



Faculty of Economics and Business

**Determinants of Export Competitiveness and
Diversification of Agricultural Products in Malaysia**

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Determinants of Export Competitiveness and Diversification of Agricultural Products in Malaysia

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DECLARATION

The work described in this Doctor of Philosophy thesis, entitled “Determinants of Export Competitiveness and Diversification of Agricultural Products in Malaysia” is to the best of author’s knowledge that of the author except where due reference is made. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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ABSTRACT

This study intends to evaluate the export competitiveness and diversification of agricultural products using the data of 186 agricultural products in Malaysia for the period ranging from 1988 to 2014. Besides, this study engages in the total export of the world with Standard International Trade Classification Revision Three-SITC Revision 3 (5-digits code) to analyse the index of comparative advantage and export diversification of agricultural products in Malaysia. The study also employs Balassa index of Revealed Comparative Advantage (RCA) to measure competitiveness and Balassa measurement for export diversification. The findings show that 56 commodities have RCA whereas, Malaysia's export market is more diversified in 2012. This study also empirically examines the determinants of competitiveness which are commodities price, GDP per capita, labour participation and capital formation in agriculture sector. In addition, GDP per capita, capital formation and trade openness have been analysed to determine the impact of each of these variables towards export diversification of Malaysian agriculture sector. ARDL approach to cointegration analysis estimation results indicate that there is a long-run relationship between the variables under study. The outcomes denote that price of commodities, GDP per capita as well as crisis in 2008 have negative association while labour participation and capital formation are positively relatedly to competitiveness. On the other hand, GDP per capita and dot-com bubble are negatively related to export diversification, while capital formation and trade openness have positive relationship with export diversification. This study suggests that government should consider intensifying the current economic policy which focus on product diversification with value-added for agriculture sector to increase competitiveness and export diversification.

Keywords: Revealed comparative advantage, competitiveness, export diversification

Penentu Daya Saing Eksport dan Kepelbagaian Produk Pertanian di Malaysia

ABSTRAK

Kajian ini bertujuan untuk menilai daya saing eksport dan kepelbagaian bagi produk pertanian dengan menggunakan 186 data produk pertanian di Malaysia untuk jangka masa dari 1988 hingga 2014. Kajian ini melibatkan jumlah eksport dunia dengan “Standard International Trade Classification Revision Three” untuk menganalisis indeks faedah berbanding dan kepelbagaian eksport untuk komoditi pertanian di Malaysia. Kajian ini juga menggunakan kaedah Balassa Keunggulan Komparatif Terungkap (RCA) sebagai pengukuran daya saing dan Balassa untuk kepelbagaian eksport. Hasil kajian menunjukkan 56 jenis komoditi mempunyai RCA manakala, pasaran eksport Malaysia adalah lebih berpelbagaian pada tahun 2012. Kajian ini juga secara empirikal meneliti faktor-faktor penentuan daya saing seperti harga komoditi, KDNK per kapita, penyertaan tenaga kerja dan pembentukan modal sektor pertanian. Tambahan pula, KDNK per kapita, pembentukan modal dan keterbukaan perdagangan telah dianalisis untuk mengetahui kesan setiap pembolehubah terhadap kepelbagaian eksport sektor pertanian di Malaysia. Keputusan ujian pendekatan “ARDL” untuk kointegrasi menunjukkan hubungan jangka panjang terjalin di antara daya saing dan semua pembolehubah tidak bersandar. Kajian mendapati harga komoditi, KDNK per kapita dan krisis pada tahun 2008 mempunyai hubungan negatif manakala, penyertaan tenaga kerja dan pembentukan modal mempunyai kesan positif terhadap RCA. Sebaliknya, KDNK per kapita dan “dot-com bubble” mempunyai hubungan negatif terhadap kepelbagaian eksport, manakala pembentukan modal dan keterbukaan perdagangan mempunyai hubungan positif dengan kepelbagaian eksport. Kajian ini mencadangkan agar kerajaan mempertimbangkan penggiatan polisi ekonomi semasa dengan

memfokuskan kepelbagaian produk yang mempunyai nilai tambah bagi produk pertanian untuk meningkatkan daya saing dan kepelbagaian eksport.

Kata kunci: *Keunggulan komparatif terungkap, daya saing, kepelbagaian eksport*

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The world population has seen doubled up from 2.9 billion in 1960 to more than 6.7 billion in 2008 where it has created demands and these demands have been countered by the stable growth in terms of the output of agricultural coupled with a continuing drop in the prices of real commodity (Wik et al., 2008). The world population has then grown to more than 7.3 billion in 2015 (United Nations, 2015). Such numbers of world population are expected to grow to almost 10 billion by 2050 and this scenario has also generated vast demands on global agricultural production (Food and Agriculture Organization of the United Nations United Nations, 2017).

The agriculture sector generates the source of food for consumption by humans, feed for animals, and raw materials for agro-based industries (Edoumiekumo and Audu, 2009). It contributes to economic growth and creates employment opportunities for the increasing population both in farming as well as for off-farm activities. These included handling, packaging, processing, transporting, and the marketing of food and the products of agricultural. In recent years, an articulated agricultural revolution has been seen, bringing more value-added activities into the downstream agro-processing sub-sector that can potentially become another platform for effective wealth generation and increased economic growth. Ultimately, this is expected to curb poverty as well.

However, the agriculture sector's success has yet to be shared equally all over the globe. Nevertheless, its sustainability to countries who are still further behind is still vague. Past studies to name a few, OECD-FAO (2016), Fuglie and Rada (2013) and Wik et al. (2008) discovered that the agricultural productivity still remains shallow for some countries, suffer from increasing food shortages and the levels of hunger and poverty is high. This is especially true in numerous of countries that are less developed such as those in sub-Saharan Africa as well as across the developing world. Thus, it is necessary to develop the agriculture sector since it is the engine of overall economic growth in major elements of the developing countries.

In contemplation of developing the agriculture sector, it is vital to identify the commodity in the sector by which a country can enjoy a comparative advantage to become competitive. A study conducted by Dunmore (1986) revealed that the agriculture sector in the USA experienced a major adjustment when foreign import demand went down, it caused land prices to fall, farm income declined, and farmers continued to leave the sector. The author further stated that, at the time of the study, the volume of the USA's agricultural exports had plunged by more than one third and that the value had decreased by nearly 40 percent from its peak in 1981 and this persisted until the early to mid-1990s. In May 1986, the USA entered into a deficit in agricultural trade for the first time in fifteen years. The reduction in export volume, value and market share clearly showed that the USA agriculture sector was no longer competitive in world markets due to losing its comparative advantage. This scenario demonstrated that, when a country failed to have a comparative advantage in producing the output, it will become uncompetitive over time.

Nevertheless, Dunmore (1986) also mentioned that it is possible for a country to face a fall in competitiveness while sustaining its comparative advantage. This means that a country is able to be competitive without enjoying comparative advantage even when competitiveness as well as comparative advantages are fundamentally inseparable in practical when it comes to international trade. Generally, comparative advantage is an economic theory which is based on the concepts of opportunity costs as well as relative efficiency in regards to resource use. For instance, the theory of comparative advantage by Ricardo indicated that lower opportunity costs for the production of a certain good relative to other goods will lead to competitiveness. Therefore, a country will concentrate in producing goods with comparative advantage, whilst on the other hand, it will trade with other countries for goods in which it has a comparative disadvantage for the benefit of each other.

On the other hand, competitiveness is known as the capability and achievement of a firm, sub-sector or country to market and source goods and services. The relative prices amongst competitors has impact towards the exportation and market share's level. This determines if the products are inexpensive in that particular country as compared to others, giving the exporting country added competitiveness. The competitiveness of a country is vastly reliant on the alterations of policy in the short-run (Dunmore, 1986). Schwab and Sala-i-Martin (2014, p.4) defined competitiveness as “the set of institutions, policies, and issues that define the productivity level of a nation”. They initiated that the productivity level determines the wealth as well as the profit gained through investments of an economy that result in economic growth. Simultaneously, to achieve competitiveness, diversification is essential for a country to vary the production of products which give comparative advantage to boost productivity and growth.

The new era allows developing countries to have greater opportunities to expand the choice in the products of agriculture so as to trade in other countries. Nevertheless, extended trade lead to more rivalry that forces countries to continue to diversify their agricultural activities specifically those which give comparative advantage (Abdullah and Alwi, 2001). Diversification is defined as “a means to increase the continuing growth of agriculture by improving the benefit as well as the stability of the sector” (Abdullah and Alwi, 2001). Diversification is also associated with improving the production as well as consumption varieties offered to a country. Diversification generally points to the growth and expanding in the production base of agricultural which distinguishes it with specialisation. In general, horizontal and vertical diversification are the two different forms of diversification. Horizontal diversification is associated with the cultivation of growing variety of produces within or inside the agriculture sector, whereas the manufacture of production inputs and the intermediary or final outputs is known as vertical diversification. Vertical diversification comprises activities either in upstream or downstream and the backward or forward linkages.

The demand for agricultural products is changing in unprecedented ways, which goes to explain why the diversification of agricultural commodities is necessary in order to meet the demand for value-added commodities. The Food and Agriculture Organization of the United Nations (FAO, 2012) and the United Nations Industrial Development Organization (UNIDO, 2009) initiated that demand for commodities with higher value, refined products and ready-prepared foods is positively linked to the level of income per capita as well as urbanisation. Apart from that, the usage of agricultural products, especially oil crops and grains, as bioenergy production of raw material is on the rise. The changing structure of demand in agriculture creates prospects for diversification and it generates value-addition in agriculture, especially in

countries that are developing. According to FAO (2007), the 1990's witnessed a diversification of production in developing countries in the world trade of non-traditional fruits and vegetables. Increasing growth in demand for food and agricultural products with value-added has brought a new focus on the development of agro-industries in relation to economic growth, food security as well as poverty reduction. The agro-industries are an element of the manufacturing sector which enhances value-addition to agricultural raw materials through processing and handling operations and subsequently promoting growth and development.

As a whole, the agricultural sector forms an integral part of a developing country's economy where it supplies ample employment opportunities and secondly, value-added goods. This also means that the value created by a worker in the agriculture sector is lower than that created by their counterparts in the non-agriculture sector. This gap, according to a study done by Gollin et al. (2011) is an average of four fold in developing countries.

1.2 Agriculture Background in Malaysia

In Malaysia, the agriculture sector makes up the largest share of national output other than the manufacturing sector, creating job opportunities for labourers (Diao et al., 2007). The agriculture sector has several sub-sectors including; palm oil, rubber, livestock, forestry and logging, fisheries, aquaculture as well as other agriculture such as paddy, fruits, vegetables, coconut, and more. According to Malaysia Productivity Corporation (MPC, 2015), Malaysia's agriculture sector contributes to national income and has the potential to support the Ringgit's foreign exchange valuation. This occurs during this time of huge world demand for agricultural products owing to a rising population in the world as well as strong economic fundamentals.

According to the World Economic Forum Competitiveness Report (WEF, 2015), Malaysia was rated as the 18th most competitive economy in the world, additionally Malaysia remains the highest ranked among the developing Asian economies. Malaysia has to remain competitive in this era of globalisation as competitiveness is essential to many countries in order to be assured of growing living standards and economic growth (Ariff, 2005).

However, the increasing level of international trade, especially in the manufacturing sector, has reduced the importance of the agriculture sector among policy makers, academics and policy analysts. This is partly caused by the low prices of agricultural commodities in world markets as well as the low level of technology being used in the agricultural sector. According to Adelman (2001), economic development as a growth process requires an organised restructuring of the factors of production. As a main sector, the agriculture sector has lower productivity, does not contribute to technology advancement, and has yielded decreasing returns. This has made the agriculture sector less attractive and thus, it is important that the sector embraces new technologies while constantly boost the ability and expertise of its labour so as to attain a change in operation (MPC, 2015). The transformation from a traditional sector to a modern sector will help to achieve a higher level of productivity and increasing returns to upsurge its competitiveness.

For a long time, agriculture has been seen as a traditional sector that gives low productivity and merely provides a country with some employment opportunities and food production. However, it is the foundation of a country's development and future transformation and thus, should never be neglected particularly for countries which are yet to shift into more advanced sectors such as the manufacturing and services sectors based on Asian Development

Bank (ADB, 2012b). According to Maheran and Haslina (2006), Malaysia has witnessed extensive changes in terms of its export share patterns and export merchandise amongst the primary commodities exporters, labour base goods and machinery or capital base manufacturing in the world market. The authors also claimed that structural effects due to the specialisation in highly value added and demanded products caused the change in export value that occurred. Unfortunately, agriculture has been neglected and poorly understood as to what it can contribute to economic development (World Bank, 2007).

Nonetheless, interest in the agriculture sector has been renewed in the national development agenda. The Malaysian government emphasises on agriculture sector as the third engine of economic growth. In view of this, research and development are needed to stimulate government programs in transforming the agriculture sector into one that is modern, productive, competitive as well as diversified. For instance, the government has introduced the National Key Economic Areas (NKEA) to support the country's economic development and sustainability by transforming the agriculture sector from an inefficient, small-scale industry into a large-scale agriculture industry (MPC, 2015).

Malaysia also aims to be an industrialised and developed nation by the year 2020. The post-independence era has clearly transformed the Malaysian economy from being heavily dependent on agricultural activities and primarily exporting commodities towards an open export oriented and manufacturing based economy. Specifically, Malaysia aimed to achieve a robust manufacturing base and products with higher value-added by becoming a knowledge-based economy through transforming the Malaysian economy from an agricultural based economy into an export market which is more diversified (Akoum, 2016). Before Malaysia

achieved independence, the colonists' economic interest was in the trading of spices and other primary commodities such as tin and rubber. Therefore, the colonists encouraged the establishment of plantations such as Dunlop Plantation, Guthrie Plantation, and Harrisons and Crossfield due to the rising economic importance of rubber. Rahim (2012) stated that the agriculture sector became the backbone of the country's economy ever since Malaya became the world's top producer of rubber, contributing vastly to export income and bringing in foreign direct investment. Nevertheless, the agriculture policy in the past neglected the participation of the people in the rubber plantations. According to Mustapha (1988), the locals were left behind with only subsistence agriculture producing largely for domestic usage as well as consumption. On the other hand, the British and other communities continued to expand their interest in commercial agriculture production and exporting crops.

Agricultural development, in this sense, has been influenced by national economic development plans to reconstruct a traditional small-scale, production based sector into a large-scale agriculture industry. This is to ultimately reduce reliance on imported goods, create more value-added products downstream and to increase productivity and competitiveness. Therefore, the nation has to be more competitive in this modern and trade-liberal era to raise the standard of living as well as economic growth. Figure 1.1 shows the chronology of the Malaysian Plans from 1966 to 2020. The First Malaysia Plan (1966 to 1970) considered Malaysia as Peninsula Malaysia, Sabah and Sarawak and was aimed to cultivate social integration among the various peoples and ultimately improve the development of an economy in addition to the people's welfare.

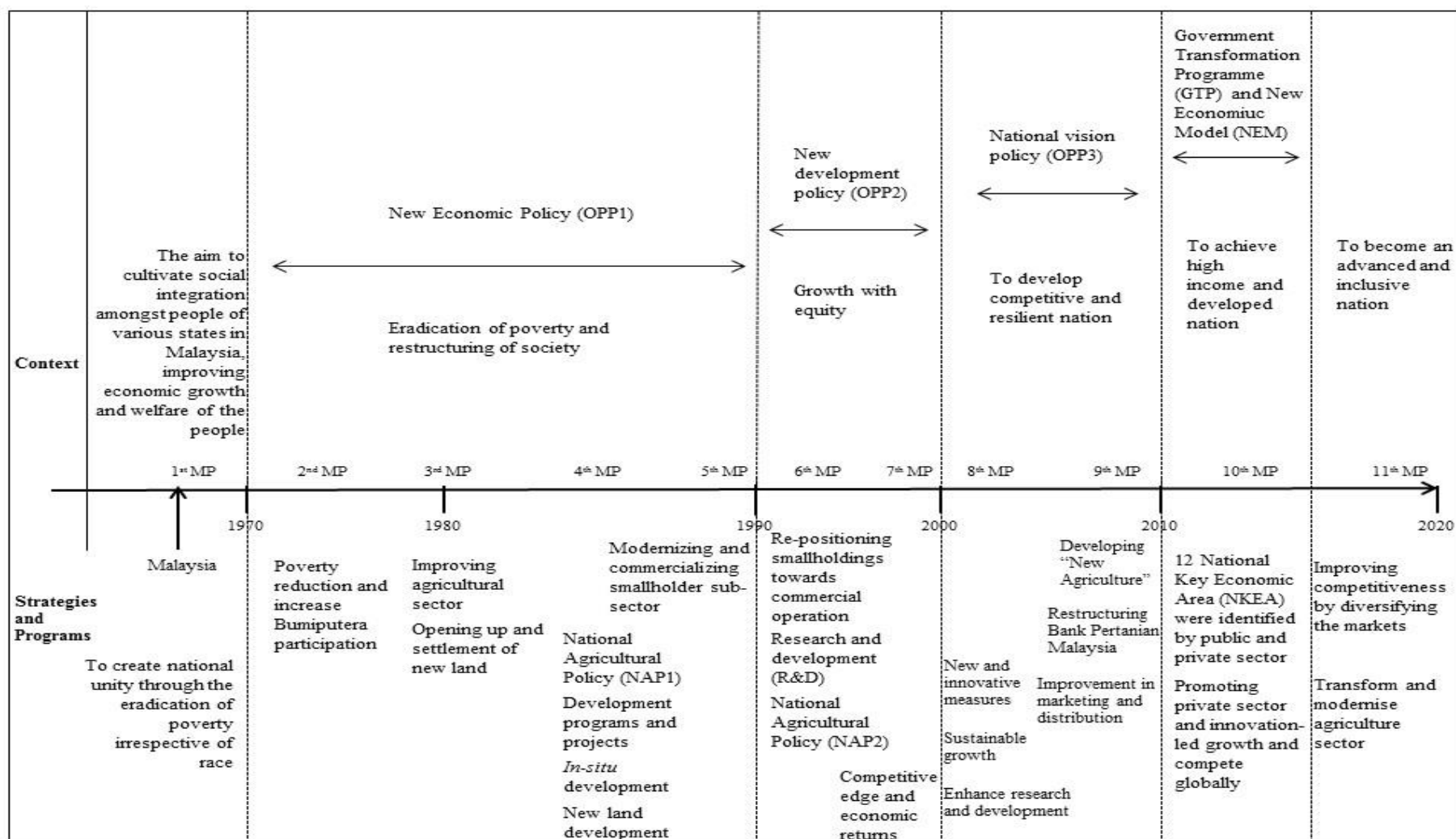


Figure 1.1: Malaysia Plan, 1966-2020 (Economic Planning Unit, 1966-2020)

The Second Malaysia Plan (1971 to 1975) focused on diversifying the crops grown in Malaysia. The highlight of this plan was the initiation of the New Economic Policy (NEP), which was outlined by the National Action Council (MAGERAN) to eradicate poverty regardless of race through the creation of national unity. This was incorporated in the 20 years of the First Outline Perspective Plan (OPP1). The involvement of the government started to take place around 1970 to 1990 in developing rural areas. The objective of this plan was to achieve a greater reduction of poverty and to increase the Bumiputeras' economic interest as well as in the restructuring of society. In rural areas, new land development, regional development and *in-situ* development programmes grow into essential tools for reestablishment and decreasing the poverty in rural and regional imbalances.

The third Malaysia Plan (1976-1980) was rolled out to modernise the agriculture sector and expand labour intensive industries. It was also aimed at enhancing the role of the agriculture sector in generating opportunities regardless of race to increase employment opportunities. This plan increased productivity in existing smallholdings, expanded income as well as improved the welfare of the rural population. Agricultural development was emphasised by opening up new lands where significant investments were injected into the improvement of drainage and irrigation to boost the production rate of paddy and other agriculture and food crops.

Development programmes and projects were the main priorities for the agricultural sector in the Fourth Malaysia plan (1981-1986) as depicted in Figure 1.1. The First National Agricultural Policy (NAP1) was implemented in 1984 and aimed to maximise the income of various groups such as farmers, livestock holders and fishermen. Furthermore, the *in-situ* development included the establishment of basic infrastructure and agricultural input as well as

the promotion of local activities. Lastly, new land development with perennial crops was made available for the benefit of the landless and underemployed farmers (Economic Planning Unit [EPU], 1984).

Efforts were made to ensure the modernising and commercialising the smallholder sub-sectors during the Fifth Malaysia plan as illustrated in Figure 1.1. Government participation further expanded, along with that of the private sector. Ultimately, the private sector's role in national agriculture increased significantly to two percent of land developed through government joint venture and 98 percent fully owned by private companies (Indrani, 2000).

The Second Outline Perspective Plan (OPP2) from 1991-2000 was developed according to the New Development Policy (NDP). It focused on strengthening the size of the Bumiputeras to boost their holding in corporate wealth as well as to achieve a more decent income distribution and abundance throughout the country. In between the OPP2, the Sixth Malaysia Plan was executed from 1991 to 1995 to further re-position smallholdings into commercial operations in order to achieve economies of scale and to be internationally competitive in the long-run. Research and development (R&D) initiatives were emphasised to achieve this (see Figure 1.1). The Second National Agriculture Policy (NAP2) was also implemented during this period and it shared a policy on R&D which was also intended to encourage a market-led, commercialised, efficient and competitive agriculture sector.

The concentration of development in the Seventh Malaysia plan from 1996 to 2000 was in areas with a competitive edge and higher economic returns. The cultivation of high-value crops and the expansion of aquaculture activities were the highlights because these initiatives

could contribute to growth (EPU, 1984). Efforts were made to upsurge the involvement of the private sector in agricultural development along with the public sector through the provision of the necessary technical and advisory support.

The emphasis of the subsequent Third Outline Perspective Plan (OPP3) was on building a resilient and competitive nation (see Figure 1.1). Increasing the development quality and to produce high and sustainable growth were the efforts made in this plan. New and innovative measures were employed to increase the contribution of the agriculture sector to the national economy during the Eighth Malaysia Plan from 2001 to 2005. Policies and strategies were aimed towards realising continuous growth with resilience. Furthermore, productivity and efficiency were increased through the development of human resource, strengthening research and development activities and by utilising the modern technologies (EPU, 2003).

According to Bank Negara Malaysia (BNM, 2005), the enhancement of national competitiveness and resilience was the aim of the Ninth Malaysia Plan (2006-2010). Within a five year period, the focus was on establishing “New Agriculture” which comprised of widening large-scale commercial farming, improving element as well as value-added processing and biotechnology (see Figure 1.1). Efforts to build entrepreneurs in agriculture and strengthen the current entrepreneurs in small and medium-scale were carried out in order to transform agriculture into a sustainable business. There was also an initiative in the re-establishing and alteration of Bank Pertanian Malaysia (BPM) to strengthen its size and efficacy in arranging loans. Small farmers and fishermen were given microcredits to facilitate their participation. Furthermore, improvements were made in marketing and the distribution infrastructure, for instance, the roles of *Lembaga Pemasaran Pertanian Persekutuan* (FAMA) and *Lembaga*

Kemajuan Ikan Malaysia (LKIM) were analysed to expand coordination and the National Agriculture and Food Corporation was established to commence the products of agriculture in terms of marketing and distribution on a large-scale basis.

The Tenth Malaysia Plan espoused the Government Transformation Programmes and the New Economic Model, which were commenced on high-income, inclusiveness as well as sustainability. The national development programmes are attuned to the six National Key Results Areas of the Economic Transformation Programme and the strategic economic reforms in the New Economic Model (EPU, 2010). Lastly, it emphasised on promoting private sector and innovation-led growth to ensure that Malaysia was competitive globally.

As a whole, when reviewing the Malaysian Plans, it can be observed that the Malaysian government has diverted its attention to transforming the role of the agriculture sector. From the earliest Malaysian Plans that focused only on the production and export of raw agricultural commodities, the most recent, the 11th Malaysian Plan (2016-2020) focused is to become an advanced and inclusive nation. Besides, this plan also aimed to improve the competitiveness by diversifying the markets to increase the value-added (EPU, 2015). Such efforts will further enhance and boost the country's competitiveness as well as longer term economic growth. It has also aimed to transform and modernise the agriculture sector into a high-income and sustainable sector by encouraging investment from private sector.

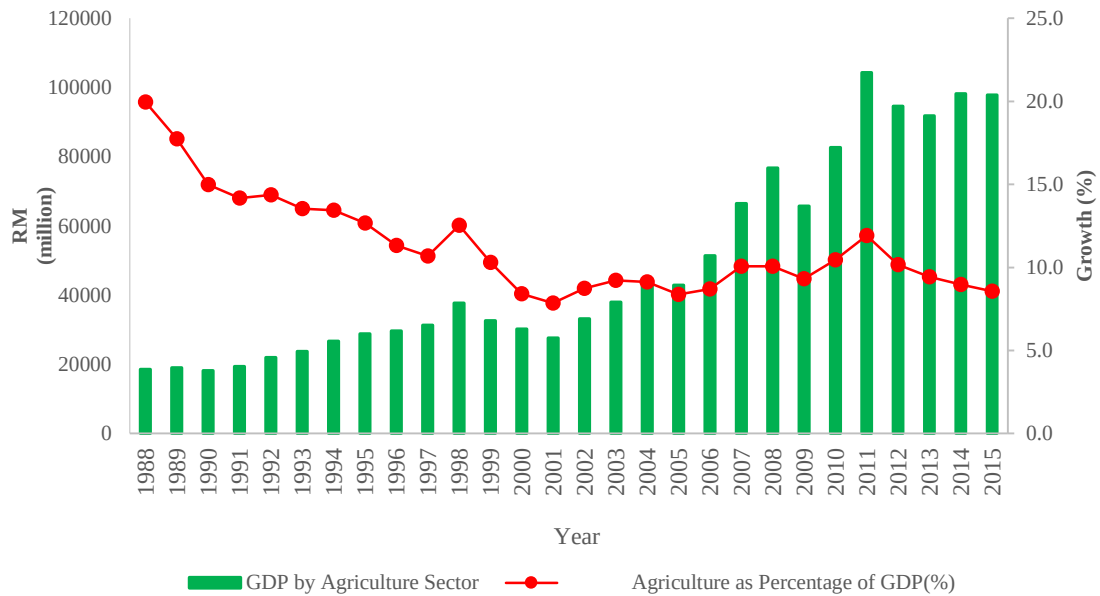


Figure 1.2: GDP Performance on the Agriculture Sector in Malaysia, 1988-2015 (Asian Development Bank)

Figure 1.2 depicts the GDP performance of the agriculture sector in Malaysia from 1988 to 2015. The figure shows that the agriculture sector had experienced a slight decrease to 9.3 percent of GDP growth in 2009 (from RM76,753 million in 2008). The sector's contribution to GDP witnessed an increase of RM16,895 million to RM82,614 million in 2010 and the sector grew marginally to 10.5 percent (see Figure 1.2). The sector continued to expand at 1.4 percent to 11.9 percent with a recorded GDP amounting to RM104,301 million in 2011. This upward trend might be due to the greater production of palm oil and food commodities such as vegetables and fruits, and poultry. According to MPC (2015, p.73), the palm oil sub-sector played a huge role in the agriculture sector whereby it contributed about 36.6 percent to the GDP, followed by other agriculture sub-sectors such as fisheries and aquaculture which contributed 20.1 percent and 14.6 percent, respectively. Regardless of a recorded decline of the agriculture sector to national GDP from 11.9 percent in 2011 to 10.2 percent in 2012 and further

declines to 9.4 percent and 9 percent in 2013 and 2014 respectively, the agriculture sector remained crucial to the nation's development.

Malaysia has an open economy thus, trade is vital to sustain the economy and its economic structure is highly dependent on the magnitude and direction of trade. Malaysia witnessed a decline in the performance in the external trade in agriculture from RM106.1 million in 2013 to RM82.1 million in 2014, which was a 22.6 percent drop (MPC, 2015). This was attributed to weakened demand and higher commodity prices, particularly palm oil. Import trade also weakened from RM75.2 million to RM57.6 million in 2014. Nevertheless, Malaysia still remained a net exporter in the agriculture sector despite the decline in the balance of trade from RM30.9 million to RM24.5 million in 2014.

Figure 1.3 shows the value added and employment trend of the agriculture, industrial and services sectors in Malaysia from 1985 to 2014. The three major industries added significant value from 1991 to 1996, but this declined drastically in 1997 as a result of the Asian financial crisis.¹

¹ This crisis was triggered by a huge devaluation of the ringgit and followed by a sharp drop in stock market values. The Thai Baht was speculatively attacked, the Malaysian ringgit was not spared and the depreciation of the ringgit led to panic selling by foreign investors, whereby causing many investors to withdraw their investments and invest in other countries which were deemed to have more stable stock market values.

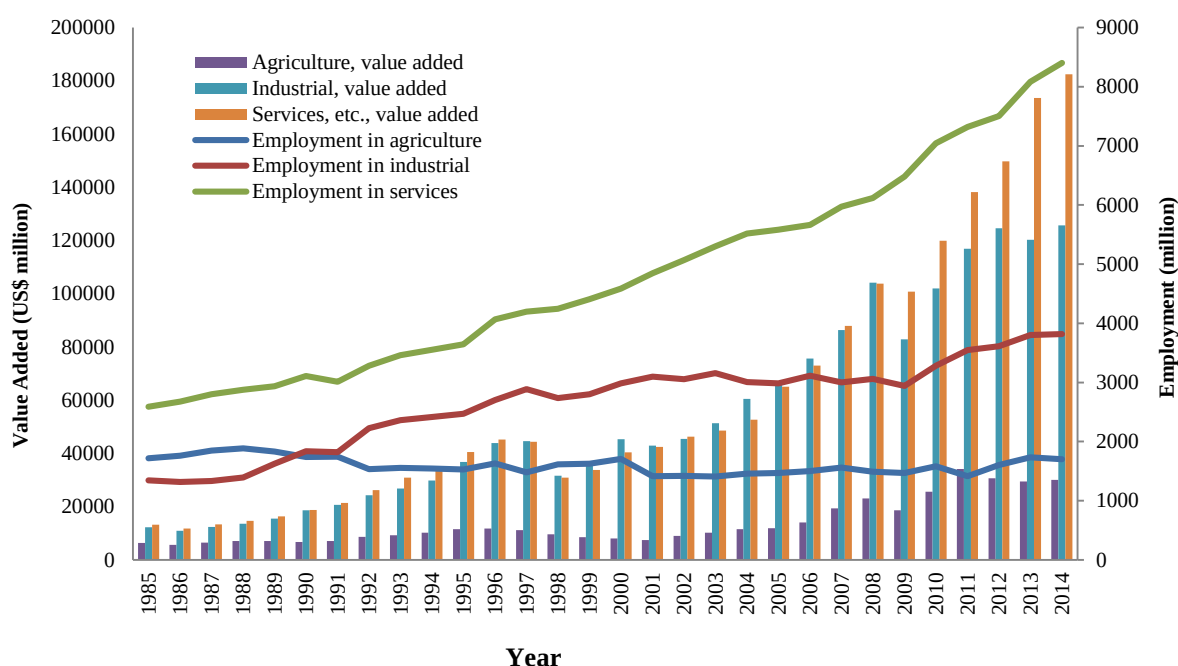


Figure 1.3: Agriculture, Industrial and Services Sectors in Malaysia, 1985-2014 (World Development Indicator, World Bank and Department of Statistics Malaysia [DOSM])

The adoption of modern techniques of paddy planting such as direct seeding, modern mechanisms of cultivating, and the use of combine harvesters for harvesting has contributed to an upsurge to Malaysia's agricultural productivity. This is portrayed in Figure 1.3 wherein the value added by the agriculture sector started to increase in 2002. This is in line with the 7th Malaysia Plan which aimed to increase the involvement in agriculture on a larger scale agriculture. The key contributors were in the production of food commodities and high-value products, especially in terms of technology-based as well as knowledge-based industries (Education and Research Association for Consumers, Malaysia [ERA], 2001; Tan and Ariff, 1997). Such efforts would provide access to a reliable and consistent supply of agricultural products and lead to export diversification which would help to reduce the reliance on imported products. At the same time, this enabled Malaysia to generate agricultural products for market with enhanced value and competitiveness in international markets.

After the Asian financial crisis, the value added by the industrial and services sectors regained their momentum in 1999, recording an increase of US\$5,105 million from US\$31,667 million in 1998 to US\$36,772 million in 1999. This growth continued up until 2012 with an exception in the year 2009 due to the onset of the global financial crisis.

Fortunately, the impact of these two financial crises upon the employment rate in Malaysia was not as shocking as in many other countries. As depicted in Figure 1.3, unemployment in 1997 increased in the agriculture sector and the industrial sector experienced a drop in numbers of employment in 1998. However, it does not affect the numbers of employment in services sector during this period. According to Goh and Lim (2010), the outbreak of the 1997-1998 Asian financial crisis not only caused Malaysia to lose 84 million jobs but also affected foreign workers based in Malaysia, where many were forced to return to their home countries. As a result, this decreased the demand for agricultural commodities and public expenditure. With the exception of employment in the services sector, the numbers of people in employment in the agriculture and industrial sectors dropped to 1,471 million and 2,942 million, respectively in 2009. However, employment started to pick up in 2010, reflecting the improving economic conditions and could partly be caused by the implementation of two stimulus packages by the Malaysian government (Goh and Lim, 2010). It can be seen in Figure 1.3 that the employment rate for the industrial and services sectors improved greatly until 2014, whereas the employment rate from the agriculture sector witnessed a greater gap as compared to the other two sectors.

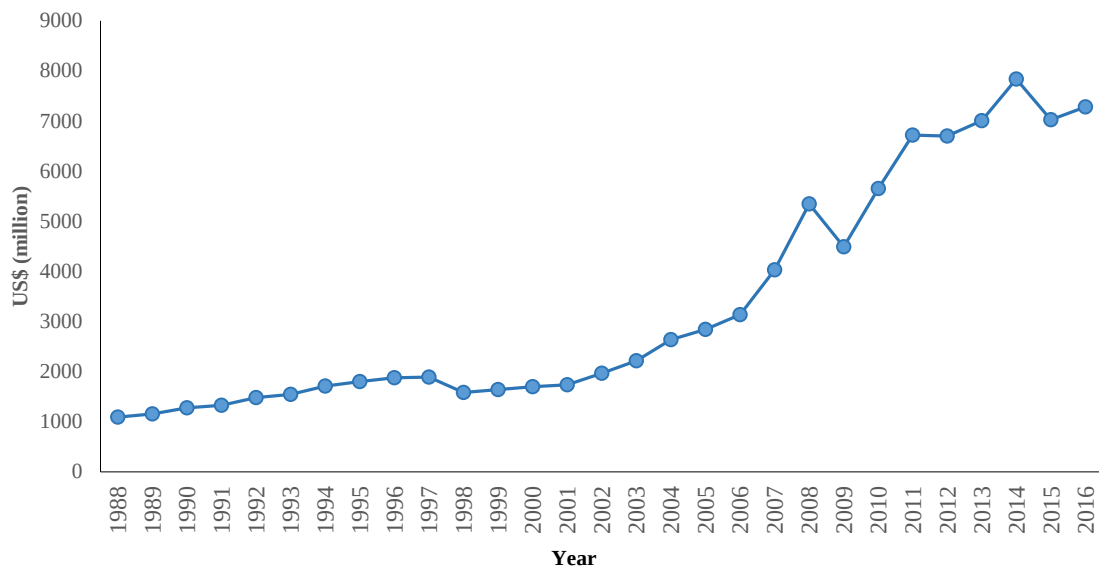


Figure 1.4: Agriculture Export Performance in Malaysia, 1988-2016 (United Nations Commodity Trade Statistics Database [UN Comtrade Database])

Figure 1.4 presents the agriculture export performance in Malaysia from 1988 to 2016. The export performance for Malaysian agricultural products revealed a stable growth as shown clearly in Figure 1.4. The export of agriculture experienced growth from 1988 to 2016 from US\$1090.026 million to US\$7283.592 million. The exports of Malaysian agriculture increased from US\$1640.181 million in 1999 to US\$7283.592 million in 2016. According to Nik Mohd Masdek et al. (2013), the biggest contributor of export performance derived from palm oil which accounted for more than US\$11300 million in 2010. Moreover, higher exports of palm oil and palm-based agriculture products has contributed to the expansion in exports of agricultural goods which expanded by 4.7 percent accounting for 9 percent share of total exports in 2016 (Ministry of International Trade and Industry [MITI], 2016). Besides, the export performance in 2016 witnessed increased due to the growing trend of exportation for fruits and vegetables which has contributed to the performance of agriculture. Despite this, Malaysia still relies heavily on the imported fruits and vegetables where the statistic by FAMA recorded the

total fruits and vegetables imported in 2014 was RM5500 million, whereas the exports of vegetables and fruits documented a total of RM1600 million (Ruban, 2016).

As shown in Figure 1.4, the export performance however witnessed a decline in 2009 due to the aftermath of global financial crisis that occurred in 2008. Global financial crisis has impacted the economic growth and also triggered the exportation for agricultural products in Malaysia. The crisis has affected the agricultural products in which the agriculture exports dropped despite the falls in prices of agricultural products. The decline in the price did not stimulate exports of the agricultural products as the global economy had slowed down and this reduced export demand for the commodity products.

The condition of Malaysian agricultural exports again revealed the ability of Malaysian agriculture to withstand from external shocks as was the incidence during the Asian financial crisis which hit the Malaysian economy between 1997 and 1998. The Asian financial crisis happened where in mid-May 1997, the Thai baht was speculatively attacked. The ringgit was also not spared and came under severe selling pressure which resulted in lower export earnings and slowed down the growth in export of agriculture to 4.1 percent during the period from 1988 to 1998.

1.3 Motivation of the Study

Agriculture has been the backbone of Malaysian economy in producing agricultural products that contributes to national income and it has been identified as one of the strategic sector that help to alleviate poverty. However, the performance of this sector has been declined

over the years despite the increase in its absolute value but share of agricultural in GDP is low while those manufacturing and services increased. The contribution of agriculture export mainly comes from the exportation of palm oil related sector whereas other agricultural related products that possibly contribute to the export performance such as spices, livestock, and fruits and vegetables are neglected. Such situation has led to dependency on import for certain products due to the low productivity and value-added of the agricultural produce. Therefore, such momentum fuelled a need to study the export competitiveness of agricultural products in Malaysia so as to discover which commodities have the potential to be develop in order to upsurge the contribution of agriculture.

By identifying agricultural products that have the potential to be develop enables Malaysia to further process the commodities into products with higher value-added by engaging in diversification so as to expand the development of agriculture's performance. This therefore require us to shift from a conventional practise of economic development from specialisation into diversification. Other than that, the concept of diversification in agriculture export is mostly confine to horizontal diversification only whereas there are much more can be gained from vertical activity of agriculture. In view of the importance of agriculture exportation towards the economy, this has motivated the current study to be conducted to understand the diversification progress of the current state of Malaysian agricultural export activities in order to boost the export competitiveness and diversification of agriculture.

Furthermore, this study helps to fill the gap of past literature reviews as no study has been done further to rule out the determinants of export competitiveness and diversification for agricultural products in Malaysia. For example, past studies such as Arip et al. (2013) and Arip

et al. (2010) conducted studies on the relationship of export diversification and economic growth, and also competitiveness of palm oil related industry. On the other hand, Irsahad et al. (2017) carried out a study on the determinants of export competitiveness of external sector in Pakistan. However, these studies do not look into the factors that influence both export competitiveness and diversification of agricultural products. Therefore, this has motivated the present study to identify the determinants of export competitiveness and diversification of agricultural products in order to boost the development of agriculture in Malaysia.

1.4 Problem Statement

The agriculture sector has been one of the important components of Malaysia's economy as discussed in the earlier section. It has significantly contributed to economic growth and employment as well as benefitting other industries through the multiplier effect. Therefore, it is crucial to identify the comparative advantage of agricultural commodities and also to understand the factors affecting the export competitiveness and diversification of agriculture products in Malaysia. For instance, Malaysia is actually capable of producing most of the vegetables and fruits for self-consumption and exportation. However, Malaysia is still very much dependent on the agricultural products from other countries to meet the demand of its local market (Ruban, 2016). Hence, there is a need to move from upstream production of basic agricultural products which focused on raw materials to downstream production of value-added products in order to boost the exportation. Thus, this can be further done by identifying the determinants of both export competitiveness and diversification in agriculture that could contribute to the export performance of agricultural products.

