the available data.

The basic steps to an econometric analysis are as follows (Das, 2019):

- Specification > formulation of the economic model and afterwards the econometric model by specifying relationships based on economic theories and incorporating the

error term. Theoretical understanding of the economic theories is important to be able to specify the correct functional form and to prevent inclusion of irrelevant variables or exclusion of relevant variables.

- Estimation > three popular methods of estimation are methods of moments, least squares and likelihood. For purposes of this paper, the least squares method will be used.
- Testing of Hypothesis > testing of hypothesis is necessary after estimating the parameters to identify goodness of fit of the model
- Forecasting > simply put is the prediction of the data's future value. Two types of forecast are ex-post forecast (made beyond the period of estimation and within the period where data is still available) and ex-ante forecast (forecast for periods when the data is not available).

3.4.1 The Classical Linear Regression Model

The classical linear regression model shows the relationship of the left-hand side variable (also called dependent variable, regressand, explained variable) to other variables on the right-hand side (also called independent variables, regressors, explanatory variables). The model satisfies four assumptions according to Hayashi (2011):

- The Linearity Assumption > the relationship between the variables on both sides of the equation – the dependent and independent variables – are linear.
- The Strict Exogeneity Assumption > for all observations, the mean is conditional on the regressors which implies that the unconditional mean of the error term is zero.
- No multicollinearity > there is no perfect linear relationship among the independent variables
- Spherical error variance > there is no serial correlation in the error term

The economic model and econometric model

The main difference between an economic model and an econometric model lies in the addition of an error term. While both models are simplified representations of real-world process, the econometric model takes into consideration the effects of other factors that are not available in the data set and incorporates it into an error term. The error term, also coined disturbance term, represents the parts of the dependent variable that cannot be predicted by the independent variable (Das, 2019).

Taking a simple equation: $y = f(x_1, x_2, x_3, \dots)$

Where:

y = the dependent variable

x_i = the independent variables

A simple economic model can be expressed as

$$y_t = \gamma_0 + \gamma_1 x_{1t} \quad (8)$$

Where: γ = the parameters to be estimated

Converting this to an econometric model will give

$$y_t = \gamma_0 + \gamma_1 x_{1t} + u_t \quad (9)$$

Where: u = the random variable or error term

The first equation is a simple economic model that provides a theoretical explanation on the relationship of the dependent and independent variable. The second equation, through the addition of the error term, analyses real-life situations. The γ 's are the parameters that describe the nature of the relationship between the dependent and independent variable whether they have direct or inverse relationships. The econometric model is simply an empirically testable form of the economic model (Das, 2019).

Ceteris Paribus and the error term

The term *ceteris paribus* means “other (relevant) factors being equal” (Woolridge, 2009). In the econometric equation, *ceteris paribus* effect can only be estimated when the error term is added. This is because we can only get reliable estimators from a random sample of data if we make the assumption that the error term $E(u) = 0$. The relationship of the unobservable u to the explanatory variable x is restricted by the assumption that as long as the intercept is included in the equation, there is nothing lost if the assumed average value of u is zero.

Data set

There are three types of data used in econometric analysis (Das, 2019):

- Time series > observations are collected over time and instead of a survey, most time series data are available in official statistics. Data in a time series are helpful in analysing trends and forecasting.
- Cross section > usually generated through sample surveys of households, firms or countries and are gathered over a period of time (e.g. one year). Cross section data are mostly used in health economics, labour economics, demography and other applied macroeconomics.
- Panel > this is a mixture of time series data and cross section data. This data is obtained by repeated survey of same sample over periods of time.

Data used are non-experimental and contrary to experimental data are not gathered through laboratory environments. It is important that the econometrician is aware of how the data used were gathered and generated before it is used in the econometric model.

Estimation of Parameters using ordinary Least Squares Method

The ordinary least squares method aims to select the estimators of the parameters that minimizes the residual sum of squares (RSS) (Das, 2019). The formula for estimating parameters using this method is:

$$\min \sum_{t=1}^n (y_t - \hat{y}_t)^2 \quad (10)$$

The estimation function that minimizes the residual sum of squares is:

$$\gamma = (X^T X)^{-1} X^T y \quad (11)$$

Where:

γ = vector of size (k x 1) of estimated parameters

X = matrix of size (n x k) of observed values of exogenous variables

y = vector of size (n x 1) of observed values of endogenous variable

3.4.2 Model Verification

Economic verification

Economic verification of the model is done to identify whether the model makes sense with economic theories. It is important to assess whether the variables included are relevant or not in order to avoid inclusion of irrelevant variables and exclusion of relevant variables. The direction and intensity of the effect of the explanatory variables on the explained variables are also being evaluated. It is also necessary to evaluate the correctness of the signs and the magnitude of the estimated parameters' numerical values. (Čechura et al., 2014)

Statistical verification

Statistical verification assesses whether the estimated parameters, the equations and the entire econometric model are statistically significant. Statistical verification can be done through the ways listed below:

Statistical significance of estimated parameters: t-test

The t-test is used to see if there is a statistical evidence that the inclusion of selected parameter to the model is significant.

The t-value is computed as:

$$t_{value} = \frac{\text{parameter absolute value}}{\text{its standard error}} = \frac{|\gamma_i|}{S_{\gamma_i}} \quad (12)$$

Given the hypotheses:

Null hypothesis (H₀): there is no relationship between the explained and explanatory variable

Alternative hypothesis (H₁): H₀ is not true

The resulting t-value is compared to a constant value from the t-table depending on the selected α .

If $t_{value} > t_{\alpha}$: reject H₀; explanatory variable is statistically significant

If $t_{value} < t_{\alpha}$: the explanatory variable is not statistically significant

Statistical significance of estimated parameters: Confidence interval

An alternative way to test statistical significance of the parameters is by using the confidence interval. The confidence interval is computed as below:

$$\gamma_i = \gamma_i \pm t_{\alpha} S_{\gamma_i} \quad (13)$$

If the resulting confidence interval contains zero (0), then the parameter is not statistically significant.

Statistical significance of entire model: F test

F-test is used to test the statistical significance of the entire model. It tells whether there is statistical evidence to prove or disprove that the explanatory variables taken jointly is relevant.

Given the hypotheses:

Null hypothesis (H₀): all explanatory variables taken jointly are not relevant

Alternative hypothesis (H₁): H₀ is not true

If $\hat{F} > F^*$ (n-p; α): the model is statistically significant and H₀ is rejected.

Coefficient of Determination (“Goodness of fit“)

The R² coefficient of determination is the ratio of the explained variation and the total variation. It indicates the percentage of change in the amount of the regressand which is explained by the changes in the regressors. This can be computed as:

$$R^2 = \frac{ESS}{TSS} = 1 - \frac{RSS}{TSS} \quad (14)$$

Where:

$$ESS \text{ (Explained Sum of Squares)} = \sum(\hat{y}_i - \bar{y})^2$$

$$TSS \text{ (Total Sum of Squares)} = \sum(y_i - \bar{y})^2$$

$$RSS \text{ (Residual Sum of Squares)} = \sum(y_i - \hat{y}_i)^2$$

- A high R² does not guarantee a cause-and-effect relationship but a cause-and-effect relationship between the regressand and regressors will result in a high R².
- R² is only a measure of “goodness of fit“ of a linear relationship.
- When there is autocorrelation or homoscedasticity, R² value is highly unreliable.

Econometric verification

The following assumptions of the econometric model are verified:

- Specification assumption
- Zero mean assumption
- Homoscedasticity using White test

Null hypothesis (H₀): Heteroskedasticity is not present

Alternative hypothesis (H₁): Heteroskedasticity is present

- Non-autocorrelation assumption using Durbin Watson test and Breusch-Godfrey test
- Independent variables are non-random and fixed in repeated samples
- Lack of perfect multicollinearity
- Normal distribution of the error term using Jarque-Bera test

Most tests can be done with the use of software and with the resulting P-value, the relevance of the model can be attested. If the p-value is less than the significance level α , then the H₀ is rejected.

Mathematical verification

Mathematical verification is simply making sure that the below equation is true:

$$\bar{Y}_t = \bar{\hat{Y}}_t \quad (\bar{U}_t = 0) \quad (15)$$

Where:

\bar{Y}_t = mean of observed y values
 $\bar{\hat{Y}}_t$ = mean of estimated y values
 \bar{U}_t = mean of error term

This means that the mean or average of the observed values of the endogenous variable should be equal to the mean or average of its estimated values based on the result of the econometric equation.

4 Practical Part

4.1 The Philippine Economy

The Republic of the Philippines is classified by the World Bank as a lower middle-income country in the region East-Asia and Pacific. In 2018, the country registered a growth rate of 6.2%, becoming a strongest performer among countries in East Asia and Pacific region (World bank, 2020). Considering the increase in GDP growth rate from an average of 4.5% in 2000 to 2009 to an average of 6.3% between 2010 to 2018, the World Bank is positive that the Philippines will leap from a lower middle-income country to an upper middle-income country. The World Bank attributes this increase to the country's sound economic fundamentals and a competitive workforce that is globally recognized.

The economic policies of the country can be said to be reactive more than strategic. Laluna, Paras and Soliva (2004), in their paper entitled *An Analysis of the History of Philippine Trade Policy* outlined the different policies set about by each Philippine administration and concluded that although there are indeed trade policies, they are implemented in reaction to global economic events or due to pressure from local economy embodied by elites who demand protection of their gains as brought about by trade liberalization.

A summary of the policies of each era prior to 1998 is outlined in Table 1. The early days of foreign trade in the country is characterized by exports dominated mostly by agricultural products and raw materials. During the Spanish Colonial Era, the Philippines was part of the Galleon Trade along with Spain, Mexico and China and its main exports are sugarcane, abaca, tobacco leaves, coconut, coffee and beans. This continued until the American period with a slight shift to processed agricultural products like processed sugar, coconut products, cigars and abaca products. At the same time, the Philippines was exporting raw materials to the United States and in return, the United States was providing manufactured goods to the Philippines.

Table 1 Philippine Global Economic Policy as Contrasted with Local Policy

| PHL Global Economic Policy as Contrasted with Local Policy | | |
|---|---|--|
| Era | Broad Characterization | PHL Economic Structure |
| Spanish Colonial Era | Absence of local economic policy -RP as part of galleon trade (Spain, Mexico, China) -In later years, commercial dominance of other western countries | Mainly agricultural Agricultural crop exports: sugarcane, abaca, tobacco leaves, coconut, coffee beans |
| American period | Local policy as part of global policy (Classical Colonial Economy) -PHL as provider of raw materials to US -US as source of manufactured goods for RP | Mainly Agricultural Main processed agricultural exports: processed sugar, coconut products, cigars, abaca products |
| Period of Reconstruction (1946 – 1950's) | Local policy as an extension of global policy (Neo-Colonialism) -PHL as provider of raw material to US and Japan | Agriculture and services-oriented (Industries were damaged by the war) Main export product: traditional agricultural products (sugar, coconut products, etc) |
| Period of Import Substitution (1950's -1960's) | Global policy as an extension of local policy (Import-substituting industrialization strategy) -Local goal of industrialization promoted thru Import and Foreign exchange controls | Increased industrial production and service sector growth; decline in agriculture Main export product: traditional agricultural products, mineral products (e.g. Copper) |
| Period of Export and Investment Promotion (mid-1960's – 1980's) | Globally dependent policy (Export promotion strategy) -Integrating local production with global market needs -Exports, Foreign Investments and Foreign Debt as tripod of local policy | Growth of Industrial and services sectors Main export products: garments, Agri products, including fisheries (prawns and tuna) and fruits (mango bananas, pineapple), mineral products (copper) |
| Globalization (1990's) | Globalization as the local policy -Continuation of trade reform and liberalization of sectors -minimal government intervention; reliance on market | Service oriented economy: Decline of Agri. Main export product: Electronics, Garments, Export crops |

Source: Perry, 2002. SMN.