In the case of the Malaysian government unable to identify the determinants of export competitiveness and diversification, the development of the agriculture agricultural products in Malaysia may be hampered due to weak investment of agricultural products capacities (Organisation for Economic Cooperation and Development [OECD], 2017). This would be especially when the indicators provided under GDP of any country is shadowing the real contribution of export performance of agricultural products to the national output. This is because the definition of economic activity tends to shift to another category once the product moves from the upstream to the downstream process with low value-added process (Food and Agriculture Organization of the United Nations [UNIDO], 2015). For the agriculture sector, all production is in the upstream process before the manufacturing activities start the downstream process, it is noted that the contribution of the upstream processes are often underestimated.

A country cannot be competitive in all industries or rely solely on a single product to sustain its economy. Downstream products offer the potential for specialised products and market segments that can be focussed upon and optimised to increase efficiency and productivity and bring about enhanced competitiveness and diversification. As an example, the major contributor of Malaysian agricultural output is attributed to palm oil (an industrial crop) due to its vast production area, rather than to food crops (Alam, et al., 2011). As the main contributor to the sector, palm oil related production and export had recorded an agricultural growth of 11.2 percent of global oils and fats produced and 25 percent of similar exports in 2014 (MPC, 2015).

Although there has been growth in palm oil related production, the current performance of Malaysia's palm oil industry is not as competitive as that of Indonesia in terms of production

(Wong, 2016). Therefore, in order for the nation to enhance its competitiveness, more focus has to be given to high-quality products and value-adding downstream processes in the world market (Rahman, 2010). Consequently, it is vital to look into other ways of becoming more efficient and producing improved products as well as downstream and pharmaceutical activities in the diversification of agricultural products (Ng, 2013; Rahman, 2010).

When looking at the value chain of the palm oil sector, Malaysia has not optimised its comparative advantages and economic potential as one of the world biggest CPO producers. This can be seen where the palm oil is still experiencing very limited local downstream and higher value-added processing in the various industrial and consumer products such as biodiesel and cosmetic products (Robert, 2014, Arip et al., 2013). This can be further rectified by Hussein (2014) who stated that the agriculture in Malaysia stopped at upstream production. For example, the palm oil industry lacks of capacity to refine the oil it extracts. Hence, optimisation of its comparative advantage can be achieved by going into downstream value-added agricultural products that will have a huge impact on national output and trade balance. Therefore, there is a need for Malaysia to enhance its agriculture sector downstream by widening the product range and high value-added productivity to increase its competitiveness in both the domestic and international markets.

Malaysia has the potential to further develop its production and efficiency of agricultural products by enhancing its competitiveness as well as diversifying the exportation of agricultural products. Policy makers in Malaysia need to understand and acknowledge that the current economy state is not diversified enough. For instance, Malaysia has the capability to produce most of the vegetables that it imports and Malaysia do plant vegetables such as

tomatoes but it is limited to agro-tourism industry and supplied to niche hypermarkets only as local produce is not able to meet the demand of local market (Ruban, 2016). In addition, Malaysia is also relying on the importation of livestock such as cattle and beef from other countries such as Australia. By viewing the important contribution and influence of the agricultural products within Malaysia, a study that identifies the comparative advantage and diversification will assist policy makers to recognise the competitiveness of agricultural commodities and current status of the diversification progress. In addition, such a study will assist the policymakers by providing more information on competitiveness and in identifying the determinants of comparative advantage as well as the factors affecting export diversification in of agricultural products. In order to generate continuous growth as well as ongoing sustainability in this sector, the agricultural policy should aim towards improving the competitiveness of the agricultural products and enhancing it's value-added.

1.5 Objectives of the Study

1.5.1 General Objective

This study aims to discuss the comparative advantage of agricultural commodities in Malaysia since there is a need for export diversification to promote rapid economic development in the agriculture sector.

1.5.2 Specific Objectives

This study is focused on the following objectives which reflect the issues highlighted in the problem statement.

- i. To calculate the comparative advantage of agricultural products in Malaysia;

- ii. To assess the performance of export diversification of agricultural products in Malaysia;
- iii. To identify the determinants of comparative advantage in the export of agriculture products in Malaysia;
- iv. To determine the factors affecting export diversification in the agriculture products in Malaysia.

1.6 Significance of the Study

Throughout this study, agricultural products that have comparative advantages and comparative disadvantages in Malaysia would be highlighted. Thus, this study will provide some insights for the development of the export performance of agriculture to transform it towards high efficiency and international competitiveness. This study may benefit and assist the Malaysian government in the implementation of prudent policies which related to the agricultural products. It can guide the policy makers in the process of decision making and propose projects that could further develop the agricultural related products in Malaysia. This study will indirectly enhance the comparative advantage of the related agricultural products and this will help to boost the Malaysian international trade opportunities on agricultural products and further contribute to the export performance of the country.

Apart from that, the determinants of export competitiveness and diversification of agricultural commodities would be identified in this study to design relevant agriculture policies in order to improve and enhance the export performance of agriculture. The findings from this study may provide useful information to policy makers to enable them to implement pertinent

policies that empower the agricultural products to improve its competitiveness whilst enhancing its value-added through export diversification. Furthermore, the government has to address indicators not only to the extent of aggregated value but also on the microeconomic components of the agriculture sector to penetrate external markets and to ensure sustainability.

There is a gap in past literatures where most of the export competitiveness and diversification studies used Balassa (1965) revealed comparative advantage and Balassa (1965) export diversification method that focused on estimating the comparative advantage and export diversification only without going in depth to rule out the determinants that influence it. In addition, past literatures pertaining to this topic mostly focused on other countries such as South Korea, Bangladesh, India, Japan and others. In view of this, this study is expected to fill the gaps in literature and it will be of great interest to understand what are the main factors affecting export competitiveness and diversification of agricultural products in Malaysia.

1.7 Scope of the Study

The scope of this research is to study the comparative advantage and comparative disadvantage of agricultural commodities and to identify the determinants of competitiveness as well as export diversification of the agricultural commodities in Malaysia. This study utilises annual exportation data of 186 agricultural related commodities in Malaysia for the empirical period of 1988 to 2014 where it engages in the total export of the world. The Standard International Trade Classification Revision Three-SITC Revision 3 (5-digits code) exportation data for these commodities is obtained from the United Nations Commodity Trade Statistics Database (UN Comtrade Database) to analyse the index for the comparative advantage and

export diversification of agricultural commodities in Malaysia. The 5-digits code will be used since it covers a longer time series of trade data as the higher number of the SITC digits code represents a more specific classification of the product category.

After calculating the index of Revealed Comparative Advantage (RCA) and export diversification, this study will be further carry on by analysing the collected data by using the Eviews 9.0 software. In order to examine the stationary properties of all of the variables under study, the non-stationary tests such as the Augmented Dickey-Fuller (ADF) and the Phillips-Peron (PP) unit root tests will be performed. Apart from that, the bounds test for cointegration and the ARDL test will be conducted using the Eviews 9.0 software. We can obtain the long-run estimates and the ECM from the ARDL model. Additionally, a series of diagnostic and stability tests, for example, the CUSUM and CUSUM squares stability tests will be employed to ascertain the appropriateness of the ARDL model.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter provides a comprehensive overview of existing literature with regards to the competitiveness and export diversification of the agriculture sector in several different countries including Malaysia. In addition, this chapter also covers the methods to measure competitiveness and export diversification. The discussion is divided into three parts. Section 2.2 discusses the different measurements of comparative advantage; Section 2.3 focuses on the methods with regard to export diversification; Section 2.4 highlights more relevant literature in measuring competitiveness and export diversification. This section also discusses the determinants of competitiveness as well as export diversification. Section 2.5 provides the concluding remarks. A summary is provided for each part of the literature review.

2.2 Measurements of Comparative Advantage

The hike in global competition necessitates Malaysia to evaluate where its comparative advantage lies. Comparative advantage is usually defined as a country's ability to produce goods at a cost which is lower as compared to other countries and therefore, should specialise in producing the goods in which comparative advantage existed and vice versa. The theory of comparative advantage does not make the comparative advantage measurement of a particular commodity easy. As such, an indirect approximation of the concept has been done by adopting the revealed information from post-trade positions as well as assumptions in regards to the link

between both unobservable and observable variables (Greenaway and Milner, 1993, p.181). In this regard, the indexes of revealed comparative advantage (RCA) are useful ways to measure both the character and strength of a country's comparative advantage or disadvantage. This shall be discussed in detail later.

2.2.1 Balassa Index of Revealed Comparative Advantage

The concept of Revealed Comparative Advantage (RCA) as developed by Balassa (1965) have been initiated in numerous studies. Equation (1.1) estimates the relative export ratio of a certain commodity against the total export of one country to the relative ratio of the total export of the same commodity against the world's total export value².

$$RCA_i^j = \frac{X_i^j / X_t^j}{X_i^w / X_t^w} \quad (1.1)$$

Where,

RCA = Index of revealed comparative advantage

X_i^j = Export of commodity i by j

X_t^j = Total export of country j

X_i^w = Export of commodity in the world

X_t^w = Total export of the world

² The underlying reason to the application of relative export rather than the net-export in this equation is rested upon the system of trade protection.

In short, the RCA index compares the share of a given sector in national exports with the share of this sector in world exports, with the value of one showing the threshold between revealed comparative advantage and revealed comparative disadvantage. If the obtained RCA value is larger than one, this shows that country j has a positive impact or comparative advantage in the production of i and vice versa. Put simply, the greater the index of RCA, the stronger the comparative advantage will be. Conversely, the smaller the index, the bigger the comparative disadvantage.

The advantages of using Balassa index of comparative advantage is because it takes into account of the exportation data. The underlying reason for the application of relative export rather than the net-export in the formula is due to the system of trade protection. Balassa (1989, p.26) clarifies that protection has a great impact on the inter-country trade pattern. As a result, in order to neutralise the effect of protectionism and to get a uniform index of “revealed” comparative advantage, the measurement has to rely on the relative export value (Balassa, 1989). Moreover, the main advantage of Balassa index are simplicity of construction and interpretation as well as low requirements to data where only export data is necessary (Gnidchenko and Salnikov, 2015). Besides, Balassa index allows estimates of a country’s individual industries in terms of export capability by ranking and comparing relative shares of different industries’ exports within the country, by ranking and comparing relative shares of different countries’ export at a sectoral level, and by revealing changes in the relative shares over time (Sanidas and Shin, 2010).

On the other hand, Balassa index has been criticised for its incomparability across time and space, which originates from its asymmetry, unstable mean across time and space, and

aggregation effect (Sanidas and Shin, 2010). Furthermore, Balassa index of revealed comparative advantage does not give any significant information except on the existence of comparative advantage and disadvantage.

2.2.2 Michaely Index

The Michaely index includes the total imports of a country additionally to total exports in generating the indices. This was introduced by Michael Michaely (1962/1967) and known as an index of dissimilarity for a country (Laursen, 1998). The first fragment of the equation signifies the percentage share of a given sector in the exports of a country, whereas the last part denotes the percentage share of a certain sector in the imports of a country. Laursen (1998) stated that the measure ranges between negative one and positive one, with a neutral zero value. A value closer to one indicating a greater degree of trade specialisation or a country is specialised in a sector if the value of the index is positive and vice versa.

The use of this index is recommended when measuring the degree of similarity between trade patterns as it is use for the comparison of trade patterns, for example, the comparison of a country's import and export patterns, export or import patterns of two countries or a group of countries (Pablo Coto- Millán, 2004). Besides, it is also used as a measure of international trade specialisation at a sector level. Michaely index is an indicator of export structure for a country and it also controls for distortions induced by macroeconomic fluctuation. Since comparative advantage are structural by definition, therefore it is important to eliminate influence of cyclical factors which can affect the flows of trade in short-run. The advantage of using this index is the simplicity of interpretation of results since it takes value from zero which is perfect stability of specialisation pattern to two, that is absolute mobility of specialisation patterns. However, the

drawbacks of Michaely index is it indicates the intensity of change instead of its direction (Coto-Millán, 2004; Halilbašić, 2012).

$$RCA = (X_{ij} / \sum X_{ij}) - (M_{ij} / \sum M_{ij}) \quad (1.2)$$

where,

X_{ij} = Total value of exports of industry i of country j

M_{ij} = Total value of imports of industry i of country j

2.2.3 Wolter Index

Wolter (1977, pp.251-267) proposed the measure as below:

$$RCA = (X_{ij} / M_{ij}) / (\sum X_{ij} / \sum M_{ij}) \quad (1.3)$$

where,

X_{ij} = Total value of exports of industry i of country j

M_{ij} = Total value of imports of industry i of country j

$\sum X_{ij}$ = Total value of exports of the country j

$\sum M_{ij}$ = Total value of imports of the country j

The RCA index employed using this method delivers information about a particular industry's export performance in regards to other groups of industry in a country. RCA index greater than one shows that the comparative advantage is stronger, whereas the smaller the index, the greater the comparative disadvantage. This measure has the advantage of weighting

successful industries more heavily than the less successful. However, the measure does have drawbacks that is not balance between imports and exports and it is bounded from below but not above.

2.3 Measurements of Export Diversification

The different definitions, dimensions, forms and levels of diversification will lead to different methods in the measurement of export diversification. Generally, the Concentration Ratio is the most common measurement used to measure diversification. Other measures include the Commodity-Specific Cumulative Export Experience Function (CSCEEF), the Absolute Deviation of the Country Commodity Shares, and the Commodity Specific Traditionalist Index (Samen, 2010). Some of the reported approaches used to estimate concentration ratios are the Balassa (1989) method, the Herfindahl-Hirschman index, and the Ogive index.

2.3.1 Balassa (1989) Measurement

The Balassa (1989) method used the standard deviation of the RCA indices to measure the degree of specialisation and diversification. Based on Equation (1.4), it is clear that a smaller value of the standard deviation indicates a higher level of diversification and vice versa.

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (RCA_i - \overline{RCA})^2} \quad (1.4)$$

where,

N = The number of commodity

RCA_i = The index of revealed comparative advantage of a particular commodity

$\overline{RCA}$ = The mean of RCA index from N number of samples

The advantage of using this measurement is the same as Balassa index of revealed comparative advantage as discussed in earlier section as it is derived from the standard deviation of Balassa RCA which only takes into account the exportation data due to the system of trade protection. Besides, there is no upper or lower limit for this measure as from time to time the standard deviation should be reduced to indicate that the country is more into diversification instead of specialisation.

2.3.2 Herfindahl-Hirschman Index

The Herfindahl-Hirschman index (HHI) is a statistical measure of concentration which is characterised as the sum of the squared market shares of firms in a given market. It was first utilised in the 1940's as a measure of skewness, then it was officially related to economic theory, more specifically to the Cournot competition model in 1976 (Cowling and Waterson, 1976).

The HHI takes into account the number of firms in a market and its concentration by including the relative size or the market share of all firms in a market. It is designed by squaring the market shares of all firms in a market, then summing the squares (Rhoades, 1993) and is given by:

$$HHI = \sum_{i=1}^n (MS_i)^2 \quad (1.5)$$

where MS_i represents the market share of firm i and where there are n firms in the market.

The upper limit of HHI is 100 and the lower limit will approach zero. Lower HHI value shows higher export or production dispersion and a lower degree on export concentration and specialisation. Besides, a lower value of HHI also indicates a higher degree of export diversification. HHI production concentrations which measure export dispersion is distinguish from the aspects of export products, and HHI geographical concentrations, which measure the same but from the aspect of export partner (World Integrated Trade Solution, 2013).

The advantages of HHI are the simplicity of the calculation to determine it and the small amount of data required for the calculation. On the other hand, the drawback of HHI stem from the fact that it is such a simple measure that it fails to take into consideration in terms of complexities of various markets in a way that allows for a genuinely accurate assessment of competitive or monopolistic market conditions. This is because other factors would also play a role in particular geographic dispersion of firms (Roberts, 2014).

2.3.3 Ogive Index

Using the Ogive Index, greater diversity exists when the economic activity of a country is equally shared among its sectors (Rodgers, 1957). With N sectors, an equal distribution implies that S_i is equal to $1/N$, the ideal share for each sector, and the Ogive index is equal to zero, which means perfect diversity. Meanwhile, an uneven share of sectoral activity will lead to a greater number of the Ogive index. The lower bound of Ogive index is zero; the upper bound is $\frac{I - 1}{1}$. When the index approaches zero, it means the economy is highly diversified, whereas a larger index shows less diversification.

According to Palan (2010), the drawbacks of this measurement is the Ogive index sets relatively more weight on industries which deviate much due to the fact that its numerator is squared. Thus, this measurement can lead to overestimation of the degree of diversity between countries. Another drawback is the sensitivity of the index towards the level of sectoral aggregation used. However, Grossberg (1982) and Jackson (1984) stated that the economic structure of a region can be characterised as being either diverse or specialised, both relative to other regions and over time depending on the value of N . Following McLaughlin (1930) and Tress (1983), the Ogive index of economic diversification is shown below:

$$OgiveIndex = \sum_{i=1}^N \frac{(S_i - 1/N)^2}{1/N} \quad (1.6)$$

where,

N = Number of sectors in an economy

S_i = The sectoral share of economic activity for the i th sector, usually expressed as the employment share

2.3.4 Theil Index

The Theil index is another measurement of export diversification. Given m industries (sectors) exist in n countries, X_{ij} indicates a value of exports from sector j of country $i=1,2,\dots,n$ as:

$$s_{ij} = X_{ij} / \sum_j X_{ij} \quad (1.7)$$

In relation to that, the typical share of industry j in total “world” exports are defined as:

$$w_j = \sum_i X_{ij} / \sum_i \sum_j X_{ij} \quad (1.8)$$

Then, the calculated relative Theil entropy index is as below (Cowell 1995, p.49):

$$RelTheil_i = \sum_{j=1}^m \left(s_{ij} \cdot \ln \frac{s_{ij}}{w_j} \right) \quad (1.9)$$

The lower bound of the Theil indices is zero, whereas the upper bound is equal to $\ln(m)$ whilst m is the number of sectors (industries). The index is positively correlated to the degree of overall specialisation. Therefore, a higher value of RelTheil is linked with less diversified export structures and vice versa. According to Wrzeszcz et al. (2010), the advantages of using Theil index is it involves in using a group of data, and splitting into within and between group of components. Meanwhile, the disadvantages of this index is there is no intuitive motivating picture, it is not directly comparable across populations with different sizes or group structures, and it has the sensitivity to transfer among the lower range.

Each measurements as discussed above has some limitation as well as superiority over the other. For the purpose of this study, Balassa index of revealed comparative advantage and Balassa (1989) export diversification is considered best for the current study as compared to the other alternative measurements. This is due to the circumstances that Balassa index compares the share of a good in terms of total exports a country with the same share in total world exports. Balassa index is interpreted as the extent of comparative advantage because an ability to export is found to be an imperative key of high productivity firms in the literature (Wagner, 2007). Furthermore, this index takes into account the import protection bias since the

degree of import protection differs from country to country and therefore, Balassa index of revealed comparative advantage omit the use of import data. Besides, by taking into the relative net export index leads to inability to identify the importance of export and import flow for the economy in terms of volumes (Gnidchenko and Salnikov, 2015). For instance, the index may take the value of one, which is high specialisation even if export is small but import is absent. Thus, Balassa index calculated from export data would correctly show very low specialisation. In summary, this enables the current study to discover agricultural products with comparative advantage as well as comparative disadvantage without the existence of protection bias since the other alternative measurements of comparative advantage takes into the consideration of import data that will lead to overestimation of the degree of export competitiveness and diversification of agricultural products.

2.4 Literature Review

2.4.1 Literature Reviews Related to Measuring Competitiveness

A number of studies have measured the competitiveness of Malaysian commodity exports such as palm oil, cocoa and rubber together with all Malaysian manufacturing products (Maheran and Haslina, 2006). Amir (2000) evaluated the revealed comparative advantage (RCA) index, as established by Balassa, in order to examine the export specialisation pattern in Malaysia between 1994 and 1998. He perceived that the drop in the RCA index in certain product groups in this category was due to rising competition following regionalisation and globalisation.

Bender and Li (2002) examined the structural performance and alteration of exports and the RCA of the East Asian as well as Latin American regions over the period of 1981 to 1997. They adopted the RCAs developed by Balassa and Vollrath to measure the comparative advantage in their study. The study was conducted to inspect the presence of changes in the pattern of export among different countries and to observe whether the changes were associated with shifts in comparative advantage. Serin and Civan (2008), on the other hand, studied the competitiveness of fruit juice, olive oil and tomato industries in Turkey relative to the EU market between 1995 and 2004. They applied both the RCA developed by Balassa and the comparative export performance (CEP) index in their study and discovered that Turkey was competitive in sectors such as the fruit juice and olive oil. This is because Turkey is one of the top five largest olive oil and fruit juice producers of the world, satisfies the domestic demand to its fullest extent and exports to more than 50 countries (Balkan and Meral, 2017). Other than that, with the help of government incentives, the number of olive trees has increased by almost 60 percent and planted acreage has expanded by almost 25 percent. Besides, Turkey is the centre point of fruit juice with innovation emerging from nectars and juice drinks. Thus, by looking at this situation, it is also useful to examine where Malaysia's comparative advantage lies due to the progressively competitive international environment.

Apart from that, Muendler (2007) used the RCA model to analyse the comparative advantages of the Brazilian agriculture, mining and manufacturing sectors from 1986 to 2001. The study employed Brazilian and worldwide export data by industry recorded according to the ISIC revision 2 industry classification. The empirical findings showed that Brazil's comparative advantage pattern was relatively stable over the study period and sector-fixed components took on most explanatory power. Besides that, the comparative advantage in Brazil remained

unchanged between 1990 and 1997 except for the processed sugar sector. Such finding is acceptable since Brazil is known as the leading global producer and exporter of sugar (Workman, 2017).

Mahmood (2004) analysed the comparative advantage of non-agriculture sector in Pakistan. Hanif and Jafri (2008) studied the textile sector's RCA of Pakistan whilst Mehmood et al. (2012) focussed on the chemical sector. However, only a handful studies have attempted to analyse actual comparative advantage for agriculture exports. For example, Akhtar et al. (2009) constructed the RCA index for fruit exports in Pakistan. Samaratunga et al. (2007) and the Centre for the Analysis of Regional Integration at Sussex (CARIS, 2008) considered the RCA of Pakistan for some broad categories of agricultural products.

The study of Riaz and Jansen (2012) used a comprehensive data set on country level trade flows and adopted the concept of revealed comparative advantage by Balassa from 1999 to 2008 in analysing the comparative advantage of agriculture export markets. From the results, numerous products and region combinations were identified and it showed that domestic comparative advantage existed. The outcome of their study focused on the opportunities in bilateral trade, particularly in trade with neighbouring countries. Moreover, the method identified the top export markets for the main exports of Pakistan and indicated the types of agricultural products that can potentially be traded internationally.

Arip et al. (2013) performed a study on assessing the competitiveness of the palm oil related industries of Malaysia and Indonesia from 1989 to 2010. They adopted the RCA approach introduced by Balassa (1989) in analysing 20 related palm oil products. Their findings

indicated that the RCA indexes for these products are not stable in Malaysia and Indonesia due to the low value-added palm oil products. They also discovered that Malaysia is seem to be competitive in downstream palm oil related industries as compared to Indonesia because Indonesia was a late comer in commercial agricultural-based industry. This study is significant because agricultural sector plays an important role in generating income in other advanced nations.

Şahinli (2013) utilised the RCA index by using food and agriculture trade data from 2008 to determine the level of competition in Turkey and the European Union agriculture sector. The study studied 420 agricultural items and found that Turkey had a comparative advantage in 95 agricultural items whilst the European Union had a comparative advantage with 91 items. Jing (2004) showed that some of the China's agro-products, such as edible vegetables and tea, have a comparative advantage due to low labour cost in agriculture. However, the RCA values have been deteriorating within 24 years and impacted future agriculture reform. The declining level of comparative advantage was triggered by the establishment of many economic integrated organisations and also the merge of member states economies, thus a solid regional trading blockage has been formed (Jing, 2004). Besides, the quality of the agricultural products is not up to the international standards as they are weak in terms of technology (Jing, 2004). Other studies on agriculture competitiveness including Zhaoyang (2001), Chuanmin (2002), Manlin (2003) and Qingxin (2003) have applied the RCA model to analyse the competitiveness of Chinese agro-products in both the Japanese market, the ASEAN market as well as the determinants of imports (Yu et al., 2005; Lin & Huie, 2004; Xiaodan, 2003). Jikun and Hengyun (2000), Yi et al. (2002) and Xiurong (2003) studied the costs of production of main agricultural

products, the competitiveness of labour-intensive agro-products, and the issues related to agricultural trade in China.

Kanaka and Chinadurai (2012) studied the comparative advantage of Indian agriculture exports and concluded that the outcome greatly depended on their respective exports after the post-reforms period with some losing their advantage. For instance, tea exports' comparative advantage declined from 1994-1995 and also between 2008-2009 and coffee exports were losing out against other exporters. Exports of sugar and cashew nuts also suffered, while, an unsteady form of comparative advantage had been reported for rice exports.

For Asian countries, Yunus et al. (2010) analysed the degree of export competition between Malaysia and the rest of the world to Singapore from 2000 to 2009. The study employed RCA indices and they found that the competitiveness in Malaysia shifted from the agro-based industry to semi-manufactured products specifically in zinc, iron and steel. This transformation is due to the declining trend of share in agriculture, whereas the manufacturing sector has experienced growth from less than one fifth to more than a quarter. Thus, a study on the export competitiveness in Malaysian agriculture is important in order to uplift its contribution to the country. A study carried out by Suntharalingam et al. (2011) examined the comparative advantage of Malaysia and its rivals, namely, Thailand, Indonesia, the Philippines, China and India by using yearly data and discovered that Malaysia's highest comparative advantage was in the trading of watermelons. The RCA index of exportation in Malaysia to its rival are ranging from more than one to more than eight signifying high comparative advantage. This is the case as melon is a strong fruit industry in Malaysia as its production appears to be stable with increasing trend in which watermelon exports in the world markets are promising

with exports to countries such as Singapore, China and Hong Kong is increasing every year. The exportation of watermelon in Malaysia has contributed about US\$20.7 million in 2016 (Workman, 2017).

Granabetter (2016) performed a study in Burgenland to examine and evaluate the export competitiveness with regards to the foreign trade of Austria for the period of 2010 to 2014. The study employed the Balassa's (1965) RCA to determine the development of the region's exports. The findings revealed that Burgenland had a comparative advantage over the Austrian exports in reed, cereals, oil seeds and straw.

Besides, Khai et al. (2016) adopted Balassa (1965) and Vollrath (1991) to measure the comparative advantage of shrimp products in Malaysia in relation to the other main shrimp exporting countries from 1999 to 2009. The outcome showed that Malaysia has no comparative advantage in the shrimp trade but Malaysia is competitive in the export of non-frozen shrimp. They also found that Thailand has impressive competitiveness in the trade of shrimp as compared to other major exporting countries.

2.4.2 Literature Reviews Related to Measuring Export Diversification

According to Ali et al. (1991), export diversification is “the change in the structure of a country's current export product mix or destination of export”. Berthelemy and Chauvin (2000) viewed export diversification as “a spread of production across several sectors”. Export diversification is regarded as the movement from exports of traditional to non-traditional and this is especially true for many developing countries and as part of an export-led growth strategy.

Diversification plays an important role in reducing any volatility in export earnings, expanding revenues of export, adding value, and enhancing economic growth.

Export diversification are divided into horizontal diversification and vertical diversification (Kenji and Mengistu, 2009). Horizontal diversification normally happens within the similar sector be it the primary, secondary or tertiary sectors and it includes an alteration in the export mix of a country by adding new products on current export baskets within the same sector (Samen, 2010). This is to overcome any adverse economic and political risks. On the other hand, a shift from the main to the secondary or tertiary sector is related to vertical diversification. This usually increases the activities for value-addition such as processing, marketing or other services. Vertical diversification has the ability to develop market opportunities for raw materials whereby value-added speculates in further downstream activities. As a result, it stabilises the commodities' price (United Nations, 2004).

Arip et al. (2010) applied the export diversification formula developed by Balassa (1989) to explain the degree of diversification in their study. They found that, in Malaysia, export diversification plays an important part in economic development, after studying the annual data from 1980 to 2007 and applying the time-series technique for cointegration and the Granger causality tests. The variables used were the real gross domestic product, employment, capital expenditure and level of specialisation, and diversification. They concluded that unique cointegrating vectors existed among these four variables and several short-run dynamic interactions were noted.

Jha et al. (2009) carried out a research on the pattern of agriculture diversification in terms of different levels, such as country (India), state (Haryana) and farms of Kurukshetra district in Haryana. Their study utilised alternate methods to measuring diversification such as the concentration index as measured by the Simpson Index, and percentage area under non-food crops on various factors for the reference periods of 1983 to 1984 and 2003 to 2004. The analysis showed that increased density of road and urbanisation boosts the agriculture commercialisation and as such, farms in a country are progressively specialised under particular crops and crop-groups relative to the resource, infrastructure and institutions of the region.

On the other hand, Birthal and Joshi (2007) ascertained that the gradual diversification of agriculture in India towards high-value crops revealed a pro-smallholder bias, with smallholders playing a proportionally larger role in the cultivation of fruits against vegetables. The study also revealed that agriculture diversification towards high-value crops have the capability to increase farmers' incomes due to growing demand.

Petersson (2005) used the cumulative export experience function to show a huge spread of emerging non-traditional accelerating export products across industry clusters of different intensities in South Africa during the period of 1990-2003. The empirical analysis revealed an improved export quality.

At a highly-disaggregated level, Pacheco and Pierola (2008) examined the differences in the patterns of export diversification among 24 developed and developing countries using data from 1990-2005 and the 6-digit level of the Harmonised System (HS) from the UN-Comtrade database. The findings demonstrated that export growth is generally explained by the growth at

the intensive margin and that export diversification is rising among developing countries. However, the extensive margin of trade is not significant for a few developing countries.

Furthermore, Mubeen (2016) employed Gini Hirschman Index (GHI) in order to estimate the level of export diversification. The study revealed the factors of export diversification by utilising data ranging from 1980 to 2015. The outcome of the study initiated that geographic concentration of exports enhance the product concentration in exports and reduces the export diversification.

2.4.3 Literature Reviews Related to the Determinants of Competitiveness and Export Diversification

The Revealed Comparative Advantage (RCA) was developed by Balassa (1965) and has become an extensively-used way to estimate comparative advantage in autarky. The theory of RCA applies to the relative performances in trade of individual countries and in particular to commodities, which can also be measured by market shares. Based on the assumption that the commodity pattern of trade shows inter-country differences in relative costs and in non-price factors, the comparative advantage of traditional countries can be found. Meanwhile, direct observations of trade performance “reveal” comparative advantage if trade performance is determined by comparative advantage. The barring of production or export subsidies will result in a greater comparative advantage in the production of that particular commodity.

Export diversification is a way for developing countries to improve their economic performance by diversifying their products in order to achieve greater income. Its practice is largely taken to be positive, driving many richer countries to favourably diversify their

production structures (Agosin et al., 2011). Various studies have been conducted to examine the factors affecting comparative advantage and export diversification using different methods of estimation and models, these shall be discussed hereafter. From the past literature being reviewed, it is notable that variables that have been used to identify the export competitiveness are price of commodities, per capita income, labour participation as well as capital formation. On the other hand, trade openness, foreign direct investment, population, infrastructural and technology and per capita income are used in conducting studies related to export diversification issue.

2.4.3.1 Price of Commodities

Hai and Heidhues (2004) conducted a study on the comparative advantage of the rice sector in Vietnam using a cost comparison to “the rest of the world”. The study used both micro and macroeconomic data in the form of primary and secondary data and the authors employed the Policy Analysis Matrix simulation model. Their findings indicated that the comparative advantage in rice was relatively higher as compared to the use of domestic resources. Other than that, they revealed that the estimated domestic resource cost analysis elasticity in respect of the world price in 1998 showed an improvement in the comparative advantage. The results of the estimation discovered that the comparative advantage of rice is very sensitive to changes in its export price. Besides, they also stated that a change in the prices of their inputs due to import tax reductions will affect the production costs of agricultural products. Furthermore, the results of the individual determining factors disclosed that the country becomes neutral in terms of its comparative advantage in rice when the world price declines by 35 percent. In contrast, the regression results revealed that the world rice price is expected to have a positive relation with the yield. Put simply, when the coefficient of the export rice price is significant at 1 percent,

it has a significant influence on the rice yield. Therefore, an upsurge in the world price of a commodity has the ability to influence the competitiveness of a country in producing that particular commodity. Other than that, there is a need for the diversification of agriculture development in order to minimise the negative impacts and risk due to world price shocks.

Apart from that, Halmai and Elekes (2002) investigated the factors affecting the accession of Hungary to the European Union and how it affected the competitiveness of Hungarian agriculture. They applied the European Simulation Model (ESIM) as a part equilibrium analysis with the adaptation of the Common Agricultural Policy. The model comprised 16 agricultural products, nine processed products and six factors of production. They concluded that price advantage is one of the most important factors of European Union competitiveness. Furthermore, they discovered that agriculture competitiveness can be influenced by higher producer prices. Albeit that those higher producer prices lead to greater production, that may result in decreasing competitiveness in terms of price and also declining demand for domestic food.

Aziz (2013) used yearly data from 1990 to 2005 for a panel of 167 countries using Zellner's (1962) "seemingly unrelated regression" (SUR) model to find the relationship between commodity price, namely the crude oil price, and comparative advantage. He found that rising oil prices reduce competitiveness and therefore cause a decline in production. Based on the first estimation results obtained, the oil price was found to be significantly less than zero for 70 percent of the RCA commodities. Besides, they found that oil price fluctuations significantly affected around 58 percent of the RCA commodities from 1997 to 2005 based on the third regression. In contrast, the findings of the second estimation revealed that oil price

fluctuations negatively affected the RCA commodities by 36 percent when a country-specific dummy was included. In addition, the fourth estimation also showed a negative association between the price of oil and the RCA for at least 16 percent of the commodities in all income groups. Hence, it can be concluded that growth in the commodities' price triggered real exchange rates to appreciate and consequently led to a loss of competitiveness in the tradable sector due to the movement of resources to a growing sector.

A descriptive study conducted by Dlamini et al. (2014) examined the factors that influence competitiveness and found that the hike in the crude oil price was a consequence of high input prices. This is also parallel with the results of Kennedy et al. (1998), who ascertained that price is influenced by the cost incurred to produce the final output. Thus, a firm has to lower the input cost in order to benefit from competitiveness since the price will be influenced by the costs incurred in input.

Grega (2002) applied partial equilibrium analysis to evaluate the impact of agricultural commodities in terms of price towards the competitiveness of the agriculture sector. Based on the study of Grega (2002), large price fluctuations in food commodities would worsen the economy as a whole. An increase in price indicates the relative shortage of food items and consequently leads to an unstable economy as well as social structure. In addition, he found that rising food prices created pressure on growth which may, in turn, cause inflation and decline in demand for agricultural products. This is because increasing prices may lead to lower real incomes and higher costs which will eventually drive competitiveness away due to the existence of comparative disadvantage.

Ali et al. (2010) revealed that the agricultural commodities price is highly affected by the level of exchange rates. This means that a weakened Malaysian currency (ringgit) tends to lower the price of commodities and this, in turn, will cause Malaysian agricultural products to become more competitive in foreign markets. Conversely, the appreciation of the Malaysian currency (ringgit) in the global market contributes to higher prices for agricultural commodities and consequently leads to the reduced competitiveness of Malaysia's agricultural products in export markets.

Liverpool et al. (2009) empirically assessed the comparative advantage farmers in Nigerian in the production of a subset of commodities such as rice, maize and cassava by using the Policy Analysis Matrix framework. The outcome of their study showed that Nigeria encountered comparative disadvantage in the export of maize production at the current world price, this was a consequence of low farm yields and high transportation costs. However, importing maize only causes the local prices of commodity to be higher, which will upsurge the production cost and thus reduce its production and competitiveness.

Besides, Akpan et al. (2016) examined the link between the price of rice in the local market and its competitiveness by employing empirical evidence from the southern Region of Nigeria. The study used data from January 2005 to June 2014 and they employed the Engle and Granger two-step method, and the Johansen co-integration approach to investigate the relationships. The findings discovered the possibility of a high degree of competitiveness and substitutability between the local and foreign rice commodity in Nigeria. The study found that the market for local rice is not as competitive in the aspects of value addition, quantity as well as quality when compared to markets of foreign rice.

Rahman et al. (2016) assessed the maize production in terms of competitiveness, advantage at the farm level and the responsiveness of input and output price changes towards maize farmers using farm survey data from 165 farmers in Bangladesh. The results of the study initiated that the production of maize is competitive and it is profitable at the farm level. Additionally, maize farmers are responsive to adjustment of prices in market where a rise in the price of maize would lead to rising outputs.

According to Grossman and Helpman (1991), small developing economies have a comparative advantage in homogeneous goods that are either labour or land intensive. However, they do not have a comparative advantage in differentiated goods, for example, skilled labour. This means that an increase in the relative prices of the homogeneous products and the wages of unskilled labour coupled with a reduction in the return of human capital or skilled labour will relocate human capital away from differentiated products and towards R&D, which consequently leads to diversification.

2.4.3.2 Per Capita Income

According to Rao et al. (2008), increasing the production of high-value commodities requires an increase in income. They analysed district based per capita income, and then divided the data into three income groups. The study employed a multivariate analysis by employing models based on OLS, Tobit and the Seemingly Unrelated Regression Equation (SURE) techniques. Their results indicated that the production of high-value commodities is highest in medium and high-income group districts, whereas production was lowest in low-income group districts.

Besides, Bhattacharya (2011) conducted research to study the competitiveness of India in terms of the vegetable, fruits and flower trade. The study covered Asia, the EU and North America and made comparisons such as United States of America and Canada versus selected other South East Asian countries. The study applied Balassa's (1965, 1979) measure of the RCA and the Comparative Export Performance (CEP) index to quantify the comparative advantage. Theoretically, income is expected to have a positive sign with competitiveness in which the import volume will expand as GDP increases. However, the findings showed that the export demand for onions and mangoes by Malaysia to the EU tended to have a negative relationship with the per capita income of the EU, whereas a positive association existed between export demand for onions, mangoes and fresh flowers with the per capita income of the EU for China, Thailand and Indonesia.

Furthermore, Pham and Riedel (2013) estimated the relationship between comparative advantage and the per capita income for a sample of twenty rapidly growing economies. The countries under study were divided into ten Asian countries and ten non-Asian countries. The study employed manufactured product-level data and Balassa's (1965) method and panel estimation have been adopted to analyse the capital intensity of comparative advantage and the per capita income. The results revealed that a statistically robust positive association occurred between the capital intensity of revealed comparative advantage and the per capita income. As such, a surge in the income per capita of one country has the ability to drive an upsurge of its comparative advantage in manufactured products.

Based on the study of Joshi et al. (2004), it was hypothesised that the per capita income is able to influence diversification on the demand side. This is because growing per capita

income is increasing the demand for livestock products in the consumption which eventually lead to export diversification of livestock sector. The Generalised Least Squares (GLS) method utilising a fixed-effect model was used to empirically test the determinants that influenced crop and livestock diversification in India. The empirical periods conducted for this study was between 1980 to 1981 and 1998 to 1999 and covered the major states of India. The analysis was applied by pooling the cross-section and time series information. Per capita income was one of the variables that were used in the demand-side model to assess the empirical findings. The results of the findings revealed that a positive and significant impact existed between the per capita income towards diversification. Furthermore, the per capita income also illustrated a positive and significant influence towards the growth of livestock activities, leading to diversification. As a result, this initiated that the diversification of agricultural commodities increases as the per capita income rises as this will increase the ability of a country to look into other ways to develop its basic commodities into high-value-added commodities. This eventually will lead to the competitiveness of that particular commodity in terms of its comparative advantage as compared to commodities without value-added.

Abro (2012) studied agriculture diversification using the Generalized Least Squares (GLS) method for a dataset taken between 1980 to 2011. He found that the per capita income was positively related to crop diversification towards high-value commodities. This was attributed to the augmented purchasing power of the farmers which enabled them to purchase more vegetables, fruits, pulses and oilseed.

Imbs and Wacziarg (2003) concluded that an increase in income reduces the risk of diversification while export diversification increases when the GDP per capita rises. However,

diversification declines after a certain level of income because the need for diversification reduces; high-income economies have a tendency to be economically and institutionally more stable. In a nutshell, per capita income growth has a positive influence on export diversification for low income countries. This also shows that lower levels of development in a given country are associated with higher or greater export diversification. On the other hand, at a high GDP per capita level, further growth in income would result in larger export concentration.