After the 1945 war, the Philippines served as a provider of raw materials to the United States and Japan. Not surprisingly, due to the fact that the Philippines was under the occupation of both countries, albeit it was a very short time of Japanese occupation (1941-1945). This period saw the beginning of a service oriented economic structure since most industries were damaged by the war. Traditional agricultural products were still being exported. The period 1950's to 1960's saw changes due to industrialization with a growth in the industrial production and service sector. Agricultural products were still exported but to a decline and was instead gaining focus on mineral products like copper. 1960's to 1980' saw further growth in industrial and services sector with the efforts of integrating local production with the needs of the market. The onset of globalisation in the 1990's produced a service-oriented economy with minimal intervention from the government. All throughout

these years, it is said that the policies of the government were enforced as a response to the global economy and not really strategic on its own.

It is interesting to see the gradual shift of the economic structure from one based in agriculture to an economy based in electronics due to the onset of globalisation. Although agricultural products still constitute a part of the country's traded commodities, the goods dominating the current export market are electronics and this is evidenced by the product mix of exported and imported goods that will be discussed in succeeding parts.

It is also interesting how the country reacts to the different demands of the world market where the main export products change depending on the need of its selected trade partners. This strengthens Laluna, Paras and Soliva' claim that the country's policies are driven by external forces and formulated in response to global needs.

Economic Policies of Philippine Presidents from 1992 to 2019

From the year 1992 to 2019, there are five administrations who lead the government of the Philippines. A short discussion of their economic policies is enumerated below.

Fidel Ramos (1992 – 1998)

The main development plan of Fidel Ramos was known as the Philippines 2000 where economic growth and sustainable development was given focused along with four other areas: peace and stability, energy and power generation, environmental protection and streamlined bureaucracy. Ramos' term was characterized by liberalization of the economy, deregulation of key industries, privatization of public entities and modernization of public infrastructure and stressed on people empowerment and global competitiveness. He received the 1997 UNESCO Peace Award for his peace agreements with military rebels and the Moro National Liberation Front (MNLF) (RPDEV, 2020).

Joseph Estrada (1998 – 2001)

Joseph Ejercito Estrada, fondly addressed in the country as “Erap”, is the 13th President of the Republic of the Philippines whose leadership lasted only for less than three years from June 1998 to January 2001. The president was ousted from power through what people called the People Power 2, in reference to the EDSA Revolution in 1986, because of corruption issues.

Throughout his leadership, his focus centered on the alleviation of poverty with his famous tagline Erap para sa Mahirap, which means Erap for the poor—Erap being his nickname.

One major legislation signed during Estrada’s administration is the Retail Trade Liberalization Act which opens the retail trade industry to foreign players (BOI, 2000). This competitive retail trade will empower the consumers by providing them with more choices, lower prices, and better quality of goods and services. The same was applied to the banking sector by the General Banking Law of 2000.

Gloria Macapagal Arroyo (2001 – 2010)

Gloria Macapagal Arroyo is the second female president of the Philippines and daughter to a former Philippine President Diosdado Macapagal (1961 – 1965). She graduated as an economist and it can be said that the economy was strong during her term considering that the country was not significantly affected by the financial crisis.

She was known for her “holiday economics” where holidays were moved either to the nearest Monday or Friday, if possible, to form a long weekend which will help to stimulate local tourism and let families spend more time together which eventually will promote economic growth. She also established the Capital Market Development Plan (CMDP) whose goals sum to *“providing an enabling policy environment where among others, Philippine capital market institutions will grow their business and contribute increasingly to national economic growth by becoming more efficient and competitive, thus*

reducing the overall cost for corporations, regardless of size, to raise long-term capital through public offerings of equity or debt instruments“(SEC, 2015) The objectives of CMDP also involves stimulation of personal savings and long-term investments through the capital market, accelerating growth and efficiency of key capital market institutions, strengthening investor protection and aligning the financial regulations with global best practices and/or standards.

Arroyo’s most controversial economic reform is the E-VAT or Extended Value Added Tax which imposed tax on commodities which were previously tax-exempt and increased taxes for some products like cigarettes and alcohol (Varela, 2019).

Benigno Aquino III (2010 – 2016)

Benigno Aquino III, son to former Philippine President Corazon Aquino (1986-1992) stepped into office on the 30th of June 2010. One key achievement of the Aquino administration is changing the education system to the K to 12 program which adds 2 years to the previous ten-year basic education cycle which aims to address the labour mismatch in the country. Another important step is the 2014 Philippine Competition Act which seeks to stop unfair business processes and level the playing field among competitors resulting to more choices and better prices for consumers (Schnabel,2015).

The administration also prioritized streamlined bureaucratic functions and made government activities more transparent and efficient like passport and driver license renewals and business registrations. Karl Kendrick Chua, World Bank’s senior economist for the Philippines in 2016 recognized Aquino’s main contribution to the economy as setting the macroeconomic fundamentals and national budget in order (Schnabel, 2016). This somehow led to stability and one major indicator is the lower interest rates which encouraged more personal and business consumption.

Rodrigo Roa Duterte (2016 – 2018, term ending in 2022)

Before becoming President, Rodrigo Duterte was a long-term Mayor of Davao City in Mindanao from 1988 to 2016 (with one term gap in 2010-2013 when he was the Vice-Mayor). A significant program under the Duterte administration is Build Build Build which focuses on infrastructure improvements and in a way helps to create more jobs—one of his government’s promise to the people. For the period of 2017- 2022, it is estimated that investments in infrastructures will amount to at most 9 trillion pesos, with funding coming from public investments and loans through official development assistance (ODA) rather than the standard public-private partnership format (Ide, 2018). In the program website, one can also see the available jobs and different infrastructure projects being worked on.

In order to fund the infrastructure improvements and other government spending, the administration is also implementing a Comprehensive Tax Reform Program which looks on different tax subjects such as tax amnesty, corporate income tax, sin taxes, and mining taxes among others. While a number of the packages for this program are still in discussion, the TRAIN or Tax Reform for Acceleration and Inclusion has been passed into law on December 2017. This law provides for the following among others: lowered and simplified personal income taxes, simplified tax for small and micro self-employed and professional taxpayers, unconditional cash transfers to ten million poorest households, expanded value-added tax base, adjusted oil excise taxes and changes in other taxes. (DOF, 2020)

4.2 Magic Quadrangle of the Philippines in Selected Years

The magic quadrangle of the economy is a good graphical representation of the state of a country economy viewed through four indicators: GDP growth, current account balance as percent of GDP, inflation and unemployment rate.

Data used in construction of the magic quadrangle are given in the table below. The first four years (1998, 2004, 2010 and 2016) matches the years when Presidential elections were held in the country and is thus a good division point to see the policy effects in each

administration. The year 2018 marks the end of the period studied in this paper. Optimal figures are as prescribed by OECD (Majerova, 2014).

Table 2 Data Set for Magic Quadrangle of Philippine Economy

| Data Set for Magic Quadrangle of Philippine Economy | | | | | | |
|---|--------|------|------|--------|--------|----------------------|
| Indicator in % | 1998 | 2004 | 2010 | 2016 | 2018 | Optimal ¹ |
| GDP Growth | - 0.58 | 6.70 | 7.63 | 6.88 | 6.24 | 3.00 |
| CA as % of GDP | 2.14 | 1.78 | 3.60 | - 0.39 | - 2.38 | 0.00 |
| Inflation | 9.23 | 4.83 | 3.79 | 1.25 | 5.21 | 2.50 |
| Unemployment | 3.61 | 3.55 | 3.61 | 2.71 | 2.52 | 5.00 |

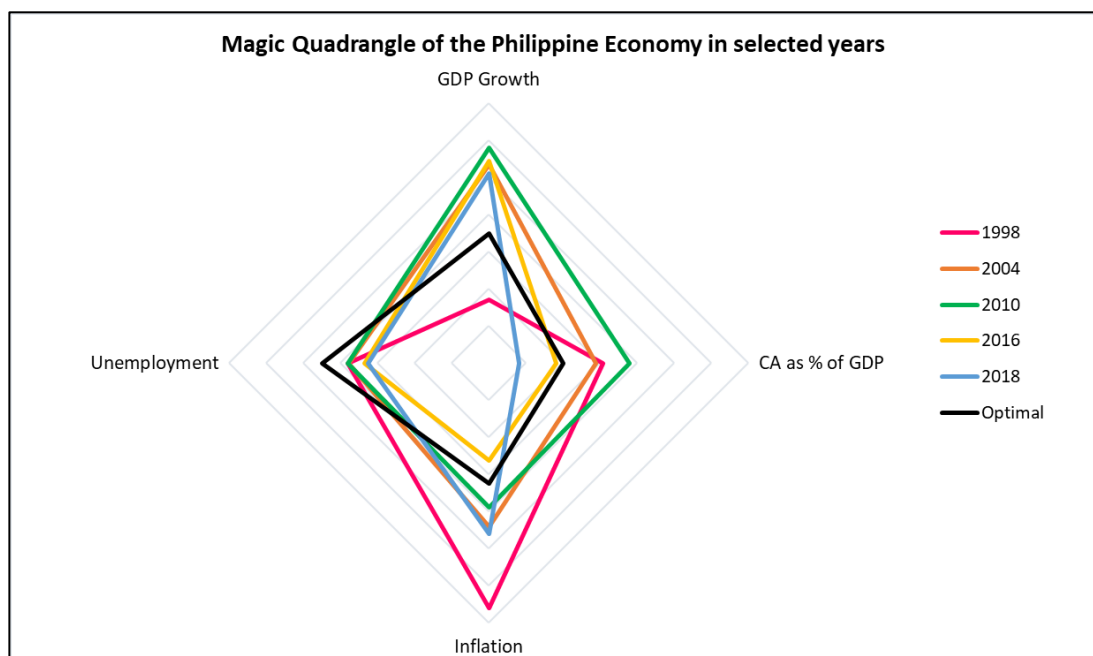
Source: The World Bank

¹ As defined by OECD

GDP growth rate is taken from data from the World Bank and is calculated at market prices based on constant local currency, of which aggregated are based on constant 20110 US dollars. Current account as percent of GDP, Inflation and Unemployment rates are also taken from the World Bank. Unemployment is based on model ILO estimate.

Based on above data, the magic quadrangle is constructed, and the result is below.

Figure 1 Magic Quadrangle of the Philippine Economy in Selected Years



Source: Own elaboration based on data from the World Bank

Following the theory that the bigger the area of the triangle, the better the state of the economy, we can see from the above figure that the quadrangles are bigger in the years 2010 and 1998. 1998 and 2010 marks the end of term of presidency of Fidel Ramos and Gloria Macapagal-Arroyo respectively. However, the closest to the optimum is the quadrangle for 2016 which is under the Presidency of Benigno Aquino III.

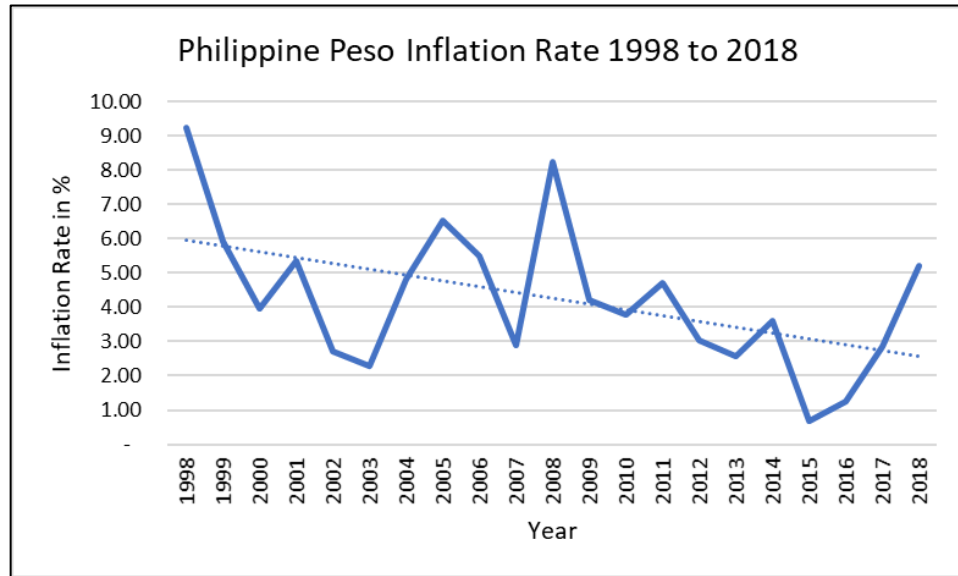
The quadrangle that represented the year 2010 seems to be the most ideal for the country. The GDP growth rate is high, there is a high positive current account balance, and inflation and unemployment are closer to the optimum.

However, the quadrangle does not take into consideration other factors that may be significant in measuring a country's economic well-being. It does not for example, say anything about poverty or quality of life in the country, nor does it tell anything about environmental protection and human rights, among others.

4.2.1 Inflation in the Philippines

Inflation rate in the Philippines has been in a downward trend although there are significant high and low peaks. Inflation rates have been fluctuating, although still in a downward trend, from 1998 to 2015 where it reached its lowest. However, the Duterte administration has been struggling to keep it in the target 2% to 4% rate but went over 5% in 2018.

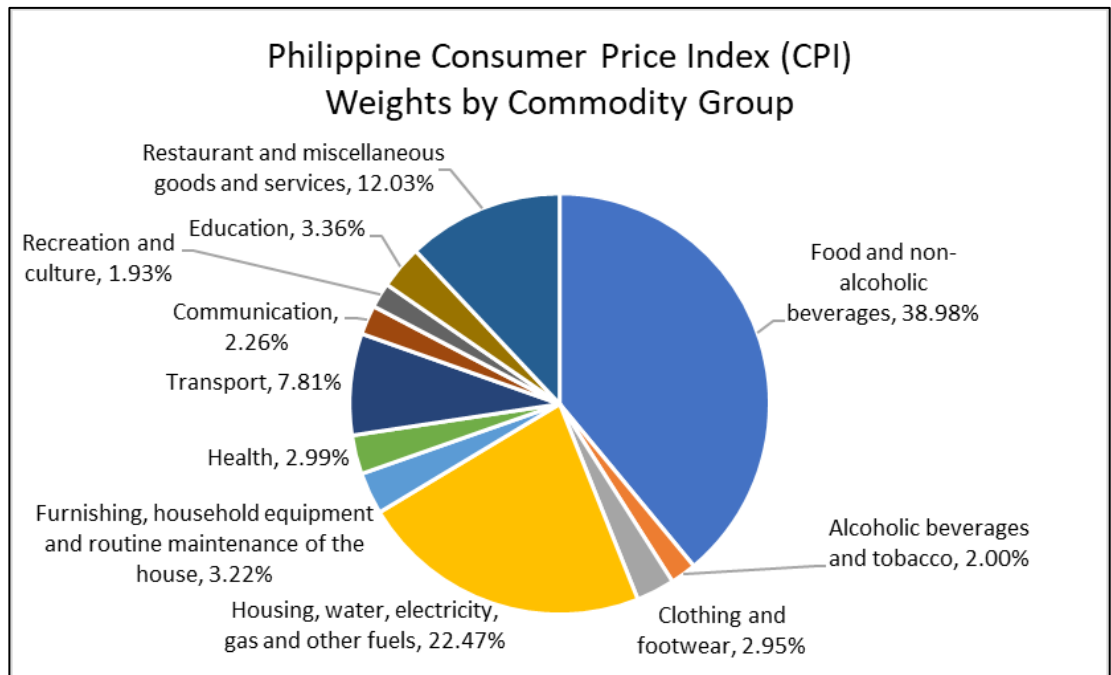
Figure 2 Philippine Peso Inflation Rate 1998 to 2018



Source: Own elaboration based on data from the World Bank

The headline inflation rate of the Philippines is based on the basket of goods as shown in the chart below.

Figure 3 Philippine Consumer Price Index (CPI) Weights by Commodity Group



Source: Philippine Statistics Authority

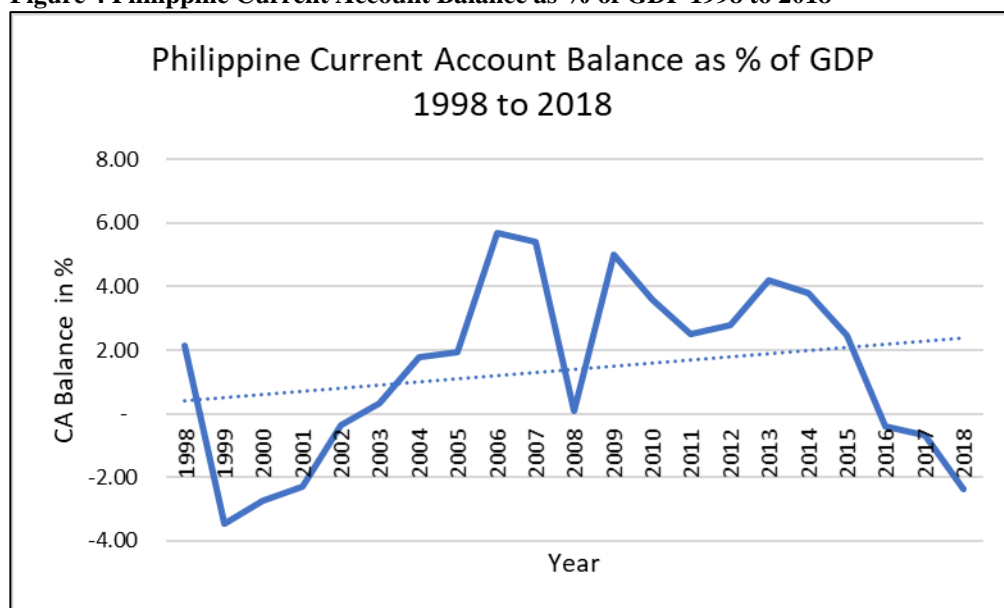
The biggest weight is allocated to Food and non-alcoholic beverages at almost 39%. Higher weights are also given to Housing, water, electricity, gas and other fuels at 22.47% and Restaurant and miscellaneous goods and service at 12.03%. The Philippines also accounts for the core inflation rate as a complementary indicator to the headline inflation rate, where it excludes goods with high volatility. Items excluded in the computation of core inflation are rice (9.6%), corn (0.6%), meat, fresh, chilled or frozen (4.8%), fish, fresh, chilled or frozen (4.3%), Vegetables, cultivated for their fruit (0.9%), Vegetables, cultivated for their roots(0.6%) and petroleum and fuels for personal (2.0%) which in totality accounts for 22.8% of the CPI (65).

4.2.2 Philippine Current Account Balance

Trade is an important aspect in the Philippine economy with the trade as percentage of GDP ending at 76.06% in 2018. This is not however the highest in this indicator as in 1997 it reached as high as 108.25%.

Current account balance of the Philippines is in an upward trend although there is a considerable decline from the year 2014 onwards. There was a significant drop in this indicator in 2008, which may be attributed to the financial crisis of that time, but it is also good to consider that the highest was in 2006. Both years are under the presidency of Arroyo.

Figure 4 Philippine Current Account Balance as % of GDP 1998 to 2018

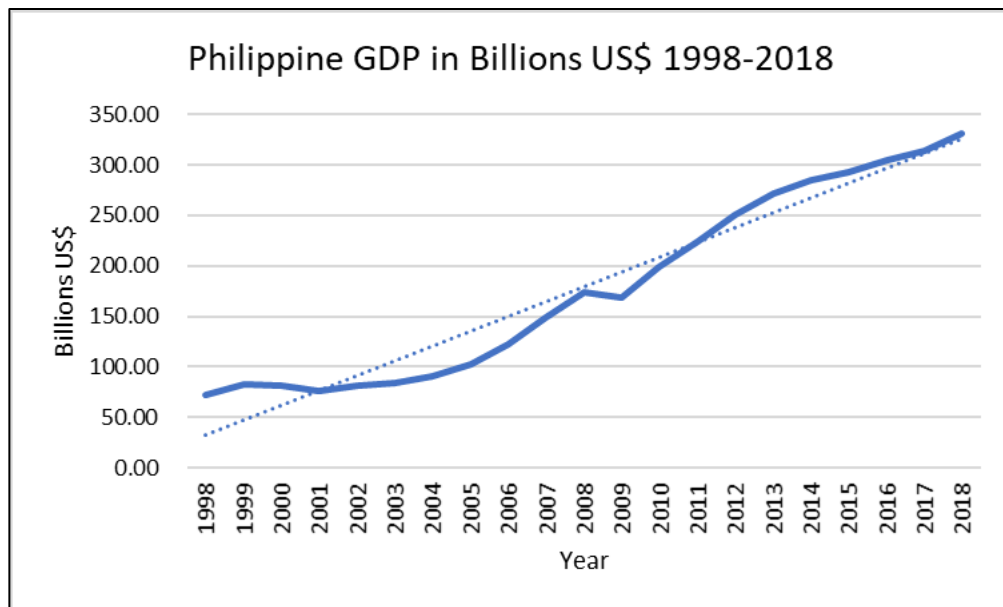


Source: Own elaboration based on data from the World Bank

4.2.3 Philippine GDP

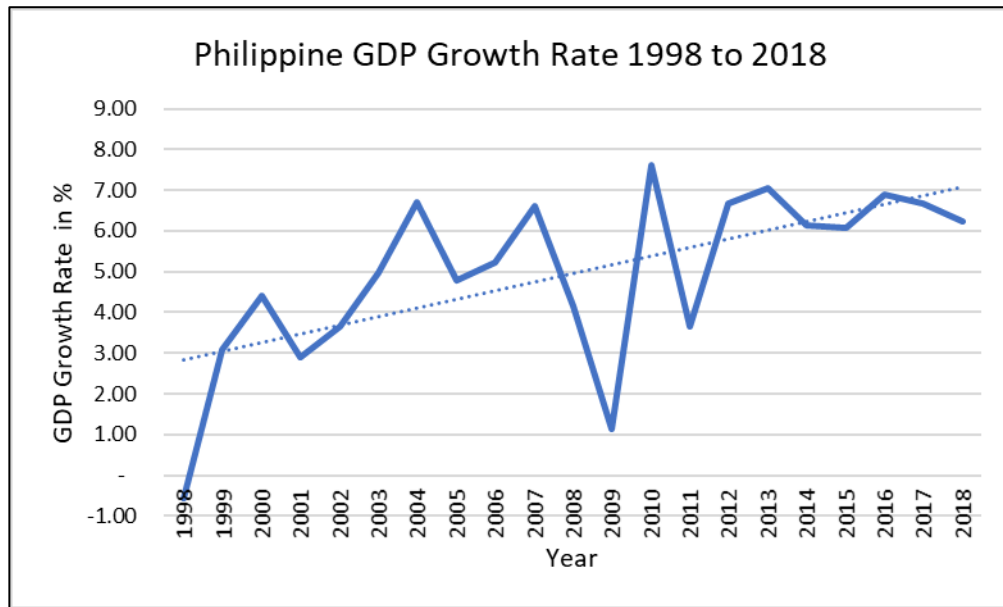
Philippine GDP and GDP growth rate are in an upward trend, although there is a significant dip in the growth rate for the year 2009. A similar decline is seen in the GDP but the dip is less considerable. For the past twenty years from 1999 to 2018, there is an increase in the GDP of the Philippines although it may not necessarily meet the target growth rate imposed by the governing administration. The increasing GDP growth rate is still a positive sign and recognized by the World Bank as a possibility for the country to step up to be an upper middle-income country in its classification.