After studying 99 countries using dynamic panel data ranging from 1961 to 2000, Hesse (2008) found that export diversification has a positive impact on the growth of per capita income. Similarly, Elhiraika and Mbate (2014) assessed the determinants of export diversification in 53 African countries, taking data from 1995 to 2011. The study revealed that per capita income as in domestic income was a driver that promoted export diversification because it increased the purchasing power and the ability of consumers to afford a diverse basket of goods. Furthermore, a study conducted by Cadot et al. (2011) on the GDP per capita and export diversification on 156 countries discovered a hump-shaped or inverted U-shaped relationship between per capita income and export diversification.

In the study of Hausmann et al. (2007), they included 55 developing countries and employed panel data spanning from 1975 to 2005. The objective of their study was to determine a factor of the level of productivity which was associated with a country's exports that explained the higher productivity levels than others through traded goods. They found that countries which are more diversified construct a huge level of productivity goods, grow more as compared to countries with a lower level of productivity goods and are more specialised. The findings also revealed that the manufacturing sector's share increases in total exports of

diversified countries and that the GDP per capita has a positive relationship with export diversification for developing countries. In summary, an increase in the GDP per capita will eventually boost export diversification.

Jha et al. (2009) believed that the diversification indices and income usually have a positive association, though the degree of the relationship depends on the country. However, their empirical analysis reported that income was negatively related to the diversification index, and this remained consistent for all of the referenced years (Abro, 2012; Joshi, et al., 2004). This challenged their hypothesis which stated that the per capita income affects diversification, measured by the percentage of non-food crops because higher income shifts the preferences of consumer from basic foods to food commodities such as fruits and vegetables.

Furthermore, the United Nations Framework Convention on Climate Change [UNFCCC] (2016) indicated that as the per capita income of a country rises, the distribution of sectoral economic activity varies. This diversifying pattern reduces with increasing per capita income and after a turning point, which takes place at a very high level of income, the sectoral distribution exhibits re-specialisation. The study employed the Theil index method in examining the relationship between per capita income and export diversification. The findings revealed that per capita income and export diversification disclosed a positive relationship and this is generally driven by the extensive margin.

2.4.3.3 Labour Participation

An empirical investigation was conducted by Ling and Lahr (2008) using input-output tables for multiregional and disaggregated data for employment. The study indicated that

decreasing labour input per unit of gross output and changes in the value-added share of the gross output would lead to changes in labour productivity and competitiveness.

Zhu (2012) found a positive association between the labour participation and productivity growth in China after studying the yearly data spanning from 1952 to 1978 and also between 1978 and 2007. The results showed that the rate of labour participation improved slightly, increasing at 0.11 percent per year in the period of 1952 to 1978. As for the period of 1978 to 2007, the labour participation improved moderately at 0.57 percent per year, whereas productivity growth grew tremendously at 3.16 percent per year. This illustrated that an increase in the participation of labour increases productivity growth, and ultimately, the comparative advantage of China.

Su and Heshmati (2011) studied the development and the source of labour productivity from 2000 to 2009 in 31 Chinese provinces. A fixed effects panel data multiple regression function model was employed in the study. The study found that labour accumulation significantly contributed to economic growth. Labour was positively significant at the 1 percent level, which caused a 0.23 percent rise in GDP. This showed that labour participation has the ability to contribute to growth which will eventually lead to comparative advantage. Besides that, Bravo-Ortega and Lederman (2005) pointed out that agriculture labour productivity has a significant influence on the average income of the poorest people in society, and this relationship is consistent across regions. As such, it can be perceived that the labour participation indeed encourages production, economic growth, and triggers competitiveness.

Edeme et al. (2016) evaluated the impact of the labour participation, capital stock, agriculture exports, non-agriculture exports and inflation on competitiveness. They employed the panel data from 15 Economic Community of West African States (ECOWAS) countries from 1980 to 2013. The results of their study discovered that the labour participation, capital stock and agriculture exports had a positive association with competitiveness in the ECOWAS region, whereas non-agriculture exports have an insignificant outcome. Thus, they concluded that the rise in the labour participation, capital stock and agriculture exports would initiate competitiveness and economic growth.

Abdychev et al. (2014) investigated the determinants of total factor productivity in relation to growth in Sub-Saharan Africa from 1980 to 2010. The study employed panel data techniques using three methods - dynamic panel estimation, cointegration for a heterogeneous panel, and panel probit analysis. The findings indicated a negative influence of labour participation, especially among female workers. However, the relationship turned positive after adjusting the share of the agriculture sector to the GDP, and this illustrated that most women were involved in low-end productivity in the agriculture sector.

The study of Weil and Galor (2000) as well as Madsen and Ang (2013) showed that higher labour participation may increase total factor productivity growth if technological progress and the labour force are complementary. In contrast, McGuckin and Ark (2005) conducted a study on European countries and found that an increase in the labour force participation is likely to show a concave result and drop over the time trend in production.

2.4.3.4 Capital Formation

A study conducted by Ma et al. (2013) showed that capital formation had an impact on agriculture total factor and agriculture productivity growth in China. Capital investment in agriculture by both government and farmers increased significantly in recent years due to improved public investment in agriculture.

According to Huang and Rozelle (1996), Fan (1997), Fan and Pardey (1997), and Jin et al. (2002), technological changes are the primary engine of agriculture growth. Enhancements in technology have contributed the biggest share of crop production growth, particularly the research and development initiatives by the government (Jin et al., 2002).

A study by Huang et al. (2002) on agricultural commodity markets in China revealed that public investment by China in plant biotechnology, becoming the largest in the world, with agriculture leaders in China arguing that past achievements were mainly due to government-supported technologies. Besides that, they also emphasised that investments in research and development in agriculture drives agricultural output. Such investment will boost competitiveness and productivity.

Tyler (1981) explored the empirical relationship between economic growth and export expansion in 55 developing countries from 1960 until 1997. The study discovered that a positive relationship exists between various economic variables such as investment and total export with economic growth. An empirical finding of Mellor (1973) revealed that enhanced growth in productivity of agriculture explains industrialisation because it eases the transfer of resources to other sectors as well as affecting the relative rates of capital formation and growth of income

in different sectors; the structure; and the overall growth rate. This is because capital formation is able to create rapid growth that leads to an efficient allocation of resources and thus, it influences the comparative advantage.

Besides, Awokuse (2009) conducted a study by using yearly data spanning from 1971 to 2006 in 15 developing countries. An ARDL model proposed by Pesaran, Shin and Smith (2001) was adopted in the study to identify the contribution of agriculture to economic growth. The empirical study revealed that gross capital formation has the ability to stimulate growth. Such a situation is deemed possible as growth influences the efficiency of resource allocation due to comparative advantage.

A research study conducted on world food and agriculture by the Food and Agriculture Organization of the United Nations (FAO, 2012) indicated that a positive association exists between capital formation and government expenditure on agriculture. They discovered that the spending on capital formation is able to form an environment for improved infrastructure and sustainable access to natural resources. Furthermore, it also contributes a positive and significant impact on productivity as well as competitiveness. The research revealed that a 0.34 percent upsurge in a country's agriculture total factor productivity is possible when there is an increment of 10 percent in public spending on agriculture.

Besides, Mehrara and Baghbanpour (2016) investigated the role of manufacturing and agriculture as keys that lead to growth in economy of developing countries. The study was carried out using a panel data approach for 34 developing countries for a time span from 1970 to 2014. The results of their research revealed that gross fixed capital formation had the ability

to affect the competitiveness of the outputs which in turn would cause an upsurge in economic performance due to the export of goods through returns of scale and increased efficiency.

Noureen and Mahmood (2014) employed a panel data set of selected ASEAN and South Asian Association for Regional Cooperation (SAARC) member countries to conduct a study related to export diversification from 1986 to 2012. In the research, capital formation was one of the variables incorporated in the model estimated. The outcomes of the empirical findings revealed that there was a positive relationship between capital formation and export diversification in the countries under study. Therefore, an increase in capital formation will cause export diversification to increase too due to the capability in processing the products into outputs with value addition.

2.4.3.5 Trade Openness

Incgo (1997) assessed the effects of agriculture trade openness in a few of the least developed and nett food-importing countries. The author reached the conclusion that an economy's structure of trade distortion can influence the changes in welfare. The study stated that most gains will come from a countries' trade liberalisation efforts that will eventually lead to trade openness. Conversely, a lack of such commitments would result in the loss of efficiency gains for some countries. For instance, a country may lose market opportunities if there are no liberalised policies and structural reforms made. In view of this, a country can create and sustain growth in the agriculture sector if they practise openness in trade and this will eventually lead to an improvement in agricultural productivity.

De Silva et al. (2013) conducted a study in Sri Lanka to examine the impact of openness of trade on the agriculture sector from 1960 to 2010. The study adopted the Ordinary Least Squares (OLS) method together with multiple regression models. They discovered that trade openness in the agriculture sector leads to improved agricultural productivity in Sri Lanka. Besides, they found that trade openness is positively associated with productivity in the agriculture sector because the exposure to international competition reduced inefficiency in resource allocation which may have led to export diversification. This obviously showed that trade openness is capable of stimulating economic growth by diversifying the commodities of the agriculture sector into commodities with value addition.

A higher degree of diversification potentially shows that a nation is engaged in many implicit and explicit international insurance schemes that may work as a shield against economic changes (Haddad et al., 2010). Openness boosts growth of a country because it promotes knowledge spillovers and investments in innovation (Grossman and Helpman, 1991) other than enhancing productivity due to intra-industrial correlations (Melitz, 2003). In this case, spillovers arose through the openness or imports from advanced countries and since technology and knowledge production is concentrated in a small number of the more advanced countries. When combined with lower tariffs due to trade liberalisation, this is expected to enhance the access to markets offshore, and ultimately will lead to the expansion in export diversification as well as a reduction in a country's vulnerability to particular sectoral shocks (Acemoglu and Zilibotti, 1997). Esanov (2012) also pointed out that trade openness is connected positively to the level of export diversification, and this is supported by Ferdous (2011) when related to the export diversification in East Asian economies. However, trade openness has an insignificant effect on export diversification when the models include resource-rich countries.

However, when Agosin et al. (2011) analysed the main determining factors of export diversification from 1962 to 2000. It was found that trade openness could promote higher specialisation instead of diversification. In line with this, Melitz (2003) stated that export concentration may occur when the activities convey a fixed cost, and under a protectionist trade regime, only a fixed number of firms are capable to afford these exporting costs. Djokoto (2013) examined the relationship between openness and agriculture performance using data covering 1995 to 2009 in Ghana and concluded a negative influence of trade openness on local producers. This is because trade openness promotes the import of agricultural commodities such as rice and poultry that can be sold at a lower price. As a result, it reduced domestic production and forces local farmers to further improve efficiency and products or risk being taken over.

Furthermore, Kurihara and Fukushima (2016) examined the impact of trade openness on export diversification, the study was performed using the panel least squares method and robust estimation within advanced economies, emerging and developing countries, and whole countries. Their findings showed that trade openness or the promotion of international trade does not lead to export diversification in either advanced economies, emerging nor developing countries.

2.4.3.6 Foreign Direct Investment

According to Gourdon (2010, p.22), FDI can lead to export diversification directly by penetrating the export sector of non-traditional, or indirectly by snowballing the exportation of traditional exports with the minimum share. Conversely, if FDI is mainly concentrating towards the natural resources exploitation, the export concentration on natural resources is expected to rise. Several studies on the FDI impact towards export diversification have been studied. For

instance, Ekholm et al. (2007) illustrated that when FDI move in the country merely for production in the markets for exportation in third countries, the growth in exports would be headed for new markets or in new industries, which will lead to export diversification. Hausmann et al. (2007) affirmed that FDI usually has a positive influence on export diversification. However, it has a greater influence on vertical diversification as compared to horizontal diversification, which transmits more expertise and knowledge into the country and simultaneously does not divert the focus of a country's economy where natural resources are intensive.

Jetter and Hassan (2013) stated that FDI shows a significant role, although it is of minor importance in affecting export diversification. They also detailed that no evident exists in analysing FDI levels among the economies of least diversified and the most diversified. Besides, Banga (2003) highlighted the impact of export diversification of FDI in developing countries. He stated that FDI has the possibility leading to export diversification if it positively affects the export intensity of the non-traditional export sector. Indirectly, FDI may boost export diversification by spillover effects on the export intensity in the non-traditional export sector of domestic firms. For example, the study revealed that the presence of both United States of America and Japanese MNCs in the same industry and the subsequently increased levels of FDI from both countries increased export intensity. The source of the FDI was also an important consideration as the United States of America originated FDI showed a stronger contribution towards diversification.

Apart from that, Bonaglia and Fukasaku (2003) introduced FDI as an important determinant in the diversification of Chilean and Costa Rican exports. They also reported how

FDI was responsible for a transformation of Kenya's horticultural industry, making it more export competitive. Iwamoto and Nabeshima (2012) examined the influence of FDI inflow on the export diversification degree for 175 countries by utilising the dynamic panel data model based on system GMM from 1980 to 2007. They discovered that the five-year lagged FDI inflow correlated positively with both export diversification and export sophistication. Moreover, the positive impacts of FDI existed only in developing countries. Iwamoto and Nabeshima (2012) indicated that FDI can positively affect export diversification through the speeding up of technology transfer and the improvement of the production capabilities of countries.

A friendly and open FDI regime is one of the important elements that drives export diversification. This is because FDI offers private investment-scarce countries with the technology transfer which is essential for producing and establishing strong private domestic investment (Spalla, 2010). This is mainly real in the current economy where the service industry and technology transfer play a huge role in the international competitiveness of firms and countries. In Malaysia, the government continues to encourage FDI and actively liberalises the FDI regime to attract more foreign investors.

However, 'Ofa et al. (2012) argued that the impact of FDI on export diversification in Africa has been sluggish due to its concentration on enclave sectors that have narrow linkages to the rest of the economy. Kamuganga (2012) conducted a study for African countries using a highly disaggregated bilateral trade flow at HS 6-digit level from 1995 to 2009. The results showed that macroeconomic developments such as exchange rate volatility, financial

underdevelopment and inappropriate FDI are the obstacles that impede African export diversification.

2.4.3.7 Population

Population growth brings higher demand and provides a market for new and higher value products. According to Parteka and Tamberi (2011), when the size of an economy increases, be it in the number or diversification of consumers, it promotes the production of more and varied goods to satisfy different tastes and preferences. Furthermore, Jetter and Hassan (2013) pointed out that an increase in a country's population increases the labour supply for the production of diversified products.

Brenton and Hoppe (2007) conducted a study involving data from 124 exporting countries to assess the factors of the trade flow of products in clothing into the US and EU markets. They employed a profit regression model that clarified whether exports to the overseas market occurred whilst the second stage of the model estimated a log-linear equation explaining the degree of the observed trade flows. Based on their study, countries with larger populations tend to export a given product to the US. The study also revealed that population size has a positive but decreasing effect on the trade volume. For instance, highly populated countries are likely to export larger quantities of clothing. Also, the magnitude of overall imports for clothing output has an impact and an approximately unitary elasticity.

Dogruel and Tekce (2011) investigated the flows of export diversification in eight MENA countries which comprised of Algeria, Egypt, Jordan, Kuwait, Morocco, Oman, Saudi Arabia, and Tunisia with the population growth rate taken as one of the independent variables

in the estimated model. The outcomes exhibited that a reduction in the population growth rate was indicative of social development which would ultimately stimulate export diversification.

Countries with bigger populations are also tend to have a larger group of entrepreneurs who support more experiments and a higher frequency of discovery (Klinger and Lederman, 2006). However, a simultaneously larger pool of imitators would also reduce the incentives for entrepreneurs to experiment and thus reduce the frequency of discovery. For Africa, it was found by Cabral (2010) that the estimated coefficient suggested that a Sub-Saharan African country with twofold the average population growth would have exports that are, on average, 15 percent to 25 percent more diversified as compared to its smaller neighbours.

2.4.3.8 Level of Development

Dogruel and Tekce (2011) examined the determinants of export diversification in selected MENA countries by taking the level of development as one of the affecting factors, which is normally captured as the GDP per capita of a country. According to Aghion and Howitt (1992) and Fiorillo (2001), both the supply and demand side growth theories suggest that the pattern of preferences guiding consumption varies as the GDP per capita grows. The change in the elasticity of demand affects sectoral productivities and consequently the structural composition of the economy, for instance, from primary to secondary or tertiary sectors.

The per capita income variable was employed to examine the determinants of export diversification (Cadot et al., 2011; Benedictis et al., 2009; Koren and Tenreyro, 2007; Parteka, 2007; Imbs and Wacziarg, 2003), and the empirical findings suggested that, in developing countries, the correlation between the level of development and export diversification has

become stronger. Acemoglu and Zilibotti (1997) emphasised on the inadequate diversification opportunities at lower development levels due to the shortage of capital and indivisibility of investment projects.

Cadot et al. (2011) conducted a study in 159 countries over a period of 17 years to examine the change of the patterns of export diversification along with economic development. They employed the Harmonised System level of disaggregation at the intensive and extensive margins using different export concentration indices. They found a hump-shaped correlation between economic development and export diversification with a turning point at around the level of US\$20, 000 to US\$22, 000 per capita at purchasing power parity. Their findings also indicated that there was diversification at the extensive and intensive margins at income levels below this turning point.

Cabral (2010) analysed the determinants of export diversification and sophistication by using disaggregated data from 48 Sub-Saharan African countries from 1960 to 2005. The empirical results suggested that a higher level of development was related to more diversified exports. For example, with all else remaining constant, a 10 percent upturn in the development level would lead to an upsurge of 2 percent in export diversification.

Besides, Dutt et al. (2008) investigated the patterns of export diversification, its progress throughout the time, the factors of export diversification, and its concern for economic development. The results showed that there is a tight link between economic development, as measured by GDP per capita, and export diversification, as measured by the Herfindahl index of exports and the extensive margin of exports. While the intensive margin of exports matters,

it does so only in the cross-sectional dimension. A rise in the extensive margin of exports is more effective in raising income per capita than increasing the exports of intensive margin.

Furthermore, Parteka and Tamberi (2011) studied the determining factors of the export diversification process for 60 countries from 1985 to 2004 by using a panel data set. They found that the income per capita is one of the robust determinants of export diversification process. The results of their study relating to the level of development in a country's fixed effects model showed that the level of development was inversely linked with the degree of specialisation. An increase in the per capita income of 1 percent was related to a drop in the specialisation measure of roughly 0.5 percent. Thus, the export diversification process occurred along the path of growth. They also claimed that, even when cross-country heterogeneity was taken into consideration, export diversification occurred in the course of economic development, albeit slowly.

2.4.3.9 Infrastructural and Technological

Joshi et al. (2004) investigated the determinants of agriculture export diversification in South Asia which covered a period across two decades from 1980-1981, 1989-1990, 1990-1991, and 1999-2000. From the study, it was revealed that irrigation in areas was significant and that irrigation drove technological advancement in the regions. The regression coefficient of technology, in this case, was negatively associated with diversification of export. The Pingali and Khawaja (2004) study also simultaneously conveyed the same message in which rapid technological change in agricultural productions promotes export diversification.

Apart from that, Joshi et al. (2007) analysed the factors affecting agriculture export diversification at diverse levels, i.e., India, Haryana, and farms of the Kurukshetra district in Haryana. They clarified that improvements in the infrastructure such as roads and markets as well as technology had an impact upon diversification. Furthermore, they found that infrastructure and technology are significant non-price factors that affect the acreage under a crop. On the other hand, technology was found to have different dimensions among which assured irrigation is crucial for the adoption of intensive agriculture practices.

Based on the findings of Jha et al. (2009), if export diversification is a tool to lower risk, then irrigation has a negative impact on diversification as measured by the Simpson index as it decreases the risk of production. Their empirical results showed that irrigation gave a positive influence from 1983 to 1984 and 1993 to 1994, but the results were insignificant from 2003 to 2004. The authors also opined that the expansion roads in the rural reveals the strengthening of market-related infrastructure since it encourages farmers to transform from their subsistence farming methods and concentrate on high-yielding crops to transport to other areas. This also means that the expansion of rural roads gives a negative effect on diversification in this sense.

Bhattacharyya (2008) discovered that the development of infrastructure is important in encouraging diversification. For example, the coefficient of roads was positive and significant. Besides, a better road network also favours the diversification of horticultural commodities since it lowers transport costs and promises easy and quick marketing of commodities; this helps to reduce the post-harvest risk in perishable commodities.

In contrast, earlier analysis by Esanov (2012) indicated that infrastructure triggers export diversification. A well-established physical infrastructure and viable institutions enable a country to diversify or expand its production base. This does not apply to export diversification because infrastructure does not play an important role here.

2.4.3.10 Natural Resources

A country's natural resources can be exploited in order to increase the exports in terms of the range of goods a country produces, particularly through beneficiation, in which value-added can be created from the resource extracted. According to Elliott et al. (2007), natural resource abundance is a blessing for economic development because it is positively linked to the output level. Malaysia, in this regard, has abundant agriculture, forestry and mineral resources; all of which can be advantageous to the country for export diversification purposes. For instance, as a resource rich country, Malaysia shifted from its major sources of exportation in rubber and tin by promoting other commodities, especially palm oil and by moving towards higher value-added products (Reinhardt, 2000; Simeh and Ahmad, 2001).

Lederman and Moaloney (2003) stated that the concentration of export revenues hinders economic growth and that there is no indication that abundance in natural resource is harmful to growth. Nevertheless, some other authors like Smith (1776) opined that natural resources are related to less human and physical capital accumulation, productivity growth as well as spillovers. This means that the more natural resources that are exploited for economic gain, the lesser human capital and physical wealth a country holds. In terms of the agriculture sector, Martin and Mitra (2001) discovered that the total factor productivity growth is higher in agriculture as compared to manufacturing in a large sample of advanced and developing

countries. Not only that, Brenton and Hoppe (2007) discovered that countries which are rich in resources is likely to have a lesser comparative advantage in the export of manufactured products such as clothing.

Wright (2001) disagreed with the statement of Smith (1776) who stated that natural resources are related with lower human and physical capital accumulation, productivity growth and spillovers because Wright (2001) found that the mining industry was a dynamic and knowledge-intensive industry in many countries and it is vital to the United States' development. Wright and Czelusta (2002) conducted a study in the United States on mineral abundance as a historical example of growth based on resources. In line with this, authors like Blomstrom and Kokko (2003) have also published literature in what way Sweden and Finland have gotten a more diversified economic structure after technology has been added into their natural resource-based production. Herzer and Lehman (2004) examined the hypothesis that export diversification is related to economic growth through the externalities of learning activities linked to exporting. They stated that export diversification, on the basis of natural resources, had a positive impact on growth. Moreover, natural resources have a higher technology content in this current era and are capable to foster the development for both upstream and downstream activities (Bonaglia and Fukasaku, 2003). It can, therefore, be seen that natural resources are important for export diversification by producing value added products and therefore, contributing to better economic performance.

Furthermore, Jetter and Hassan (2013) conducted a study on the roots of export diversification by engaging in Bayesian Model Averaging to expose the roots of export diversification among 43 potential determinants in long-run. Their study pointed out that natural

resource rents as a percentage to the GDP are one of the factors affecting export diversification. Their empirical findings revealed a value of one, which indicated that the variable has a positive influence on the HHI of a country in all models and directly leads to complete specialisation instead of diversification. The conclusion drawn was that countries, where the exploration and production of natural resources have a firm role in supporting the domestic economy, may face difficulties in diversifying exports.

Moreover, Arawomo et al., (2014) conducted a study by examining the extent of export diversification in Nigeria by utilising the Herfindahl Hirshcman index method based on 4-digit SITC product classification. The results indicated that the export diversification dropped in 1980s, remained low till 2000 but it has then been improving. The generalized Moment Methods was employed to analyse their model and the empirical result showed that natural resources is not significant. This means that natural resources does not has an impact on export diversification in Nigeria as they focused only on the production of crude oil without much value-added.

Besides, a study conducted by Alemu (2016) indicated that natural resources abundance has negative impact on vertical and horizontal export diversification in Africa. Such an inverse relationship is due to the natural resource curse. This study argues that the natural resources can be a blessing if the natural resources is well managed where Africa can diversify its economies into a vibrant agricultural and resource-based manufacturing as it has been seen in other countries. For example, Thailand focused on diversification in agriculture and fishery resource based manufacturing before it shifted to exportation of clothing and electronics. Therefore, from

this study, Malaysia can also diversify its natural resource based sector into agro processing and value-added sector such as palm oil.

2.5 Concluding Remarks

To sum up, the related comparative advantage and export diversification literature reviewed in this chapter has provided useful information on assessing the determinants of comparative advantage and export diversification in this study. The most widely use method of computing the RCA is by using the Balassa (1965) Index of RCA. For example, such measurement is applied in the studies of Amir (2000), Bender and Li (2002), Serin and Civan (2008), Granabetter (2016) and Khai et al. (2016) to name a few. On the other hand, the HHI is generally employed to quantify the industrial concentration in the past. However, there are other approaches that can be applied to measure export diversification such as the Balassa (1989) approach which is adopted by Arip et al. (2010) in their study, and the Simpson Index as employed in the study of Jha et al. (2009).

With regards to the literature reviewed, most of the studies related to competitiveness and export diversification were performed in different sectors such as the manufacturing sector whereas the current study is specifically related to agricultural commodities in the Malaysian agriculture sector. Besides, there exists a gap in existing literature where former studies have only concentrated on measuring the impact of the macroeconomic variables on competitiveness and export diversification in other mainstream sectors whereas study on finding the determinants of competitiveness and export diversification in the Malaysian agriculture sector has not previously been conducted. For example, various past studies only generated the index of the RCA without going into depth to find the factors affecting both comparative advantage

and export diversification on the sub-sectors of agricultural commodities. On the other hand, even though there are past studies such as Jha et al. (2009) that looked into the drivers of export diversification in the agriculture sector of India the study only covered the country, state and farm levels. This showed that their study had yet to engage, in depth, on the agriculture sub-sector commodities and to find out the factors that affect competitiveness and export diversification. Such study, however, has not yet been conducted, especially in the case of Malaysia, due to data constraints as well as the need to deal with the vast amounts of data on agricultural commodities. A summary of the literature reviewed is provided as follows:

Table 2.1: The Summary of Price of Commodities

Author (Year)	Country	Method of Estimation/Model	Important Findings
Hai and Heidhues (2004)	Vietnam	• Policy Analysis Matrix simulation model	• They discovered that comparative advantage of rice is very sensitive to changes in its export price. • The changed in prices of their inputs due to import tax reductions will affect the production costs of agricultural products.
Halmai and Elekes (2002)	Hungary	• European simulation model	• They found that agriculture competitiveness can be influenced by higher producer prices. Albeit higher producer prices encourage production, they may result in decreasing price competitiveness and decreasing domestic food demand.
Aziz (2013)	167 countries	• Zellner's (1962) "seemingly unrelated regression" (SURE) model •	• Rising oil prices reduce the competitiveness and reduce the production. Based on the first estimation results obtained, oil price was found to be significantly less than zero for 70 percent of the RCA commodities. • In the second estimation, oil price fluctuation negatively affects RCA commodities by 36 percent when country-specific dummy was included. • Besides, oil price fluctuations significantly affected around 58 percent of RCA commodities in 1997 to 2005 based on third regression. • In contrast, the findings of fourth estimation showed a negative relationship between oil price and RCA for at least 16 percent of the commodities in all income groups.
Dlamini et al. (2014)	Africa-Swaziland	• Descriptive study using Porter's (1998) theory	• Increase in the prices of crude oil was a consequence of high input prices. Therefore, a higher input prices cause productivity to fall and eventually less competitive.

Table 2.1 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
Kennedy et al. (1998)	U.S.	Analytical framework	- They ascertained that price is influenced by the cost incurred to produce final output. - Consequently, a firm must lower input costs as compared to those incurred by rivals in order to achieve competitiveness.
Grega (2002)	Czech Republic	Partial equilibrium analysis	High price fluctuation in food commodities would worsen the economy as a whole. Increased in the level of price indicates the relative shortage of food items and it leads to an unstable economy and social structure.
Ali et al. (2010)	Malaysia	- Dickey-Fuller generalized least squares - Co-integration test	Price of agricultural commodities is highly influence by the exchange rates. This means weakened Malaysian currency tends to lower the price of commodities and this in turn cause Malaysian agricultural products to be more competitive in foreign markets.
Liverpool et al. (2009)	Nigeria	Policy Analysis Matrix simulation model	- The study showed that Nigeria encountered comparative disadvantage in the production of maize for export at the current world price which is due to low farmer yields and high transportation costs. - Importing maize leads to higher local prices of the commodity, which increase the cost of production.
Akpan et al. (2016)	Southern region of Nigeria	- Engle and Granger two-step method - Johansen co-integration approach	The findings discovered the possibility of high degree of competitiveness and substitutability between the local and foreign rice commodity in Nigeria.
Rahman et al. (2016)	Bangladesh	- Policy Analysis Matrix (PAM) - Cost-Benefit Analysis	Maize production is found to be competitive and profitable at the farm level. A rise in maize price would lead to rising outputs.

Table 2.2: The Summary of Per Capita Income

Author (Year)	Country	Method of Estimation/Model	Important Findings
Rao et al. (2008)	Andhra Pradesh, India	• Simple correlation Coefficient • Multivariate analysis based on OLS, Tobit and Seemingly Unrelated Regression Equation (SURE) technique	• They analysed the study by taking district based to per capita income, and then divided into three income groups by taking a third of districts in each group. • The production of high value crops is highest in medium and high income group districts, whereas lowest in low-income group districts.
Bhattacharya (2011)	Asia, the EU and North America	• Balassa's (1965, 1979) measure of Revealed Comparative Advantage (RCA) • Comparative Export Performance Index (CEPT)	• The export demand for onions and mangoes by Malaysia to EU tend to have negative relationship with per capita income of EU, whereas a positive association existed between export demand for onions, mangoes and fresh flowers in China, Thailand and Indonesia.
Pham and Riedel (2013)	20 countries (10 Asian countries and 10 non-Asian countries)	• Balassa's (1965) method • Panel estimation	• A positive association exists between the capital intensity of revealed comparative advantage and per capita income.
Joshi et al. (2004)	South Asian countries	• GLS with fixed effect model	• Per capita income and urbanization are the two demand side variables adopted in their study and they indicated that growth of livestock activities has a positive impact.
Kumar and Mathur (1996)	India	• GLS with fixed effect model	• The rising per capita income and growing urbanization are raising the demand for livestock products in the consumption basket which eventually lead to diversification in the livestock sector.

Table 2.2 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
Abro (2012)	Pakistan	• GLS method	• Per capita income is positively related with crop diversification towards high value commodities. • Crop diversification towards high value commodities enhanced with the increasing of income per capita due to the purchasing power of the farmers augmented.
Jha et al. (2009)	India	• Herfindahl-Hirschman index • Entropy index • Simpson index	• Diversification indices and income are positively related. • However, empirical analysis reported that income was negatively related with diversification index and consistent during all the reference year.
Imbs and Wacziarg (2003)	A wide panel of countries	• Herfindahl-Hirschman index • The coefficient of variation of sector shares (COEFVAR) • The max-min spread (MAXMIN) • The log-variance of sector shares (LOGVAR)	• Increase in income lead to drop in the risk of diversification, and export diversification rises as GDP per capita increases. • However, diversification declines after a certain level of income because the need for diversification reduces when high income economies tend to be economically and institutionally more stable.
Hesse (2008)	Developing countries	• GMM	• There is a positive effect of export diversification on per capita income growth.
Elhiraika and Mbate (2014)	53 African countries	• Cross country panel regressions • System Generalized Methods of Moments (S-GMM)	• Per capita income known as the drivers which lead to export diversification by viewing that increases in a country's per capita income offer opportunities for increased diversification. • This increases the purchasing power and the ability of consumers in order to afford a diverse basket of goods.

Table 2.2 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
Cadot et al. (2011)	156 countries	• Theil index	• They discovered a hump-shaped or inverted U-shaped relationship between per capita income and export diversification.
Hausmann et al. (2007)	55 developing countries	• Fixed effect model	• Countries which are more diversified construct huge level of productivity goods, grow more as compared to countries lower level of productivity goods and more specialized. • The findings revealed that the share of manufacturing sector increase in total export of diversify country and GDP per capita has positive relationship with export diversification for developing countries.
United Nations Framework Convention on Climate Change [UNFCCC] (2016)	Various countries	• Theil Index	• As per capita income of a country rises, the sectoral distribution of economic activity diversifies. • A positive relationship has existed between per capita income and export diversification, and this is generally driven by the extensive margin.

Table 2.3: The Summary of Labour Participation

Author (Year)	Country	Method of Estimation/Model	Important Findings
Ling and Lahr (2008)	7 regions of China	• Multiregional input-output tables	• They indicated that decreasing labour input per unit of gross output and changes in the value added share of the gross output lead to change in labour productivity.
Zhu (2012)	China	• Cobb-Douglas production function	• Labour participation and productivity growth has a positive association. • The outcome of the study showed that increase in labour participation lead to rapid growth in China as this was driven by productivity growth.
Su and Heshmati (2011)	Chinese provinces	• Fixed effects panel data multiple regression function model	• Labour accumulation has significant contribution towards economic growth. • For example, labour is positively significant at 1 percent level, by seeing that a 1 percent increase in labour leads to 0.23 percent rise in GDP.
Bravo-Ortega and Lederman (2005)	Latin America and Caribbean countries	• Granger causality test • GMM • OLS regression • Fixed Effects Regression	• They found that agriculture labour productivity has a significant effect on the average income of the poorest and this relationship is consistent across regions. • As such, it can be perceived that labour participation rate indeed encourage production through productivity as well as boost economic growth, which at the same time leads to comparative advantage.
Edeme et al. (2016)	15 ECOWAS countries	• Fixed Effects Regression	• The results of their study discovered that labour participation rate, capital stock and agriculture exports had a positive association with competitiveness of the ECOWAS region. • A rise in labour participation rate, capital stock and agriculture exports would initiate competitiveness and economic growth.

Table 2.3 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
Abdychev et al. (2014)	Sub-Saharan Africa	• Dynamic Panel Estimation • Cointegration for Heterogeneous Panel • Panel Probit Analysis	• The findings indicated that there is a negative relationship between labour participation, especially female with productivity. However, the relationship turns out to be positive by adjusting share of agriculture sector to GDP and this illustrated that most of women involved in low end productivity in agriculture sector.
McGuckin and Ark (2005)	European countries	• Regression Analysis	• They found that increased in the labour force participation on productivity growth is likely to be concave and drop over time.
Weil and Galor (2000)	Western Europe	• Malthusian Regime • Modern Growth Regime	• Higher labour force participation especially women, may increase total factor productivity growth if technological progress and labour force are complementary.
Madsen and Ang (2013)	6 Asian miracle economies; China, India, Japan, Korea, Singapore and Taiwan	• Pooled cross section • Seemingly Unrelated Regressions (SUR) • Three Square Least Square estimators	• They found that increase in labour force participation leads to increase in production which contributes to growth in productivity.

Table 2.4: The Summary of Capital Formation

Author (Year)	Country	Method of Estimation/Model	Important Findings
Ma et al. (2013)	China	• Regression model	• Capital investment in agriculture by both government and farmers increased, especially in recent years. • They also discovered that farmers' capital formation in agriculture increased as a result of public investment in agriculture.
Huang and Rozelle (1996), Fan (1997)	China	• Regression model	• Technological changes have been the primary engine of agriculture growth. • Other than that, improvements in technology have contributed the largest share of crop production growth.
Fan and Pardey (1997)	China	• Cobb-Douglas Production Function	• They found that the shift towards capital intensive contributed to increase in output
Jin et al. (2002)	China	• Standard Divisia Index • Tornquist-Theil Total Factor Production Index	• Investment in research and development by the government has led to technological improvements which eventually boost the growth.
Huang et al. (2002)	China	• Two-stage survey	• Public investment of China in plant biotechnology became the largest in the world, with China's agriculture leaders arguing that past gains were mainly due to government-supported technologies. • Besides, they stated that investments in research and development in agriculture sector play an important part as a driver of agricultural output.
Tyler (1981)	55 middle income developing countries	• Bivariate analysis	• The study discovered that positive relationship exists between various economic variables such as investment, and total export with economic growth. • Apart from that, the results showed that capital formation and exports play major roles in economic growth.

Table 2.4 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
Mellor (1973)	Taiwan, Japan and India	• -	• The study revealed that accelerated growth in agriculture productivity justifies industrialization because it not only facilitates the transfer of resources to other sectors but also affects the relative rates of capital formation and income growth of different sectors, as well as the structure and overall rates of growth.
Awokuse (2009)	15 developing countries	• ARDL	• The empirical study revealed that gross capital formation has the ability to stimulate growth.
Food and Agriculture Organization of the United Nations (2012)	Sub-Saharan Africa and South Asia	• -	• The findings indicated that positive association exist between capital formation and government expenditure on agriculture. • They discovered that the spending on capital formation is able to form an environment for infrastructure and sustainable access to natural resources. • Furthermore, it also contributes positive and significant impact on productivity.
Mehrara and Baghbanpour (2016)	Developing countries	• Panel approach	• The results of their research revealed that gross fixed capital formation has the ability to affect competitiveness of the outputs which in turn would lead to upsurge in economic growth.
Noureen and Mahmood (2014)	ASEAN and SAARC member countries	• Fully Modified Ordinary Least Squares (FMOLS) cointegration test • HHI	• The empirical findings revealed that there is a positive relationship between capital formation and export diversification in the countries under study.

Table 2.5: The Summary of Trade Openness

Author (Year)	Country	Method of Estimation/Model	Important Findings
Incgo (1997)	Least-developed countries	• Trade function	• The study stated that most gains comes from countries trade liberalization efforts that eventually lead to trade openness.
De Silva et al. (2013)	Sri Lanka	• OLS	• They found that trade openness is positively associated with productivity in agriculture sector.
Haddad et al. (2010)	77 developing and developed economies	• Linear dynamic panel data model • Generalized Method of Moments (GMM)	• A higher degree of diversification showed that a country is involved in a larger number of both implicit as well as explicit international insurance schemes that is likewise work as a cushion against such fluctuations.
Acemoglu and Zilibotti (1997)	117 countries	• Cross-sectional	• Diversification of its production and export base through trade openness may also result in a reduction in a country's vulnerability to particular sectorial shocks.
Esanov (2012)	Resource rich countries	• Panel data • Random effects	• The study revealed positive impacts of trade openness on diversification.
Ferdous (2011)	East Asian economies	• Fixed Effect Panel data • HHI	• Greater economic integration will lead to export diversification. • Conversely, trade openness tends to have insignificant impact on export diversification when the models take into account of resource-rich countries.
Shaukat et al. (2011)	Pakistan	• Augmented Dickey-Fuller (ADF) test • Johansen co-integration test • OLS regression • Vector Error-Correction Model (VECM)	• Their analysis showed that export export diversification and openness showed positive impact on export performance.

Table 2.5 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
Alexander and Warwick (2007)	Pakistan	• OLS regression	• They discovered that the greater the number of export of a country, the greater the growth will be.
Hassler (2004)	Developing countries	• Multi-Fibre Arrangement (MFA)	• Trade have significant impact on growth.
Marhubi (2000)	91 countries	• Cross-countries sample • OLS regression • HHI	• The empirical results showed positive coefficient with the indication that the higher the number of export, the higher the growth and diversification.
Sepehrdoust and Khodaei (2014)	Developing countries	• Generalized Method of Moments (GMM)	• A bi-causal relationship existed between export diversification and trade openness.
Agosin et al (2011)	Asia, Latin America, Africa, Eastern Europe, Middle eastern countries	• HHI • Gini coefficient	• They found that trade openness have the ability to prompt higher specialisation instead of diversification.
Melitz (2003)	-	• Demand model • Production model • Aggregation model	• Openness in trade can lead to enhancement in productivity due to intra-industry. • Lower tariffs due to trade liberalization is expected to improve the access to foreign markets, which will eventually lead to export diversification as the country becomes capable of facing a more diverse demand from its partners.
Djokoto (2013)	Ghana	• Autoregressive Distributed Lag	• The study found a negative impact of trade openness on local producers because trade openness promotes import of agricultural commodities.
Kurihara and Fukushima (2016)	Advanced economies, emerging and developing countries, and whole countries	• Panel least square	• Trade openness or promotion of international trade does not lead to export diversification.