Figure 5 Philippine GDP in Billions US\$ 1998 to 2018



Source: Own elaboration based on data from the World Bank

Figure 6 Philippine GDP Growth Rate 1998 to 2018



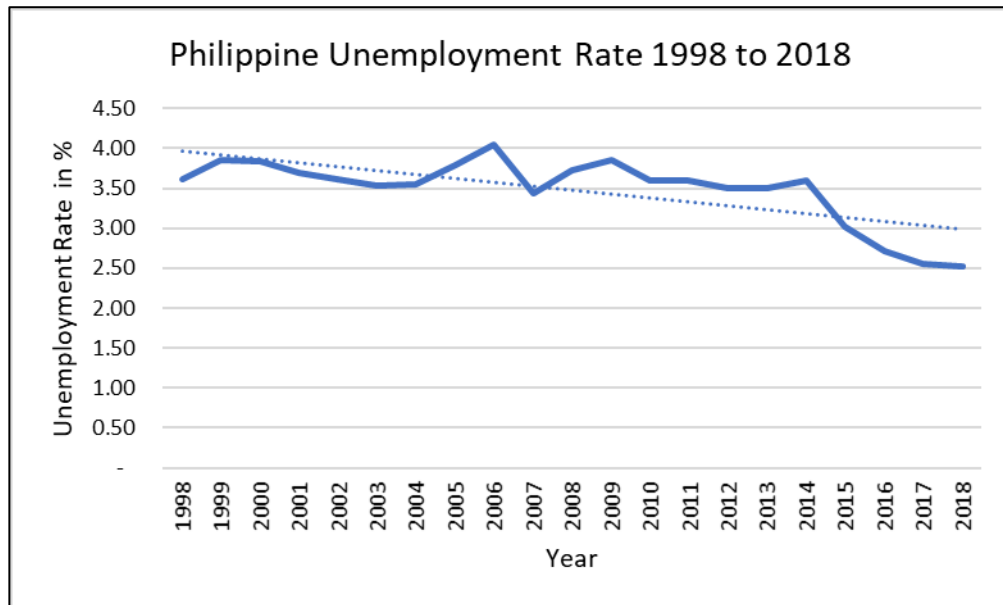
Source: Own elaboration based on data from the World Bank

4.2.4 Unemployment in the Philippines

Unemployment in the Philippines is seeing a downward trend which at first glance may be a positive sign, however, this may not obviously reflect the current employment situation of those who are employed nor the quality of life of those who are not. While people have jobs and are employed, there is still a need to consider if it is underemployment or overemployment, or whether they are in regular jobs or in contracts, if they are working full time or part-time, among others. The salary and benefits, nor the quality of the job are not transparent in this indicator.

The level of unemployment has continuously gone down from 2014 from the Aquino administration and continued until the Duterte administration. The government's Build Build Build project may have been helping to create jobs in this sense, the downside is when the projects are finished and constructed, then the workers would again be unemployed as the employment is not continuous.

Figure 7 Philippine Unemployment Rate 1998 to 2018

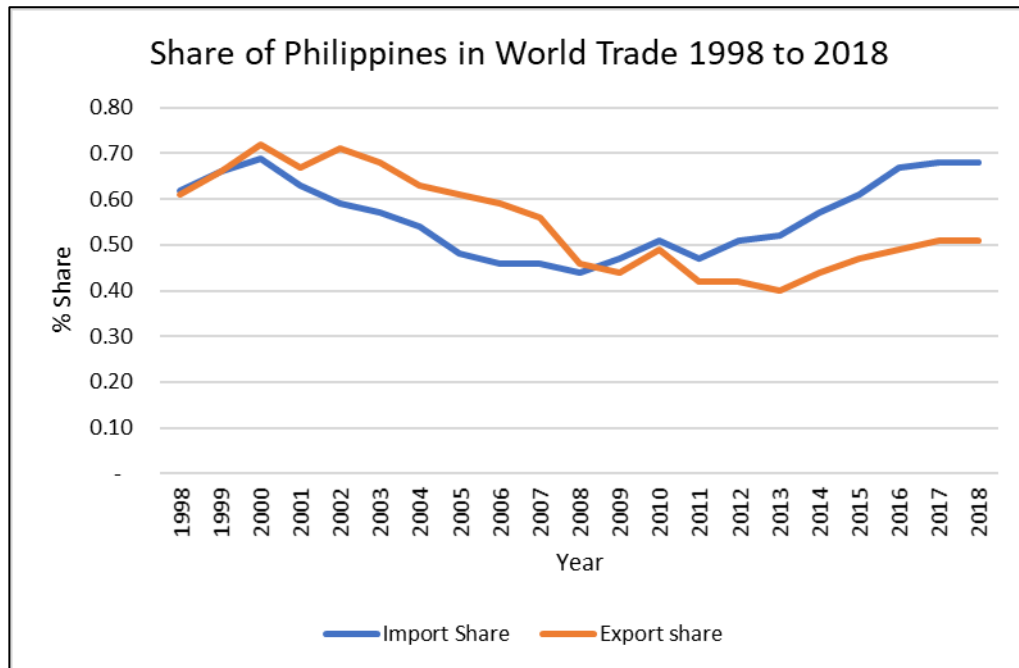


Source: Own elaboration based on data from the World Bank

4.3 The Philippines in International Trade

The table below shows the dynamics between the Philippines' share in the world's import and export market. Up until 2008, the Philippine exports occupy a bigger share in the world's export market compared to its share in the imports market. The situation was reversed after 2018 when the country's share of imports to the world market became higher than its share of exports.

Figure 8 Share of Philippines in World Trade 1998 to 2018



Source: Own elaboration based on data from the World Bank

4.4 Revealed Comparative Advantage of Philippine Commodities

This section focuses on the Philippines' trade activities from the revealed comparative advantage standpoint. The Balassa and Vollrath indices of Philippine commodities based on the categories of the HS 1988/92 product nomenclature will be computed. Indices for the Philippines dominantly traded sector of Machine and Electrical Equipment is also computed for the major exporting and importing countries in the world namely China, United States of America and Germany.

4.4.1 Recent Trade data

For the selected period, 1998 to 2018, the Philippines have been trading the below commodity classifications based on product nomenclature HS 1988/92 (list of subcategories can be found in Appendix 1) :

- Machine and Electrical Equipment
- Vegetable

- Transportation
- Miscellaneous
- Metals
- Plastic or Rubber
- Minerals
- Textiles and Clothing
- Food Products
- Fuels
- Wood
- Hides and Skins
- Stone and Glass
- Chemicals
- Animal
- Footwear

Figure 9 Product Share of Philippine Exports 1998, 2008 and 2018

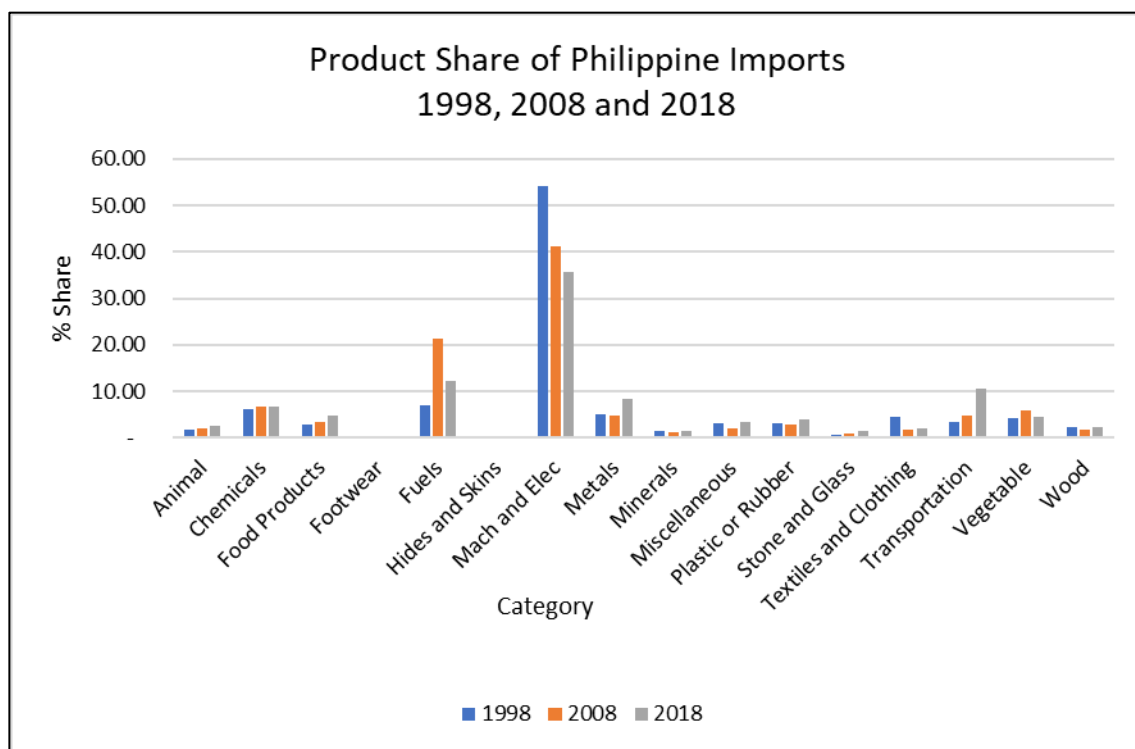


Source: Own elaboration based on data from WITS

Figure 9 above shows the share of each sector in actual exports of the Philippines for selected years 1998, 2008 and 2018. Machine and Electrical Equipment constitute majority of the value of exports at an average of 62% and has been the consistent top export of the Philippines. The other sectors' share are but minimal percentages compared to Machine and Electrical Equipment. Hence we can see that this sector is an integral part of Philippine exports.

The next table shows the product shares of the various sectors on Philippine imports, for 1998, 2008 and 2018. Machine and Electrical Equipment still constitute a big part of Philippine imports although not as significant as its export product share. The sector only covers 44% of imports on average while it covers 62% of exports on average, still giving a positive trade balance.

Figure 10 Product Share of Philippine Imports 1998, 2008 and 2018



Source: Own elaboration based on data from WITS

4.4.2 Balassa Index of Selected Philippine Commodities

Balassa indices of Philippine commodities based on HS 1988/92 nomenclature as enumerated above were computed and the average results are shown in the table below. Averages are used because the results of Balassa indices are stable over the 21-year period. Yearly results can be found in Appendix 2.

Table 3 Balassa indices of Philippine Traded Commodities

| Sector | 20-yr Average | Remarks |
|----------------------------------|---------------|--------------------------|
| Machine and Electrical Equipment | 2.33 | Comparative advantage |
| Minerals | 1.48 | Comparative advantage |
| Vegetable | 1.45 | Comparative advantage |
| Wood | 1.10 | Comparative advantage |
| Textiles and Clothing | 1.01 | Comparative advantage |
| Food Products | 0.87 | Comparative disadvantage |
| Hides and Skins | 0.84 | Comparative disadvantage |
| Miscellaneous | 0.69 | Comparative disadvantage |
| Animal | 0.52 | Comparative disadvantage |
| Metals | 0.46 | Comparative disadvantage |
| Transportation | 0.40 | Comparative disadvantage |
| Stone and Glass | 0.35 | Comparative disadvantage |
| Plastic or Rubber | 0.33 | Comparative disadvantage |
| Footwear | 0.28 | Comparative disadvantage |
| Chemicals | 0.19 | Comparative disadvantage |
| Fuels | 0.16 | Comparative disadvantage |

Source: Own calculation and elaboration

A country is said to have a revealed comparative advantage when the Balassa index is greater than one (1). Not surprisingly, the Balassa index for the main sector Machine and Electrical Equipment was the highest among the commodities with an average of 2.33 for the selected period of 1998 to 2018. The Philippines also exhibits comparative advantage for Minerals, Vegetable, Wood and Textiles and Clothing. Balassa indices are lowest for Fuels, Chemicals and Footwear.

4.4.3 Vollrath Index of Selected Philippine Commodities

After computing competitiveness on exports, the Vollrath indices of the sectors are also computed to take into account the imports as well. Average Vollrath indices for the 21-year period are shown on the table below. The yearly Vollrath index per sector can be found in Appendix 3.

Revealed comparative advantage using the Vollrath index is achieved when the resulting value is greater than zero (0). Vollrath indices are highest for Hides and Skins, Miscellaneous and Textiles and Clothing. The main traded commodity Machine and Electrical Equipment still exhibit a good revealed comparative advantage using the Vollrath index at 0.34. Lowest Vollrath indices are seen for Fuels, Chemicals and Plastic or Rubber, of which the values are negative and therefore the country has comparative disadvantage for these goods.

Table 4 Vollrath Indices of Philippine Traded Commodities

| Sector | 20-yr Average | Remarks |
|----------------------------------|---------------|--------------------------|
| Hides and Skins | 0.92 | Comparative advantage |
| Miscellaneous | 0.84 | Comparative advantage |
| Textiles and Clothing | 0.61 | Comparative advantage |
| Wood | 0.38 | Comparative advantage |
| Machine and Electrical Equipment | 0.34 | Comparative advantage |
| Stone and Glass | 0.26 | Comparative advantage |
| Minerals | 0.18 | Comparative advantage |
| Vegetable | 0.14 | Comparative advantage |
| Footwear | 0.00 | Comparative advantage |
| Food Products | - 0.38 | Comparative disadvantage |
| Transportation | - 0.45 | Comparative disadvantage |
| Metals | - 0.51 | Comparative disadvantage |
| Animal | - 0.78 | Comparative disadvantage |
| Plastic or Rubber | - 0.87 | Comparative disadvantage |
| Chemicals | - 1.38 | Comparative disadvantage |
| Fuels | - 1.90 | Comparative disadvantage |

Source: Own calculation and elaboration

Combining the indices of Balassa and Vollrath, the sectors which exhibit revealed comparative advantage for both are Machine and Electrical Equipment, Minerals, Vegetable, Wood, and Textiles and Clothing.

Table 5 Philippine Sectors that possess Revealed Comparative Advantage

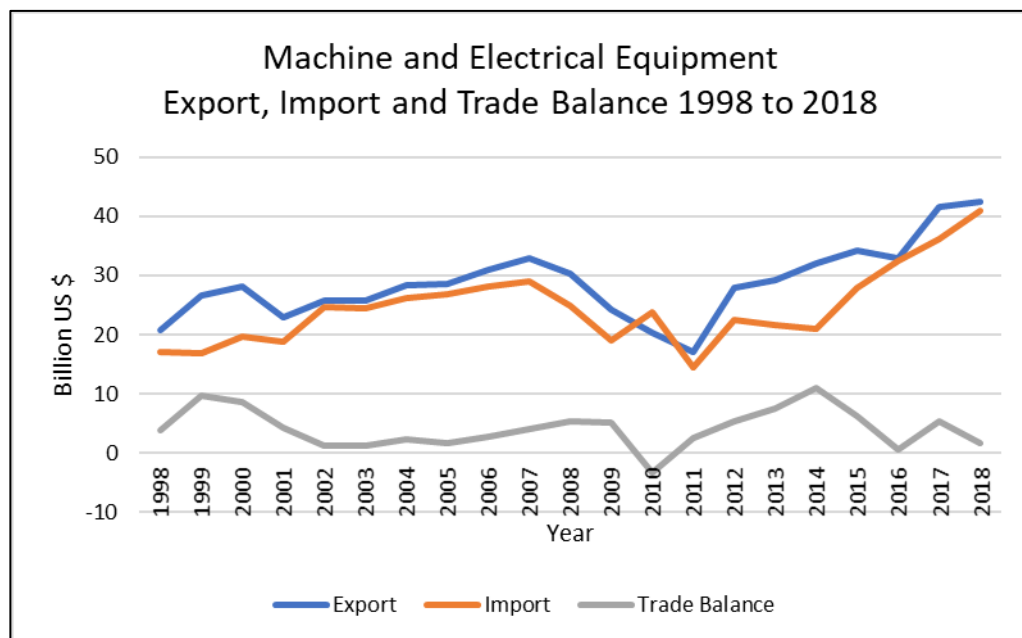
| Sector | Balassa index | Vollrath index |
|----------------------------------|---------------|----------------|
| Machine and Electrical Equipment | 2.33 | 0.34 |
| Minerals | 1.48 | 0.18 |
| Vegetable | 1.45 | 0.14 |
| Wood | 1.10 | 0.38 |
| Textiles and Clothing | 1.01 | 0.61 |

Source: Own calculation and elaboration

4.4.4 Machine and Electrical Equipment – The Philippines’ Major Traded Sector

Machine and electrical equipment dominate the Philippines’ foreign trade activities for the duration covered by this paper. In 2018, the total value of Machine and Electrical Equipment exported by the Philippines amounted to 42.52 Billion US \$ while imports were at 40.96 Billion \$. Consistently, there is a positive trade flow for this sector where in the trade balance is always positive, with the exception of the year 2010 when the value of imports for Machine and Electrical Equipment exceeded the exports value.

Figure 11 Machine and Electrical Equipment Export, Import and Trade balance 1998 to 2018

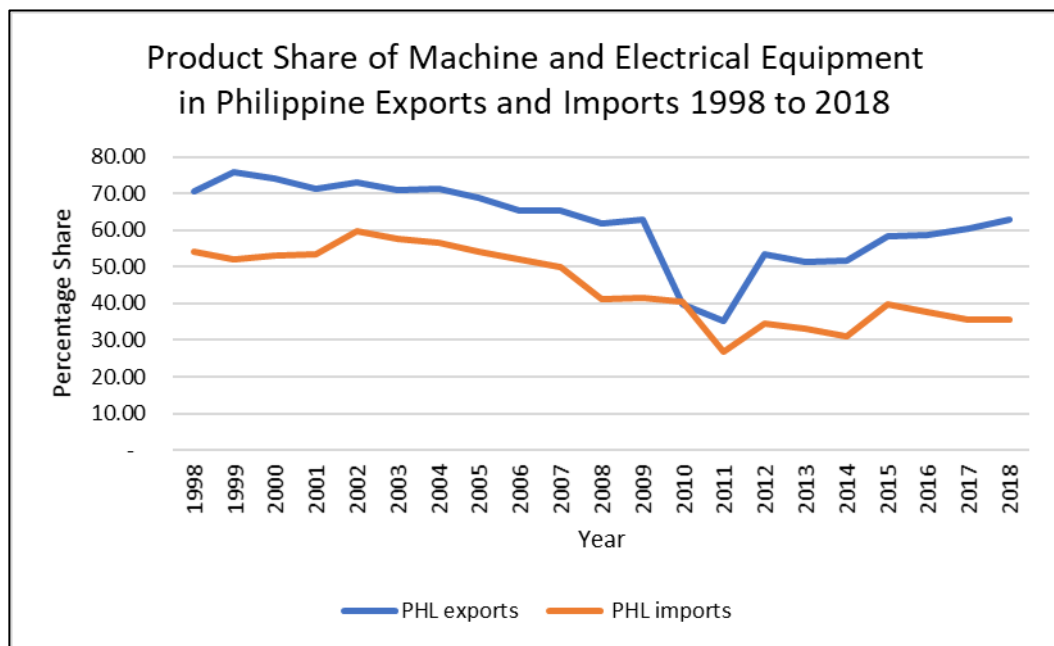


Source: Own elaboration based on data from WITS

The highest share in Philippine exports for this sector was seen in 1999 at 75.88% while the lowest was at 2011 at 35.32%. The decline was attributed to the sudden increase of Miscellaneous goods that captured the export product share for both 2010 and 2011.

In terms of imports, the highest import for this sector was in 2002 at 59.52% of total Philippine imports and lowest at 26.74% in 2011. The decrease might have been caused by the increase in the product share of Fuels for both exports and imports for the years 2010 and 2011.

Figure 12 Product Share of Machine and Electrical Equipment in Philippine Exports and Imports 1998 to 2018

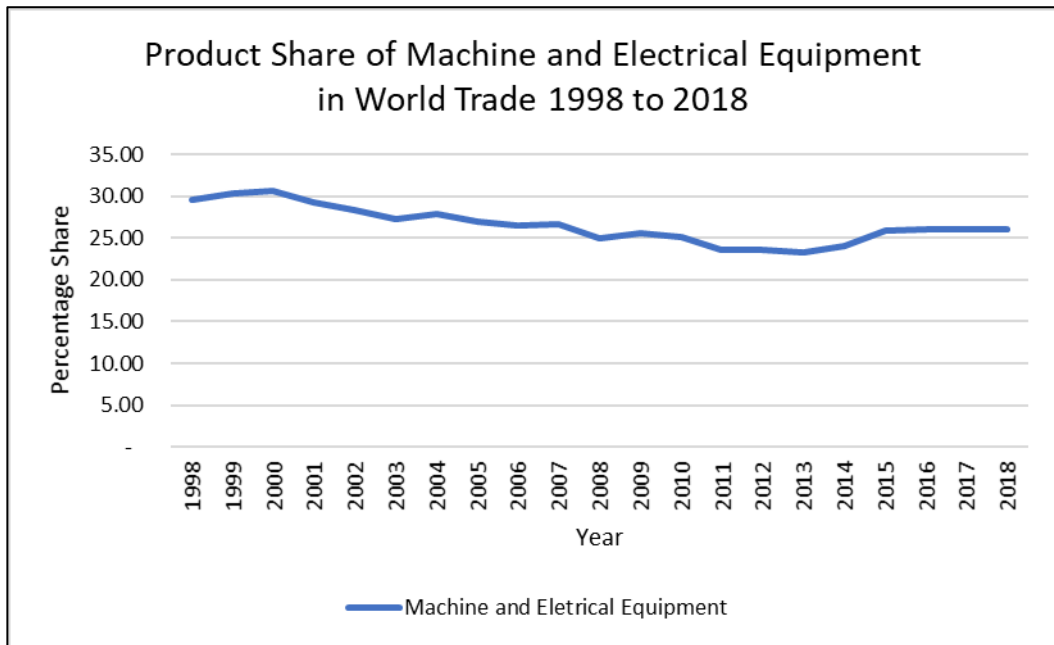


Source: Own elaboration based on data from WITS

4.4.5 The world market for Machine and Electrical Equipment and revealed comparative indices of China, United States and Germany

The world market for Machine and Electrical Equipment is dominated by China, United States and Germany. Although the Philippines only contribute a small percentage in the world market for this sector, it is good to see how it compares to other countries, considering that this is its main traded commodity. The average product share for Machine and Electrical Equipment in the world market hovers around 26.54% with a rather consistent trend.