Table 2.6: The Summary of Foreign Direct Investment

Author (Year)	Country	Method of Estimation/Model	Important Findings
Gourdon (2010, p.22)	Countries of Middle East and North Africa (MENA)	• Theil index • HHI • Gini coefficient	• FDI can lead to export diversification directly by entering the non-traditional export sector, or indirectly by increasing exports of traditional exports with the lowest share. Conversely, if FDI is mainly directed to the exploitation of natural resources, export concentration on natural resources is expected to rise.
Ekholm et al. (2007)	Ireland, Belgium, Holland, Singapore, Malaysia, Hong Kong, Canada and Mexico	• Three-region model	• They illustrated that FDI enters the country merely for producing in export markets in third countries. Therefore, the growth in exports would be towards new markets or on new industries, which lead to export diversification.
Hausmann et al. (2007)	Mozambique, Swaziland, Armenia, India and China	• Descriptive statistics	• FDI have a generally positive influence on export diversification. • However, it has a higher impact on vertical diversification as compared to horizontal diversification, which transfers more knowledge into the country and simultaneously does not distract the focus of the economy of a country where natural resources are intensive.
Jetter and Hassan (2013)	Africa, Europe, Oceania, Asia, South America, the Caribbean and North America	• Bayesian Model Averaging • HHI	• FDI show a significant role, although of minor importance in affecting export diversification. They also detailed that no notable pattern in comparing FDI levels among the least and the most diversified economies.

Table 2.6 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
Banga (2003)	Japan and US	• Panel data estimation • OLS • Fixed effect model • Random effect model	• He stated that FDI may lead to export diversification of developing countries if it positively affects the export-intensity of the non-traditional export sector. • Indirectly, FDI may boost export diversification by spillover effects on the export intensity of domestic firms in the non-traditional export sector. For example, the study revealed that the presence of US and Japanese MNCs in the same industry, and increased levels of FDI from the US and Japan are associated with increased export intensity. • He also notes that the source of the FDI is an important consideration with the US originated FDI having a stronger contribution towards diversification.
Bonaglia and Fukasaku (2003)	29 low income nations	• HHI • Theil entropy index • Gini Index	• He initiated FDI as important determinant in the diversification of Chilean and Costa Rican exports. • It also reports how FDI was responsible for a transformation of Kenya's horticultural industry making it more export competitive.
Iwamoto and Nabeshima (2012)	175 countries	• GMM	• They discovered that the five-year lagged FDI inflow correlates positively with both export diversification and export sophistication. Moreover, they indicated that positive impacts of FDI exist only in developing countries.
Spalla (2010)	Chile, Algeria and Malaysia	• Descriptive statistics	• A friendly and open FDI regime is the driver of export diversification. • FDI provides private investment-scarce countries with the technology transfer required for creating and developing strong private domestic investment.

Table 2.6 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
'Ofa et al. (2012)	49 African countries	• Grubel-Lloyd Index • HHI	• He argued that the impact of FDI on export diversification in Africa has been weak owing to its concentration on enclave sectors that have limited linkages to the rest of the economy.
Kamuganga (2012)	Africa	• HHI	• The result showed that macroeconomic developments such as exchange rate volatility, financial underdevelopments and inappropriate FDI are the obstacles that impede Africa from diversifying its exports.

Table 2.7: The Summary of Population

Author (Year)	Country	Method of Estimation/Model	Important Findings
Parteka and Tamberi (2011)	60 countries	• Country Fixed Effects • General Additive Models	• The study concluded that as the size of an economy increases, be it in terms of number or diversity of consumers, there is an incentive for the production of more and varied goods for consumption so as to satisfy different tastes and preferences.
Jetter and Hassan (2013)	Africa, Europe, Oceania, Asia, South America, the Caribbean and North America	• Bayesian Model Averaging • HHI	• They discovered that increase in a country's population is related with increased labour which can be used as an input factor in the production of diversified products.
Brenton and Hoppe (2007)	US and European Union	• Two-stage modeling approach: Probit regression and Log linear equation	• Countries with larger population are more likely to export a given product to the US. • The study also revealed that population size has a positive but decreasing effect on the volume of trade.

Table 2.7 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
Dogruel and Tekce (2011)	MENA countries such as Algeria, Egypt, Jordan, Kuwait, Morocco, Oman, Saudi Arabia and Tunisia	• Descriptive statistics • Random effects estimation • HHI	• Based on the results obtained, reduction in the population growth rate is considered as an indicator of social development. • Besides, positive and significant parameters estimated for this variable shows that social development stimulated the export diversification. •
Klinger and Lederman (2006)	-	• Descriptive statistics	• They stated that countries with larger populations are likely to have a larger pool of entrepreneurs, which in turn leading to more experiments and a higher frequency of discovery. • It is also possible that a larger pool of imitators, although increasing the social value of discovery, would reduce incentives for entrepreneurs to experiment. • Thus, it leads to a lower frequency of discovery. However, scale variables such as total population were found to be insignificant in their empirical findings.
Cabral (2010)	Sub Saharan Africa	• Pooled OLS estimation • Fixed effect models	• He estimated coefficient suggests that a Sub Saharan Africa country with double of the average population would have exports that is, on average, 15 percent to 25 percent more diversified than an average size country in the region.

Table 2.8: The Summary of Level of Development

Author (Year)	Country	Method of Estimation/Model	Important Findings
Dogrueel and Tekce (2010)	MENA countries such as Algeria, Egypt, Jordan, Kuwait, Morocco, Oman, Saudi Arabia and Tunisia	• Descriptive statistics • Random effects estimation • HHI	• They employed level of development as one of the factors affecting export diversification and it is usually captured by the country's GDP per capita.
Aghion and Howitt (1992)	Least developed countries	• Production function	• Both supply and demand side growth theories suggest that the pattern of preferences guiding consumption varies as GDP per capita grows. • The change in the elasticity of demand affects sectorial productivities and thus the structural composition of the economy.
Parteka (2007)	Developing countries	• Absolute measures of specialisation • Relative measures of specialisation	• The empirical findings suggest that there is an increasing relationship between the levels of development and export diversification.
Acemoglu and Zilibotti (1997)	-	• Cross-sectional	• Their findings emphasize on limited diversification opportunities at lower levels of development due to the scarcity of capital and indivisibility of investment projects.
Imbs and Wacziarg (2003)	A wide panel of countries	• HHI • The coefficient of variation of sector shares (COEFVAR) • The max-min spread (MAXMIN) • The log-variance of sector shares (LOG-VAR)	• They reported that poor country tends to diversify, and it is not until they have grown to relatively higher levels of per capita income which lead to specialisation instead of diversification.

Table 2.8 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
Cabral (2010)	48 Sub-Saharan Africa	• Pooled OLS estimation • Fixed effect models	• Higher level of development is related with more diversified exports. • For example, everything else constant, 10 percent increase in the level of development would lead to upsurge of 2 percent in the number equivalent.
Dutt et al. (2008)	South Korea	• HHI • Extensive and intensive exports margins	• There is a tight link between economic development, as measured by per capita GDP, and export diversification as measured by the Herfindahl index of exports and the extensive margin of exports.
Parteka and Tamberi (2011)	60 countries	• Theil index	• The results of their study relating to the level of development in a country fixed effects model showed that the development level is negatively related with the degree of specialisation. • A rise in income per capita by 1 percent is related with a decline in specialisation measure by approximately 0.5 percent. Thus, export diversification process takes place along the path of growth. • They also claimed that even when cross-country heterogeneity is taken into consideration, diversification takes place in the course of economic development, but it is rather slow.

Table 2.9: The Summary of Infrastructural and Technological

Author (Year)	Country	Method of Estimation/Model	Important Findings
Joshi et al. (2004)	South Asian countries	GLS with fixed effect model	- They revealed that irrigated area turned out to be significant and represented the technological advancement in the region. - The regression coefficient of technology is negatively associated with diversification. - Crop diversification is more prominent in rain fed areas due to technological advancement in terms of irrigation.
Joshi et al. (2007)	India	- OLS regression - GLS with random effect	- They clarified that improvement in infrastructure such as roads and markets as well as technology has impact on diversification. - Furthermore, they also found that infrastructure and technology are important non-price factors that influence acreage under a crop.
Jha et al. (2009)	India	- HHI - Entropy index	- Their empirical results showed that irrigation is positive for the years of 1983 to 1984, 1993 to 1994 while, the estimate is negative for 2003 to 2004 which revealed an insignificant result. - Besides, expansion of rural roads reflects the strengthening of market-related infrastructure. For example, market encourages farmers to get rid of their subsistence type of production.
Bhattacharyya (2008)	West Bengal India	SDI	- The empirical results showed that fertilizer used is positively related to the degree of diversification. - On the other hand, the coefficient of irrigation is negative implying that crop diversification drops with the increase of irrigated area. - He discovered that development of infrastructure is important in encouraging diversification. For example, the coefficient of road is positive and significant.

Table 2.10: The Summary of Natural Resources

Author (Year)	Country	Method of Estimation/Model	Important Findings
Elliot et al. (2007)	-	-	Natural resource abundance is of great advantageous for economic development by showing a positive correlation between resource abundance and output level.
Lederman and Moaloney (2003)	Various countries: Argentina, Australia, Canada	- Cross sectional regressions - Ordinary Least Square (OLS) regression - Generalized Method of Moments (GMM)	They indicated that a growth prospect is hinder by the concentration in export revenues and there is no evidence that natural resource abundance is detrimental to growth.
Smith (1776)	-	-	He discovered that natural resources are related to lower human and physical capital accumulation, productivity growth as well as spillovers.
Martin and Mitra (2001)	38 countries for manufacturing: 23 developing countries and 15 developed countries for manufacturing. 49 countries for agriculture: 32 developing countries, 17 developed countries	- Cobb-Douglas production function - Fixed effect method	They initiated that the total factor productivity growth is higher in agriculture than in manufactures in a large sample of advanced and developing countries.
Wright and Czelusta (2002)	United States of America	-	They indicated that resource based activities can sustain growth over long periods.
Blomstrom and Kokko (2003)	Sweden and Finland	-	A more diversified economic structure can be achieved by adding technology into their natural resource based production.

Table 2.10 continued

Author (Year)	Country	Method of Estimation/Model	Important Findings
Herzen and Lehman (2004)	Chilean	• Unit root tests • Cointegration test • Dynamic ordinary least squares (DOLS)	• Export diversification is linked to economic growth through externalities of learning activities related with exporting. • They stated that export diversification on the basis of natural resources has a positive influence on growth.
Bonaglia and Fukasaku (2003)	Low income countries	• Annex Table	• Natural resources have higher technology content and are able to create the development of upstream and downstream activities.
Jetter and Hassan (2013)	Africa, Europe, Oceania, Asia, South America, the Caribbean and North America	• Bayesian Model Averaging • Herfindahl-Hirschman index (HHI)	• Their study pointed out that natural resource rents as a percentage of GDP is one of the factors affecting export diversification. • For instance, their empirical findings revealed a value of 1 which indicates that a variable has a positive influence on a country's HHI in all models and therefore, it causes export diversification to fall. • This is because it indicates complete specialisation instead of diversification. Thus, they conclude that countries in which natural resources play a strong role in the domestic economy find it harder to diversify their exports.
Brenton and Hoppe (2007)	Africa	• Gravity model	• They discovered that countries which are rich in resources will not have a comparative advantage in manufactured products such as clothing.
Alemu (2016)	Africa	• HHI	• He indicated that natural resources abundance has negative impact on vertical and horizontal export diversification in Africa. Such an inverse relationship is due to the natural resource curse.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Chapter 3 aims to describe the overall methodology employed in this study to estimate the empirical analysis and it is divided into few parts. Section 3.2 focuses on the theoretical framework, whereas Section 3.3 discusses the conceptual framework. Section 3.4 highlights the revealed comparative advantage and export diversification, Section 3.5 describes the empirical model, meanwhile, Section 3.6 emphasises on data description. Besides, Section 3.7 discusses the unit root tests such as the Augmented Dickey-Fuller (ADF) test and the Phillips-Peron (PP) test will be engaged to examine the time series properties of the variables under study. The next three sections discuss the empirical testing procedure to seek the determinants of competitiveness and export diversification of the agriculture sector in Malaysia. Specifically, Section 3.8 focuses on the bounds testing approach to cointegration, Section 3.9 emphasises the Autoregressive-Distributed Lag (ARDL) model as recommended by Pesaran et al. (2001) and consequently, the error-correction based on the ARDL model will be discussed in Section 3.10. Lastly, a battery of diagnostic tests will be carried out to check for the robustness of the results and these are discussed in Section 3.11.

3.2 Theoretical Framework

The empirical analysis in this chapter is build based on two theories. First, the comparative advantage using the revealed comparative advantage (RCA) estimations of a

nation. Second, the export diversification estimation. Generally, the theory of comparative advantage states that a country produces goods where it is relatively cost efficient as compared to other countries. Balassa (1989, pp42-44) stated that measuring the comparative advantage and testing the Hecksher-Ohlin theory have some complications due to the fact that the relative prices under autarky are not observable. Therefore, Balassa (1965) introduced the concept of the RCA and suggested that comparative advantage is “revealed” by observed trade patterns. The RCA measurement is a measurement of comparative advantage of a country based on the relative export ratio of a certain commodity of a particular country against that of the world. On the other hand, to explain the theory of export diversification, Porter (1990) stated that a country cannot merely rely on the activities a particular industry and ought be more proactive to offset national factor disadvantages in order to be sustainable in national competitive advantage³. Accordingly, these theoretical explanations imply that comparative advantage and export diversification can be examined using the RCA index and the export diversification index, respectively by taking into account the composition of the export commodity of that particular country.

3.3 Conceptual Framework

Comparative advantage can be pondered upon from two perspectives, which are specialisation and diversification. The concept of specialisation was first highlighted by Ricardo, Hecksher-Ohlin, and Samuelson. Kılıç (2002) indicated that the theory of absolute advantage as developed by Adam Smith in his book, “The Wealth of Nations”, was the first trade theory that showed the importance of specialisation in production and the division of

³ See Michael. E. Porter, *The Comparative Advantage of Nations* (New York: The Press, 1990): p.606.

labour. This concept is not something new, as, in the 16th century, Smith (1776) had mentioned that, in order for two nations to trade with each other voluntarily, both nations must be able to gain by each specialising in the production of the commodity which gives it an absolute advantage. In return, the trading partner imports those goods and services where an absolute disadvantage exists. In line with this, resources are efficiently utilised and the output of both commodities will increase through free trade. Smith also mentioned that some countries are omitted from importing, and therefore can only gain from the trade (Smit, 2010). This means that the absolute cost advantage drives specialisation.

However, specialisation may not necessarily lead to gains from trade, and this can be explained using Ricardo's theory of comparative advantage. Ricardo showed that the potential gains from trade are far superior than the concept of absolute advantage. This was explained by Krugman and Obstfeld (2006), who pointed out that a country has to specialise in a commodity that it can produce relatively more efficiently. A country can still export goods and services in which its absolute cost disadvantages are the smallest, and import those with the greater absolute disadvantage. In other words, it means giving more attention to specialised products and export products that give the largest absolute advantage and importing products with the lowest absolute advantages. Such comparative advantage may lead to specialisation, but this is different from the specialisation based on absolute advantage because the latter assumes that a country will always import goods and services regardless of its overall efficiency in production as compared to other countries.

Based on the review of Salvatore (2002), the theory of comparative advantage by Ricardo is fundamentally the labour theory of value. This theory indicates that labour is the

only factor of production and that it is used in fixed proportions in the production of all products. Ricardo's theory is also related to opportunity cost in the theory of comparative advantage due to the same assumption of homogeneous labour, which states that a nation enjoys a comparative advantage in the production of goods and services if the opportunity cost of production is lower (Kılıç, 2002). However, in the current era, the difference in technology advancement between countries is a major determinant that shapes the international division of labour and consumption as well as trade patterns.

The downside of the Ricardian theory is it does not take into account the direction of trade (Smit, 2010). This, in turn, is explained using the Heckscher-Ohlin (H-O) theory for the comparative advantage differences between countries. The H-O theory states that the comparative advantage is determined by the difference in the factor endowment among countries, such as labour and capital. It also states that international trade encourages the specialisation in production, and countries which export commodities that can be mass produced will result in relatively intensive production as compared to other countries (Jones, 2008). In short, a country exports a commodity when two conditions are fulfilled, for example, when its production is a relatively intensive factor and the country is relatively well-endowed for it (Leishman, et al., 1999). For example, a land-abundant country will export land-intensive goods, whereas a capital-abundant country will export capital-intensive goods.

The Heckscher-Ohlin theory has been extended through the work of Samuelson, Leontief and others (Memedovic, 1994). The Samuelson theory indicated that free trade must be able to improve the welfare of all parties in a representative agent economy where everyone

is the same. If not, a country could choose to continue in autarky, ignoring the rest of the world. The theory also stated that labour and capital are perfectly mobile across sectors (Rogoff, 2005).

From the comparative theory, further expansion was also made by economists into diversification, which has so far been triggered by a shift from diminishing returns to increasing returns. To explain this, a reference must be made to the study of Leontief (1953) who intended to verify the H-O theory. The traditional theory states that a capital abundant country should focus on capital intensive products, but Leontief discovered that the United States of America, though known as a capital-intensive country, was also dominant in exporting labour-intensive products at that point in time. As a result, this has led to diversification catalysed by government policies, and as such, it is against the theory of specialisation.

The International trade theory was dominated by the theory of comparative advantage up until the 1970s with the introduction of new models of monopolistic competition. The Krugman model indicated that trade is initiated by economies of scale rather than by the differences in factor endowments or technology. This approach differed from other theories of trade because it emphasised on increasing returns, which Krugman (1979) explained using a new trade theory by shifting the attention from a perfectly competitive market to a monopolistically competitive market. The new trade theory suggested that specialisation occurs through intra-industry trade and large scale production with lower prices. Consequently, when there is a larger selection of products, it will lead to diversification.

Porter (1990) developed a new theory to explain national competitive advantage due to a dissatisfaction with existing economic trade theories. Four classes of country attributes were

identified to form the National Diamond, specifically factor conditions; demand conditions; related supporting industries; and company strategy, structure and rivalry. Porter (1990) defined factor conditions as human resources, physical resources, knowledge resources, capital resources, and infrastructure. These factor conditions are further segmented into elementary and advanced factors; the former are comprised of unskilled labour, raw materials, climatic conditions, and water resources. The latter are established to form a country's foundation for the sustainable competitive advantage through reinvestment and innovation to specialised factors.

As for the demand condition, Porter (1990, 1998) identified that it is the home demand which creates international demand, industry segments with a significant share of home demand and demanding buyers are the important condition that affects demand. Therefore, home countries continuously improve their positions due to competitiveness in terms of quality of products, features as well as service demands. Apart from that, the strategy, structure and rivalry of firms play an important role in contributing to national competitive advantage. These are influenced by national environment, and there are systematic differences in all countries' business sectors that govern the way in which firms compete domestically and eventually determines their competitive advantage.

Another important subject that needs to be reviewed is the empirical measurement of comparative advantage and diversification. There is no quantitative method to measure specialisation and diversification for the aforementioned theories on comparative advantage and diversification. To the best of our knowledge, the most reliable method to measure comparative advantage is the Balassa index of Revealed Comparative Advantage (RCA)

method. The Balassa index of RCA measurement has been further enhanced and discussed by a number of economists such as Michaely and Wolter. The advantages of using the Balassa (1965) index of RCA is that it takes into account the export ratio of a particular commodity against the total export of one country to the relative ratio of the total export of the same commodity against the total export value of the world. Besides, the essential intention for the application of relative export rather than the net-export in Balassa's (1965) equation is rested upon the system of trade protection. According to Balassa (1979), protection will impose great influence on the inter-country trade pattern. Thus, in order to neutralise the effect of protectionism and to gain uniform index of 'revealed' comparative advantage, the measurement has to rely on the relative export figure.

On the other hand, the Balassa (1989) method is used to measure export diversification. Other alternatives to measure export diversification, such as the Herfindahl-Hirschman index (HHI), are usually used to measure industrial concentration. However, the disadvantage of the HHI is that it does not take into account overall economic activity, but only the number of firms in a market. Other less well-known methods to measure comparative advantage and export diversification are specific to a certain industry to capture all related economic activities. This has been reviewed in this study as well in terms of the ten determinants of export competitiveness and diversification (see Figure 3.1 below). However, for the purpose of this study, not all of the determinants will be included in the empirical model and further discussion is provided in Section 3.5.

In general, researchers have different views as well as perceptions on comparative advantage and export diversification, thus, this has led to different measurements for both

comparative advantage and export diversification. There are several methods to measure comparative advantage as well as export diversification which have been discussed in Section 2.2 and Section 2.3, respectively. As noted earlier, the objective of this chapter is to analyse the RCA index to examine both the competitiveness as well as the export diversification of agricultural products in Malaysia. According to Hesse (2008), the competitiveness of a country's exports since globalisation and accelerating cross-border trade reveals the export of countries' to worldwide competition. Thus, the exports of a country have to be internationally competent to take advantage of leveraging world markets so as to be successful in export diversification. In this regard, to enhance the discussion of this study, the methodology for the empirical inquiry is designed to include two approaches to analysing national competitiveness and export diversification. First, the application of RCA indices to examine the competitiveness of Malaysian agricultural products, and by using the RCA index to generate the export diversification. Second, this study adopts a time series analysis by examining the contribution of particular determinants towards comparative advantage and export diversification of the agriculture sector.

In terms of export competitiveness, price of agricultural products or commodities and labour participation are the determinants that contributes to export competitiveness. In terms of price of agricultural products, demand for agricultural products will decline when the price increases because the products have become expensive and, this affected the competitiveness by reducing the exportation of agricultural products in the international market and vice versa., As for labour participation, it is capable in contributing to export competitiveness because a country is able to produce more outputs when there is more labour participation. Therefore, it will result in better bargaining power in international markets because people can benefit from

better and cheaper price of products when a country is able to produce more outputs. Apart from that, per capita income and capital formation can be either linked with export competitiveness or diversification. Per capita income is able to stimulate export competitiveness and diversification as it helps to upsurge the purchasing power and ability to afford diverse products. Increase in purchasing power allow the country to look into other ways to develop its basic commodities into high-value-added commodities. Other than that, agricultural products can be produced efficiently at a lower price with net investment in capital goods such as equipment, machinery, infrastructure and technology. Moreover, capital formation upsurges capacity in production, contributes to the competitiveness of firms and sectors through diversification of higher value-added outputs.

On the other hand, natural sources, trade openness, foreign direct investment (FDI), population, and infrastructural and technology are associated with export diversification. A country with natural resource abundance is a blessing can be beneficial to the country for export diversification purposes. For instance, as a resource rich country, Malaysia shifted from its major sources of exportation in rubber and tin by promoting other commodities, especially palm oil and by moving towards higher value-added products (Reinhardt, 2000; Simeh and Ahmad, 2001). Therefore, natural resources are important for export diversification by producing value-added products and this in turn contributing to better export performance.

With trade openness, a country is able to benefit from knowledge spillovers and also investments in innovation and technology that boost production. As such, we are able to produce products with better quality by going into downstream processing in order to diversify the current products into a higher value-added product. Apart from that, the trade openness of

a country would also promote growth due to export and import activities, lower tariffs and fewer trade barriers among the trading countries so as to remain competitive in the international market. Besides, FDI is able to stimulate the market through the speeding up of technology transfer and the improvement of the production capabilities of a country. As such, diversification of products into higher value-added output is possible due to the advancement of technology being transferred from other country. The same goes to infrastructural and technology where improvement in infrastructure or speedy technological change in agricultural productions promotes export diversification.

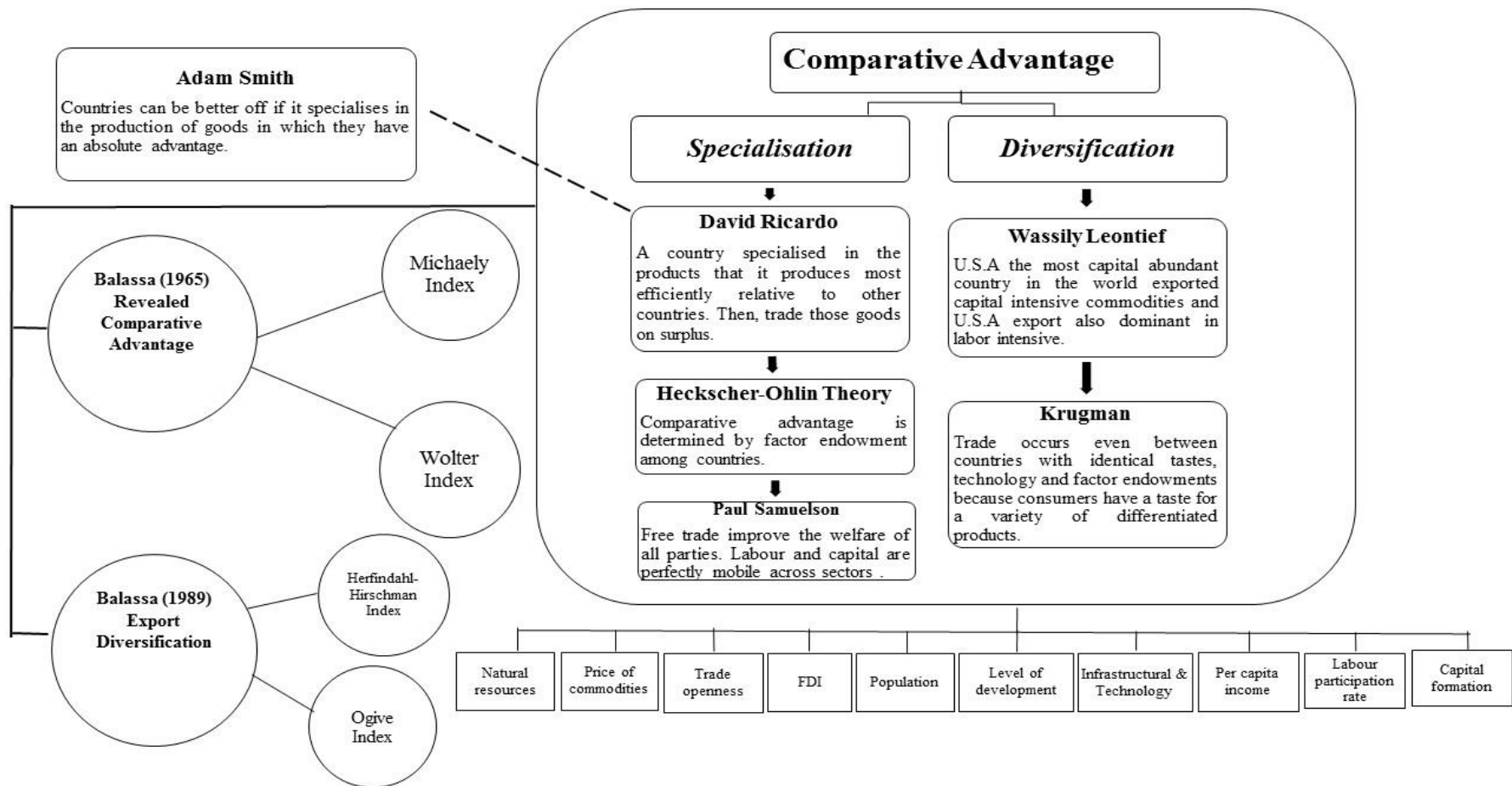


Figure 3.1: Theories of Comparative Advantage Concerning Specialisation and Diversification

3.4 Revealed Comparative Advantage and Export Diversification

Most researchers have preferred to use the standardised net export shares measurement which is known as the revealed comparative advantage (RCA) as developed by Balassa (1965) in order to determine the comparative advantage of a certain commodity or product in the market. According to Balassa (1965), the RCA is a measurement of comparative advantage of a country which is built on the relative export ratio of a particular commodity in that particular country against that of the world (As discussed in Section 2.2.1). The RCA index was pioneered by Balassa⁴ and it has grown to become a useful empirical research on the patterns of trade.

However, the RCA measurement may not be able to differentiate between the effects of factors endowment from the policy of trade. Nevertheless, it does provide a sign regarding the flow of comparative advantage in a region (Bender and Li, 2002). Based upon the findings of Aini et al. (2010), the RCA measurement has a role in quantifying the commodity-specific degree of comparative advantage. In addition, RCA indices provide a beneficial guide to the underlying comparative advantage and offer a further understanding into the competitiveness of the Malaysian agricultural related commodities. According to Hassan (2013) and, Shinoj and Mathur (2008), the pro of using the comparative advantage index is that it considers the intrinsic advantage of a particular export commodity and is consistent with the changes of relative factor endowment and productivity in an economy.

Therefore, in order to measure the RCA index of the Malaysian agricultural commodities, this study adopts the formula developed by Balassa (1965) in estimating comparative advantage and the RCA index is computed from Equation 1.1 (see Section 2.2.1).

⁴ See Balassa, (1965).

Equation 1.1 calculates the relative export ratio of a particular commodity against the total export of one country to the relative ratio of the total exports of the same commodity against the total export value for the world. The underlying reason for the application of relative export rather than the net-export in the formula is rested upon the system of trade protection. Balassa (1989, p.26) clarifies that protection has a great influence on the inter-country trade pattern. As a result, in order to neutralise the effect of protectionism and to get a uniform index of “revealed” comparative advantage, the measurement has to rely on the relative export value (Balassa, 1989).

On the other hand, this study will measure the index of export diversification and the index will be computed from the methodology proposed by Balassa (1989) as shown in Equation 1.4 (see Section 2.3.1). Generally, the subject of export diversification has been overlooked in the past due to the conventional theory of comparative advantage which stated that a nation ought to specialise in the production in which it has a comparative advantage in order to gain from trade activities. Arip (2008) indicated that due to the conventional theory of comparative advantage, that so as to gain from trade activities, a nation should specialise in its production activities. A country cannot merely depend on specific industrial activities in the modern international trade environment. In fact, it should be more proactive to offset national factor disadvantages in sustaining national competitive advantage.⁵ The critical impacts of diversity on the performance of an economy was further verified by past studies, to name a few, Maliza and Ke (1993), Wagner and Deller (1998), Trendle and Shorney (2004) and Woerter (2007).

⁵ See Micheal E. Porter, *The Competitive Advantage of Nations* (New York: The Free Press, 1990) p. 606.

3.5 Model for the Determinants of Export Competitiveness and Diversification

After generating the index of revealed comparative advantage (RCA) and export diversification, this study will continue by estimating the time series Autoregressive-Distributed Lag (ARDL) approach model. In this study, the comparative advantage model will take into account a few variables, namely, the price of commodities, the GDP per capita, the labour participation and capital formation. On the other hand, the export diversification model includes variables such as the GDP per capita, capital formation and trade openness. The following functional form is employed in the analysis of the determinants of the revealed comparative advantage (RCA) and the export diversification of Malaysian agriculture sector in this study. The model for the RCA is expressed as below:

$$RCA = f \left\{ PM^{+/-}, GDPC^{+/-}, LABOUR^{+/-}, CAPFORM^+ \right\} \quad (3.1)$$

The +, or +/- sign above each variable denote its expected sign.

Specifically, the model can be expressed as below:

$$LRCA_t = \alpha + \beta_1 LPM_t + \beta_2 LGDPC_t + \beta_3 LLABOUR_t + \beta_4 LCAPFORM_t + \varepsilon_t \quad (3.2)$$

where,

$LRCA_t$ = Log of indicator for the revealed comparative advantage for Malaysia at period t

LPM_t = Log of the price for agricultural products in Malaysia at period t

$LGDPC_t$ = Log of the GDP per capita at period t

$LLABOUR_t$	=	Log of the labour participation in the agriculture sector ⁶ at period t
$LCAPFORM_t$	=	Log of capital formation in the agriculture sector at period t
α	=	Constant
ε_t	=	Error term
$\beta_1\beta_2\beta_3\beta_4$	=	The estimated coefficients of the specified determinants of revealed comparative advantage

Basically, the equation above is based on the production function and demand theory. The equation takes into account price as determinants because comparative advantage is looking at the cost in which price will reflect the cost where low price shows the cost of production is low. As for GDP, according to Keynesian theory, GDP is a way to measure production of a country. Aggregate demand takes and shows how it relates to level of price and it is a way to proxy the cost of production where low GDP shows low cost of production in which will affect export competitiveness. Labour and capital formation are related to the output of a production process to physical inputs which shows the level of productivity. Therefore, productivity will influence the competitiveness because the participation of labour and capital formation will affect the output level which result in bargaining power in the foreign market and affect export competitiveness.

The rationale for using the above mentioned independent variables is because they are important variables that can influence the comparative advantage. Local price is adopted in this study because the competitiveness of one product can be reflected by the price of commodities.

⁶ The statistics of labour force comprise of Malaysian citizens and non-citizens (Department of Statistics Malaysia, 2016).

Generally, increase in the price of agricultural products will lead to drop in demand as the price of agricultural products is expensive, and this in turn will caused the products to be less competitive in the agriculture export (Tuah, 2013). As such, this can depict how changes in price can have an impact on the revealed comparative advantage. As for the studies of Mukherjee and Chakraborty (2013) and Drechsel et al. (2004), the authors disclosed that the local price might be appropriate to determine the financial implication for farmers. According to Hai and Heidhues (2004), they found that countries become neutral in terms of comparative advantage in rice as the price increased. In contrast, they revealed that price is positively related to the yield which results in competitiveness. Besides, a negative relationship is found when higher producer prices may result in declining price competitiveness as well as reducing demand (Halmai and Elekes, 2002).

Adjusting GDP in agriculture sector to population is used in this study because it is an indicator of the level of economic development. We also considered the effect of the distribution of income among rural households, this enabled the impact of poverty alleviation strategies to be observed, and in particular the livelihoods of rural dwellers (Mucavele, 2010). Furthermore, the GDP originating from agriculture is twofold as effective in eliminating poverty in which the GDP growth from agriculture influences mostly the poorer section of the rural population. In other words, the per capita GDP shows the relative performance of the country and plays a role as an indicator of the standard of living. Furthermore, Pham and Riedel (2013) stated that the per capita income has the ability to upsurge the comparative advantage.

The basis of using the labour participation variable is due to its possible effect on economic growth. For example, by boosting the labour participation, fully mobilising untapped

pools of labour resources in the informal sectors to cope with the challenge of an ageing population, and addressing high rates of structural unemployment by lessening barriers to job creation would help (Norris, et al., 2013). According to Verick (2014), economies can grow at a faster pace in response to higher labour inputs in regards to an increase in the participation of the labour force. As such, this could have a significant impact on producing agricultural products. This is because increase in labour participation will lead to upsurge in the productive capacity which allows for reduction in the cost of their output that results in export competitiveness. Aziz (2013) reported that labour would capture the relative differences in factor endowments among countries. Zhu (2012) and Madsen and Ang (2013) pointed out that the labour participation and export competitiveness is positively linked and this is driven by the productivity. This is because higher agricultural produce means improved competitiveness where people will benefit from better and cheaper products that eventually lead to competitiveness in its exportation.

Capital formation was added in this study because with the net investment in capital goods such as equipment, machinery, infrastructure and technology will enable the agriculture products to be produced efficiently at a reasonably low price. Other than that, capital formation upsurgences capacity in production, contributes to the competitiveness of firms and sectors through higher value-added outputs. This, in turn, will speed up the rate of technological advance and innovation across the economy which will eventually generate investment as well as income to the economy (Malik, 2012; European Commission, 2007). Besides, the measure of capital formation is an essential variable that captures the relative differences in factor endowments that contribute to a country's competitiveness (Aziz, 2013). Mehrara and Baghbanpour (2016) revealed that gross fixed capital formation has the ability to affect competitiveness and value-

added outputs which in turn would lead to economic growth. As a whole, investment in capital formation is important in order to promote long-run economic growth by improving productivity and capacity. Jin et al. (2002) learnt that investment in research and development had led to technological improvements that brings competitiveness in the export markets.

On the other hand, the model for export diversification is shown as below:

$$DIV = f \left\{ GDPC^{+/-}, CAPFORM^+, TOGDP^{+/-} \right\} \quad (3.3)$$

The +, or +/- sign above each variable denote its expected sign.

Specifically, the empirical model used in this study is expressed as follows:

$$LDIV_t = \alpha + \beta_1 LGDPC_t + \beta_2 LCAPFORM_t + \beta_3 LTOGDP_t + \varepsilon_t \quad (3.4)$$

where,

$LDIV_t$	=	Log of indicator for export diversification for Malaysia at period t
$LGDPC_t$	=	Log of the GDP per capita at period t
$LCAPFORM_t$	=	Log of capital formation in the agriculture sector at period t
$LTOGDP_t$	=	Log of trade openness to the GDP at period t
α	=	Constant
ε_{it}	=	Error term

Same goes to Equation 3.2 which is based on the production function and demand theory. The equation takes into account GDP per capita as determinants of export diversification. As mentioned earlier on, GDP is a way to quantify a country's production and it is a way to proxy the production cost that have association with export diversification. Besides, capital formation is related to the output of a production process to inputs which illustrates productivity level. Therefore, with capital formation, a country is able to diversify the products into more value-added produce that will influence the degree of diversification. Other than that, through trade openness, people in one country can have better choice from various demand in various emerging economies.

GDP per capita is used since it is an indicator of the economic progress. Hesse (2008) found robust empirical indication of the positive result of export diversification on the growth of per capita income. The study conducted by Elhiraika and Mbate (2014) stated that per capita income has the ability to influence export diversification by noting that the increase in per capita income will result in greater diversification. Besides, Jha et al. (2009) initiated that the diversification index and income are positively related, though the extent of such a positive relationship depends on the region. Nevertheless, their empirical results showed that the per capita income and diversification were negatively related. Capital formation was employed in export diversification model since the advancement in technology will create a competitive environment which will boost the export performance of a country. This can be done by diversifying the agricultural products into a more value-added output (FAO, 2012).

The basis of using the ratio of total trade to the GDP is because it takes into account the effects of market size as well as the volumes exchanged. Trade openness has the ability to boost

growth. For example, Grossman and Helpman (1991) initiated that an economy will grow when the country is engaging in trade openness, thus it leads to knowledge spillovers as well as an improvement in investments. Past studies, to name a few, Alexander and Warwick (2007), Hassler (2004), Marhubi (2000) and, Sepehrdoust and Khodaei (2014) pointed out that countries experience improved economic growth due to diversification as they pursue trade openness. As a result, this scenario leads to a positive impact of trade openness which results in diversification. This is because when a country is more open, this will lead to increase productive capacity which will have impact on export diversification. In addition, Esanov (2012) indicated that positive impacts exist between trade openness and diversification. However, Mahadevan (2003) pointed out that the chances for trade in locally produced agricultural products will arise when there is an increasing openness. Consequently, this will generate market opportunities which in turn increase the sales level leading to higher output. In contrast, increased openness would lead to the import of cheap agricultural products which eventually triggers competition with the local producer thus, it causes the agriculture performance to decline. Therefore, trade openness can either lead to a positive or negative relationship depending on the competition or market access effect. Apart from that, Agosin et al. (2011) reported that trade openness has the ability to prompt higher specialisation instead of diversification.

However, this study excludes other variables such as natural resources, FDI, population infrastructure and technology in the empirical models. The reason for excluding the other variables is due to the data constraint as there is no available data for the aforementioned variables based on agricultural products or by agriculture sector itself. As for population, it has

already been taken into account in the income per capita by adjusting the GDP per capita to population in order to reveal the level of development.

3.6 Data Description

For analytical purposes, this study uses annual exportation data of 186 agricultural related commodities⁷ in Malaysia for the empirical period of 1988 to 2014. This study will engage in the total export of the world. The exportation data for these commodities is obtained from the United Nations Commodity Trade Statistics Database (UN Comtrade Database)⁸ with the Standard International Trade Classification Revision Three-SITC Revision 3 (5-digits code) to analyse the index for the comparative advantage and export diversification of agricultural commodities in Malaysia. The 5-digits code will be used since it covers a longer time series of trade data as the higher number of the SITC digits code represents a more specific classification of the product category.

For the purposes of consistency, this analysis uses the 5-digits code of the SITC classification products. The SITC classification is the means by which exports are classified according to commodity type. The detailed breakdowns are important as there are a number of categories within each broad SITC heading (Smyth, 2005). By using this classification, it is possible to reveal the comparative advantages and diversification of related products in Malaysian exportation.