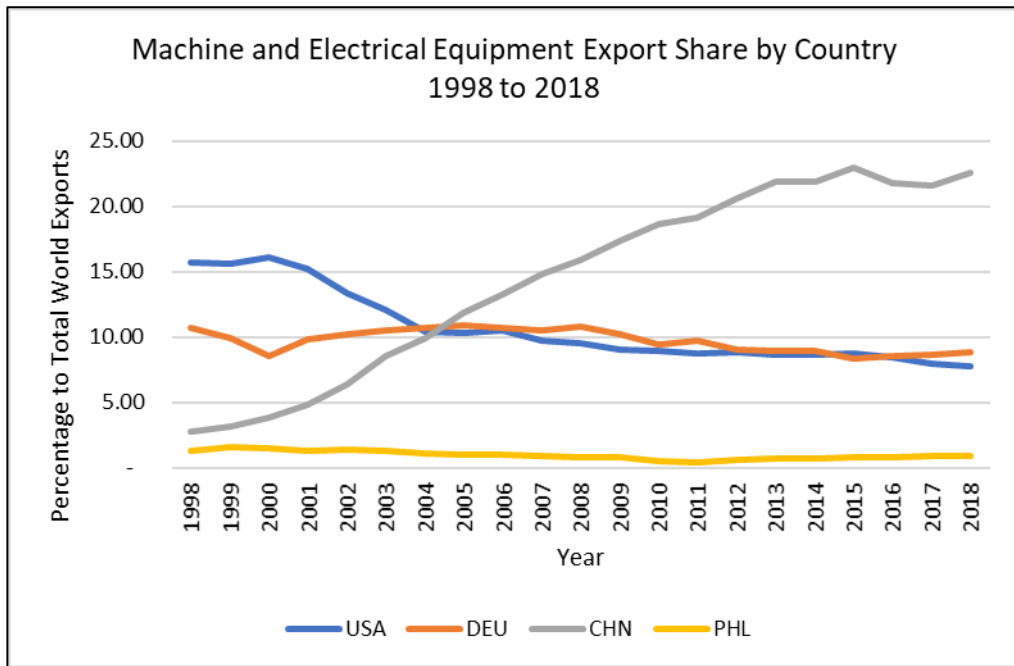
Figure 13 Product Share of Machine and Electrical Equipment in World Trade 1998 to 2018



Source: Own elaboration based on data from WITS

The chart below shows the share of each country in the world’s total exports for Machine and Electrical Equipment for the years 1998 to 2018. In terms of exports, China started to grab a major share of the world exports for this sector exceeding the exports of the United States and Germany in 2005. The time that China started to take a major share of the exports is also the same time that United States exports for this sector started to plateau. Although United States is still a major exporter of this sector, the difference in product shares between United States and China widens year after year and are very significant reaching more than 10% gap. Germany and the Philippines, on the other hand, shows a consistent trend in terms of exports for the years covered.

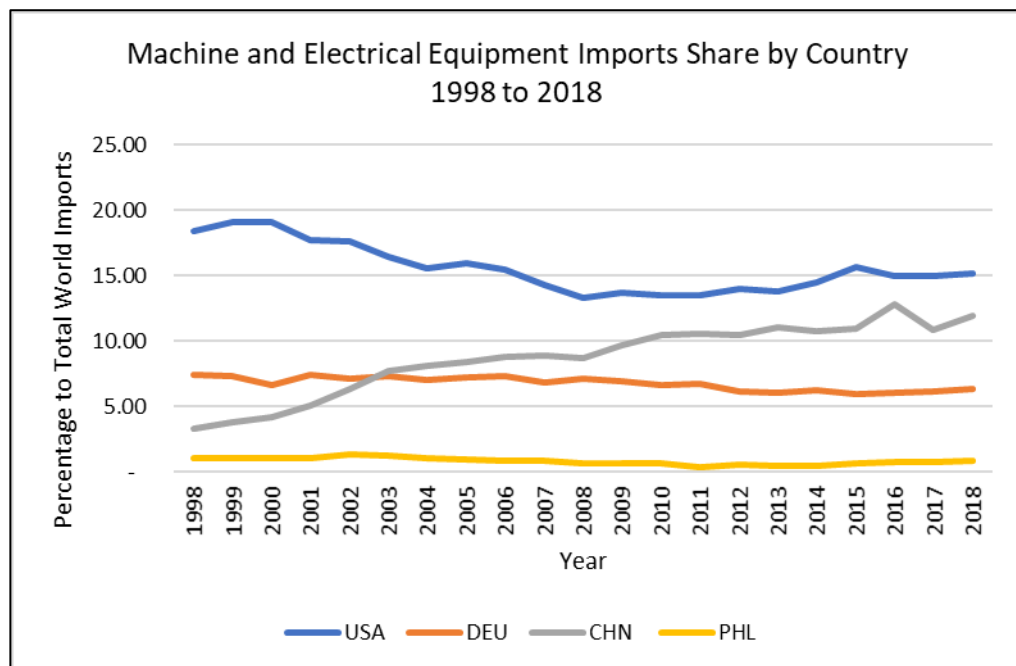
Figure 14 Machine and Electrical Equipment Export Share by Country



Source: Own elaboration based on data from WITS

In terms of total imports, United States take the lead with an average import product share of 15.55 for the 21 years from 1998 to 2018. China is also gaining traction on the import side with an increasing pattern obviously seen in the import trend. Just like in exports, Germany and the Philippines stay afloat in their somewhat consistent product share over the years.

Figure 15 Machine and Electrical Equipment Imports Share by Country 1998 to 2018



Source: Own elaboration based on data from WITS

The Balassa and Vollrath indices of the sector Machine and Electrical Equipment for China, United States and Germany are compared alongside that of the Philippines. Resulting values are shown in Table 6.

On average, all selected countries have revealed comparative advantage for Machine and Electrical Equipment for the years 1998 to 2018, with the United States slowly having a disadvantage starting from the year 2009. However, the resulting indices for the Philippines are comparatively higher than China, United States and Germany. This is reasonable considering that the average product shares of this sector in their economies are lower. For China, average product share of Machine and Electrical Equipment is 39.46% for exports and 36.58% for imports; 29.21% and 27.09% for the United States and 28.38% and 24.32% for Germany.

Table 6 Balassa and Vollrath Indices for Machine and Electrical Equipment (PHL, CHN, USA and DEU)

| | PHL | | CHN | | USA | | DEU | |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | RCA | VCA | RCA | VCA | RCA | VCA | RCA | VCA |
| 1998 | 2.39 | 0.25 | 0.80 | - 0.44 | 1.22 | 0.16 | 1.04 | 0.21 |
| 1999 | 2.50 | 0.36 | 0.88 | - 0.38 | 1.23 | 0.20 | 1.00 | 0.14 |
| 2000 | 2.42 | 0.32 | 0.96 | - 0.27 | 1.29 | 0.25 | 0.98 | 0.15 |
| 2001 | 2.44 | 0.27 | 1.09 | - 0.23 | 1.25 | 0.27 | 1.03 | 0.09 |
| 2002 | 2.58 | 0.20 | 1.26 | - 0.18 | 1.23 | 0.26 | 1.05 | 0.11 |
| 2003 | 2.60 | 0.21 | 1.44 | - 0.08 | 1.23 | 0.26 | 1.04 | 0.13 |
| 2004 | 2.57 | 0.23 | 1.50 | 0.00 | 1.15 | 0.20 | 1.06 | 0.16 |
| 2005 | 2.57 | 0.24 | 1.57 | 0.02 | 1.16 | 0.20 | 1.13 | 0.16 |
| 2006 | 2.46 | 0.22 | 1.61 | 0.02 | 1.19 | 0.22 | 1.12 | 0.17 |
| 2007 | 2.46 | 0.25 | 1.63 | 0.07 | 1.12 | 0.15 | 1.06 | 0.18 |
| 2008 | 2.48 | 0.39 | 1.71 | 0.16 | 1.13 | 0.16 | 1.15 | 0.19 |
| 2009 | 2.47 | 0.42 | 1.75 | 0.21 | 1.03 | 0.00 | 1.09 | 0.19 |
| 2010 | 1.58 | 0.00 | 1.76 | 0.27 | 1.04 | 0.02 | 1.10 | 0.17 |
| 2011 | 1.50 | 0.30 | 1.78 | 0.31 | 1.04 | - 0.01 | 1.16 | 0.21 |
| 2012 | 2.27 | 0.47 | 1.78 | 0.34 | 1.02 | - 0.06 | 1.14 | 0.20 |
| 2013 | 2.21 | 0.48 | 1.84 | 0.36 | 1.02 | - 0.08 | 1.15 | 0.22 |
| 2014 | 2.16 | 0.54 | 1.72 | 0.33 | 0.99 | - 0.09 | 1.10 | 0.18 |
| 2015 | 2.26 | 0.42 | 1.63 | 0.24 | 0.95 | - 0.11 | 1.01 | 0.13 |
| 2016 | 2.25 | 0.50 | 1.64 | 0.26 | 0.92 | - 0.13 | 1.01 | 0.13 |
| 2017 | 2.32 | 0.58 | 1.66 | 0.30 | 0.90 | - 0.17 | 1.04 | 0.14 |
| 2018 | 2.41 | 0.60 | 1.68 | 0.30 | 0.87 | - 0.21 | 1.06 | 0.15 |
| Average | 2.33 | 0.35 | 1.51 | 0.08 | 1.09 | 0.07 | 1.07 | 0.16 |

Source: Own calculation and elaboration

Another interesting point to note is the dynamics of indices for China and United States. Looking at the Vollrath indices, from 1998 to 2004, China has comparative disadvantage and from 2011 to 2018, the United States has the negative values while China's comparative advantage is increasing. On the other hand, Balassa index for the United States is decreasing while Balassa index for China is increasing. More so, the indices for China have higher values now that it is dominating the market, even reaching 1.84 in 2013; while the highest Balassa index for the United States is only 1.29 in the year 2000. This is another clear manifestation of the transfer or shift in trading activities and dominance from the United States to China.