⁷ See Appendix A for the list of 186 agricultural commodities

⁸ See more information for UN Comtrade Database: <http://comtrade.un.org/>

Furthermore, the local price of commodities or unit values and the ratio of trade openness to the GDP were also attained from the UN Comtrade Database. The denominated currency of price of commodities is in US dollar which have taken into account the effect of exchange rate. The Unit values were generated by dividing the trade value with trade quantity, whereas the ratio of trade openness to the GDP was calculated based on the 3-digits code trade value in order to simplify the discussion. The trade value is measured in terms of the exports of the commodities, whereas trade quantity is in weight in kilograms. All the variables, namely the GDP per capita, the labour participation rate, and capital formation were obtained from the Asian Development Bank.

After generating the index of Revealed Comparative Advantage (RCA) and export diversification, this study will be further carry on by analysing the collected data by using the Eviews 9.0 software. In order to examine the stationary properties of all of the variables under study, the non-stationary tests such as the Augmented Dickey-Fuller (ADF) and the Phillips-Peron (PP) unit root tests will be performed. Apart from that, the bounds test for cointegration and the ARDL test will be conducted using the Eviews 9.0 software. We can obtain the long-run estimates and the ECM from the ARDL model. Additionally, a series of diagnostic and stability tests, for example, the CUSUM and CUSUM squares stability tests will be employed to ascertain the appropriateness of the ARDL model.

3.7 Unit Root Tests

The earliest section of the analysis focuses on inspecting the nature of the data which encompasses testing for the order of integration of each variable that enters the comparative

advantage and the export diversification models. The unit root test results can determine the stationarity of the data.

3.7.1 Augmented Dickey-Fuller (1979) Unit Root Test⁹

The use of the Dickey-Fuller tests considers an AR(1) process at first:

$$y_t = \mu + \rho y_{t-1} + \varepsilon_t \quad (3.5)$$

where x_t are optional exogenous regressors which may consist of constant, or a constant and trend, μ and ρ are parameters and ε_t are assumed to be white noise. If $|\rho| \geq 1$, y is a non-stationary series and the variance of y increases steadily with time and goes to infinity. If $|\rho| < 1$, y is a (trend-) stationary series. Therefore, the hypotheses of a stationary series can be evaluated by testing whether the absolute value of ρ is strictly smaller than one. The null and alternative hypotheses for the unit root are $H_0: \rho=1$, $H_1: \rho<1$.

The standard DF test is carried out by estimating an equation with y_{t-1} subtracted from both sides of the equation:

$$\Delta y_t = \mu + \lambda y_{t-1} + \varepsilon_t \quad (3.6)$$

where $\lambda = \rho-1$ and the null hypothesis are:

⁹ The discussion in this section is adapted from EViews User's Guide, pp. 321-323.

$$H_0: \gamma = 0$$

$$H_1: \gamma < 0$$

In order to capture serial correlation, ADF used a parametric autoregressive. The degree of stationarity can be examined based on the critical value or the probability value. Meanwhile, the critical value depends on the size of the sample. As a result, the null hypothesis for this test is not rejected if the t-statistic is smaller than the critical value and the data is non-stationary. On the other hand, if the ADF's value is greater than the critical value, the null hypothesis is rejected and it reveals the data is stationary.

The ADF is evaluated using the conventional t-ratio for γ :

$$t_y = \hat{\gamma} / (se(\hat{\gamma}))$$

where $\hat{\gamma}$ is estimated of γ and $se(\hat{\gamma})$ represents the coefficient standard error. According to Dickey and Fuller (1979), this statistic does not follow the conventional t-distribution and they derived asymptotic outcome, and simulated critical values for the various tests as well as sample sizes under the null hypothesis of a unit root. Apart from that, MacKinnon (1991) implemented a large set of simulated Dickey-Fuller tests. He estimated the response surfaces for the simulation results, permitting the calculation of the Dickey-Fuller critical values and ρ -values for arbitrary samples sizes.

The simple Dickey-Fuller unit root test is valid only for the AR(1) process. The assumption of white noise disturbances ε_t is violated if the series is correlated at higher-order lags. Furthermore, the ADF test makes a parametric correction for higher-order correlation by assuming that the y series follows an AR(ρ) process and by adding ρ lagged difference terms to the dependent variable y to the right-hand side of the test regression.

The ADF controls for higher-order correlation by adding lagged difference terms of the dependent variables y to the right-hand side of the regression:

$$\Delta y_t = \mu + \gamma_{t-1} + \delta_1 \Delta y_{t-1} + \delta_2 \Delta y_{t-2} + \dots + \delta_p \Delta y_{t-p} + \varepsilon_t \quad (3.7)$$

The augmented specification is used to test:

$$\begin{aligned} H_0 : \gamma &= 0 \\ H_1 : \gamma &< 0 \end{aligned} \quad (3.8)$$

Fuller (1976) obtained important results that an asymptotic distribution of the t-ratio for γ is independent of the number of lagged first differences included in the ADF regression. Furthermore, the assumption y follows an autoregressive (AR) process may seem restrictive. Said and Dickey (1984) stated that the ADF test is asymptotically valid in the presence of a moving average (MA) component and provide the sufficient lagged difference terms are included in the test regression. An integrated variable of order one is a variable whose first

difference is stationary. The notation $I(1)$ is use to denote such a variable and $I(0)$ to denote a stationary variable. The term “levels” refer to the actual values of the variable y_t , (or x_t or u_t) and the term “differences” refer to first differences $\Delta y_t = (1 - L)y_t = y_t - y_{t-1}$. By definition, if y_t is $I(1)$, then Δy_t is $I(0)$. First differencing is appropriate for $I(1)$ time series, and time-trend regression on the other hand is appropriate for trend stationary $I(0)$ time series. Thus, the ADF test is designed to test whether the variables are either in $I(1)$, $I(0)$ or integrated of higher order (Sjö, 2011; Harrigan et al., 2002).

3.7.2 Phillips-Peron (PP) Unit Root Test

The Phillips-Peron (PP) unit root test was conducted in this study to serve as a robustness test on the result obtained from the ADF unit root test. Phillips and Peron (1988) developed numerous unit root tests that have turn out to be well known especially in the analysis of financial time series data. In general, the PP unit root tests differ from the ADF tests in how they deal with both serial correlation and the heteroskedasticity in the errors. Specifically, the PP tests ignore any serial correlation in the test regression, whereas the ADF tests use a parametric autoregression to approximate the ARMA structure of the errors in the test regression. The test regression for the PP tests is as below:

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + u_t \quad (3.9)$$

where u_t is $I(0)$ and may be heteroskedastic. The PP tests correct any serial correlation and heteroskedasticity in the errors u_t of the test regression by directly modifying the test statistics

$t_\pi = 0$ and $T\hat{\pi}$. These modified statistics, denoted Z_t and $Z\pi$ are given by:

$$Z_t = \left(\frac{\hat{\sigma}^2}{\hat{\lambda}^2} \right)^{1/2} \cdot t_\pi = 0 - \frac{1}{2} \left(\frac{\lambda^2 - \hat{\sigma}^2}{\lambda^2} \right) \cdot \left(\frac{T \cdot SE(\hat{\pi})}{\hat{\sigma}^2} \right)$$

The terms $\hat{\sigma}^2$ and $\hat{\lambda}^2$ are consistent estimates of the variance parameters:

$$\sigma^2 = \lim_{T \rightarrow \infty} T^{-1} \sum_{t=1}^T E[u_t^2]$$

$$\lambda^2 = \lim_{T \rightarrow \infty} \sum_{t=1}^T E[T^{-1} S_T^2]$$

where $S_T = \sum_{t=1}^T u_t$. The sample variance of the least squares residual $\hat{u}_t$ is a consistent estimate of σ^2 , and the Newey-West long-run variance estimate of u_t using $\hat{u}_t$ is a consistent estimate of λ^2 .

The PP Z_π statistics have similar asymptotic distributions to the ADF t-statistic and normalised bias statistics under the null hypothesis that $\pi = 0$. One of the advantages of the PP tests is that they are robust to general forms of heteroskedasticity in the error term u_t as compared to the ADF tests. In addition, the user does not have to indicate a lag length for the

test regression which is another added advantage of employing the PP tests. Moreover, Baharumshah et al. (2003) initiated that the PP tests are able to generalise the ADF procedure allowing for less restrictive assumptions and thus, nuisance parameters can be eliminated.

3.8 Bounds Testing Approach to Cointegration and Autoregressive-Distributed Lag (ARDL) Approach Model

The decision either to proceed with cointegration or not is made after utilising the unit root tests to examine the order of integration of each variable in the model. The conventional cointegration tests attributed to Johansen (1988) will be applied if the variables encompass the same order of integration. In contrast, the bounds testing approach to cointegration needs to be conducted if the results revealed that the series do not have the similar order of integration.

Pesaran et al. (2001) verified that the distribution of the F -statistic in the bounds tests is non-standard regardless of whether the regressors are $I(0)$ or $I(1)$, and have therefore tabulated the appropriate critical values. A pair of critical values which comprise of an upper as well as a lower bound, respectively are provided based on the number of regressors and on whether an intercept and or a time trend are included in the equation., The null hypothesis is clearly rejected if the F -statistic is greater than the upper bound and the conclusion is that a long-run link exists among the test variables. In contrast, if the F -statistic is smaller than the lower bound, the null hypothesis cannot be rejected and estimation can continue to assume that there is no long-run association. If the F -statistic falls between the two bounds, the result is, therefore, inconclusive. Nevertheless, although there is no cointegration found in the bounds test estimation, it does not

indicate that the variables employed in the study do not have a long-run relationship. This is because there is more superior test for cointegration-lagged ECT (Bahmani-Oskooee, 2001).

On the other hand, this study adopted the Autoregressive-Distributed Lag (ARDL) framework proposed by Pesaran and Shin (1995, 1999), Pesaran et al. (1996) and Pesaran (2001) to obtain the long-run estimates of the model and to establish the causation direction amongst variables. There are benefits of using the ARDL approach as compared to conventional cointegration methods such as Johansen and Juselius (1990). According to Pesaran and Shin (1995), the ARDL method engages only a single reduced form equation and on the other hand, the conventional cointegration method estimates the long-run relationship within the context of a system of equations. In addition, the ARDL approach does not involve pre-testing variables, which means that the test on the existence of a relationship between variables in levels is applicable irrespective of whether the underlying regressors are purely $I(0)$, purely $I(1)$ or a combination of both.

Apart from that, the ARDL method avoids the larger number of specification to be made in the standard cointegration test. This includes decisions concerning the number of endogenous and exogenous variables (if any) to be included, the treatment of deterministic elements and also the optimal number of lags to be specified. In practice, the empirical outcomes are usually very sensitive to the lag lengths and to the estimation procedure. The ARDL method enables different variables to have different optimal lags whereas this is unattainable with the standard cointegration test.

In addition, the ARDL method can identify the cointegration relation in small sample cases more efficiently as compared to the Engle-Granger, Johansen and Juselius procedures (Hoque & Yusop, 2010; Alam & Quanzi, 2003; Tang, 2003). This is particularly useful for limited sample data that range from 30 to 80 observations. Lastly, a dynamic error-correction model (ECM) can be derived from the ARDL model through a simple linear transformation. The ECM incorporates the short-run dynamics with the long-run equilibrium without losing the long-run information (Lan et al., 2010).

The ARDL model specification in this study can be represented by the following equation for the Revealed Comparative Advantage (RCA):

$$\begin{aligned} \Delta LRCA_t = & \alpha + \sum_{i=1}^p \beta_{1i} \Delta LRCA_{t-i} + \sum_{i=0}^p \beta_{2i} \Delta LPM_{t-i} + \sum_{i=0}^p \beta_{3i} \Delta LGDPC_{t-i} + \sum_{i=0}^p \beta_{4i} \Delta LLABOUR_{t-i} \\ & + \sum_{i=0}^p \beta_{5i} \Delta LCAPFORM_{t-i} + \beta_6 LRCA_{t-1} + \beta_7 LPM_{t-1} + \beta_8 LGDPC_{t-1} \\ & + \beta_9 LLABOUR_{t-1} + \beta_{10} LCAPFORM_{t-1} + \beta_{12} DUM_{t-1} + \varepsilon_t \end{aligned} \quad (3.10)$$

where,

Δ = Differencing of each of the variable

$LRCA_t$ = Log of indicator for the revealed comparative advantage for Malaysia at period t

LPM_t = Log of price for agricultural commodities in Malaysia at period t

$LGDPC_t$ = Log of the GDP per capita at period t

$LLABOUR_t$ = Log of the labour participation in the agriculture sector at period t

$LCAPFORM_t$	=	Log of capital formation in the agriculture sector at period t
DUM_t	=	Dummy variable to capture the global financial crisis which takes the value of “1” in year 2008, and “0” otherwise
α	=	Constant
ε_t	=	Error term
$\beta_1\beta_2\beta_3\beta_4\beta_5$	=	The estimated coefficients of the specified determinants of comparative advantage

On the other hand, the ARDL model specification for export diversification is shown as the following:

$$\begin{aligned}\Delta LDIV_t = & \alpha + \sum_{i=1}^p \beta_{1i} \Delta LDIV_{t-i} + \sum_{i=0}^p \beta_{2i} \Delta LGDPC_{t-i} + \sum_{i=0}^p \beta_{3i} \Delta LCAPFORM_{t-i} + \sum_{i=0}^p \beta_{4i} \Delta TOGDP_{t-i} \\ & + \beta_5 LDIV_{t-1} + \beta_6 LGDPC_{t-1} + \beta_7 LCAPFORM_{t-1} + \beta_8 LTOGDP_{t-1} + \beta_9 DUM_{t-1} + \varepsilon_t\end{aligned}\quad (3.11)$$

where,

Δ	=	Differencing of each of the variable
$LDIV_t$	=	Log of indicator for export diversification for Malaysia at period t
$LGDPC_t$	=	Log of the GDP per capita at period t
$LCAPFORM_t$	=	Log of capital formation in the agriculture sector at period t
$LTOGDP_t$	=	Log of trade openness to GDP at period t
DUM_t	=	Dummy variable to capture the dot-com bubble, which takes the value of “1” in year 2008, and “0” otherwise

α	=	Constant
ε_t	=	Error term
$\beta_1\beta_2\beta_3\beta_4$	=	The estimated coefficients of the specified determinants of export diversification

3.9 Error Correction based on ARDL Model

A dynamic error correction model (ECM) can be attained from a simple linear transformation from the ARDL model (Shahbaz, 2011; Banerjee et al., 1993). The ECM is capable of integrating short-run dynamics with the long-run equilibrium at the same time without losing the long-run equilibrium. The presence of an error correction representation is aroused when a long-run relationship among the variables exists. The following is the reduced form of the estimated ECM equation for the RCA and export diversification:

$$\begin{aligned}\Delta LRCA_t = & \alpha + \sum_{i=1}^p \beta_{1i} \Delta LRCA_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta LPM_{t-i} + \sum_{i=1}^p \beta_{3i} \Delta LGDPC_{t-i} + \sum_{i=1}^p \beta_{4i} \Delta LABOUR_{t-i} \\ & + \sum_{i=1}^p \beta_{5i} \Delta LCAPFORM_{t-i} + \sum_{i=1}^p \beta_{6i} DUM_{t-i} + \eta ECT_{t-1} + v_t\end{aligned}\quad (3.12)$$

$$\begin{aligned}\Delta LDIV_t = & \alpha + \sum_{i=1}^p \beta_{1i} \Delta LDIV_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta LGDPC_{t-i} + \sum_{i=1}^p \beta_{3i} \Delta LCAPFORM_{t-i} \\ & + \sum_{i=1}^p \beta_{4i} \Delta LTGDP_{t-i} + \sum_{i=1}^p \beta_{5i} DUM_{t-i} + \eta ECT_{t-1} + v_t\end{aligned}\quad (3.13)$$

where,

ECT_{t-1} = Lagged Error correction term

v_t = Disturbance term

The ECT is among a set of cointegrated series that changes the response variable as a function of both the disequilibrium levels in the cointegrating relationship which is denoted by the ECM and the changes in the other explanatory variables. Generally, the ECT coefficient illustrates the speed of adjustment from short-run to long-run equilibrium and it should be statistically significant with a negative sign (Shahbaz, 2011; Pahlavani, 2005). According to Bannerjee et al. (1998), significant lagged error term with a negative sign is a means to confirm that the established long-run relationship is stable.

3.10 Diagnostic Tests

A series of diagnostic and the stability tests will be carried out to determine the suitability and to ensure the robustness of the ARDL model (Shrestha & Chowdhury, 2005). In addition, Shahbaz (2011) also reported that diagnostic and stability tests are utilised to ascertain the goodness-of-fit of the ARDL model. Particularly, the model is inspected for serial correlation, functional form, normality as well as heteroskedasticity. In contrast, stability tests are performed by utilising the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMsq). The purpose of the stability tests is to examine if the obtained parameters are stable over time throughout the sample period of

the study. A stable and well-fitted model is imperative to generate a credible result for policy makers.

CHAPTER 4

EMPIRICAL RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the empirical results of the statistical analysis and its interpretation. The results of the Revealed Comparative Advantage (RCA) and the export diversification of the agricultural products in Malaysia are presented in this chapter. This chapter starts with a discussion on the RCA results for agricultural products in Malaysia. Subsequently, the export diversification results for Malaysian agriculture sector will be discussed.

It is followed by the Augmented Dickey-Fuller (ADF) and the Phillips-Peron (PP) unit root test results will be presented to observe the order of integration of each of the variables that enter the RCA and the export diversification of the agricultural products models. In addition, empirical testing procedures such as the bounds testing approach to cointegration, the Autoregressive-Distributed Lag (ARDL) model and error correction based on the ARDL model were performed to identify the relationship between the comparative advantage with its determinants as well as the association of the export diversification with a set of its contributing factors. Lastly, a diagnostic check was carried out to scrutinise the goodness-of-fit of the model. The empirical analysis utilised time series data namely, the index of RCA, the index of export diversification, the local price of commodities, the GDP per capita, the labour participation rate, capital formation and trade openness. Moreover, there was also the inclusion of a dummy variable for the comparative advantage and the export diversification model in order to capture the 2008 global financial crisis and the 2002 dot-com bubble, accordingly.

4.2 Revealed Comparative Advantage Measurement Results

In general, a country has a comparative advantage in the exportation of a commodity if the RCA index is greater than one. This also indicates that a country produces those goods in which it is relatively efficient in cost. However, according to Arip et al. (2013, p. 141), a commodity does not necessary have a higher share of export although it has a higher RCA index. This is because the RCA index is obtained from two sets of relative export value, which consist of the relative export values of a country and the relative export performance of the world. Therefore, the pattern of the RCA index is overlooked of its contribution to the national export income but depending on the relative size of demand and supply in both the national as well as international market.

Appendix A shows the list of 186 agricultural related commodities in Malaysia and on the other hand, Appendix B illustrates the RCA measurement results for agricultural commodities, Malaysia-World from year 1988 to 2014. The cells highlighted showed the comparative advantage indexes that are greater than one ($RCA > 1$). By using Formula (1.1), Appendix B displays the results of the RCA measurement for 186 agriculture related commodities from the year 1988 to 2014. As a whole, the RCA results showed that only 56 agriculture related commodities have an RCA index that is greater than one during the empirical period. The results of agricultural commodities with RCA index greater than one has been summarised in Table 4.1. It includes the products with SITC code S3-01689, S3-03414, S3-03611, S3-03633, S3-03637, S3-03713, S3-03715, S3-03721, S3-04719, S3-04812, S3-04813, S3-05452, S3-05483, S3-05645, S3-05647, S3-05648, S3-05729, S3-05779, S3-05791, S3-05795, S3-05798, S3-05893, S3-06194, S3-07131, S3-07132, S3-07231, S3-07232, S3-07511, S3-07512, S3-07523, S3-07524, S3-07527, S3-08138, S3-09811, S3-09891, S3-09894, S3-

12232, S3-12239, S3-23121, S3-23125, S3-23129, S3-24502, S3-26331, S3-26339, S3-26873, S3-29232, S3-29299, S3-42119, S3-42179, S3-42229, S3-42231, S3-42239, S3-42241, S3-42249, S3-43131 and S3-43133. The results clearly revealed that Malaysia had a comparative advantage in the exportation of these products. However, not all of these agriculture related commodities have had a comparative advantage throughout the 27 year period. For example, the commodity with SITC code S3-01689 (other meat and edible meat offal salted, in brine, dried or smoked; edible) had a comparative advantage only in the years 1993 and 1994 with a generated index of 1.089 and 1.041, respectively (See Appendix B).

Furthermore, the results also revealed that Malaysia was competitive in the production of the commodity with SITC code S3-03611 (shrimps and prawns, frozen) in 1988. However, Malaysia had a comparative disadvantage in the exportation of this agriculture product for the following 11 years. This is consistent with the past findings of Tada and Ono (2008) who discovered that the comparative advantage of shrimp production had been declining. Nevertheless, the RCA index upsurged from 1.033 in 2000 to 1.129 in 2001, and then further declined to 1.029 in 2014. Besides, the commodity with SITC code S3-04813 (Other rolled or flaked cereal grains, except rice of subgroup 042.3) has a comparative advantage throughout the years, except for 2014. In contrast, the RCA index for some of the agricultural commodities is lower than one in the estimated period as depicted in Appendix B. As a result, this showed that Malaysia had a comparative disadvantage in the exportation of these agriculture products.

Table 4.1: Results of Agricultural Products with Revealed Comparative Advantage

S#-016	Meat and edible meat offal, salted, in brine, dried or smoked; edible flours and meals of meat or meat offal
	S3-01689
S#-034	Fish, fresh (live or dead), chilled or frozen
	S3-03414
S#-036	Crustaceans, molluscs and aquatic invertebrates, whether in shell or not, fresh (live or dead), chilled, frozen, dried, salted or in brine; crustaceans, in shell, cooked by steaming or boiling in water, whether or not chilled, frozen, dried, salted or in brine; flours, meals and pellets of crustaceans or of aquatic invertebrates, fit for human consumption
	S3-03611
	S3-03633
	S3-03637
S#-037	Fish, crustaceans, molluscs and other aquatic invertebrates, prepared or preserved, n.e.s.
	S3-03713
	S3-03715
	S3-03721
S#-047	Other cereal meals and flours
	S3-04719
S#-048	Cereal preparations and preparations of flour or starch of fruits or vegetables
	S3-04812
	S3-04813
S#-054	Vegetables, fresh, chilled, frozen or simply preserved (including dried leguminous vegetables); roots, tubers and other edible vegetable products, n.e.s., fresh or dried
	S3-05452
	S3-05483
S#-056	Vegetables, roots and tubers, prepared or preserved, n.e.s.
	S3-05645
	S3-05647
	S3-05648
S#-057	Fruit and nuts (not including oil nuts), fresh or dried
	S3-05729
	S3-05779
	S3-05791
	S3-05795
	S3-05798
S#-058	Fruit, preserved, and fruit preparations (excluding fruit juices)
	S3-05893
S#-061	Sugars, molasses and honey
	S3-06194
S#-071	Coffee and coffee substitutes
	S3-07131
	S3-07132
S#-072	Cocoa
	S3-07231
	S3-07232

Table 4.1 continued

S#-075	Spices
	S3-07511
	S3-07512
	S3-07523
	S3-07524
	S3-07527
S#-081	Feeding stuff for animals (not including unmilled cereals)
	S3-08138
S#-098	Edible products and preparations, n.e.s.
	S3-09811
	S3-09891
	S3-09894
S#-122	Tobacco, manufactured (whether or not containing tobacco substitutes)
	S3-12232
	S3-12239
S#-231	Natural rubber, balata, gutta-percha, guayule, chicle and similar natural gums, in primary forms (including latex) or in plates, sheets or strip
	S3-23121
	S3-23125
	S3-23129
S#-245	Fuel wood (excluding wood waste) and wood charcoal
	S3-24502
S#-263	Cotton
	S3-26331
	S3-26339
S#-268	Wool and other animal hair (including wool tops)
	S3-26873
S#-292	Crude vegetable materials, n.e.s.
	S3-29232
	S3-29299
S#-421	Fixed vegetable fats and oils, "soft", crude, refined or fractionated
	S3-42119
	S3-42179
S#-422	Fixed vegetable fats and oils, crude, refined or fractionated, other than "soft"
	S3-42229
	S3-42231
	S3-42239
	S3-42241
	S3-42249
S3-431	Animal or vegetable fats and oils, processed; waxes; inedible mixtures or preparations of animal or vegetable fats or oils, n.e.s.
	S3-43131
	S3-43133

Specifically, the results as shown in Appendix B also revealed that only 10 products have a comparative advantage throughout the analysis period from 1988 to 2014, namely products with SITC code S3-07511, S3-08138, S3-23125, S3-42119, S3-42229, S3-42239, S3-42241, S3-42249, S3-43131 and S3-43133. However, the RCA index of the aforementioned commodities revealed an inconsistent trend during the period of analysis. For example, the RCA index of S3-07511 showed that it decreased from 6.782 in 1988 to 4.886 in 1999. The RCA index then increased about 0.146 to 5.032 in 2000 and it declined further to 1.616 in 2013. This is owing to the fluctuation of price of pepper where the global demand exceeds the supply (Ministry of Plantation Industries and Commodities [MPIC], (2016). According to MPIC (2016), pepper recorded a huge amount at over RM500 million in 2015 as it is used for a lot of things. For instance, Malaysia exports pepper to Japan, China and Taiwan in which these countries emphasised a lot on the quality of the products. Therefore, innovation in pepper is needed in order to ensure that it has the quality to increase value-added and to be competitive in the export market.

In 1988, the commodity with SITC code S3-23125 had the highest RCA index which was 22.086. This indicated that Malaysia had a higher comparative advantage on the exportation of S3-23125 in 1988 as compared to all other agricultural related products. This is due to the popularity of rubber and demand for rubber increased especially for its compatible ramin wood which was short in supply during late 1980s (Lembaga Getah Malaysia, 2011). Despite the fact that value-added elements exist in rubberwood, the price of rubber remained low and this has contributed to the competitiveness of rubber. In addition, the RCA index for S3-42241 dropped tremendously after year 1991 and only increased from 11.494 in 2013 to 14.270 in 2014. Therefore, this finding showed that there is possibility of shifting these

commodities further into downstream processing as the index indicated comparative advantage existed.

Moreover, Appendix B illustrated that Malaysia documented high RCA indices namely for products with SITC code S3-08138 (oilcake and other solid residues of oil from palm nuts or kernel), S3-42229 (palm oil, refined, and its fractions) and S3-42249 (palm kernel or babassu oil, refined, and fractions thereof) as compared to other agricultural commodities throughout the study period. This is clear since Malaysia is one of the major producers as well as exporters of palm oil. According to the Malaysia Palm Oil Council (2013), Malaysia recorded a number of 39 percent of world palm oil production and 44 percent of world exports. However, Arip et al., (2013) indicated that being one of the largest producers of crude and refined palm oil does not necessarily lead to diversification and expansion or specialisation in the agriculture industry which brings about higher value-added products. According to Arip et al., (2013), it is essential for the agriculture sector to move from the low to high value-added sector from time to time in order to sustain the long-term development of the agriculture sector. In the case of the palm oil industry, its comparative advantage can be retained by diversifying from upstream to a broader scope of downstream industrial products that will add higher value-addition to the content.

In order to simplify the discussion, Table 4.2 showed the results of the Malaysia-world total trade value of comparative advantage and disadvantage for agricultural products based on SITC Revision 3 (3-digits code). A total of 40 agricultural products based on the 3-digits code has been identified (see Appendix C for the list of agricultural commodities). The results in Table 4.2 revealed that Malaysia has the highest number of commodities with a comparative advantage in the exportation of products S3-422 (Fixed vegetable fats and oils, crude, refined

or fractioned, other than “soft”) in 1990. Specifically, the commodities that fall under this group are S3-42249, S3-42241, S3-42239, S3-42231 and S3-42229. The RCA indexes of the aforementioned commodities are 29.636, 24.606, 5.285, 4.186 and 31.887 (see Appendix B), accordingly, with a total trade value of US\$1578.5 million in 1990 as depicted in Table 4.2. However, the results revealed that the number of commodities that showed a comparative advantage has declined to only 4 commodities which are S3-42249, S3-42241, S3-42239 and S3-42229 in 1995 with RCA indexes of 31.933, 3.516, 2.852 and 30.811, respectively (see Appendix B) with a trade value of US\$3789.3 million as shown in Table 4.2. By looking back at the comparative advantage of agricultural products, it is noticeable that most of the agricultural products that fall under S3-422 are still at the refining stage although Malaysia is one of the largest producer of S3-422. This means that Malaysia do not produce the commodity further into end product such as cosmetics, soaps or detergents. Therefore, to further enhance the export competitiveness requires shifting the production process from upstream to downstream processing so as to create higher value-added.

In 2010, the RCA index for S3-42249, S3-42241, S3-42239 and S3-42229 were 21.096, 3.588, 4.840 and 18.627, respectively (see Appendix B) with a trade value amounting to US\$1104.9 million in Table 4.2. Such circumstance is due to lack of competitiveness which has reduced the exportation of these commodities. Although the volume of total trade had increased tremendously after 2010, the value of the RCA index is in a decreasing trend. For example, Appendix B showed that the RCA index for S3-42249 declined from 2010 to 2014. Thus, this indicated that there exists potential to develop the commodity into high value-added products in order to increase the export competitiveness. As for commodity S3-42241, the RCA index increased throughout the years from 2010 to 2014. Nevertheless, the increase in the value

of the RCA index did not necessarily mean that the sector was performing well. This is because high RCA values do not inevitably entail that countries manage to utilise their potential (Nilsson, et al., 2007). Furthermore, Welfens et al. (2009) stated that a booming export market also does not reflect the competitiveness of a country or that it is dealing well with the challenges of structural change.

As illustrated in Table 4.2, Malaysia has the greatest level of comparative disadvantage in the exportation of products S3-054, S3-056 as well as S3-057. There are 17 commodities under the subgroup of S3-054 that have a comparative disadvantage which is accompanied by an increasing total volume of trade between the five-year gap from 1990. As for commodity S3-056 (Vegetables, roots and tubers, prepared or preserved, n.e.s.), the total trade volume increased by more than double to US\$7.9 million in 1995 as compared to US\$3.2 million in 1990 although the number of commodities with a comparative advantage remained the same. Besides, the estimated analysis showed that there were 3 commodities with a comparative advantage in the year 2000 as compared to a total of 12 commodities that discovered a comparative disadvantage in the exportation of S3-056 as the RCA value was less than one (see Appendix B and Table 4.2). Nevertheless, the trade volume showed a difference of US\$2.7 million between 1995 and 2000 where the trade value decreased from US\$7.9 million in 1995 to US\$5.2 million in 2000. Furthermore, Malaysia was left with only one commodity that had a revealed comparative advantage in 2005, 2010, 2011, 2012, 2013 and 2014 (see Table 4.2). In contrast, commodities that fell under the sub-group of S3-056 had recorded a number of 14 commodities with comparative disadvantage where the trade value continues to expand except for 2014. The reason for such findings is that Malaysia still depends on the import of agricultural products for fruits and vegetables from other countries to meet the demand of its

local market while Malaysia is actually capable of producing most of the vegetables it imports (Ruban, 2016). Therefore, it is crucial to move from upstream production of basic agricultural products to downstream production of value-added products in order to boost the exportation in agriculture.

The commodity with SITC code S3-057 (Fruit and nuts [not including oil nuts], fresh or dried) illustrated that a comparative advantage only existed in 1990, 1995, 2000 and 2005, whereas the number of commodities that indicated a comparative disadvantage increased from 16 in 2005 to 17 commodities from 2010 onwards. There were 3 commodities with a comparative advantage in 1990 that are categorised in the subgroup of S3-057, namely S3-05798, S3-05795 and S3-05791 with an RCA value of 1.249, 1.227 and 1.049 accordingly (see Appendix B). The trade value as depicted in Table 4.2 for S3-057 in 1990 was US\$47.0 million, and this amount declined to US\$33.8 million in 1995 when it was left with one commodity with an improvement of 1.246 in terms of its comparative advantage for S3-05791 (see Appendix B). In 2000, the RCA index as illustrated in Appendix B for S3-05798 and S3-05791 were 1.142 and 1.594, respectively with a total trade value of US\$63.2 million as shown in Table 4.2. Furthermore, the results in Table 4.2 showed that the total trade of comparative disadvantage increased in its value in 1990 and 1995. It then dropped to US\$16.6 million in 2000 and increased further in 2005, 2010 until it reached an amount of US\$126.2 million in 2014. This is due to the fruits commodity could be experienced shortage of supply and this reduce the opportunity for Malaysia to penetrate the market for exportation to fulfil the insufficient domestic demand (Abdul Rahim, 2014).

As a whole, the results illustrated that a high RCA index does not signify the real performance of the commodities without taking into account the trade volume. This is because exports of these products are mostly as raw and unprocessed commodities that do not contribute much value-added, in spite of the fast-growing volume of export. Therefore, Malaysia needs to move from the export of raw materials to the export of processed products in order to increase the value-added element of the commodity (Le, 2010).

As discussed earlier on, there are 56 agricultural related commodities showed comparative advantage but not throughout the 27 years from 1988 to 2014. However, once the trend in comparative advantage are rectified in the commodities, this hints the possibility of commodity to be developed further. This is because the trend of comparative advantage showed the potential of commodities to be developed by diversifying commodities into high value-added output. This can be done by injecting funds for research and development to increase export competitiveness. Besides, industrial crop is commodities that is run by private sector and on the other hand, food crop is commodities that yet to be given focus by industrial sector where it is run by smallholder. Therefore, if these commodities with comparative advantage can be develop further since it has the potential, this can help to eradicate poverty as well as boost the export performance for agriculture.

Furthermore, the production of S3-011, S3-012, S3-016 that falls under livestock and S3-022 (Milk and cream), and S3-024 (Cheese and curd) showed comparative disadvantage with increasing trade value. This is because livestock in Malaysia are raised in small scale where it is unable to meet the local demand (Mohamed, 2007). Therefore, Malaysia still depends on the import of milk, beef and mutton which upsurges the trade balance of food products, and it

is forecasted to have deficit trade balance in 2020 which will be amounted to 3,615,000 tonnes (Sahar and Chamburi, 2016). Thus, this clearly shows that Malaysia is highly dependent on the import of livestock, and milk and cheese products.

Table 4.2: Total Trade value of Comparative Advantage and Disadvantage for Agricultural Products, Malaysia-World Results
(US\$ million)

Commodity Code	Year																	
	1990		1995		2000		2005		2010		2011		2012		2013		2014	
	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.
S3-011		1 (5.6)		1 (2.2)		1 (2.2)		1 (4.0)		1 (14.3)		1 (14.6)		1 (12.1)		1 (11.5)		1 (8.4)
S3-012		2 (0.3)		2 (5.1)		2 (3.1)		2 (1.8)		2 (5.3)		2 (6.7)		2 (7.9)		2 (10.0)		2 (9.1)
S3-016		1 (0.006)		1 (1.5)		1 (0.1)		1 (0.3)		1 (0.674)		1 (0.9)		1 (0.7)		1 (0.5)		1 (0.4)
S3-022		2 (25.5)		2 (44.7)		2 (38.8)		2 (89.6)		2 (84.2)		2 (112.7)		2 (126.1)		2 (158.2)		2 (235.6)
S3-024		1 (0.006)		1 (0.1)		1 (0.2)		1 (0.036)		1 (0.631)		1 (0.8)		1 (0.5)		1 (0.5)		1 (0.2)
S3-034	1 (6.8)	9 (18.8)		10 (30.6)		10 (18.7)		10 (60.3)		10 (98.9)		10 (98.5)		10 (103.0)		10 (101.8)		10 (97.2)
S3-035		4 (2.0)		4 (1.8)		4 (3.1)		4 (3.3)		4 (3.9)		4 (12.9)		4 (9.1)		4 (4.8)		4 (5.6)
S3-036	2 (22.3)	4 (83.4)		6 (149.5)	1 (165.0)	5 (42.9)	2 (342.2)	4 (17.2)	1 (357.7)	5 (438.5)		6 (517.4)		6 (434.7)		6 (397.4)	1 (371.2)	5 (89.0)
S3-037	1 (49.3)	6 (25.9)	1 (46.1)	6 (67.2)		7 (74.5)		7 (93.3)		7 (100.6)		7 (116.5)		7 (133.8)		7 (134.5)		7 (147.8)
S3-042		1 (0.016)		1 (0.4)		1 (0.028)		1 (0.952)		1 (0.303)		1 (0.3)		1 (0.2)		1 (6.2)		1 (18.0)
S3-045		1 (0.035)		1 (0.1)		1 (0.1)		1 (0.037)		1 (0.125)		1 (0.1)		1 (0.063)		1 (0.1)		1 (0.1)
S3-047		3 (0.7)		3 (1.3)		3 (1.7)		3 (1.3)		3 (2.5)		3 (3.0)		3 (3.4)		3 (3.6)		3 (6.2)
S3-048	1 (3.5)	6 (32.3)	1 (5.6)	6 (107.5)	2 (15.2)	5 (113.1)	1 (5.0)	6 (204.8)	1 (16.3)	6 (373.3)	1 (16.7)	6 (453.2)	1 (16.8)	6 (475.3)	1 (18.3)	6 (496.5)		7 (614.6)
S3-054	1 (1.2)	16 (25.0)		17 (37.6)		17 (46.8)		17 (86.1)		17 (110.7)		17 (118.5)		17 (109.5)		17 (143.9)		17 (123.9)
S3-056	2 (3.2)	13 (14.9)	2 (7.9)	13 (15.7)	3 (5.2)	12 (14.1)	1 (5.2)	14 (22.6)	1 (10.4)	14 (56.7)	1 (16.6)	14 (68.8)	1 (14.0)	14 (79.3)	1 (14.6)	14 (76.4)	1 (15.5)	14 (62.2)

Notes: The figures above (...) refer to the number of commodities with Comparative Advantage (C.A.) and Comparative Disadvantage (C.D.). The figures in (...) refer to the total trade value.

Source: Computed and tabulated based on the UN Comtrade database, 2015.

Table 4.2 continued

Commodity Code	Year																	
	1990		1995		2000		2005		2010		2011		2012		2013		2014	
	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.
S3-057	3 (47.0)	14 (5.4)	1 (33.8)	16 (27.7)	2 (63.2)	15 (16.6)	1 (1.4)	16 (68.5)		17 (76.5)		17 (80.5)		17 (79.4)		17 (108.0)		17 (126.2)
S3-058	1 (29.1)	2 (0.099)	1 (22.9)	2 (0.092)		3 (8.7)		3 (11.2)		3 (10.4)		3 (10.8)		3 (6.8)		3 (6.7)		3 (6.9)
S3-059		1 (1.0)		1 (1.6)		1 (2.5)		1 (7.4)		1 (15.4)		1 (21.4)		1 (22.9)		1 (13.3)		1 (9.6)
S3-061		7 (89.6)	1 (1.2)	6 (47.2)		7 (68.9)		7 (103.4)		7 (198.9)		7 (233.5)		7 (200.2)		7 (195.7)		7 (172.2)
S3-062		2 (13.9)		2 (30.8)		2 (22.6)		2 (19.8)		2 (54.4)		2 (63.1)		2 (72.6)		2 (80.8)		2 (82.5)
S3-071		3 (3.4)		3 (16.4)	1 (38.1)	2 (1.5)	1 (71.4)	2 (2.6)	2 (240.9)	1 (2.6)	1 (306.3)	2 (6.4)	1 (378.1)	2 (7.1)	2 (404.8)	1 (4.1)	1 (394.6)	2 (5.2)
S3-072	1 (4.5)	1 (1.6)	1 (4.8)	1 (4.9)	2 (17.6)		2 (40.1)		2 (149.8)		2 (228.5)		2 (157.1)		2 (117.8)		2 (127.8)	
S3-074		5 (1.9)		5 (1.5)		5 (2.8)		5 (8.5)		5 (15.0)		5 (18.3)		5 (24.0)		5 (30.7)		5 (35.3)
S3-075	2 (44.5)	8 (4.0)	2 (41.3)	8 (2.4)	3 (97.6)	7 (6.0)	2 (32.2)	8 (17.5)	2 (62.1)	8 (32.2)	2 (93.5)	8 (35.1)	2 (79.5)	8 (34.5)	1 (77.4)	9 (41.8)	2 (124.4)	8 (29.8)
S3-081	1 (92.7)	8 (10.8)	1 (103.1)	8 (26.8)	1 (59.9)	8 (34.7)	1 (8.4)	8 (58.0)	1 (20.3)	8 (113.5)	1 (299.6)	8 (141.2)	1 (295.9)	8 (191.0)	1 (376.8)	8 (176.8)	1 (366.6)	8 (170.8)
S3-091		1 (2.7)		1 (6.7)		1 (5.5)		1 (7.9)		1 (20.9)		1 (27.5)		1 (23.9)		1 (19.2)		1 (23.3)
S3-098		7 (26.3)	2 (75.5)	5 (10.4)	1 (41.8)	6 (29.6)	1 (87.0)	6 (49.0)	1 (309.4)	6 (124.6)	1 (382.9)	6 (143.0)	1 (487.3)	6 (154.0)	1 (538.8)	6 (188.7)	1 (545.5)	6 (227.0)
S3-122		2 (1.9)	1 (19.0)	1 (2.6)	1 (48.0)	1 (10.9)	1 (43.8)	1 (7.6)	1 (32.3)	1 (72.8)	1 (47.7)	1 (84.0)	1 (113.5)	1 (73.0)	1 (110.8)	1 (10.9)	1 (105.5)	1 (3.5)
S3-211		1 (1.1)		1 (1.5)	1 (6.9)			1 (3.3)		1 (5.0)		1 (6.6)		1 (11.7)		1 (10.0)		1 (8.9)
S3-222		2 (0.048)		2 (0.2)		2 (0.4)		2 (2.3)		2 (2.0)		2 (3.2)		2 (2.3)		2 (0.7)		2 (0.2)

Notes: The figures above (...) refer to the number of commodities with Comparative Advantage (C.A.) and Comparative Disadvantage (C.D.). The figures in (...) refer to the total trade value.

Source: Computed and tabulated based on the UN Comtrade database, 2015.

Table 4.2 continued

Commodity Code	Year																	
	1990		1995		2000		2005		2010		2011		2012		2013		2014	
	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.	C.A.	C.D.
S3-231	3 (912.9)		3 (1406.6)		2 (583.0)	1 (6.6)	1 (1411.8)	2 (21.8)	1 (2647.4)	2 (47.6)	1 (4110.1)	2 (26.0)	1 (2382.7)	2 (34.9)	2 (2089.6)	1 (30.8)	2 (1293.9)	1 (15.6)
S3-245	1 (2.9)		1 (9.4)		1 (12.8)		1 (12.3)		1 (20.1)		1 (23.3)		1 (21.7)		1 (20.0)		1 (20.4)	
S3-263		2 (2.2)	1 (5.2)	1 (4.8)	1 (1.1)	1 (3.2)	1 (1.7)	1 (3.9)		2 (8.4)		2 (9.1)		2 (8.1)		2 (9.0)		2 (1.9)
S3-268	1 (37.5)	1 (1.2)		2 (46.3)		2 (2.3)		2 (11.4)	1 (4.9)	1 (12.2)		2 (33.0)		2 (29.1)	2 (47.6)		2 (52.3)	
S3-291		4 (1.6)		4 (5.5)		4 (6.7)		4 (6.6)		4 (6.4)		4 (9.7)		4 (6.9)		4 (13.1)		4 (7.4)
S3-292	1 (5.8)	9 (1.6)	1 (13.3)	9 (0.8)	1 (2.7)	9 (1.1)	1 (1.0)	9 (3.8)	2 (24.8)	8 (6.5)	1 (41.7)	9 (8.1)	2 (47.6)	8 (9.4)	2 (48.6)	8 (11.2)	2 (79.4)	8 (10.9)
S3-411		1 (0.010)		1 (0.047)		1 (0.1)		1 (0.1)		1 (0.6)		1 (1.3)		1 (0.5)		1 (1.7)		1 (0.6)
S3-421	2 (27.3)	2 (6.1)	1 (57.5)	3 (37.9)	1 (75.8)	3 (13.0)	1 (57.9)	3 (32.8)	1 (140.3)	3 (47.4)	1 (180.1)	3 (74.9)	1 (175.3)	3 (80.9)	1 (146.2)	3 (76.9)	1 (149.9)	3 (81.4)
S3-422	5 (1578.5)	1 (1.0)	4 (3789.3)	2 (21.7)	5 (2470.8)	1 (3.5)	5 (4184.0)	1 (2.0)	4 (1104.9)	2 (28.3)	4 (15147.7)	2 (50.1)	4 (11896.4)	2 (44.6)	4 (10134.6)	2 (21.7)	5 (9614.3)	1 (13.1)
S3-431	2 (121.9)	1 (0.1)	2 (492.4)	1 (0.2)	2 (391.2)	1 (0.1)	2 (665.3)	1 (0.004)	2 (1190.7)	1 (1.3)	2 (1654.0)	1 (1.6)	2 (1366.7)	1 (2.0)	2 (129.5)	1 (1.3)	2 (1464.7)	1 (1.7)

Notes: The figures above (...) refer to the number of commodities with Comparative Advantage (C.A.) and Comparative Disadvantage (C.D.). The figures in (...) refer to the total trade value.

Source: Computed and tabulated based on the UN Comtrade database, 2015.

4.3 Export Diversification Measurement Results

In order to shield from the unforeseen changes in terms of trade, a lot of developing countries have taken export diversification as a deliberate growth strategy. The concept of export diversification explains an inverse relationship between the export diversification index and the degree of export diversification as a whole. For example, the higher the export diversification index, the lower the export diversification degree. In other words, a smaller value of the standard deviation shows a higher level of export diversification and vice versa.

Figure 4.1 shows the relative export diversification measured for Malaysia, based on the method expressed in Formula (1.4). Based on Figure 4.1, it illustrates that the export diversification index in the year 2012 is the lowest throughout the empirical period from 1988 to 2014, which is 2.0. This indicates that Malaysia had diversified its export structure for agriculture products in the year 2012. This is due to the implementation of Economic Transformation Programme which focusses on 12 national key economic areas in the tenth Malaysia plan where agriculture was one of the identified economic area. According to EPU (2010), effort has been placed on high value agriculture activities in tenth Malaysia plan which was commenced in 2011 to 2010 to develop new products by diversifying into higher value added outputs that contribute to the export performance in agriculture.

On the other hand, export diversification in the year 2001 is at the highest level, which is 5.3. This revealed the lowest degree of export diversification of agricultural products in Malaysia during this year. In other words, Malaysia had experienced less diversification instead of specialisation in its export structure for agricultural products in year 2001. Such consequences were due to the low supply of palm oil since August 2001 and palm oil prices

averaged RM944 per tonne. Low price of palm oil prompted the government to introduce incentive to reduce the supply of palm oil by reducing the existing stocks and encouraging replanting. As such, this has affected the level of diversification in 2001 since Malaysia is one of the major producers and exporters of palm oil. Besides, the dot-com bubble collapse has caused huge losses for investors in equity markets and during this time, the investment in commodity markets started to rise. Nevertheless, investors who had invested and suffered losses in equity market have limited capital to re-invest in the commodity market and at the end of the boom, there is no higher value production which impede the ability to improve the development of agriculture (Mayer, 2010; Buysse & Vincent, 2015).

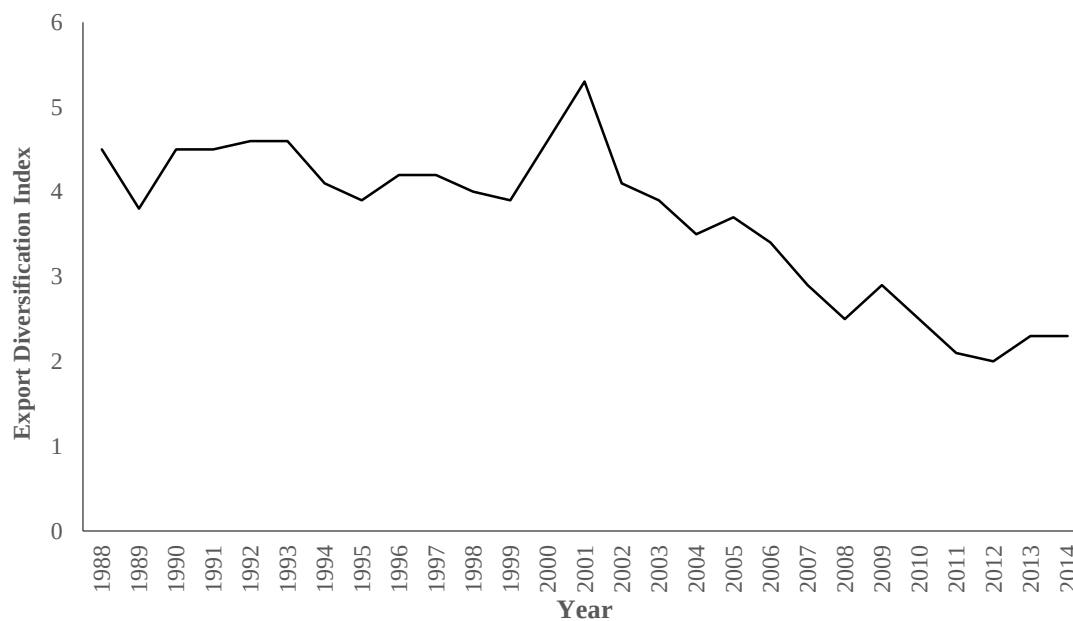


Figure 4.1: Export Diversification Index of Agriculture in Malaysia, 1988-2014 (Computed and tabulated based on the UN Comtrade Database, 2015)

4.4 Unit Root Test Results

The first step of the empirical testing procedure focused on investigating the nature of the data which also encompassed testing the order of integration of each of the variables that enter the comparative advantage and the export diversification models. The results of the unit root tests conducted to determine whether the data are stationary or non-stationary or whether the variables built in this study are integrated at $I(0)$ or $I(1)$ or a combination of both.

4.4.1 Augmented Dickey-Fuller (1979) Unit Root Test Results

Before determining the most appropriate approach in analysing the data to eradicate spurious problems in regressions when using non-stationary times series, the stationary properties of the time series data need to be tested. The null hypothesis under the ADF unit root test is that a time series variable appears to be non-stationary at a level as compared to the alternative of stationary. The optimal lag length in the ADF unit root test in this study was selected using the Schwarz Information Criterion (SIC). This is because SIC has relatively better performance in lag choice accuracy (Hacker and Hatemi, 2008).

The results of the ADF unit root test are presented in Table 4.3. Firstly, the trend and intercept of the variables will be estimated. Then, we will check on whether the trend of the variable is significant or not significant. If the result shows the trend is significant, then we will proceed with trend and intercept which means trend is needed. On the other hand, if the trend of the variable is not significant, we drop and estimate again with trend and intercept and take this as the outcome. The results disclosed that at the level form with intercept, LLABOUR is found to be stationary at the 5 percent level, while the LTOGDP variable is stationary at the level form with trend and intercept indicating the existence of $I(0)$ variable in the model. In

contrast, the null hypothesis of non-stationary can be rejected at first difference when the t-statistic value is negative and statistically significant at 5 percent significance level. In view of this, the ADF unit root test results indicated that the selected variables in this study are in a combination of $I(0)$ and $I(1)$ processes.

Table 4.3: Augmented Dickey-Fuller (ADF) Unit Root Test Results

Series	Level		First difference	
	Trend & intercept	Intercept	Trend & intercept	Intercept
LRCA	-2.853(0)	-	-	-4.956(1)***
LDIV	-2.085(0)	-	-	-4.495(2)***
LPM	-	-1.634(0)	-	-6.989(0)***
LGDPC	-2.196(0)	-	-	-4.758(0)***
LLABOUR		-3.084(0)**	-	-
LCAPFORM	-	-2.647(0)	-	-4.057(0)***
LTOGDP	-3.873(0)**	-	-	-

Notes: Asterisks (**) and (***) indicate significant at the 5% and 1% levels, respectively. LRCA = natural log of index of revealed comparative advantage, LDIV = natural log of index of export diversification, LPM = natural log of price of agricultural commodities in Malaysia, LGDPC = natural log of GDP per capita, LLABOUR = natural log of labour participation rate in agriculture sector, LCAPFORM = natural log of capital formation in agriculture sector and LTOGDP = natural log of trade openness.

4.4.2 Phillips-Peron(PP) Unit Root Test Results

Other than the ADF unit root test, the PP unit root test was conducted to test the order of integration of the time series data. The outcomes of the PP test are presented in Table 4.4. Similarly to the ADF test results, a mixture of $I(0)$ and $I(1)$ time series data in the PP test results are found. LLABOUR appeared to be stationary at a level form, while the LTOGDP variable

is stationary at the level form with trend and intercept. In contrast, other variables are found to be non-stationary at the level form.

Table 4.4: Phillips-Perron (PP) Unit Root Test Results

Series	Level		First difference	
	Trend & intercept	Intercept	Trend & intercept	Intercept
LRCA	-2.946(1)	-	-	-7.320(9)***
LDIV	-1.945(4)	-	-	-5.267(6)***
LPM	-	-1.422(1)	-	-7.009(1)***
LGDPC	-2.177(3)	-	-	-5.102(9)***
LLABOUR	-	-3.070(2)**	-	-
LCAPFORM	-2.647(0)	-	-	-4.002(4)***
LTOGDP	-3.950(2)**	-	-	-

Notes: Asterisks (**) and (***) indicate significant at the 5% and 1% levels, respectively. LRCA = natural log of index of revealed comparative advantage, LDIV = natural log of index of export diversification, LPM = natural log of price of agricultural commodities in Malaysia, LGDPC = natural log of GDP per capita, LLABOUR = natural log of labour participation rate in the agriculture sector, LCAPFORM = natural log of capital formation in the agriculture sector and LTOGDP = natural log of trade openness.

4.5 Bounds Testing Approach to Cointegration Results

Bounds testing and the Autoregressive-Distributed Lag (ARDL) tests introduced by Pesaran et al. (2001) were conducted in this study since the series do not have the same order of integration as shown in the unit root tests estimated earlier on. According to Choong et al. (2003) and Choong et al. (2005), bounds testing does not enforce restrictive assumptions that all of the underlying variables must be integrated in the similar order. As a result, it is applicable to use bounds testing under these circumstances. Moreover, another reason for utilising these tests is because unlike the conventional multivariate cointegration tests, they are appropriate

for small sample size studies (Pesaran et al., 2001). This is particularly useful in the case of the present study in which the sample data is less than 30 observations. Referring to Pesaran and Shin (1999) and Haug (2002), the Monte Carlo studies suggested that bounds testing performs better as compared to other tests such as the Engle and Granger (1987), Johansen and Juselius (1990) and Phillips and Hansen (1990) cointegration tests in small samples.

The null hypothesis of no cointegration is rejected if the F -statistic is larger than the upper bound of the critical value. The asymptotic distribution of critical values depends upon the number of variables, sample size and whether the variables in the ARDL model are all $I(0)$, all $I(1)$ or mutually cointegrated (Handa & Kahsay, 2011; Narayan, 2005). According to Narayan (2005, p.1981), two sets of critical values are reported in Pesaran and Pesaran (1997), and in Pesaran et al. (2001). These two sets of critical values provide the critical value bounds for all classifications of the regressors into purely $I(1)$, purely $I(0)$ or mutually cointegrated. In this study, the critical values for the bounds test for cointegration due to Pesaran et al. (2001) were adopted. However, these critical values are generated for sample sizes of 500 and 1000 observations, with 20000 and 40000 replications, respectively. Narayan (2004a, 2004b) and Narayan (2005) argued that the present Pesaran et al. (2001) critical values are not appropriate to be employed in small sample size studies because they are built on large sample sizes. As the sample size in the current study is less than 30, therefore, we also utilised the critical values reported in Narayan (2005) for samples sizes of 30 to 80 to serve as a robustness check for the obtained bounds testing results from Pesaran et al. (2001).

Table 4.5 illustrated the results of the bounds test for cointegration whereby the bounds testing procedure is based on the joint F -statistic and the critical values are obtained from

Pesaran et al. (2001) and Narayan (2005). As presented in Table 4.5, the F -statistic computed under the bounds test by the revealed comparative advantage model is 9.048. This value clearly shows that it is greater than the upper bound of the critical values at the 5 percent level of significance as presented in Pesaran et al. (2001). Therefore, it can be concluded that there exists a long-run relationship between the test variables. As for the export diversification model, the F -statistic generated under the bounds test is 1.822 which showed that the value is less than the lower bound critical values at the 5 percent significance level as tabulated in Pesaran et al. (2001). Thus, this indicated that the cointegration between the variables for the model in this study does not exist because the null hypothesis of no cointegration cannot be rejected.

Table 4.5: Results of Bounds Test for Cointegration

Models	Lag order			
	<i>F</i> -statistic			
<i>Revealed Comparative Advantage Model</i>	(1,2,2,1,1)			
lrca lpm lgdpc llabour lcapform & dum2008	9.048			
<i>Export Diversification Model</i>	(4,0,0,1)			
ldiv lgdpc lcapform ltogdp & dum2002	1.822			
Critical values bounds of the <i>F</i> -statistic: unrestricted intercept and no trend				
Significant level	Pesaran Critical Values ^A	Pesaran Critical Values ^B	Narayan Critical Values ^A	Narayan Critical Values ^B
	<i>I</i> (0)	<i>I</i> (1)	<i>I</i> (0)	<i>I</i> (1)
90% level	2.2	3.09	2.37	3.20
95% level	2.56	3.49	2.79	3.67
99% level	3.29	4.37	3.65	4.66

Notes: Critical values are obtained from Pesaran et al. (2001), table Case II: restricted intercept and no trend, and Narayan (2005), table Case II: restricted intercept and no trend. Pesaran critical values^A and Narayan critical values^A are referred when 4 explanatory variables are used, while Pesaran critical values^B and Narayan critical values^B are referred when 3 explanatory variables are used.

Alternatively, the Narayan critical values were adopted in this study to serve as a robustness check for the variables employed in the empirical models. The bounds test results in

Table 4.5 depicted an inference that a long-run cointegration existed for revealed comparative advantage model as the computed F -statistic of 9.048 is above the critical values at the 5 percent significance level. Hence, there is cointegration between the variables tested in the model. As for the export diversification model, it portrays that no cointegration existed among the variables employed in the model. For example, the F -statistic computed, 1.822 is smaller than the lower bound as tabulated in Narayan (2005). Consequently, the bounds test results showed that there is no cointegration between the variables for export diversification model in this study because the null hypothesis of no cointegration failed to be rejected.

Nevertheless, there are past studies that have reported that although there is no cointegration found in bounds testing estimation, it does not truly verify that the variables used in the study do not have a long-run relationship. This is because a superior test for the cointegration of the bounds test exists. According to Kremers et al. (1992), a significant ECM is relatively more capable of establishing cointegration. In summary, the ECM result is a better indication for cointegration as compared to the F -test under bounds testing. There are a few scholars that have supported this argument, namely Weliwita and Ekanayake (1998) and Bahmani-Oskooee (2001) in which they stated that a negative and significant ECM denotes that there is a tendency for the variables to restore equilibrium after a short-run disturbance. In view of this, we have generated the ECT values for the revealed comparative advantage and the export diversification models from the error correction model based on the ARDL. The obtained ECT values are reported in Table 4.6. We found that all of the ECT values had a negative sign and statistically significant at the 1 percent level. This finding entailed that a long-run cointegration relationship existed among the variables under study for the revealed comparative

advantage model and the export diversification model. Therefore, we proceeded to estimate the long-run parameters in the next step using the ARDL approach.

Table 4.6: ARDL Error Correction Model Results

Regressor	Revealed Comparative Advantage Model (1,2,2,1,1) $\Delta LRCA$	Export Diversification Model (4,0,0,1) $\Delta LDIV$
ECT_{t-1}	-0.989 [0.000]***	-0.845 [0.000]***

Notes: Asterisk (***) denote the rejection of null hypothesis at 1% level. The figures in (...) refer to the selected lag length based on AIC. The figures in [...] refer to the p-value.

4.6 ARDL Estimation Results

The optimal model can be selected using model selection criteria like the Schwartz-Bayesian Criteria (SBC) and the Akaike Information Criteria (AIC). In this current study, the optimal model is chosen on the basis of the AIC which can be performed on small data samples (Enders, 2004, pp.69-70). Furthermore, the advantage of the AIC lies in its property to generally lead to a higher order of the ARDL model than the SBC because it leads to smaller estimated standard errors as well as a higher chance of white-noise property of the residuals (Belke & Polleit, 2005, p.23).

The generated ARDL model long-run estimates with respect to the RCA are illustrated in Table 4.7. The test statistic for the revealed comparative advantage model (LRCA) indicated that the LPM, the LGDPC as well as DUM2008 are negatively related to the RCA, whereas the LLABOUR and the LCAPFORM variables had a positive relationship with the RCA. As presented in Table 4.7, the coefficient of PM -0.272 is negative and is statistically significant at the 1 percent level. Accordingly, it suggests that in the long-run, an upsurge of one percent

in the PM is related with a decline of 0.272 percent change in the comparative advantage. As such, a negative relationship existed between the LPM and the comparative advantage. This can be reinforced by the finding of Tuah (2013) who revealed that increase in the price of agricultural products will lead to drop in demand as the price of agricultural products is expensive, and this in turn results in loss of competitiveness in the agriculture export. Besides, Othman et al. (2009) indicated that highly priced agricultural products will impede the competitiveness and its value-added products in the export market.

Table 4.7: ARDL Estimation Results of the Revealed Comparative Advantage Model

Regressor	Revealed Comparative Advantage Model (1,2,2,1,1)	
	LRCA	
Constant	-1.378	{-0.703} [0.495]
LPM	-0.272***	{-3.262} [0.007]
LGDPC	-0.688***	{-10.906} [0.000]
LLABOUR	0.557***	{2.329} [0.038]
LCAPFORM	0.227***	{4.224} [0.001]
DUM2008	-0.100***	{-1.951} [0.007]

Notes: Asterisk (***) denotes the rejection of null hypothesis at 1% significant level, respectively. The figures in (...) refer to the selected lag length based on AIC. The figures in {...} and [...] refer to the *t*-statistics and probabilities, respectively.

Meanwhile, the LGDPC variable has a negative coefficient sign which is consistent with the past findings of Bhattacharya (2011). In the comparative advantage model, an increase of one percent in the LGDPC variable will lead to a drop of 0.688 unit change in the competitiveness of agricultural products in Malaysia (see Table 4.7). It is undeniable that the GDP has the ability to contribute to a country's economic growth. However, the obtained result is deemed possible as the contribution from the GDP in Malaysia is possibly diverted to other sectors such as the services sector and the manufacturing sector as these sectors account for a bigger share of the economy. Such a situation can be seen in the quarterly bulletin of BNM (2016) which reported that the services sector recorded a continuous growth of 5.1 percent in the first quarter of 2016 as compared to the fourth quarter of 2015 which was 5 percent. In addition, the manufacturing sector continued to grow at a level of 4.5 percent in the first quarter of 2016. On the other hand, growth in the production of agriculture contracted by 3.8 percent in the first quarter of 2016 from 1.5 percent in the fourth quarter of 2015. Therefore, this situation ultimately initiates that most of the resources have been allocated and have been emphasised on to these sectors in Malaysia. In contrast, the agriculture sector has been declining over the long-run in terms of its contribution to the GDP (Nambiar, 2012). As a result, the other sectors overtook agriculture to become the leading sectors of the economy in Malaysia (Malaysian Investment Development Authority [MIDA], 2016; Tengku Ahmand and Suntharalingam, 2009). Due to this, the competitiveness of the agriculture has been impacted in terms of the comparative advantage of its commodities as resources might be diverted to the services as well as the manufacturing sectors.

As for the LLABOUR variable, the estimated empirical results displayed that it is statistically significant at the 1 percent level and positively linked to comparative advantage,

which implies that as the LLABOUR variable increases, the comparative advantage will rise too. The obtained result is deemed plausible in the case of Malaysia because immigrant workers have become one of the main sources of labour especially in labour intensive sectors, namely, the agriculture sector (Moreno, 2016; Ismail and Yuliyusman, 2014). This is in line with the findings discussed by Zhu (2012) in the literature reviews. Zhu (2012) documented that a positive association existed between the labour participation and productivity growth and this helped to boost the comparative advantage in China. This is because increase in labour will increase the output. This in turn will lead to increasing bargaining power in the foreign market which lead to competitiveness.

Furthermore, the coefficient of the LCAPFORM variable as shown in Table 4.8 is 0.227 is statistically significant at the 1 percent level. This also indicates that a one percent increase in capital formation will cause an upsurge of 0.227 percent in the comparative advantage. This is in line with past findings such as Huang et al. (2002), Tyler (1981), Mellor (1973) and FAO (2012). In the case of Malaysia, the allocation of capital formation in the agriculture in Malaysia has witnessed a growth from 7.3 percent in 2014 to 8.3 percent in 2015 (Department of Statistics Malaysia [DOSM], 2016). With such an improvement in capital formation in the agriculture sector, Malaysia is competent to enhance the competitiveness of its agricultural products in terms of the quality of the output. This is deemed plausible as growth in addition to capital formation will lead to the efficiency in resource allocation due to the comparative advantage. Consequently, this, in turn, will boost productivity.

In estimating the factors influencing comparative advantage, this model also takes into account a dummy variable created due to the 2008 global financial crisis which triggered

economic growth towards the agriculture sector and also caused other sectors such as the manufacturing sector to slow down. The DUM2008 variable is statistically significant at the 1 percent level with a negative coefficient sign. The significance of the dummy variable implied that the global financial crisis and food crisis which occurred in 2008 had an adverse effect on the comparative advantage of the agricultural products in Malaysia. In general, the global financial crisis resulted in the Malaysian economy slowing down as the crisis has exposed the vulnerability of export-dependent growth of Malaysia wherein the manufacturing sector was highly impacted. However, the crisis also affected the agricultural products in which the agriculture exports also declined despite commodity prices dropping. The decline in the commodity price did not stimulate exports of the commodity products as the global economy had slowed down and this reduced export demand for the commodity products. For example, as reported by Goh and Lim (2010), the exports of palm oil reduced by 32 percent and exports of crude oil dropped by 33 percent from quarter to quarter. Nonetheless, the cost to maintain the planted agricultural commodity remained the same but the decline in demand resulted in less revenue for the farmers. Therefore, such scenario led to inefficiency in production and subsequently a higher cost of production which triggered comparative disadvantage.

Apart from that, the global financial crisis is one of the factors that caused the food crisis that occurred in 2008 in which the financial market had an impact on the commodity markets. This is because of speculation in the financial market, including futures trading, worsened the energy and food crisis by increasing prices regardless of a global economic slowdown (Hermida, 2008). During this time, the demand for food and energy prices were expected to increase due to an upsurge in demand and a decline in outputs. An example of a commodity market that has been traded on the Malaysian Stock Exchange during this crisis was palm oil. Besides, the crisis

also exaggerated Malaysia in terms of higher food import bills, a rise in the Consumer Price Index as well as social unrest to the economy (Arshad and Hameed, 2010). Thus, this eventually led to comparative disadvantage.

On the other hand, Table 4.8 showed the results of the export diversification model. For this model, the test statistic illustrated that the LGDPC and the DUM2002 variables are found to be negatively related to export diversification whereas, the LCAPFORM and the LTOGDP variables had a positive relationship with export diversification. The LGDPC and export diversification have a negative relationship and it is statistically significant at the 1 percent level indicating that increases in the LGDPC variable would lead to a drop in the export diversification of the agriculture in Malaysia. This can be seen when a country may diversify its commodities based on its relative advantages whilst on the other hand, reducing the proportion of commodities for example in the export of agriculture products by increasing the exports of other sectors (Hamed et al., 2014). Such a situation would eventually lead to a decline in the export diversification of the agriculture when economic growth upsurges.

In contrast, Table 4.8 showed that the LCAPFORM variable is positively related to the export diversification of the agricultural products with a coefficient of 0.069. However, the obtained result for this variable in the model is not significant. In the case of Malaysia, capital formation has been allocated to boost the performance of the agriculture sector in order to become competitive. However, the effort to diversify the commodities of agriculture is mostly placed on commodities such as the oil and gas, rubber and palm oil by diversifying towards downstream industries instead of diversifying cultivation of fruits and vegetables (Rahuman et al., 2014). Therefore, it is suggested that a country should not just concentrate in commodities

in which it has a comparative advantage to become a world leader. For example, antibiotic free chickens can potentially be a good global prospect for Malaysia when diversifying its exportation of poultry (Tengku Ahmad and Suntharalingam, 2009). Therefore, investment in capital formation is crucial to enhance competitiveness through productivity gains as the generation of new knowledge, tools or techniques through research and development would be able to create specialised agriculture industries, quality improvements and diversification that can enable Malaysia to become competitive at the international level.

Table 4.8: ARDL Estimation Results of the Export Diversification Model

Regressor	Export Diversification Model (4,0,0,1)
	LDIV
Constant	7.199*** {18.883} [0.000]
LGDPC	-0.984*** {-7.997} [0.000]
LCAPFORM	0.069 {0.825} [0.424]
LTOGDP	0.328** {2.971} [0.011]
DUM2002	-0.165** {-2.267} [0.041]

Notes: Asterisks (**) and (***) denote the rejection of null hypothesis at 5% and 1% significant levels, respectively. The figures in (...) refer to the selected lag length based on AIC. The figures in {...} and [...] refer to the *t*-statistics and probabilities, respectively.

Furthermore, the LTOGDP variable is significant at the 5 percent level in which the increase of one percent in the LTOGDP variable is related to an increase of 0.328 percent

change in export diversification (see Table 4.8). This result can be supported with the findings as discussed in the literature review earlier. Past studies indicated that trade openness would lead to growth due to knowledge spillovers and also investments in innovation and technology which will eventually boost productivity and export diversification. Apart from that, the trade openness of a country would also promote growth due to export and import activities, lower tariffs and fewer trade barriers among the trading countries so as to remain competitive in the international market. Consequently, this, in turn, would add value to the commodities either in terms of its quality or diversity. In Malaysia's situation, the Government has made an effort in developing the resource-based industries, which was closely related to the upstream production of natural rubber and tin ore in order to promote the import substitution. Under vertical diversification, the production of resource-based industries eventually emerged from raw or basic upstream commodity products into more advanced and complex downstream outputs such as the manufacturing of petrochemicals, oleochemicals, refined petroleum and palm oil, rubber gloves, tyres and prophylactic products (Rahuman et al., 2014). However, an effort to widen the diversification of other commodities such as poultry, fruits and vegetables into more value-added finished products is needed too so that the country will have a variety of options. As such, Malaysia will be more competitive and at the same time, it enables the country to increase exports whilst reducing imports from other countries.

As displayed in Table 4.8, the DUM2002 variable is negative and statistically significant at the 5 percent level. This means that the crisis, which is dot-com bubble has adverse impact on export diversification of agricultural products. Athukorala and Devadason (2011) indicated that the dot-com bubble impacted the export-oriented manufacturing especially the electronics industry. Such a situation also has an influence towards other sectors as investors

who have already invested in Internet-based companies suffered significant losses from such investments. According to Mayer (2010), the dot-com bubble crash resulted in great losses for investors in equity markets and the amount of investment in the commodity market started to rise intensely in early 2005. This is because equity market became less attractive to investors and shifted more into commodities trading such as agricultural commodities. However, previous investors who had previously invested in the equity market have limited capital to invest in the commodity market, even though they desired to recover their investment losses in the equity market. Therefore, dot-com bubble impedes the performance of export diversification of agriculture as there is limited capital can be utilised in diversifying agriculture products further into downstream processing with high value addition for exportation.

4.7 Error-Correction Representation Results

The empirical results from the error correction model (ECM) based on the ARDL model is presented under this section. As indicated by Banerjee et al. (1993), a dynamic ECM can be obtained from the ARDL model over a simple linear transformation. As far as it is concerned, the ECM integrates the short-run dynamics with the long-run equilibrium without losing the information in long-run. Moreover, the ECM coefficient shows how fast or slow the variables return to the equilibrium and it should have a negative sign and coefficient that is statistically significant (Pahlavani, 2005).

The ECM results based on the ARDL tests for the Revealed Comparative Advantage (RCA) model are illustrated in Table 4.9. The coefficient of the ECT_{t-1} for the comparative advantage model is found to be highly statistically significant at the 1 percent significance level

with the correct negative coefficient value of -0.989. This demonstrated that there is a stable short-run relationship between the variables. The ECM coefficient in the dynamic model shows the speed of adjustment to the equilibrium following shocks. For example, the coefficient of the ECT is -0.989, suggesting that a deviation from the long-term comparative advantage is corrected by 98.9 percent over the following year. Thus, it further implies that there is a relatively fast adjustment process and it would take around a year of disequilibria of the previous shock adjusts back to the long-run equilibrium in the current year. The absolute value is smaller than one, signifying that the error-correction process monotonically converges to the equilibrium path, instead of fluctuating around the long-run values with declining magnitude (Shabaz and Islam, 2011; Chandran and Krishnan, 2008).

Table 4.9: ARDL Results of Error-Correction Representation for the Selected ARDL Models (Revealed Comparative Advantage Model)

Revealed Comparative Advantage Model	
Regressor	Coefficient [t-statistic]
D(LPM)	-0.078 [-1.448]
D(LPM(-1))	0.152 [3.438]***
D(LGDPC)	-0.717 [-15.587]***
D(LGDPC(-1))	-0.109 [-2.371]**
D(LLABOUR)	0.034 [0.367]
D(LCAPFORM)	-0.029 [-0.656]
D(DUM2008)	-0.106 [5.196]***
ECT	-0.989 [-8.783]***
Diagnostic Tests:	
JB	0.049 [0.976]
AR [2]	0.766 [0.202]
ARCH [1]	0.031 [0.854]
RESET [1]	0.051 [0.825]
CUSUM	Stable
CUSUM ²	Stable

Notes: JB is the Jarque-Bera statistic for testing normality, AR[2] and ARCH[1] are the Lagrange Multiplier test for 2nd order serial correlation and ARCH effects, respectively. RESET refers to Ramsey RESET specification test while CUSUM is cumulative sum of residuals stability test and CUSUM2 is cumulative sum of squares of recursive residuals stability test. Asterisks (**) and (***) denote the rejection of null hypothesis at 5% and 1 % significant levels. The figures in [...] refer to the probabilities.

In addition, a battery of diagnostic and stability tests was carried out to determine the robustness of the revealed comparative advantage (RCA) model. The result of diagnostic tests for the comparative advantage model was revealed in Table 4.9. The diagnostic tests result showed that the model is free from the problem of serial correlation, functional form, normality and heteroscedasticity.

On the other hand, Table 4.10 showed the ECM results for export diversification of the agriculture sector in Malaysia. The ECT value is statistically significant with a negative sign at the 1 percent level. The generated coefficient of the ECT value is -0.845 which suggests that about 84 percent of the short-run deviations of export diversification of the agriculture sector will be adjusted towards the long-run equilibrium on a yearly basis.

Table 4.10: ARDL Results of Error-Correction Representation for the Selected ARDL Models (Export Diversification Model)

Export Diversification Model	
Regressor	Coefficient [t-statistic]
D(LDIV(-1))	0.077 [1.043]
D(LDIV(-2))	0.051 [0.744]
D(LDIV(-3))	-0.143 [-1.998]
D(LGDPC)	-0.753 [-12.046]***
D(LCAPFORM)	0.013 [0.254]
D(LTOGDP)	0.035 [0.437]
D(DUM2002)	-0.133 [-4.854]***
ECT	-0.845 [-5.642]***
Diagnostic Tests:	
JB	0.293 [0.864]
AR [2]	0.326 [0.526]
ARCH [1]	0.089 [0.754]
RESET [1]	0.003 [0.956]
CUSUM	Stable
CUSUM ²	Stable

Notes: JB is the Jarque-Bera statistic for testing normality, AR[2] and ARCH[1] are the Lagrange Multiplier test for 2nd order serial correlation and ARCH effects, respectively. RESET refers to Ramsey RESET specification test while CUSUM is cumulative sum of residuals stability test and CUSUM2 is cumulative sum of squares of recursive residuals stability test. Asterisk (***) denote the rejection of null hypothesis at 1% significant level. The figures in [...] refer to the probabilities.

Moreover, the diagnostic and stability tests were performed and presented in Table 4.10 in order to serve as a robustness check and also to confirm the suitability of the ARDL model. The obtained results indicated that the export diversification model passed the tests of serial correlation, functional form, normality and heteroscedasticity. In summary, none of the models suffer from autocorrelation and misspecification problems, and the obtained parameters are also normally distributed with constant variance.

Furthermore, the CUSUM and CUSUM of squares stability tests based on the two models, specifically the comparative advantage model and the export diversification model of the agriculture sector were conducted to examine the stability of the estimated comparative advantage and export diversification function during the sample periods in the study. The drive of the stability tests was to observe whether the obtained parameters are stable over time. Figure 4.2 to Figure 4.5 depicted the CUSUM and CUSUM squares stability tests result for the two models. From Figure 4.2 to 4.4, it is illustrated that the CUSUM and CUSUM squares statistics are lying well within the 5 percent critical bounds, indicating that all of the estimated coefficients in the ECM are structurally stable over time. This implies that the structure of the parameters has not diverged abnormally over time in this study (Jayaraman and Choong, 2007). In short, the diagnostic test results indicate that the models do not suffer from major time series estimation problems. This finding is important as a stable and well-fitted model is essential to generate a convincing result for policymakers. On the other hand, Figure 4.5 revealed the estimated model is not stable over the sample period. Past studies to name a few, Turner (2009) and Talas et al. (2013) stated that CUSUM test has higher power and produces more robust results than CUSUM squares.