This comparison, however, needs to be interpreted with caution because as discussed in 3.3.1, it is not entirely appropriate to compare countries with different levels of development and the table shows us why. The Philippines for one is a developing country and the size of its economy is way smaller than that of the United States and Germany which are both developed countries. China, on the other hand, is not yet considered a developed country. China and the Philippines have relatively higher values of Balassa indices compared to Germany and the United States. Still, it is worth to note the changes in the index value within one country. In the case of the United States for example, the significance of this sector decreases with time while in China is vice versa. The Philippines and Germany remains in consistent range for the duration of the observed period.

4.5 Econometric Analysis

The main goal of using econometric analysis in this paper is to determine whether there is an interrelation or causality that exist among the Philippine GDP, real exchange rate, total exports, Balassa index and Vollrath index of main traded commodity, and if it does, to be able to gauge the degree that these variables affect the Philippine GDP.

4.5.1 Economic model

This objective can be translated to algebraic model as below:

$$y_{1t} = f(x_{1t}, x_{2t}, x_{3t}, x_{4t}) \quad (16)$$

Where:

y_{1t} ... Philippine GDP in Billion US\$

x_{1t} ... Exchange rate of Philippine Peso per US \$

x_{2t} ... Total Export value of the Philippines in Billion US\$

x_{3t} ... Balassa index of selected commodity

x_{4t} ... Vollrath index of selected commodity

However, since the variables have different units of measurement, the power function will be used to be able to end up with a linear equation expressed in natural logarithm. The economic model is as follows:

$$y_{1t} = x_{1t}^{\gamma_1} \cdot x_{2t}^{\gamma_2} \cdot x_{3t}^{\gamma_3} \cdot x_{4t}^{\gamma_4} \quad (17)$$

This model assumes that the endogenous variable Y_{1t} Philippine GDP in Billion US \$ is affected by the exogenous variables x_{1t} to x_{4t} namely: Exchange rate of 1 US \$ to Philippine Peso in Php, Total export value of the Philippines expressed in Billion US \$, Balassa index of selected commodity and Vollrath index of selected commodity. The assumption is that all exogenous variables have direct relationship with the endogenous variable as expressed in the statements below:

- If the exchange rate increases (Philippine Peso depreciates), the GDP increases.
- If the total export value increases, the GDP increases.
- If the Balassa index increases, the GDP increases.
- If the Vollrath index increases, the GDP increases.

4.5.2 Econometric model

From the economic model, the econometric model will be derived.

$$y_{1t} = x_{1t}^{\gamma_1} \cdot x_{2t}^{\gamma_2} \cdot x_{3t}^{\gamma_3} \cdot x_{4t}^{\gamma_4} \cdot u_t^\varepsilon \quad (18)$$

Transforming to linear form will result to below equation, a one-equation linear form expressed as:

$$\ln y_{1t} = \gamma_0 \ln x_{0t} + \gamma_1 \ln x_{1t} + \gamma_2 \ln x_{2t} + \gamma_3 \ln x_{3t} + \gamma_4 \ln x_{4t} + \varepsilon \ln u_t \quad (19)$$

4.5.3 Data set

The data set below pertains to the sector of Machine and Electrical Equipment, which is the major traded commodity of the Philippines on both the exports and imports side. The

endogenous variable Philippine GDP and the exogenous variable Total exports of Philippines are both recalculated to be expressed in Billion US \$.

Table 7 Data Set for Regression Analysis

| Variable | Philippine GDP in Billion US\$ (Current) | Real Exchange Rate Php/1 US\$ | Total exports of Philippines in Billion US\$ | Balassa index (Machine and Electrical Equipment) | Vollrath index (Machine and Electrical Equipment) |
|----------|--|-------------------------------|--|--|---|
| Year | y | x ₁ | x ₂ | x ₃ | x ₄ |
| 1998 | 72.21 | 95.47 | 29.41 | 2.39 | 0.25 |
| 1999 | 83.00 | 100.36 | 36.58 | 2.50 | 0.36 |
| 2000 | 81.03 | 91.60 | 38.08 | 2.42 | 0.32 |
| 2001 | 76.26 | 86.44 | 32.15 | 2.44 | 0.27 |
| 2002 | 81.36 | 86.74 | 35.21 | 2.58 | 0.20 |
| 2003 | 83.91 | 79.40 | 36.23 | 2.60 | 0.21 |
| 2004 | 91.37 | 76.02 | 39.68 | 2.57 | 0.23 |
| 2005 | 103.07 | 80.04 | 41.26 | 2.57 | 0.24 |
| 2006 | 122.21 | 88.22 | 47.41 | 2.46 | 0.22 |
| 2007 | 149.36 | 95.33 | 50.47 | 2.46 | 0.25 |
| 2008 | 174.20 | 97.77 | 49.08 | 2.48 | 0.39 |
| 2009 | 168.33 | 96.02 | 38.44 | 2.47 | 0.42 |
| 2010 | 199.59 | 100.00 | 51.50 | 1.58 | 0.01 |
| 2011 | 224.14 | 100.22 | 48.31 | 1.50 | 0.30 |
| 2012 | 250.09 | 104.76 | 52.10 | 2.27 | 0.47 |
| 2013 | 271.84 | 107.58 | 56.70 | 2.21 | 0.48 |
| 2014 | 284.58 | 106.29 | 62.10 | 2.16 | 0.54 |
| 2015 | 292.77 | 111.44 | 58.83 | 2.26 | 0.42 |
| 2016 | 304.90 | 108.22 | 57.41 | 2.25 | 0.50 |
| 2017 | 313.62 | 103.37 | 68.71 | 2.32 | 0.58 |
| 2018 | 330.91 | 100.46 | 67.49 | 2.41 | 0.60 |

Source: Own elaboration based on data from the World Bank and own computation

The Philippine GDP in Billion US\$ and are expressed in current US dollars. Exchange rate of Philippine Peso to one US dollar is in real effective exchange rate with 2010=100. Total exports of Philippines in Billion US dollars are the freight-on-board value of goods in current US dollar. These three variables are taken from the World Bank database. Balassa and Vollrath indices are computed by the author based on data taken from the World Bank's World Integrated Trade Solutions's (WITS) database.

A correlation matrix was generated in Gretl using the above data with the following results:

Table 8 Multicollinearity of original data set

| X1 | X2 | X3 | X4 | |
|-----------|-----------|-----------|-----------|-----------|
| 1.0000 | 0.6761 | -0.4942 | 0.6209 | X1 |
| | 1.0000 | -0.3482 | 0.6581 | X2 |
| | | 1.0000 | 0.0938 | X3 |
| | | | 1.0000 | X4 |

Source: Gretl results

The table shows that there is no multicollinearity that exists among the exogenous variables, and hence, succeeding steps in the econometric analysis may be performed.

Adding logs to the exogenous variables will also show that there is no multicollinearity present as seen in the table below.

Table 9 Multicollinearity of data with natural logarithm

| l_x1 | l_x2 | l_x3 | l_x4 | |
|-------------|-------------|-------------|-------------|-------------|
| 1.0000 | 0.6506 | -0.4425 | 0.2511 | l_x1 |
| | 1.0000 | -0.3309 | 0.2228 | l_x2 |
| | | 1.0000 | 0.4521 | l_x3 |
| | | | 1.0000 | l_x4 |

Source: Gretl results

4.5.4 Estimation of parameters

Using Gretl software, parameters for the model are estimated and listed on the preceding table. Complete results generated from Gretl may be found in the Appendix (Appendices 4 to 7).

Table 10 Estimated Parameters

| Parameters | Value of parameters |
|--|----------------------------|
| γ_0 | -5.28527 |
| γ_1 ...Exchange rate Php/1 US\$ | 1.02843 |
| γ_2 ...Phil Total Exports in Billion US\$ | 1.64356 |
| γ_3 ...Balassa index of Machine and Electrical Equipment | -0.663563 |
| γ_4 ...Vollrath index of Machine and Electrical Equipment | 0.0814769 |

Source: Own elaboration based on Gretl results

Substituting the above results to the one-equation econometric model will result to the final equation:

$$\ln \hat{y}_{1t} = -5.28527 + 1.02843 \ln x_{1t} + 1.64356 \ln x_{2t} - 0.663563 \ln x_{3t} + 0.0814769 \ln x_{4t} \quad (20)$$

4.5.5 Economic verification

To perform the economic verification, it is necessary to evaluate the direction and intensity of the estimated parameters. With the assumption of *ceteris paribus*, the following conclusions can be derived:

- If the exchange rate increases (Philippine peso depreciates) by 1%, Philippine GDP increases by 1.02843%, *ceteris paribus*
 - This corresponds to the assumption of direct relationship between exchange rate and Philippine GDP, the intensity of the estimated parameter is also acceptable.
- If total export value increases by 1 %, Philippine GDP increases by 1.64356%, *ceteris paribus*
 - This corresponds to the assumption of direct relationship between total export value and Philippine GDP, the intensity of the estimated parameter may be higher than what is expected.
- If Balassa index for Machine and Electrical Equipment increases by 1%, Philippine GDP decreases by 0.663563%, *ceteris paribus*
 - This result does not correspond to the assumption of direct relationship. However, this in a way also makes sense because the Balassa index includes only export values and not import values.
- If Vollrath index for Machine and Electrical Equipment increases by 1%, Philippine GDP increases by 0.0814769%, *ceteris paribus*
 - This corresponds to the assumption of direct relationship between Vollrath index and Philippine GDP, the intensity of the estimated parameter is also acceptable.

Based on the above results, it can be concluded that the Total export value affects the Philippine GDP the most as it has the highest intensity of 1.64356% among the parameters.

4.5.6 Statistical verification

The coefficient of determination R^2 resulted to a value of 0.936886 which means that the exogenous variables explain the endogenous variable by 93.6886%. On the other hand, the value of adjusted R^2 is 0.921107 which shows that 92.1107% of changes in the endogenous variable can be explained by the exogenous variables.

Statistical significance of estimated parameters: t-test

The t-test is used to verify the statistical significance of the estimated parameters. The p-value of the estimated parameters in Gretl are shown in the table below.

Table 11 T-test

| Parameters | Value of parameters | p-value | Significance at 0.1 |
|-------------------|----------------------------|----------------|----------------------------|
| γ_1 | 1.02843 | 0.0545 | <0.10; significant |
| γ_2 | 1.64356 | 2.16e-07 | <0.10; significant |
| γ_3 | -0.663563 | 0.0837 | <0.10; significant |
| γ_4 | 0.0814769 | 0.1719 | >0.10; not significant |

Source: Own elaboration based on Gretl results

Given the significance level $\alpha = 0.10$ and the below hypothesis:

Null hypothesis (H_0): there is no relationship between the explained and explanatory variable

Alternative hypothesis (H_1): H_0 is not true

Then the following conclusions can be derived:

- γ_1 is less than the significance level $\alpha = 0.10$, therefore reject H_0 , there is sufficient evidence that the variable has effect on the population level
- γ_2 is less than the significance level $\alpha = 0.10$, therefore reject H_0 , there is sufficient evidence that the variable has effect on the population level
- γ_3 is less than the significance level $\alpha = 0.10$, therefore reject H_0 , there is sufficient evidence that the variable has effect on the population level

- γ_4 is greater than the significance level $\alpha = 0.10$, therefore H_0 cannot be rejected, there is no sufficient evidence of correlation between this variable and the endogenous variable

Statistical significance of estimated parameters: Confidence interval

Statistical significance of estimated parameters can also be verified by using the confidence interval value. At significance level of 0.10, the confidence interval generated in Gretl is shown on the preceding table.