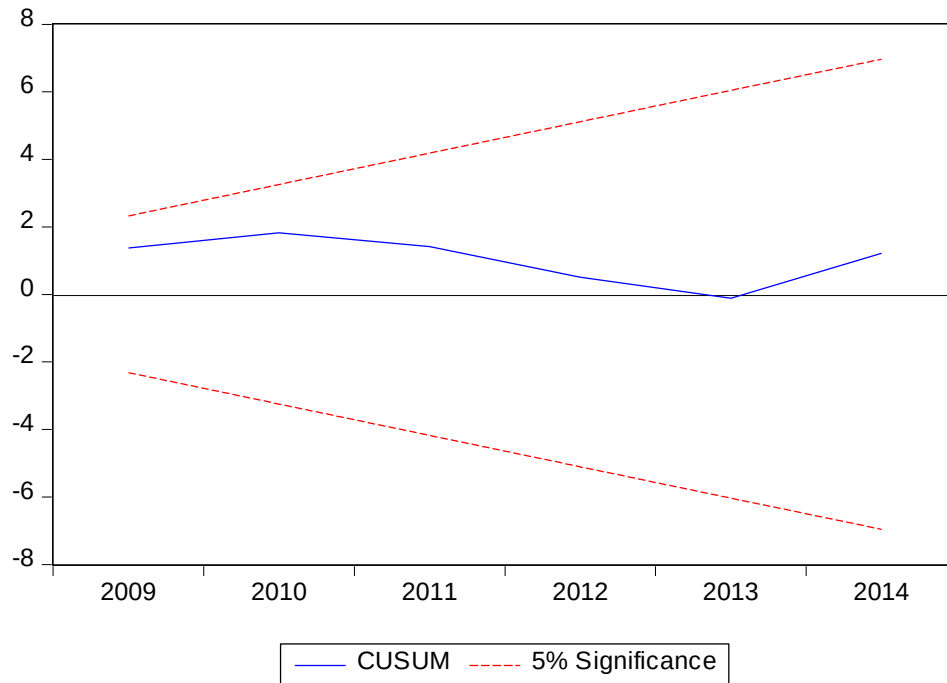


Figure 4.2: CUSUM Stability Test for the Revealed Comparative Advantage Model

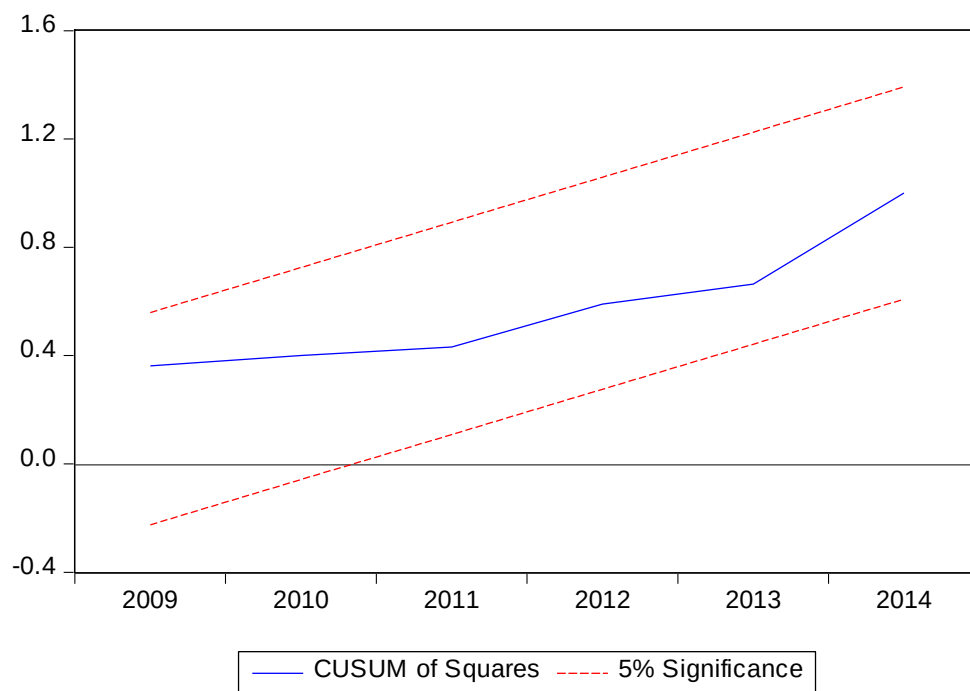


Figure 4.3: CUSUM Squares Stability Test for the Revealed Comparative Advantage Model

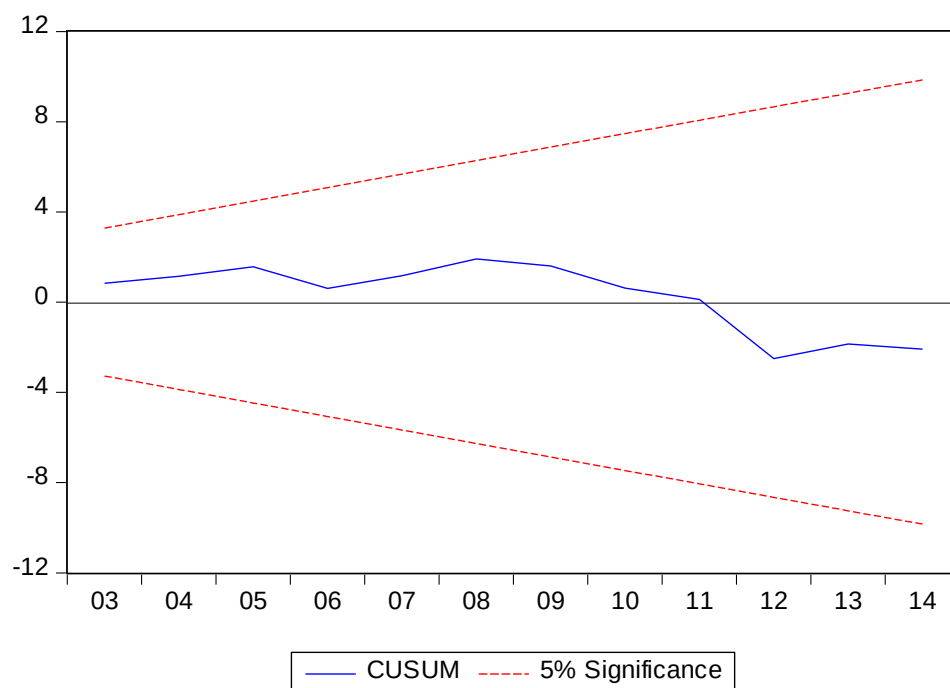


Figure 4.4: CUSUM Stability Test for the Export Diversification Model

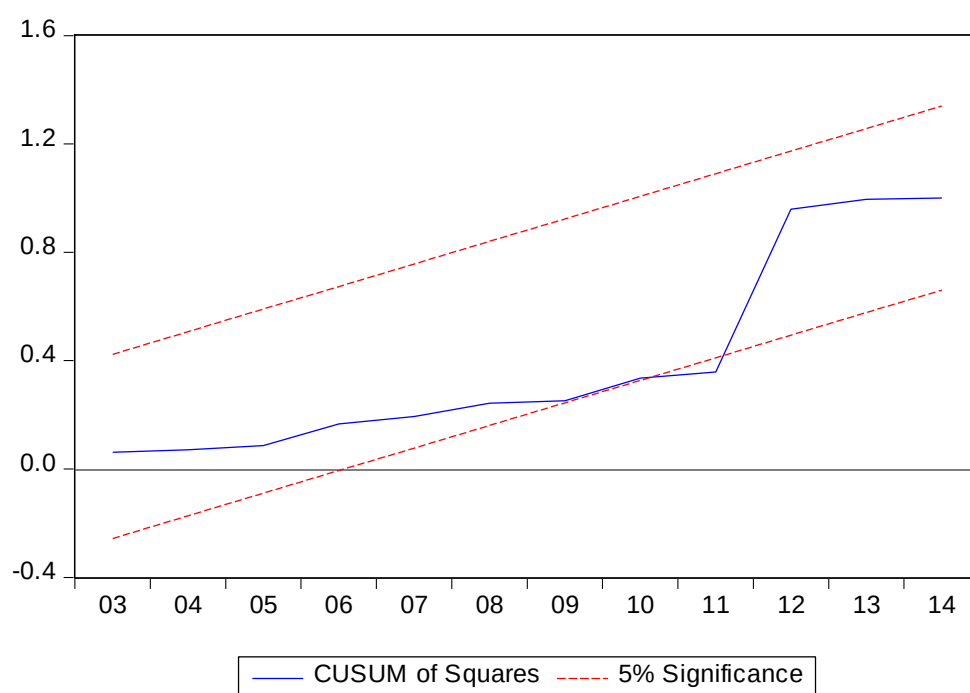


Figure 4.5: CUSUM Squares Stability Test for the Export Diversification Model

CHAPTER 5

CONCLUSION AND POLICY IMPLICATIONS

5.1 Introduction

Chapter 5 is divided into three sections. Section 5.0 focuses on summarising the study and Section 5.1 provides the policy implications from this study. Lastly, Section 5.2 discusses the limitations of the study.

5.2 Conclusion

This study was conducted to discuss the competitiveness of agricultural related products in Malaysia from the year 1988 to 2014. It examines the revealed comparative advantage (RCA) of agricultural products in Malaysia. Furthermore, this study reveals the export diversification of agricultural products in Malaysia too. From here, a set of independent variables is employed to find out the determinants of export competitiveness as well as diversification of agricultural products in Malaysia. This study is significant as it fills gaps in existing literature where there is a lack of information regarding the performance of agricultural products, especially in Malaysia.

Besides, there were 186 agricultural commodities used in this study and the annual exportation data of agricultural commodities in both Malaysia and the world are employed. In terms of the measurement of competitiveness, the comparative advantage index was computed by using the revealed comparative advantage measurement which was developed by Balassa

(1965). Apart from that, it is also important to have the export diversification measurement in the computation of the export diversification index for Malaysia in order to study the degree of export diversification of agricultural products in Malaysia.

The empirical findings of this study showed that only 56 agriculture-related products have a comparative advantage in which the generated RCA index is greater than one during the study period. Nevertheless, not all of the agriculture-related products have a comparative advantage throughout the study period from 1988 to 2014. Besides, the results revealed that only 10 commodities have a comparative advantage throughout the analysis from 1988 to 2014, specifically products with SITC code S3-07511, S3-08138, S3-23125, S3-42119, S3-42229, S3-42239, S3-42241, S3-42249, S3-43131 and S3-43133. However, the RCA index of the aforementioned commodities revealed an unstable trend during the period of analysis.

Malaysia recorded high RCA indices, namely, for products with SITC code S3-08138 (oilcake and other solid residues of oil from palm nuts or kernel), S3-42229 (palm oil, refined, and its fractions) and S3-42249 (palm kernel or babassu oil, refined, and fractions thereof) as compared to other agricultural commodities during the study time frame. This is self-explanatory since Malaysia is one of the major producers as well as exporters of palm oil.

To simplify the discussion, the results of the total trade value of comparative advantage and disadvantage for agricultural commodities, Malaysia-world based on SITC Revision 3 (3-digits code) has been illustrated in Chapter 4. A total of 40 agricultural products based on the 3-digits code has been identified. The results illustrated that high RCA indexes do not signify the real performance of commodities without taking into account the trade volume. This is

because exports of these products are mainly in the form of raw materials and unprocessed commodities and do not bring much value-added, in spite of the fast-growing volume of export. Therefore, Malaysia needs to move from exports of raw materials to exports of processed products in order to increase the value-added element of the commodity (Le, 2010).

The results revealed that Malaysia is still very much dependent on the import of agricultural products for fruits and vegetables from other countries to meet the demand of its local market while Malaysia is actually capable of producing most of the vegetables it imports (Ruban, 2016). Therefore, it is crucial to move from upstream production of basic agricultural products to downstream production of value-added products in order to boost the exportation in agriculture.

Furthermore, the production of livestock showed comparative disadvantage with increasing trade value. This is because livestock in Malaysia are raised in small scale where it is unable to meet the local demand (Mohamed, 2007). Therefore, Malaysia still depends on the import of milk, beef and mutton which upsurges the trade balance of food products, and it is forecasted to have deficit trade balance in 2020 which will be amounted to 3,615,000 tonnes (Sahar and Chamburi, 2016). Thus, this clearly shows that Malaysia is highly dependent on the import of livestock, and milk and cheese products.

On the other hand, Malaysia had diversified its export structure for agriculture products in the year 2012 which is due to the implementation of Economic Transformation Programme (ETP) which focusses on 12 national key economic areas in the tenth Malaysia plan. In the ETP, agriculture was one of the identified economic area that have been given priority. According to

EPU (2010), effort has been placed on high value agriculture activities in tenth Malaysia plan to develop new products by diversifying into higher value-added outputs that contribute to the export performance in agriculture.

However, Malaysia had experienced less diversification instead of specialisation in its export structure for agricultural products in year 2001. Such consequences were due to the low supply of palm oil since August 2001 and palm oil prices averaged RM944 per tonne. Low price of palm oil prompted the government to introduce incentive to reduce the supply of palm oil by reducing the existing stocks. Since Malaysia is one of the major producers and exporters of palm oil, such circumstances has affected the level of diversification in 2001. Besides, the dot-com bubble collapse has caused huge losses for investors in equity markets and during this time, the investment in commodity markets started to rise. Nevertheless, investors who had invested and suffered losses in equity market have limited capital to re-invest in the commodity market and at the end of the boom, there is no higher value production which impede the ability to improve the development of agriculture (Mayer, 2010; Buysse & Vincent, 2015).

This study employed time series econometric methods to investigate the relationship between the revealed comparative advantage with its determinants, namely price for agricultural commodities, the GDP per capita, the labour participation and the capital formation of the agricultural products in Malaysia. On the other hand, time series econometric methods were also used to study the association between export diversification, trade openness, the GDP per capita and the capital formation of the agricultural products in Malaysia. Besides, the ADF test and the PP test were performed to examine the stationary properties of the time series data. The obtained ADF unit root test results showed that the selected variables in this study are in a

combination of $I(0)$ and $I(1)$ processes. In a similar vein to the ADF test results, the PP test results disclosed a mixture of $I(0)$ and $I(1)$ time series data. In summary, a decent validation for employing the bounds tests for cointegration and the ARDL approaches as proposed by Pesaran et al. (2001) in this study can be supported due to the order of integration of the ADF and the PP tests either in $I(0)$ or $I(1)$ processes.

The bounds testing approach to cointegration was utilised to study the relationship of the specified variables in the model. The bounds testing for cointegration was based on the joint F -statistic and the critical values were obtained from Pesaran et al. (2001). However, these critical values are created for sample sizes of 500 and 1000 observations, with 2000 and 40000 replications, correspondingly. On the other hand, it has been argued that the existing Pesaran et al. (2001) critical values are not suitable to be engaged in a small sample size study as they are based on large sample sizes (Narayan 2004a, 2004b; Narayan, 2005). As the sample size in this study is less than 30, we, therefore, also utilised the critical values tabulated in Narayan (2005) for samples sizes of 30 to 80 to serve as a robustness check for the obtained bounds test results from the Pesaran et al. (2001) model.

The revealed comparative advantage model showed that a cointegration relationship exists among the test variables, whereas the findings of the export diversification model indicated that no cointegration occurred. Even though the obtained test results for the employed variables do not have cointegration, this does not really verify that there would be no long-run relationship. Such a consequence is due to the existence of a superior test for cointegration for bounds testing. According to Kremers et al. (1992), a significant ECM is relatively more capable of establishing cointegration. In summary, the ECM result is a better indication for

cointegration as compared to the F -test under bounds testing. There are a few scholars who have supported this argument, namely Weliwita and Ekanayake (1998) and Bahmani-Oskooee (2001) in which they stated that a significant and negative ECM denotes that there is a tendency for the variables to restore equilibrium after a short-run disturbance. As such, we have generated the ECT values for the revealed comparative advantage and export diversification models from the error correction model based on the ARDL model. We found that all of the ECT values are statistically significant at the 1 percent level with a negative sign. Hence, such findings demonstrated that a long-run cointegration relationship existed among the variables under study for the revealed comparative advantage and export diversification models, respectively. Consequently, the long-run parameter estimation was conducted in the next step using the ARDL approach.

In conclusion, the empirical evidence showed a plausible outcome for the revealed comparative advantage model. The price of agricultural commodities is found to be statistically influencing the revealed comparative advantage. Specifically, the price of agricultural commodities can negatively influence the competitiveness of the agriculture sector in Malaysia. Tuah (2013) revealed that increase in the price of agricultural products will lead to drop in demand as the price of agricultural products is expensive, and this in turn results in loss of competitiveness in the agriculture export. Besides, Othman et al. (2009) indicated that highly priced agricultural products will impede the competitiveness and its value-added products in the export market.

Besides, the LGDPC is also an important determinant and this variable is reported to be statistically significant in Malaysia. This variable has a negative coefficient sign. It is

undeniable that the GDP has the ability to contribute to a country's economic growth. However, the obtained result is deemed possible as the contribution from the GDP in Malaysia is possibly diverted to other sectors such as the services sector and the manufacturing sector as these sectors account for a bigger share of the economy. Furthermore, the estimated empirical results displayed that the LLABOUR is statistically significant and positively related to comparative advantage, which implied that as the LLABOUR increases, the comparative advantage will rise too. The obtained result is deemed plausible in the case of Malaysia because foreign immigrant workers have become one of the main sources of labour especially in labour-intensive sectors, such as the agriculture in Malaysia (Ismail and Yuliyusman, 2014; Moreno, 2016). This result can be reinforced with the findings of by Zhu (2012) in the literature review.

Apart from that, the estimated results of this study showed that LCAPFORM variable is positively linked to competitiveness, where when capital formation rises, it increases the competitiveness too. However, this result is not significant. This situation can be reinforced with the discoveries of previous studies as discussed in the earlier chapters. For instance, an improvement in capital formation is able to improve the competitiveness as well as the quality of agricultural products. Consequently, improvement in capital formation will lead to efficiency in resource allocation due to the comparative advantage which in turn strengthen as well as further develop the competitiveness and boost the exportation. Finally, the global financial crisis had an important impact on the competitiveness of the agriculture sector in Malaysia. These one-off events had an adverse impact towards the Malaysian agricultural products' competitiveness.

The dynamic interaction between the variables in the revealed comparative advantage model has been examined in this study using ECM. The optimal lag length for this model is chosen based on the AIC. The revealed comparative advantage model demonstrated that there is a stable short-run relationship among the variables and the obtained ECT value further denotes that there is a relatively fast adjustment process. It would take around a year of disequilibria of the previous shock to adjust back to the long-run equilibrium in the current year.

Moreover, to ascertain the appropriateness of the ARDL model, diagnostic tests have been utilised in order to serve as a robustness check in which the test results demonstrated that the model passes all of the diagnostic tests. In summary, the model does not suffer from autocorrelation and misspecification problems, and the generated parameters are normally distributed with constant variance. Moreover, the CUSUM and CUSUM of squares stability test results showed that the estimated parameters in the ECM are stable over time for the sample period under study. This illustrated that the model does not suffer from any major time series estimation problems.

Next, the empirical results for the export diversification model showed that one out of four of the determinants had a negative relationship with export diversification, namely, the GDP per capita. Therefore, if there is any increase in this determinant, the export diversification may reduce, and vice versa. In contrast, trade openness and capital formation yield a positive impact on export diversification. Hence, higher export diversification is associated with higher trade openness, and conversely, lower export diversification is related to lower trade openness. The same goes for capital formation where higher capital formation will lead to greater export

diversification and vice versa. Moreover, the inclusion of the dummy variable of DUM2002 posed a significant and negative effect towards export diversification.

The findings from this study indicated that the LGDPC and export diversification have a negative relationship showing that increases in the LGDPC would lead to a drop in the export diversification in the agriculture sector in Malaysia. This can be supported by the past study of Hamed et al. (2014) who indicated that a country may diversify its commodities based on its relative advantages and on the other hand, reducing the proportion of commodities for export in the agriculture sector by increasing the export level of other sectors. This scenario would eventually cause the export diversification of the agriculture sector to drop when economic growth increases.

Besides, the LCAPFORM variable is found to have positively relationship with the export diversification of the agriculture sector. However, the obtained result for this variable in the model is not significant. For the case of Malaysia, capital formation has been allocated to boost the performance of the agricultural products in order to become competitive. However, Malaysian agriculture sector is characterised as dualistic in which the effort to diversify the agricultural products is mostly placed on commodities such as oil and gas, rubber and palm oil by diversifying towards downstream industries instead of diversifying the other agriculture such as the cultivation of fruits and vegetables (Rahuman et al., 2014). This statement is also in line with the current finding of this study in which the result of revealed comparative advantage index showed that the production of fruits and vegetables do not have consistent comparative advantage throughout the empirical period. This is because Malaysia is still depending on the import of fruits and vegetables from other countries. Other than that, the antibiotic free chickens

can also potentially be a good global prospect for Malaysia in diversifying its exportation of livestock (Tengku Ahmad and Suntharalingam, 2009). This initiated that there is still a great potential to maintain, strengthen and further diversify its market for exportation in specific livestock type.

Furthermore, the LTOGDP variable is significant and it has a positive relationship with export diversification. In Malaysia's situation, the Government has made an effort to develop resource-based industries, which is closely related to the upstream production of natural rubber and tin ore in order to promote import substitution. Under vertical diversification, the production of resource-based industries eventually evolved from raw materials or basic upstream commodity products towards more advanced and complicated downstream products such as the manufacture of petrochemicals, oleochemicals, refined petroleum and palm oil, tyres, rubber gloves and prophylactic products (Rahuman et al., 2014). However, additional effort is required to widen the diversification of other commodities such as fruits and vegetables into more value-added finished products, so as the country can be more independent and competitive rather than import products from other countries.

Lastly, the dummy variable DUM2002 is statistically significant and negative. Based on the research of Mayer (2010), the dot-com bubble crash resulted in large losses for investors in equity markets. As a consequence, the level of investment in commodity markets started to rise intensely in early 2005. However, investors who had invested and lost in the equity markets might not have had additional capital to re-invest in the commodity markets, even if they desired to recover their previous investment losses in the equity market. Therefore, this condition has negatively impacted the diversification of exports in the agriculture sector as well.

The dynamic interaction between the variables in the export diversification model has been examined in this study using ECM. The optimal lag length for this model is selected based on the AIC. The ECT value is statistically significant with a negative sign at the 1 percent level and the generated coefficient of the ECT value is -0.845 which suggests that about 84 percent of the short-run deviations of export diversification of the agriculture will be adjusted towards the long-run equilibrium on a yearly basis.

Diagnostic tests have been adopted in order to determine the appropriateness of the ARDL model. The test results demonstrated that the model passes all of the diagnostic tests. The obtained results indicated that the export diversification model passed the tests of serial correlation, functional form, normality and heteroscedasticity. In summary, none of the models suffers from autocorrelation and misspecification problems, and the obtained parameters are also normally distributed with constant variance. Moreover, the CUSUM and CUSUM of squares stability tests results showed that the estimated parameters in the ECM are structurally stable over time. This illustrated that the model does not suffer from any major time series estimation problems. This implies that the structure of the parameters has not deviated strangely over time in this study (Jayaraman and Choong, 2007).

5.3 Policy Implications

From the results obtained in Chapter 4, this section aims to provide some policy recommendations in order to sustain the export competitiveness and diversification in Malaysia as well as further improving the performance of the agricultural products in order to gain more benefits for the country. As can be seen in the previous chapter, there are 186 agricultural

products that have been utilised to analyse the comparative advantage and export diversification in Malaysia. However, the results revealed that there are only 56 agriculture-related products that have a comparative advantage. Nonetheless, not all of the agriculture-related products have a comparative advantage throughout the sample period under study. As for export diversification, Malaysia experienced less diversification instead of specialisation in its export structure for agricultural products in 2001. Therefore, this study employed econometric models to establish the empirical findings to identify the determinants affecting competitiveness as well as export diversification in Malaysia. These factors will be the centre of the following policy recommendations.

The price of agricultural commodities is an important variable that affects comparative advantage in Malaysia under this study as it determines the economic incentives necessary to encourage greater efficiency in the usage of resource. In general, increase in the price of agricultural products will lead to drop in demand as the price of agricultural products is expensive, and this in turn results in loss of competitiveness in the agriculture export. Besides, highly priced agricultural products will impede the competitiveness and its value-added products in the export market. Therefore, stable prices are important to provide domestic and investors from other countries with confidence and to allow farmers and traders to take informed, long-term decisions. At the same time, effective price systems are required in order to ensure that the agricultural producers and consumers face price that reflect the comparative advantages. This is because higher prices of agricultural products without improvement in quality will impede the export competitiveness and therefore, it is necessary to venture further into downstream industries in order to generate value-added agricultural products for exportation. For instance, this is in line with the effort of The Malaysian Pepper Board (MPB)

that concentrating on creating more downstream pepper products in order to keep the demand consistent and have higher value-added, and keep the price stable (MPIC, 2016). Thus, monitoring the fluctuation of commodity prices is essential since the global demand for pepper is more than supply which leads to price fluctuation.

Moreover, the GDP per capita is another important determinant influencing the competitiveness of the agricultural products in Malaysia. The Malaysian economy has to further develop the agricultural products in order to achieve sustained high growth. This is because most of the contribution to the GDP has been diverted to develop other sectors such as manufacturing and the services sectors as these sectors account for a larger share of the economy. Noting that the agriculture sector's allocation of government resources has been stagnant in the past, an upsurge in the allocation made is needed in order to increase the competitiveness of agricultural products. Such a policy recommendation is in parallel with the government effort stated in the 11th Malaysian Plan where the government aims to promote private investment in agriculture to spearhead competitiveness, promoting services exports and diversifying markets (EPU, 2015). For example, a record level of private investment in excess of RM3 billion has been placed on agricultural products such as palm oil downstream processing, covering a wide variety of products with higher value-addition from oleo derivatives such as bio-polyols and bio-lubricants to phytonutrients namely tocotrienols and carotene (EPU, 2015).

Other than diversifying palm oil products, efforts to develop other agricultural products is needed as well in order to boost export competitiveness. For example, Malaysia is still relying on the production of fruits and vegetables from other countries to meet the demand of its local

market while Malaysia is actually having the potential in producing fruits and all kinds of vegetables due to its fertile soil. Therefore, it is crucial to move from upstream production of basic agricultural products to downstream production of value-added products in order to boost the exportation in agriculture. Besides, Malaysia is also dependent on the import of livestock such as cattle and beef from Australia where this actually can be overcome by having a larger scale of cattle breeding to reduce the dependency, thus increase competitiveness in export market.

Besides, the labour participation is another determinants of the competitiveness of the agricultural products in Malaysia. It is undeniable that Malaysia is very much dependent on low-skilled foreign migrant workers, be it in the manufacturing, services or agriculture sectors although the aim of the policy is to produce higher value-added output (Ismail and Yuliyusman, 2014; Moreno, 2016). This is owing to the fact that foreign workers are cost savings. Increase in labour participation will lead to rise in agricultural produce due to cheaper cost of hiring foreign workers. Therefore, it results in better bargaining power for agricultural products in the foreign market. This in turn can help to boost the export performance of agricultural products in Malaysia through export earnings in international markets. In view of this, it is crucial to provide incentives or training that would result in more skilled labour force in order to encourage more labour participation in agriculture. This in turn enables agricultural products to be produced with better quality. Moreover, providing a good and attractive welfare system motivates workers to work harder as well as to raise the working efficiency. By and large, it will indirectly result in better performance that leads to export competitiveness.

Apart from that, capital formation cannot be excluded in determining the competitiveness of the agriculture products in Malaysia. According to Hussin and Saidin (2012), investment in the Malaysian agricultural products will add to capital formation and result in competitiveness in producing its output and eventually this will have an effect towards the export performance of a country. This is parallel with the earlier results of Huang et al. (2012), Tyler (1981), Mellor (1973) and FAO (2012), to name a few. In Malaysia, the public sector has contributed 34.6 percent to the allocation of capital formation in 2015. However, the private sector continued to be the main driver of investment in Malaysia with a share of 65.4 percent in 2015 as compared to 63.8 percent in 2014 (DOSM, 2016). Other than that, services activities accounted for the largest contribution to capital formation from the private sector with a share of 51.2 percent, followed by manufacturing which consisted of 25.7 percent (BNM, 2015). Alternatively, the contribution of capital formation from the private sector in agriculture accounted for only 4.6 percent in 2014 (BNM, 2015).

In view of this, an obvious gap in capital formation existed between the aforementioned sectors where most of the investments were allocated to mainstream sectors as compared to the agriculture sector which has been given a lower priority. According to MPC (2016), a low level of dynamic capabilities would only cause the sector to be engrossed in commodities and constrained by its ability to build high-value downstream outputs. Therefore, further improvement in capital formation in terms of tools, equipment and machinery so as to uplift agricultural products' competitiveness is needed by encouraging more private investment in capital formation and upgrade its technological capabilities. There is no doubt that initiatives have been taken to boost private investment in the Malaysian agricultural products such as the replanting and new planting of palm oil and rubber, and the upgrading of machinery and

equipment (BNM, 2015). Besides, determination also has been placed in the planting of pineapples which was raised in the 11th Malaysia Plan where the cultivation of pineapple will be expanded (Lim, 2016). Therefore, the effort to produce pineapple products will need to be doubled up in order to be competitive in the export market.

In terms of export diversification, the GDP per capita is perceived as one of the main causes affecting the export diversification of the agriculture in Malaysia. Commercialisation of higher value-added agricultural products will help in enhancing the agriculture export performance where this will contribute to the GDP and boost the competitiveness of the country. For example, agricultural product such as spices, livestock, and fruits and vegetables has the opportunity to grow since it has the comparative advantage by emphasising on more downstream processing to ensure higher value agriculture produce. In view of this, increases in the diversification of this production due to the involvement of commodities in the downstream process activities will eventually create value-added.

Other than that, capital formation is vital in influencing the export diversification of the agricultural products in Malaysia. However, the efforts in export diversification in the Malaysian agricultural products are mainly placed on diversifying the mainstream commodities such as oil and gas, rubber and palm oil instead of diversifying other commodities such as the cultivation of fruits and vegetables (Rahuman et al., 2014). According to Yahya (2001), there are prospects for downstream activities in Malaysia such as the processed fruit industry which comprises of juices, puree, concentrates and processed fruit products and it has become one of the major agri-businesses in the world. There are opportunities to grow in this field such as processed fruits, tropical fruit juices, natural food ingredients, functional food, modified food

ingredients, health food, convenience food, frozen fruits, beverages and high fibre products. Therefore, the Malaysian government may try to stimulate the private sector to invest in capital formation of the agricultural products by improving the structure of the agriculture sector. This can be done by transforming the export of agriculture raw inputs into outputs with value-added. Thus, by improving the structure of the Malaysian agriculture sector, it would be able to attract increased capital formation from the private sector and the addition of capital formation at the same time would help to realise its potential for agriculture diversification.

Lastly, efficiency in resource allocation, as well as better export performance of agriculture products can be gained through trade openness. This is because trade openness allows us to benefit in terms of technology, induces investment from other countries as well as knowledge spillovers which in turn would help to shape diversification. Other than that, better quality outputs with value-added can be obtained when trade openness is involved due to the growth in export and import activities, tariff reductions and fewer trade barriers. As such, this leads to competitiveness and the diversification of outputs in the agriculture sector. Furthermore, opening to trade can increase the availability of agricultural products in importing countries. Therefore, it is suggested that the Malaysian government may utilise trade openness to promote commodities that have potential to be developed but are yet to be diversified into a high value-added produce such as spices, livestock, fruits and vegetables other than focusing just on the mainstream commodities as stated in Rahuman et al. (2014). This is because by viewing the competitiveness of downstream outputs, widening the diversification of other commodities will enable the country to have a diverse selection of value-added outputs that would lead to snowballing exports and decreasing imports from other nations.

5.4 Limitations of the Study

Despite the usefulness of this study in providing relevant information for government and policymakers to manage and improve the export performance of agriculture products in Malaysia, there are several limitations that should be taken into account. First, the study could consider other determinants of competitiveness as well as the export diversification of the Malaysian agricultural products. Thus, other determinants such as the exchange rate could be included in future studies to examine the determinants of export competitiveness and diversification of the agricultural products in Malaysia.

Moreover, in terms of the time span of the period for study. This study utilised yearly data from 1988 to 2014. Thus, future studies may expand the analysis by covering a longer time period in presenting the entire phenomenon of the Malaysian agricultural products exportation market. The final outcome of this study can only present the phenomenon in these 27 years. This study is unable to present the occurrence before and also after these 27 years. Hence, it is strongly recommended to future studies to cover longer empirical period to provide more comprehensive understanding on the exportation markets of agricultural products in Malaysia.

Apart from that, the constraint of data has disallowed the study to be detailed in the empirical study according to the sub-category analysis of agricultural products as the economics data such as GDP, labour participation, capital formation and trade openness for all the agricultural products or agriculture sector on its own are not obtainable. As such, this has restricted the current study from going into depth on specific sub-category that can provide a more pertinent finding for the policy makers to improve the exportation of agricultural products to be competitive in international markets.

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APPENDICES

Appendix A: List of 186 Agricultural Products based on SITC Revision 3 (5-Digits Code)

No.	Product Code	Name of Agriculture Products
1.	S3-01122	Meat of bovine animals, frozen, boneless
2.	S3-01221	Meat of swine, fresh or chilled
3.	S3-01235	Poultry cuts and offal (other than liver), frozen
4.	S3-01689	Other meat and edible meat offal salted, in brine, dried or smoked; edible
5.	S3-02221	Milk, concentrated or sweetened, in solid form, of a fat content, by weight
6.	S3-02222	Milk and cream, concentrated or sweetened, in solid form, of a fat content
7.	S3-02499	Other cheese
8.	S3-03414	Tunas, skipjack or stripe-bellied bonito, fresh or chilled (excluding livers and roes)
9.	S3-03415	Herrings, sardines, sardinella, brislings or sprats, fresh or chilled (excluding livers and roes)
10.	S3-03418	Other fish, fresh or chilled (excluding livers and roes)
11.	S3-03421	Salmonidae, frozen (excluding livers and roes)
12.	S3-03422	Flat-fish, frozen (excluding livers and roes)
13.	S3-03423	Tunas, skipjack or stripe-bellied bonito, frozen (excluding livers and roes)
14.	S3-03424	Herrings, sardines, sardinella, brislings or sprats, frozen (excluding livers and roes)
15.	S3-03428	Other fish, frozen (excluding livers and roes)

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
16.	S3-03451	Fish fillets and other fish meat, fresh or chilled
17.	S3-03455	Fish meat (other than fillets), frozen
18.	S3-03512	Fish fillets, dried, salted or in brine, but not smoked
19.	S3-03513	Fish (excluding fillets), dried, whether or not salted, but not smoked, n.e.s.
20.	S3-03522	Anchovies, salted (but not dried or smoked) or in brine
21.	S3-03529	Other fish, salted (but not dried or smoked) or in brine
22.	S3-03611	Shrimps and prawns, frozen
23.	S3-03619	Other crustaceans, frozen, including flours, meals and pellets of crustac
24.	S3-03633	Cuttlefish, octopus and squid, fresh or chilled
25.	S3-03635	Other molluscs and aquatic invertebrates, fresh or chilled
26.	S3-03637	Cuttlefish, octopus and squid, frozen, dried, salted or in brine; flours
27.	S3-03639	Other molluscs and aquatic invertebrates, frozen, dried, salted or in brine
28.	S3-03712	Herrings, sardines, sardinella and brislings or sprats, prepared or prese
29.	S3-03713	Tunas, skipjack and Atlantic bonito (<i>Sarda</i> spp.), whole or in pieces, but not minced
30.	S3-03714	Mackerel, prepared or preserved, whole or in pieces, but not minced

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
31.	S3-03715	Other fish, prepared or preserved, whole or in pieces, but not minced
32.	S3-03716	Other fish, prepared or preserved, n.e.s.
33.	S3-03721	Crustaceans, prepared or preserved, n.e.s.
34.	S3-03722	Molluscs and other aquatic invertebrates, prepared or preserved, n.e.s.
35.	S3-04231	Rice, semi-milled or wholly milled, whether or not polished, glazed, parboiled or converted
36.	S3-04599	Cereals, unmilled, n.e.s.
37.	S3-04711	Maize (corn) flour
38.	S3-04719	Cereal flours, other than of maize, wheat or meslin
39.	S3-04722	Groats and meal of cereals other than maize and wheat
40.	S3-04811	Prepared foods obtained by the swelling or roasting of cereals or cereal
41.	S3-04812	Cereals other than maize (corn), in grain form, precooked or otherwise prepared
42.	S3-04813	Other rolled or flaked cereal grains, except rice of subgroup 042.3
43.	S3-04814	Other worked cereal grains (e.g., hulled, pearled, clipped, sliced or kibbled
44.	S3-04841	Crispbread, rusks, toasted bread and similar products
45.	S3-04842	Sweet biscuits, waffles and wafers, gingerbread and the like

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
46.	S3-04849	Bread and bread products, n.e.s.
47.	S3-05421	Peas, dried, shelled, whether or not skinned or split
48.	S3-05422	Chick-peas, dried, shelled, whether or not skinned or split
49.	S3-05423	Beans, other than broad beans and horse beans, dried, shelled, whether or not skinned or split
50.	S3-05425	Broad beans and horse beans, dried, shelled, whether or not skinned or split
51.	S3-05429	Other dried leguminous vegetables
52.	S3-05451	Onions and shallots, fresh or chilled
53.	S3-05452	Garlic, leeks and other alliaceous vegetables
54.	S3-05453	Cabbage and similar edible brassicas, fresh or chilled
55.	S3-05454	Lettuce and chicory (including endive), fresh or chilled
56.	S3-05455	Carrots, turnips, salad beetroot, salsify, celeriac, radishes and similar
57.	S3-05456	Cucumbers and gherkins, fresh or chilled
58.	S3-05457	Leguminous vegetables, fresh or chilled
59.	S3-05458	Mushrooms and truffles, fresh or chilled
60.	S3-05459	Other vegetables, fresh or chilled

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
61.	S3-05469	Other vegetables and mixtures of vegetables (uncooked or cooked by steaming)
62.	S3-05481	Manioc (cassava) fresh or dried, whether or not sliced or in the form of pellets
63.	S3-05483	Arrowroot, salep, Jerusalem artichokes, sweet potatoes and similar roots
64.	S3-05612	Onions, dried, whole, cut, sliced, broken or in powder, but not further prepared
65.	S3-05613	Mushrooms and truffles, dried, whole, cut, sliced, broken or in powder, b
66.	S3-05619	Other dried vegetables; mixtures of vegetables
67.	S3-05641	Flour and meal of potatoes
68.	S3-05642	Flakes, granules and pellets of potatoes
69.	S3-05645	Tapioca and substitutes therefor prepared from starch, in the form of flakes, grains, pearls, siftings or in similar forms
70.	S3-05647	Flour and meal of sago, roots or tubers of headings 054.81 and 054.83
71.	S3-05648	Flour, meal and powder of the products of any heading of group 057
72.	S3-05661	Potatoes prepared or preserved otherwise than by vinegar or acetic acid, frozen
73.	S3-05671	Vegetables, fruit, nuts and other edible parts of plants, prepared or preserved by vinegar or acetic acid
74.	S3-05673	Tomatoes, prepared or preserved otherwise than by vinegar or acetic acid, n.e.s.
75.	S3-05674	Mushrooms and truffles prepared or preserved otherwise than by vinegar or acetid acid

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
76.	S3-05676	Potatoes prepared or preserved otherwise than by vinegar or acetic acid, not frozen
77.	S3-05677	Sweet corn prepared or preserved otherwise than by acetic acid, not frozen
78.	S3-05679	Other vegetables prepared or preserved otherwise than by vinegar or acetid acid, not frozen
79.	S3-05711	Oranges, fresh or dried
80.	S3-05712	Mandarins (including tangerines and satsumas); clementines, wilkings and similar citrus hybrids, fresh or dried
81.	S3-05721	Lemons and limes, fresh or dried
82.	S3-05729	Citrus fruit, n.e.s., fresh or dried
83.	S3-05751	Grapes, fresh
84.	S3-05752	Grapes, dried (e.g., raisins)
85.	S3-05773	Cashew nuts, fresh or dried, whether or not shelled or peeled
86.	S3-05774	Almonds, fresh or dried, whether or not shelled or peeled
87.	S3-05777	Chestnuts, fresh or dried, whether or not shelled or peeled
88.	S3-05779	Edible nuts (excluding mixtures), fresh or dried, n.e.s., whether or not shelled or peeled
89.	S3-05791	Melons (including water melons) and papaws (papayas), fresh
90.	S3-05792	Pears and quinces, fresh

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
91.	S3-05795	Pineapples, fresh or dried
92.	S3-05796	Dates, fresh or dried
93.	S3-05797	Avocados, guavas, mangoes and mangosteens, fresh or dried
94.	S3-05798	Other fresh fruit
95.	S3-05799	Fruit, dried, n.e.s., and mixtures, n.e.s., of nuts or dried fruits of group 057
96.	S3-05893	Pineapples, prepared or preserved
97.	S3-05894	Citrus fruit, prepared or preserved
98.	S3-05895	Apricots, cherries and peaches, prepared or preserved
99.	S3-05995	Juice of any other single fruit or vegetable
100.	S3-06129	Other beet or cane sugar in solid form, other than flavoured or coloured
101.	S3-06151	Cane molasses
102.	S3-06159	Beet sugar molasses and other molasses (e.g., corn molasses)
103.	S3-06191	Lactose and lactose syrup
104.	S3-06193	Glucose (dextrose) and glucose syrup, not containing fructose or containing, in the dry state, less than 20% by weight of fructose
105.	S3-06194	Glucose and glucose syrup, containing, in the dry state, at least 20% but not more than 50% by weight of fructose

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
106.	S3-06199	Other sugars (including invert sugar); sugar syrup, not containing added
107.	S3-06221	Chewing-gum, whether or not sugar-coated, not containing cocoa
108.	S3-06229	Other sugar confectionery, not containing cocoa
109.	S3-07111	Coffee, not roasted, not decaffeinated
110.	S3-07131	Extracts, essences and concentrates of coffee and preparations with a bas
111.	S3-07132	Coffee substitutes containing coffee in any proportion
112.	S3-07231	Cocoa paste, not defatted (liquor)
113.	S3-07232	Cocoa paste, wholly or partly defatted (cocoa cake)
114.	S3-07411	Green tea (not fermented), in immediate packings of a content not exceeding 3 kg, whether or not flavoured
115.	S3-07412	Other green tea (not fermented), whether or not flavoured
116.	S3-07413	Black tea (fermented) and partly fermented tea, in immediate packings of a content not exceeding 3 kg, whether or not flavoured
117.	S3-07414	Other black tea (fermented) and other partly fermented tea, whether or not flavoured
118.	S3-07432	Extracts, essences and concentrates of tea or mat , and preparations with a basis of tea, mate, or their extracts, essences or concentrates
119.	S3-07511	Pepper of the genus Piper, neither crushed nor ground

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
120.	S3-07512	Pepper, of the genus Piper, crushed or ground
121.	S3-07513	Fruits of the genus Capsicum or of the genus Pimenta, dried or crushed or ground
122.	S3-07522	Cinnamon and cinnamon-tree flowers, neither crushed nor ground
123.	S3-07523	Cinnamon and cinnamon-tree flowers, crushed or ground
124.	S3-07524	Cloves (whole fruit, cloves and stems)
125.	S3-07525	Nutmeg, mace and cardamoms
126.	S3-07526	Seeds of anise, badian, fennel, coriander, cumin or caraway; juniper berries
127.	S3-07527	Ginger (excluding ginger preserved in sugar or conserved in syrup)
128.	S3-07529	Other spices; mixtures of two or more of the products of different headings of group 075
129.	S3-08111	Cereal straw and husks, unprepared, whether or not chopped, ground, press
130.	S3-08126	Bran, sharps and other residues, of wheat
131.	S3-08131	Oilcake and other solid residues of oil from soya beans
132.	S3-08137	Oilcake and other solid residues of oil from coconut or copra
133.	S3-08138	Oilcake and other solid residues of oil from palm nuts or kernel
134.	S3-08139	Oilcake and other solid residues of oil from other oil-seeds

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
135.	S3-08142	Flours, meals and pellets, of fish or of crustaceans, molluscs or other aquatic invertebrates, unfit for human consumption
136.	S3-08195	Dog or cat food, put up for retail sale
137.	S3-08199	Preparations of a kind used for animal food, n.e.s.
138.	S3-09101	Margarine (excluding liquid margarine)
139.	S3-09811	Homogenized preparations from meat and edible meat offal
140.	S3-09813	Cooked fruit preparations, homogenized
141.	S3-09814	Homogenized composite food preparations
142.	S3-09843	Mustard flour and meal and prepared mustard
143.	S3-09891	Pasta, cooked or stuffed; couscous, whether or not prepared
144.	S3-09893	Food preparations for infant use, put up for retail sale, of flour, meal, starch or malt extract (not containing cocoa or containing cocoa in a proportion by weight of less than 40% calculated on totally defatted basis, n.e.s., or of goods of heading 022
145.	S3-09894	Malt extract; food preparations of flour, meal, starch or malt extract n.e.s.
146.	S3-12232	Smoking tobacco, whether or not containing tobacco substitutes in any proportion
147.	S3-12239	Manufactured tobacco, extracts and essences, n.e.s.