Table 12 Confidence Interval

| Parameters | Value of parameters | Confidence interval | Significance at 0.10 |
|-------------------|----------------------------|----------------------------|-----------------------------|
| γ_1 | 1.02843 | 0.162973 to 1.89389 | Significant |
| γ_2 | 1.64356 | 1.30966 to 1.97746 | Significant |
| γ_3 | -0.663563 | -1.29172 to -0.0354026 | Significant |
| γ_4 | 0.0814769 | 00.0179919 to 0.180946 | Significant |

Source: Own elaboration based on Gretl results

Statistical significance of entire model: F test

The resulting F-value $F(4,16)$ in Gretl is 59.37697. This value is greater than the F critical value at given degrees of freedom (n-p; α) of 2.33274487.

Considering the hypotheses:

Null hypothesis (H_0): all explanatory variables taken jointly are not relevant

Alternative hypothesis (H_1): H_0 is not true

Since $\hat{F} 59.37697 > F^* (16-4; 0.10) 2.33274487$: the model is statistically significant and H_0 is rejected.

4.5.7 Econometric verification

- Homoscedasticity using White test

The resulting p-value from White Test is 0.274321, at significance level α of 0.10, the p-value is greater than the significance level and therefore there is constant variance on each conditional distribution of the error term, hence, null hypothesis cannot be rejected.

Null hypothesis (H₀): Heteroskedasticity is not present

Alternative hypothesis (H₁): Heteroskedasticity is present

- Non-autocorrelation assumption using Durbin Watson test

The Durbin-Watson test is used to test for autocorrelation. The Durbin-Watson value generated in Gretl software is 1.601268. As the value is between 1.5 to 2.5, it can be said that the correlation is still normal and should not be a cause of concern.

- Independent variables are non-random and fixed in repeated samples
- Lack of perfect multicollinearity

See correlation matrix under the subchapter Data Set.

- Normal distribution of the error term using Jarque-Bera test

Jarque-Bera test was used in Gretl to verify normal distribution of the error term.

4.5.8 Mathematical verification

To conduct mathematical verification, the following equation must be true:

$$\bar{Y}_t = \bar{\hat{Y}}_t \quad (\bar{U}_t = 0)$$

Computing for the estimated values of the endogenous variables will give the results on below table. The mean for both the observed values and estimated values of the endogenous variable both equal to 5.0448.

Table 13 Mathematical Verification

| Year | $\ln y_{1t}$ | $\ln \hat{y}_{1t}$ |
|-------------|---------------|--------------------|
| 1998 | 4.2796 | 4.2695 |
| 1999 | 4.4188 | 4.6793 |
| 2000 | 4.3948 | 4.6634 |
| 2001 | 4.3341 | 4.3062 |
| 2002 | 4.3989 | 4.3977 |
| 2003 | 4.4297 | 4.3526 |
| 2004 | 4.5149 | 4.4725 |
| 2005 | 4.6354 | 4.5931 |
| 2006 | 4.8057 | 4.9435 |
| 2007 | 5.0064 | 5.1364 |
| 2008 | 5.1602 | 5.1473 |
| 2009 | 5.1259 | 4.7359 |
| 2010 | 5.2963 | 5.2503 |
| 2011 | 5.4123 | 5.4591 |
| 2012 | 5.5218 | 5.3904 |
| 2013 | 5.6052 | 5.5763 |
| 2014 | 5.6510 | 5.7382 |
| 2015 | 5.6794 | 5.6474 |
| 2016 | 5.7200 | 5.5943 |
| 2017 | 5.7482 | 5.8342 |
| 2018 | 5.8018 | 5.7529 |
| Mean | 5.0448 | 5.0448 |

Source: Own elaboration based on Gretl results

5 Results and Discussion

The practical part of this thesis dealt firstly with a discussion of the development of the Philippine foreign trade and the shift of the country from agriculture driven foreign trade to industrial and service focused economy. The main argument is that, up until the early 1990's, the country's economic policies are set in response to outside forces rather than a premeditated strategic plan. While it is important to adjust to the needs of the global economy, it is also imperative to be able to have a solid outlook especially in the macroeconomic level. The situation of the Philippine economy is far from ideal and considering the various calamities that the country faces annually, it is important to have a solid plan of approach to handling the economy.

The five recent administrations based on Presidency showed more promising, although not perfectly successful, efforts in terms of economic policies. Ramos (1992-1998) had the Philippines 2000 vision with focus on liberalization of the economy and deregulation of key industries, among others. The administration also sought to modernize public infrastructures and there were a number of huge infrastructures built during that time, which unfortunately, are not anymore fully functional today or is being used for other purposes. Estrada (1998-2001) had a shorter term due to impeachment and there is not much to be said about the economic policies effected. However, he was able to sign the Retail Trade Liberalization Act which empowered Filipino consumers by making available products more competitive in terms of price and quality. Arroyo (2001-2010) who replaced Estrada established the Capital Market Development Plan which focuses more on capital market. There were also some controversies on the Extended Value Added Tax that this administration implemented. However, at the end of her term, the Philippine's GDP growth was at 7.63% and there was a positive current account balance at 3.60% of GDP. Her successor, Aquino (2010-2016), used the approach of internal order and efficiency to attain a more favourable credit rating. The country had lower interest rates which was attractive to foreign investors. Duterte, on the other hand, is showing more a combination of Ramos and Arroyo strategy. His main project Build Build Build is focused on erecting infrastructures which helps to increase jobs. In order to assist in the funding, a Comprehensive Tax Reform Program is being implemented in parts.

Considering these administrations and the corresponding magic quadrangle constructed based on the end of their terms, it can be said that the most effective for the country are the policies enacted by Gloria Macapagal-Arroyo.

It is possibly because among these five presidents, only she and Aquino have economic backgrounds and therefore have better understanding of the dynamics in the market and how decisions, policies and political situation can affect the country's economy. In fact, she was a professor of Economics at the Ateneo de Manila University, and Aquino was one of her former students. Another possible reason is the tenure and therefore continuity of the administration. She was president longer than usual and is therefore able to maintain her policies. The economic policies focusing on the strengthening of the capital market proved to be beneficial for the economic health of the country so much so that the country was not severely affected by the 2007 financial crisis.

In terms of foreign trade, the Philippines can be considered a small player in the world market with only less than 1% share in total for both exports and imports. The country's most dominant export and import category is the Machine and Electrical Equipment sector. This sector accounts for an average of 62% of the country's exports and 42% of its imports. Seeing that this category dominates the country's foreign trade, Balassa and Vollrath indices were computed in order to establish whether the Philippines has revealed comparative advantage in this sector. The results for Balassa index and Vollrath index show that the Philippines has revealed comparative advantage on this category, consistently for the 21 years 1998 to 2018. There are also other categories identified as having stable Balassa and Vollrath indices which are Minerals, Vegetable, Wood and Textiles and Clothing. These categories may have the potential to be significant sectors in the country's foreign trade if given proper focus and further developed.

The Balassa and Vollrath indices of the sector's big players in the world market – China, USA and Germany – were also computed. Both Germany and the Philippines have relatively consistent indices, but this is not the case for China and USA. China's indices were increasing while USA's indices had been decreasing. One possible reason is that the total share of China in the world trade for this category has also been increasing and it can be seen

as a transfer of power from USA to China. It is observable that the indices of the Philippines are significantly higher than that of the three countries and one may be inclined to think that the Philippines is better. However, this may not be the case as it has to be considered that the Philippines is still considered a developing country and both USA and Germany are developed countries. While China is still considered a developing country, its economic growth is at a rapid pace compared to that of the Philippines. The Philippines indices may be higher because the diversity of traded categories is narrower compared to the other three countries, which means that the percentage share of each traded category will be higher compared to a country with highly diversified trade products. Moreover, comparing the Philippines to China, USA and Germany cannot be considered an apple to apple comparison because of the different economic status.

Using data from 1998 to 2018, a regression analysis was performed in order to identify if there is a relationship among the endogenous variable Philippine GDP and the exogenous variables: real exchange rate of US to Philippine Peso, total exports of the Philippines, Balassa index of Machine and Electrical Equipment and Vollrath index of Machine and Electrical Equipment. The computation was performed in Gretl and the resulting values show that the Philippine GDP has a direct relationship with real exchange rate, total export and Vollrath index. It has, however, an indirect relationship with Balassa index, which makes sense, considering that the Balassa index do not take into account the import trade. The variable with the most significant effect to the Philippine GDP is the total export value which has a value of 1.64356. As the regression used is in the form of natural logarithm, this can be interpreted such that a percent increase in the total export value will cause a 1.64356% increase in the Philippine GDP, *ceteris paribus*. On the other hand, an increase of 1% in the other variables real exchange rate of US to PHP, Balassa index and Vollrath index will have the following effects to Philippine GDP respectively: increase of 1.02843%, decrease of 0.663563% and increase of 0.0814769%.

6 Conclusion and Recommendation

There is still much to be done about the current state of the Philippine economy. Although there have been ups and downs in the country's economic performance, it is not impossible but has proven to be challenging to maintain a stable economic growth. Basing on the results of the magic quadrangle, the inclination is to conclude that policies focusing on the strengthening of the capital market coupled with certain tax reforms. The year 2010, which marks the end of the Arroyo administration, had the biggest quadrangle which in theory means that it has the most favourable state of economic growth, employment, inflation and external trade.

To answer the other main question posed at the beginning of this paper, based from the computations, it is evident that the country possesses revealed comparative advantage in the sector Machine and Electrical Equipment, its most dominantly traded category. Balassa index for this sector has consistently been more than the value of 2 from the analysed period of 1998 to 2018, with the exception only of the years 2010 and 2011. The Vollrath index for this category has also been consistently above 0. Thus, it can be said that the country has revealed comparative advantage for this category in the export side point of view as well as the export-import point of view. This category, on average, comprise 62% of the country's exports and 44% of its imports. Balassa and Vollrath indices for other categories of the Philippines traded goods were also computed and four other categories show favourable revealed comparative advantage: Mineral, Vegetables, Wood and Textile and Clothing. These categories, however, comprise significantly lesser portion of Philippine trade compared to Machine and Electrical Equipment.

Considering that Machine and Electrical Equipment is the country's main traded product group, a regression analysis was performed to establish the effect of this category's Balassa and Vollrath indices, as well as the US \$ to PHP exchange rate and total export value of the Philippines, to the country's GDP. Results show that among the four variables, the total export value has the strongest effect on the GDP of the Philippines. Balassa index of the selected category is in an indirect relationship with the Philippine GDP. A one percent increase in the value of Balassa index of Machine and Electrical Equipment will mean a 0.663563% decrease in the value of Philippines GDP, *ceteris paribus*. On the other hand,

Vollrath index has a direct relationship with Philippine GDP and a one percent increase in the value of Vollrath index will mean a 0.0814769% increase in the value of Philippine GDP.

Due to limitations in this paper, it is recommended to consider the following for further studies:

- Measure the revealed comparative index of Machine and Electrical Equipment using other methods or indices
- Delve deeply into the Machine and Electrical Equipment sector to identify which sub-commodities ultimately possess the revealed comparative advantage and to see the trade dynamics within the sector
- Study the feasibility of other commodities that show revealed comparative advantage on their Balassa and Vollrath indices namely Minerals, Vegetable, Wood and Textiles and Clothing.

The Republic Philippines may well be on its way into becoming an upper-middle income country if the appropriate economic policies are executed and monitored. However, there are many other factors that need to be considered which are well beyond the scope of this paper.

7 References

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