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
148.	S3-21199	Hides and skins, n.e.s., raw (fresh, or salted, dried, limed, pickled or otherwise preserved, but not tanned, parchment-dressed or further prepared), whether or not dehaired or split
149.	S3-22211	Groundnuts (peanuts), not roasted or otherwise cooked, in shell
150.	S3-22212	Groundnuts (peanuts), not roasted or otherwise cooked, shelled
151.	S3-23121	Smoked sheets of natural rubber (other than latex)
152.	S3-23125	Technically specified natural rubber (TSNR)
153.	S3-23129	Other natural rubber
154.	S3-24502	Wood charcoal (including shell or nut charcoal), whether or not agglomerated
155.	S3-26331	Cotton yarn waste (including thread waste)
156.	S3-26339	Cotton waste (including pulled or garnetted rags), not carded or combed
157.	S3-26863	Noils of wool or of fine animal hair, not garnetted
158.	S3-26873	Wool tops and other combed wool
159.	S3-29115	Coral and similar materials, unworked or simply prepared but not otherwise
160.	S3-29195	Skins and other parts of birds, with their feathers or down, feathers and parts of feathers (whether or not trimmed edges) and down, not further worked than cleaned, disinfected or treated for preservation; powder and waste of feathers or parts of feathers

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
161.	S3-29196	Products of fish or crustaceans, molluscs or other aquatic invertebrates; dead animals of division 03, unfit for human consumption
162.	S3-29199	Animal products, n.e.s.
163.	S3-29231	Bamboos
164.	S3-29232	Rattans
165.	S3-29239	Vegetable materials, other than bamboos or rattans, of a kind used primarily for plaiting
166.	S3-29242	Ginseng roots
167.	S3-29252	Seeds of forage plants (other than beet seed), of a kind used for sowing
168.	S3-29254	Other vegetable seeds of a kind used for sowing
169.	S3-29259	Seeds, fruit and spores, n.e.s., of a kind used for sowing
170.	S3-29294	Vegetable saps and extracts
171.	S3-29296	Mucilages and thickeners, whether or not modified, derived from vegetable
172.	S3-29299	Vegetable materials and vegetable products, n.e.s.
173.	S3-41111	Fish liver oils and their fractions
174.	S3-42111	Soya bean oil, crude, whether or not degummed
175.	S3-42119	Soya bean oil, refined, and its fractions

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix A continued

No.	Product Code	Name of Agriculture Products
176.	S3-42142	Other olive oil and its fractions
177.	S3-42179	Rape, colza or mustard oil, refined, and fractions thereof
178.	S3-42229	Palm oil, refined, and its fractions
179.	S3-42231	Coconut (copra) oil, crude
180.	S3-42239	Coconut (copra) oil, refined, and its fractions
181.	S3-42241	Palm kernel or babassu oil, crude
182.	S3-42249	Palm kernel or babassu oil, refined, and fractions thereof
183.	S3-42299	Fixed vegetable fats and oils, crude, refined or fractionated, n.e.s.
184.	S3-43121	Animal fats and oils and their fractions, partly or wholly hydrogenated, inter-esterified; re-esterified or elaidinized, whether or not refined, but not further prepared
185.	S3-43131	Fatty acids; acid oils from refining
186.	S3-43133	Degras; residues resulting from the treatment of fatty substances or animal or vegetable waxes

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix B: Revealed Comparative Advantage (RCA) Index for Agricultural Products, Malaysia-World, 1988-2014 Results

Malaysia-World	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
S3-01122	0.011	0.020	0.053	0.093	0.001	0.009	0.015	0.017	0.024	0.017	0.018	0.015	0.024	0.032	0.032	0.027	0.021	0.025	0.018	0.018	0.023	0.036	0.037	0.027	0.025	0.024	0.015
S3-01221	0.000	0.000	0.000	0.000	0.000	0.003	0.014	0.011	0.018	0.013	0.011	0.008	0.006	0.004	0.004	0.006	0.006	0.005	0.004	0.008	0.005	0.005	0.004	0.001	0.004	0.010	0.009
S3-01235	0.018	0.005	0.008	0.019	0.020	0.027	0.031	0.031	0.037	0.047	0.038	0.047	0.026	0.022	0.022	0.035	0.021	0.004	0.003	0.004	0.006	0.012	0.010	0.013	0.014	0.017	0.015
S3-01689	0.003	0.002	0.010	0.655	0.993	1.089	1.041	0.952	0.916	0.049	0.113	0.106	0.069	0.025	0.024	0.029	0.140	0.150	0.113	0.033	0.030	0.058	0.026	0.023	0.025	0.016	0.009
S3-02221	0.003	0.005	0.013	0.010	0.003	0.023	0.013	0.032	0.031	0.028	0.016	0.046	0.074	0.215	0.351	0.295	0.274	0.304	0.263	0.225	0.189	0.180	0.139	0.166	0.234	0.386	0.611
S3-02222	0.135	0.201	0.395	0.475	0.541	0.502	0.506	0.397	0.471	0.718	0.490	0.448	0.526	0.407	0.321	0.495	0.526	0.599	0.689	0.915	0.750	0.565	0.253	0.213	0.291	0.248	0.278
S3-02499	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
S3-03414	0.501	0.793	1.194	1.204	1.970	1.111	1.158	0.602	0.689	0.695	0.402	0.492	0.454	0.378	0.196	0.071	0.079	0.457	0.406	0.349	0.403	0.437	0.169	0.020	0.004	0.003	0.000
S3-03415	0.002	0.003	0.002	0.003	0.002	0.006	0.005	0.012	0.002	0.016	0.025	0.013	0.007	0.022	0.004	0.000	0.000	0.000	0.000	0.003	0.001	0.002	0.003	0.001	0.000	0.000	0.000
S3-03418	0.257	0.210	0.200	0.191	0.229	0.347	0.252	0.219	0.261	0.137	0.119	0.174	0.251	0.167	0.205	0.198	0.225	0.286	0.253	0.331	0.208	0.201	0.194	0.178	0.270	0.320	0.295
S3-03421	0.010	0.003	0.007	0.022	0.008	0.007	0.007	0.012	0.011	0.007	0.004	0.002	0.003	0.010	0.007	0.005	0.026	0.043	0.045	0.044	0.054	0.072	0.004	0.003	0.002	0.004	0.009
S3-03422	0.002	0.001	0.004	0.006	0.004	0.015	0.020	0.020	0.002	0.005	0.030	0.031	0.001	0.103	0.010	0.012	0.018	0.099	0.046	0.064	0.039	0.038	0.007	0.005	0.001	0.013	0.005
S3-03423	0.031	0.075	0.231	0.170	0.203	0.273	0.223	0.214	0.154	0.129	0.129	0.116	0.029	0.041	0.051	0.068	0.130	0.269	0.062	0.158	0.219	0.195	0.162	0.040	0.024	0.024	0.034
S3-03424	0.040	0.064	0.052	0.031	0.187	0.191	0.127	0.035	0.029	0.031	0.014	0.030	0.009	0.017	0.007	0.024	0.024	0.021	0.021	0.025	0.045	0.113	0.086	0.096	0.101	0.102	0.063
S3-03428	0.162	0.237	0.236	0.200	0.208	0.140	0.176	0.190	0.136	0.092	0.120	0.075	0.084	0.083	0.093	0.155	0.257	0.298	0.175	0.263	0.260	0.208	0.224	0.186	0.210	0.211	0.204
S3-03451	0.000	0.002	0.001	0.001	0.000	0.000	0.001	0.004	0.002	0.001	0.004	0.001	0.001	0.001	0.004	0.010	0.014	0.006	0.016	0.024	0.032	0.028	0.011	0.017	0.028	0.044	0.043
S3-03455	0.009	0.001	0.004	0.003	0.005	0.003	0.006	0.001	0.022	0.006	0.003	0.018	0.007	0.060	0.010	0.100	0.099	0.097	0.380	0.469	0.236	0.430	0.345	0.242	0.264	0.421	0.484
S3-03512	0.001	0.000	0.004	0.002	0.001	0.004	0.004	0.009	0.000	0.003	0.004	0.007	0.018	0.013	0.011	0.004	0.021	0.019	0.064	0.038	0.058	0.096	0.028	0.014	0.009	0.011	0.012
S3-03513	0.266	0.256	0.236	0.251	0.172	0.163	0.142	0.121	0.105	0.108	0.093	0.198	0.252	0.267	0.226	0.201	0.245	0.224	0.223	0.238	0.143	0.175	0.127	0.356	0.263	0.158	0.203
S3-03522	0.005	0.059	0.150	0.121	0.166	0.226	0.039	0.047	0.069	0.029	0.024	0.013	0.073	0.040	0.077	0.025	0.005	0.082	0.719	0.235	0.347	0.141	0.089	0.521	0.817	0.584	0.450
S3-03529	0.005	0.009	0.036	0.007	0.003	0.001	0.007	0.005	0.001	0.001	0.005	0.022	0.012	0.005	0.020	0.010	0.015	0.029	0.057	0.026	0.031	0.027	0.022	0.055	0.027	0.057	0.094
S3-03611	1.047	0.627	0.657	0.742	0.629	0.521	0.527	0.576	0.595	0.733	0.716	0.824	1.033	1.129	0.946	0.937	1.363	1.562	1.126	1.189	1.079	1.009	1.066	0.976	0.976	0.859	1.029
S3-03619	0.005	0.009	0.036	0.007	0.003	0.001	0.007	0.005	0.001	0.001	0.005	0.022	0.012	0.005	0.020	0.010	0.015	0.029	0.057	0.026	0.031	0.027	0.022	0.055	0.027	0.057	0.094
S3-03633	1.613	1.324	2.399	3.929	4.142	1.666	1.700	0.895	0.927	0.688	0.687	0.949	0.575	0.377	0.794	0.376	0.367	0.366	0.401	0.388	0.430	0.589	0.403	0.247	0.306	0.545	0.436
S3-03635	0.149	0.225	0.270	0.279	0.276	0.224	0.227	0.061	0.041	0.113	0.048	0.075	0.066	0.150	0.108	0.095	0.110	0.180	0.064	0.086	0.037	0.080	0.038	0.095	0.113	0.090	0.057

S3-03637	0.645	0.724	1.008	1.040	0.985	0.628	0.479	0.442	0.520	0.672	0.811	0.695	0.805	0.852	0.906	0.924	1.185	1.275	1.438	1.309	0.898	0.655	0.429	0.343	0.388	0.430	0.465
S3-03639	0.121	0.250	0.471	0.488	0.403	0.328	0.154	0.126	0.075	0.052	0.063	0.216	0.260	0.354	0.227	0.220	0.227	0.194	0.216	0.203	0.190	0.193	0.194	0.129	0.242	0.260	0.178
S3-03712	0.053	0.078	0.056	0.193	0.261	0.216	0.177	0.074	0.081	0.204	0.169	0.222	0.357	0.252	0.203	0.225	0.239	0.276	0.232	0.237	0.221	0.267	0.212	0.218	0.210	0.255	0.370
S3-03713	2.030	0.757	0.535	0.480	0.470	0.459	0.284	0.197	0.184	0.180	0.141	0.165	0.220	0.178	0.144	0.105	0.111	0.081	0.123	0.034	0.020	0.032	0.014	0.011	0.015	0.015	0.014
S3-03714	0.030	0.003	0.003	0.019	0.030	0.071	0.047	0.099	0.111	0.151	0.120	0.251	0.263	0.206	0.188	0.236	0.459	0.443	0.493	0.540	0.581	0.668	0.521	0.426	0.466	0.601	0.678
S3-03715	0.015	0.027	0.237	0.943	1.549	2.249	1.715	1.256	0.957	0.802	0.588	0.472	0.370	0.597	0.407	0.455	0.363	0.351	0.441	0.338	0.243	0.317	0.273	0.254	0.264	0.318	0.391
S3-03716	0.104	0.440	0.331	0.284	0.664	0.920	0.748	0.570	0.613	0.572	0.547	0.621	0.779	0.952	0.719	0.588	0.567	0.846	0.590	0.362	0.431	0.395	0.439	0.418	0.582	0.745	0.973
S3-03721	1.525	1.587	1.608	1.474	1.244	1.100	0.983	0.663	0.634	0.740	0.669	0.521	0.630	0.750	0.525	0.416	0.450	0.377	0.320	0.286	0.129	0.121	0.075	0.055	0.141	0.131	0.172
S3-03722	0.235	0.247	0.256	0.123	0.150	0.157	0.242	0.269	0.297	0.263	0.212	0.226	0.219	0.245	0.178	0.147	0.160	0.147	0.167	0.192	0.200	0.380	0.286	0.203	0.226	0.265	0.238
S3-04231	0.002	0.000	0.000	0.000	0.000	0.000	0.002	0.003	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.005	0.003	0.000	0.001	0.001	0.001	0.000	0.000	0.012	0.040
S3-04599	0.076	0.017	0.051	0.100	0.031	0.046	0.060	0.101	0.074	0.033	0.037	0.207	0.101	0.032	0.034	0.066	0.047	0.010	0.048	0.038	0.022	0.024	0.013	0.009	0.005	0.007	0.005
S3-04711	0.784	0.254	0.418	0.617	0.828	0.504	0.226	0.130	0.229	0.340	0.154	0.092	0.119	0.054	0.108	0.031	0.022	0.038	0.016	0.013	0.038	0.054	0.044	0.053	0.042	0.050	0.117
S3-04719	1.975	0.270	0.186	0.303	0.377	0.427	0.163	0.294	0.293	0.296	0.194	0.455	0.446	0.822	0.422	0.391	0.481	0.321	0.354	0.249	0.246	0.265	0.224	0.180	0.257	0.292	0.269
S3-04722	0.136	0.167	0.387	0.629	0.460	0.484	0.272	0.132	0.175	0.543	0.237	0.139	0.493	0.356	0.033	0.059	0.056	0.045	0.042	0.009	0.015	0.024	0.020	0.008	0.059	0.111	0.373
S3-04811	0.117	0.200	0.323	0.307	0.254	0.372	0.352	0.356	0.353	0.221	0.181	0.305	0.330	0.289	0.240	0.231	0.199	0.260	0.231	0.182	0.152	0.171	0.153	0.151	0.179	0.182	0.456
S3-04812	0.115	0.135	0.210	0.211	1.423	0.642	0.307	0.340	1.074	1.153	0.853	1.339	2.031	1.049	0.361	0.309	0.556	0.625	0.295	0.171	0.202	0.256	0.162	0.146	0.180	0.214	0.330
S3-04813	1.615	1.701	1.972	1.632	2.435	2.381	2.125	2.242	3.249	3.360	2.094	2.214	2.634	2.441	2.152	1.632	1.618	1.071	2.163	1.998	1.197	1.432	1.493	1.022	1.059	1.250	0.925
S3-04814	0.099	0.113	0.096	0.145	0.136	0.093	0.096	0.103	0.166	0.070	0.179	0.188	0.402	0.267	0.158	0.113	0.167	0.140	0.081	0.035	0.123	0.090	0.053	0.035	0.024	0.054	0.029
S3-04841	0.047	0.125	0.191	0.193	0.237	0.191	0.263	0.288	0.286	0.206	0.118	0.083	0.146	0.349	0.214	0.177	0.103	0.206	0.200	0.170	0.271	0.272	0.274	0.184	0.188	0.181	0.155
S3-04842	0.084	0.179	0.244	0.343	0.363	0.413	0.615	0.673	0.657	0.545	0.431	0.602	0.823	0.791	0.575	0.448	0.452	0.642	0.565	0.540	0.464	0.629	0.566	0.514	0.638	0.735	0.810
S3-04849	0.132	0.248	0.286	0.294	0.352	0.328	0.397	0.366	0.395	0.344	0.245	0.412	0.631	0.637	0.515	0.465	0.483	0.578	0.548	0.455	0.465	0.589	0.522	0.493	0.573	0.646	0.730
S3-05421	0.002	0.002	0.002	0.004	0.017	0.007	0.013	0.019	0.028	0.020	0.008	0.010	0.009	0.003	0.018	0.047	0.039	0.048	0.041	0.025	0.015	0.012	0.013	0.005	0.005	0.007	0.003
S3-05422	0.007	0.000	0.002	0.006	0.009	0.038	0.044	0.047	0.037	0.019	0.005	0.001	0.011	0.031	0.010	0.039	0.019	0.013	0.010	0.011	0.016	0.009	0.005	0.003	0.015	0.009	0.007
S3-05423	0.060	0.014	0.009	0.008	0.009	0.006	0.004	0.004	0.008	0.012	0.015	0.047	0.014	0.014	0.019	0.062	0.076	0.040	0.019	0.009	0.010	0.046	0.030	0.020	0.021	0.035	0.018
S3-05425	0.003	0.008	0.019	0.052	0.009	0.017	0.029	0.026	0.014	0.018	0.016	0.020	0.018	0.024	0.016	0.016	0.013	0.013	0.008	0.003	0.003	0.032	0.014	0.010	0.021	0.035	0.011
S3-05429	0.633	0.431	0.927	0.726	0.433	0.376	0.136	0.140	0.161	0.118	0.132	0.256	0.272	0.398	0.453	0.403	0.236	0.396	0.512	0.539	0.501	0.548	0.156	0.768	0.774	0.570	0.524
S3-05451	0.080	0.366	0.152	0.106	0.188	0.216	0.120	0.145	0.232	0.170	0.156	0.322	0.486	0.439	0.459	0.621	0.740	0.823	0.503	0.261	0.305	0.263	0.202	0.144	0.157	0.385	0.172

S3-05452	1.022	0.802	0.485	0.392	0.460	0.478	0.582	0.656	0.572	0.771	0.411	0.577	0.622	0.649	0.502	0.468	0.523	0.443	0.354	0.220	0.292	0.115	0.060	0.075	0.099	0.155	0.167
S3-05453	0.097	0.274	0.298	0.151	0.228	0.349	0.206	0.157	0.142	0.188	0.122	0.126	0.199	0.203	0.145	0.124	0.106	0.105	0.113	0.098	0.075	0.104	0.116	0.113	0.125	0.143	0.125
S3-05454	0.042	0.057	0.055	0.018	0.021	0.124	0.098	0.080	0.085	0.114	0.060	0.052	0.178	0.220	0.178	0.113	0.129	0.121	0.097	0.092	0.073	0.087	0.091	0.082	0.102	0.127	0.114
S3-05455	0.042	0.057	0.055	0.018	0.021	0.124	0.098	0.080	0.085	0.114	0.060	0.052	0.178	0.220	0.178	0.113	0.129	0.121	0.097	0.092	0.073	0.087	0.091	0.082	0.102	0.127	0.114
S3-05456	0.097	0.126	0.124	0.034	0.067	0.230	0.154	0.117	0.132	0.142	0.125	0.131	0.183	0.184	0.164	0.097	0.083	0.105	0.092	0.082	0.078	0.123	0.109	0.111	0.113	0.141	0.121
S3-05457	0.665	0.891	0.729	0.123	0.152	0.670	0.409	0.295	0.322	0.263	0.258	0.241	0.340	0.522	0.423	0.340	0.332	0.445	0.379	0.299	0.248	0.292	0.255	0.268	0.301	0.273	0.375
S3-05458	0.003	0.007	0.010	0.011	0.018	0.046	0.020	0.014	0.014	0.017	0.011	0.015	0.021	0.023	0.023	0.029	0.049	0.129	0.155	0.170	0.131	0.160	0.145	0.160	0.247	0.302	0.391
S3-05459	0.167	0.181	0.171	0.082	0.119	0.274	0.194	0.156	0.159	0.164	0.130	0.179	0.281	0.331	0.247	0.179	0.160	0.193	0.179	0.157	0.136	0.159	0.148	0.125	0.120	0.133	0.128
S3-05469	0.003	0.005	0.014	0.011	0.006	0.005	0.003	0.003	0.004	0.008	0.004	0.004	0.005	0.010	0.009	0.008	0.011	0.016	0.012	0.008	0.010	0.013	0.011	0.014	0.026	0.031	0.030
S3-05481	0.036	0.002	0.004	0.003	0.000	0.000	0.001	0.002	0.001	0.002	0.004	0.002	0.018	0.024	0.017	0.023	0.016	0.020	0.014	0.008	0.008	0.003	0.003	0.001	0.002	0.010	0.008
S3-05483	2.076	2.342	1.973	0.385	0.155	0.283	0.165	0.186	0.205	0.175	0.172	0.359	0.331	0.297	0.268	0.247	0.169	0.172	0.135	0.124	0.116	0.100	0.090	0.052	0.063	0.059	0.052
S3-05612	0.004	0.013	0.044	0.023	0.028	0.025	0.021	0.031	0.014	0.023	0.034	0.065	0.163	0.154	0.201	0.069	0.055	0.063	0.084	0.029	0.064	0.205	0.089	0.104	0.298	0.230	0.368
S3-05613	0.006	0.020	0.044	0.051	0.010	0.001	0.004	0.035	0.124	0.086	0.010	0.106	0.081	0.245	0.624	0.068	0.044	0.048	0.097	0.106	0.118	0.073	0.039	0.022	0.022	0.017	0.020
S3-05619	0.007	0.019	0.013	0.007	0.014	0.020	0.013	0.011	0.007	0.022	0.012	0.043	0.061	0.111	0.056	0.009	0.038	0.032	0.045	0.032	0.030	0.061	0.034	0.027	0.056	0.122	0.042
S3-05641	0.007	0.004	0.026	0.004	0.029	0.006	0.019	0.010	0.021	0.001	0.025	0.035	0.030	0.097	0.033	0.023	0.071	0.140	0.159	0.095	0.113	0.160	0.096	0.083	0.149	0.190	0.105
S3-05642	0.000	0.000	0.000	0.012	0.000	0.005	0.006	0.003	0.007	0.001	0.002	0.007	0.016	0.009	0.011	0.010	0.058	0.005	0.024	0.003	0.004	0.005	0.001	0.003	0.013	0.002	0.015
S3-05645	7.585	3.780	5.683	4.947	2.476	1.618	2.285	2.232	2.687	3.015	1.710	1.071	1.552	1.587	1.426	0.623	1.680	0.204	0.258	0.283	0.103	0.651	0.476	0.287	0.605	0.570	0.672
S3-05647	14.958	0.601	0.692	0.805	0.752	0.832	0.556	0.841	0.909	1.275	1.907	2.269	2.450	3.461	2.573	2.428	1.660	0.454	0.591	0.635	0.568	1.009	0.245	0.167	0.438	0.289	0.204
S3-05648	0.071	0.069	1.416	3.108	4.202	5.033	3.108	3.859	2.960	3.175	2.821	2.764	2.039	2.431	2.699	1.903	1.900	1.353	1.955	1.677	2.172	2.764	1.934	2.136	2.158	2.230	2.179
S3-05661	0.045	0.029	0.036	0.039	0.053	0.045	0.039	0.036	0.029	0.016	0.009	0.009	0.006	0.008	0.017	0.027	0.019	0.027	0.025	0.023	0.032	0.036	0.031	0.029	0.022	0.036	0.059
S3-05671	0.018	0.010	0.013	0.022	0.019	0.025	0.013	0.010	0.027	0.011	0.009	0.027	0.045	0.052	0.031	0.012	0.006	0.004	0.003	0.010	0.010	0.013	0.017	0.010	0.014	0.019	0.018
S3-05673	0.012	0.007	0.004	0.005	0.006	0.011	0.007	0.003	0.009	0.002	0.003	0.007	0.005	0.008	0.006	0.001	0.004	0.009	0.005	0.003	0.004	0.006	0.003	0.004	0.006	0.009	0.009
S3-05674	0.011	0.029	0.033	0.085	0.069	0.063	0.101	0.116	0.051	0.028	0.046	0.064	0.220	0.198	0.134	0.037	0.159	0.151	0.093	0.074	0.086	0.086	0.052	0.019	0.009	0.013	0.141
S3-05676	0.006	0.002	0.045	0.083	0.091	0.117	0.102	0.067	0.081	0.083	0.113	0.143	0.212	0.365	0.340	0.323	0.347	0.420	0.432	0.363	0.410	0.469	0.616	0.600	0.879	0.926	0.500
S3-05677	0.005	0.004	0.004	0.005	0.010	0.003	0.004	0.003	0.003	0.003	0.005	0.006	0.009	0.004	0.001	0.001	0.004	0.002	0.008	0.009	0.004	0.007	0.006	0.007	0.003	0.008	0.033
S3-05679	0.104	0.196	0.339	0.292	0.229	0.188	0.145	0.110	0.117	0.125	0.088	0.078	0.132	0.115	0.095	0.060	0.055	0.052	0.050	0.047	0.049	0.074	0.062	0.057	0.068	0.065	0.067
S3-05711	0.002	0.002	0.002	0.007	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.004	0.003	0.002	0.002	0.003	0.005	0.004	0.004	0.009	0.007	0.005	0.003	0.005	0.009	0.013	0.024

S3-05712	0.000	0.001	0.004	0.001	0.000	0.001	0.001	0.004	0.001	0.002	0.001	0.003	0.006	0.003	0.003	0.003	0.004	0.006	0.003	0.002	0.002	0.003	0.004	0.002	0.002	0.008	0.007
S3-05721	0.031	0.026	0.035	0.032	0.035	0.053	0.052	0.031	0.030	0.026	0.026	0.031	0.044	0.060	0.048	0.032	0.029	0.038	0.043	0.031	0.017	0.023	0.021	0.025	0.026	0.033	0.063
S3-05729	0.458	0.801	0.866	0.148	0.149	0.368	0.219	0.262	0.108	0.376	0.074	0.080	0.119	0.029	0.095	0.103	1.017	1.622	0.233	0.225	0.158	0.091	0.036	0.039	0.032	0.091	0.347
S3-05751	0.002	0.001	0.004	0.003	0.000	0.000	0.011	0.003	0.013	0.005	0.004	0.007	0.012	0.007	0.009	0.006	0.004	0.003	0.005	0.005	0.005	0.008	0.008	0.010	0.010	0.012	0.008
S3-05752	0.023	0.014	0.019	0.030	0.001	0.004	0.006	0.003	0.038	0.066	0.020	0.098	0.156	0.358	0.406	0.056	0.022	0.031	0.022	0.013	0.018	0.043	0.023	0.027	0.030	0.037	0.060
S3-05773	0.000	0.001	0.001	0.001	0.004	0.000	0.000	0.000	0.001	0.004	0.004	0.002	0.001	0.002	0.002	0.009	0.015	0.019	0.014	0.001	0.001	0.000	0.002	0.002	0.001	0.000	0.003
S3-05774	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.001	0.001	0.002	0.002	0.003	0.002	0.002	0.000	0.008	0.054	0.001	0.001	0.003	0.002	0.005	0.002	0.007	0.003	0.002
S3-05777	0.013	0.012	0.005	0.005	0.001	0.000	0.003	0.001	0.004	0.002	0.004	0.010	0.011	0.001	0.005	0.010	0.009	0.025	0.025	0.014	0.031	0.070	0.057	0.060	0.036	0.036	0.023
S3-05779	1.009	0.689	0.685	0.497	0.366	0.477	0.396	0.353	0.392	0.581	0.398	0.365	0.467	0.224	0.126	0.100	0.107	0.194	0.191	0.207	0.148	0.096	0.103	0.067	0.107	0.261	0.202
S3-05791	0.653	0.758	1.049	0.890	1.244	1.670	1.377	1.246	1.275	1.250	1.038	1.247	1.594	1.890	1.633	1.122	0.941	0.824	0.677	0.399	0.297	0.360	0.324	0.308	0.344	0.407	0.497
S3-05792	0.025	0.017	0.015	0.012	0.000	0.002	0.021	0.007	0.005	0.009	0.010	0.010	0.010	0.013	0.019	0.011	0.020	0.016	0.009	0.006	0.007	0.005	0.008	0.006	0.003	0.005	0.010
S3-05795	0.663	0.923	1.227	0.582	0.643	0.938	0.520	0.395	0.288	0.215	0.194	0.175	0.315	0.300	0.224	0.132	0.106	0.121	0.127	0.117	0.100	0.175	0.155	0.098	0.116	0.135	0.356
S3-05796	0.081	0.140	0.120	0.060	0.018	0.011	0.022	0.032	0.083	0.298	0.058	0.273	0.346	0.447	0.369	0.105	0.068	0.076	0.062	0.054	0.115	0.263	0.169	0.135	0.135	0.144	0.295
S3-05797	0.208	0.313	0.183	0.159	0.229	0.253	0.174	0.119	0.186	0.127	0.072	0.170	0.241	0.343	0.226	0.144	0.139	0.074	0.056	0.044	0.043	0.046	0.029	0.028	0.029	0.082	0.108
S3-05798	0.796	1.163	1.249	1.592	1.551	2.120	1.441	0.750	0.938	0.764	0.689	1.073	1.142	1.161	0.727	0.636	0.460	0.373	0.338	0.277	0.211	0.275	0.251	0.185	0.188	0.241	0.229
S3-05799	0.017	0.017	0.015	0.012	0.013	0.010	0.012	0.024	0.047	0.024	0.020	0.131	0.169	0.174	0.201	0.068	0.084	0.052	0.031	0.018	0.016	0.041	0.026	0.034	0.039	0.048	0.051
S3-05893	10.421	2.560	2.974	2.303	2.025	1.889	1.688	1.607	1.389	1.587	1.152	0.890	0.835	0.842	0.792	1.064	0.788	0.674	0.583	0.624	0.281	0.389	0.369	0.259	0.218	0.261	0.267
S3-05894	0.029	0.018	0.011	0.015	0.010	0.016	0.010	0.008	0.004	0.001	0.000	0.001	0.013	0.005	0.003	0.003	0.004	0.020	0.057	0.047	0.008	0.005	0.002	0.002	0.001	0.000	0.002
S3-05895	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.003	0.001	0.004	0.003	0.002	0.004	0.003	0.005	0.003	0.001	0.002	0.002	0.012
S3-05995	0.120	0.087	0.128	0.208	0.212	0.230	0.146	0.099	0.076	0.102	0.142	0.162	0.180	0.283	0.298	0.309	0.277	0.247	0.258	0.211	0.190	0.268	0.247	0.252	0.329	0.212	0.155
S3-06129	0.284	0.685	0.801	0.728	0.626	0.518	0.538	0.286	0.293	0.362	0.320	0.472	0.771	0.889	0.872	0.745	0.610	0.529	0.456	0.617	0.278	0.328	0.419	0.377	0.386	0.481	0.494
S3-06151	0.612	0.220	0.333	0.239	0.088	0.133	0.262	0.159	0.206	0.096	0.162	0.048	0.069	0.039	0.010	0.023	0.030	0.066	0.024	0.026	0.030	0.035	0.030	0.025	0.030	0.036	0.050
S3-06159	0.018	0.095	0.071	0.074	0.077	0.071	0.068	0.054	0.029	0.044	0.044	0.057	0.021	0.021	0.030	0.056	0.052	0.051	0.053	0.031	0.044	0.035	0.422	0.039	0.025	0.019	0.026
S3-06191	0.003	0.028	0.044	0.008	0.004	0.008	0.009	0.005	0.001	0.003	0.004	0.038	0.049	0.028	0.054	0.039	0.045	0.015	0.025	0.008	0.006	0.013	0.005	0.009	0.005	0.008	0.085
S3-06193	0.050	0.067	0.098	0.149	0.202	0.235	0.534	0.469	0.146	0.206	0.133	0.417	0.477	0.303	0.233	0.155	0.165	0.179	0.128	0.085	0.030	0.181	0.144	0.106	0.130	0.049	0.050
S3-06194	0.093	0.182	0.448	0.540	0.592	0.627	0.721	1.000	0.877	0.390	0.251	0.077	0.056	0.040	0.158	0.163	0.116	0.379	0.351	0.565	0.333	0.053	0.038	0.016	0.095	0.018	0.028
S3-06199	0.640	0.643	0.755	0.532	0.612	0.262	0.262	0.134	0.153	0.200	0.163	0.170	0.337	0.380	0.469	0.428	0.225	0.732	0.396	0.368	0.469	0.765	0.767	0.590	0.858	0.921	0.886

S3-06221	0.014	0.041	0.048	0.007	0.002	0.006	0.020	0.023	0.018	0.018	0.030	0.008	0.006	0.130	0.079	0.095	0.141	0.213	0.243	0.249	0.300	0.455	0.354	0.303	0.669	0.742	0.557
S3-06229	0.157	0.239	0.335	0.433	0.307	0.326	0.367	0.371	0.406	0.310	0.225	0.274	0.343	0.300	0.201	0.168	0.147	0.146	0.153	0.134	0.128	0.183	0.196	0.186	0.218	0.265	0.283
S3-07111	0.140	0.001	0.006	0.004	0.006	0.004	0.005	0.004	0.004	0.004	0.003	0.003	0.006	0.007	0.006	0.008	0.006	0.007	0.009	0.006	0.004	0.008	0.005	0.005	0.006	0.010	0.011
S3-07131	0.055	0.133	0.135	0.168	0.152	0.122	0.131	0.281	0.350	0.293	0.312	0.572	1.132	1.896	1.637	1.110	1.206	1.093	0.953	0.978	0.955	1.465	1.614	1.440	1.966	2.404	2.491
S3-07132	0.077	0.059	0.031	0.103	0.072	0.182	1.124	0.209	0.175	0.062	0.033	1.011	0.622	0.661	1.512	0.939	0.404	0.171	0.101	0.437	0.957	2.203	1.363	0.631	0.522	1.181	0.491
S3-07231	0.192	0.241	0.240	0.137	0.149	0.217	0.317	0.444	0.746	0.778	0.466	0.743	1.120	0.897	0.776	0.589	0.938	1.314	1.589	1.817	1.416	1.362	1.358	1.502	1.584	1.441	1.735
S3-07232	0.761	1.013	2.597	1.864	2.148	4.128	5.693	3.654	2.069	1.969	5.026	4.928	7.609	10.967	11.092	10.655	10.043	8.900	5.010	3.824	5.289	7.122	5.940	5.395	4.862	5.206	2.350
S3-07411	0.078	0.200	0.119	0.042	0.035	0.016	0.056	0.112	0.153	0.156	0.064	0.037	0.026	0.185	0.210	0.086	0.086	0.091	0.039	0.021	0.010	0.019	0.020	0.031	0.032	0.033	0.047
S3-07412	0.080	0.184	0.451	0.159	0.002	0.017	0.055	0.021	0.059	0.022	0.014	0.034	0.057	0.086	0.096	0.167	0.096	0.059	0.056	0.057	0.068	0.162	0.107	0.054	0.110	0.076	0.053
S3-07413	0.068	0.062	0.040	0.038	0.043	0.038	0.033	0.039	0.061	0.032	0.021	0.029	0.049	0.046	0.098	0.036	0.010	0.014	0.014	0.013	0.016	0.026	0.017	0.028	0.037	0.033	0.034
S3-07414	0.027	0.019	0.014	0.012	0.017	0.013	0.016	0.013	0.020	0.019	0.010	0.008	0.011	0.011	0.035	0.028	0.023	0.040	0.029	0.031	0.029	0.036	0.036	0.043	0.054	0.047	0.070
S3-07432	0.281	0.319	0.408	0.158	0.044	0.023	0.108	0.101	0.374	0.492	0.176	0.282	0.378	0.516	0.415	0.314	0.881	0.567	0.348	0.335	0.387	0.452	0.325	0.343	0.526	0.748	0.960
S3-07511	6.782	4.191	4.899	4.545	3.775	3.756	4.523	2.993	4.111	5.659	4.538	4.886	5.032	5.250	3.447	2.870	2.813	3.109	2.543	2.030	1.487	1.859	1.713	1.530	1.270	1.616	3.273
S3-07512	0.213	2.344	4.347	4.299	3.005	2.908	2.388	2.138	3.063	2.868	2.426	3.058	5.940	5.157	3.255	2.140	1.725	2.198	2.464	2.096	1.090	1.691	1.245	1.095	1.086	0.954	1.632
S3-07513	0.052	0.083	0.126	0.104	0.145	0.097	0.078	0.049	0.097	0.158	0.157	0.236	0.314	0.402	0.541	0.299	0.584	0.516	0.499	0.392	0.252	0.453	0.360	0.181	0.175	0.217	0.122
S3-07522	0.777	0.254	0.052	0.016	0.032	0.025	0.004	0.030	0.025	0.033	0.083	0.037	0.053	0.069	0.070	0.040	0.020	0.024	0.041	0.040	0.105	0.160	0.147	0.098	0.124	0.048	0.077
S3-07523	0.009	0.003	0.000	0.009	0.050	0.011	0.013	0.095	0.053	0.145	0.864	1.025	1.244	1.824	0.659	0.641	0.372	0.355	0.432	0.382	0.224	0.157	0.090	0.014	0.035	0.035	0.024
S3-07524	2.424	0.687	0.708	0.528	0.623	0.852	0.605	0.526	1.104	0.527	0.130	2.653	0.140	0.121	0.083	0.064	0.159	0.222	0.161	0.139	0.077	0.116	0.141	0.092	0.126	0.146	0.168
S3-07525	0.178	0.702	0.431	0.112	0.173	0.050	0.092	0.061	0.125	0.126	0.123	0.160	0.079	0.176	0.192	0.153	0.129	0.181	0.313	0.252	0.128	0.138	0.128	0.127	0.096	0.100	0.108
S3-07526	0.048	0.092	0.128	0.188	0.112	0.058	0.058	0.080	0.200	0.095	0.059	0.073	0.120	0.098	0.340	0.080	0.107	0.041	0.050	0.044	0.059	0.077	0.081	0.082	0.054	0.048	0.050
S3-07527	1.025	0.314	0.496	0.654	0.606	0.258	0.140	0.028	0.059	0.097	0.035	0.029	0.039	0.133	0.116	0.090	0.031	0.116	0.074	0.201	0.097	0.146	0.066	0.068	0.078	0.022	0.029
S3-07529	0.175	0.272	0.377	0.338	0.249	0.260	0.249	0.193	0.172	0.223	0.259	0.440	0.594	0.726	0.553	0.573	0.737	0.900	0.667	0.535	0.641	0.751	0.575	0.491	0.742	0.819	0.800
S3-08111	0.072	0.176	0.154	0.078	0.024	0.100	0.103	0.015	0.009	0.028	0.031	0.031	0.020	0.008	0.003	0.011	0.069	0.114	0.100	0.046	0.035	0.080	0.069	0.052	0.073	0.060	0.079
S3-08126	0.055	0.102	0.159	0.061	0.022	0.015	0.019	0.024	0.078	0.036	0.079	0.270	0.508	0.229	0.203	0.186	0.090	0.318	0.186	0.096	0.074	0.098	0.184	0.106	0.025	0.025	0.119
S3-08131	0.022	0.009	0.011	0.008	0.006	0.009	0.012	0.016	0.011	0.010	0.028	0.051	0.044	0.036	0.065	0.035	0.020	0.023	0.021	0.017	0.013	0.018	0.018	0.017	0.027	0.008	0.013
S3-08137	0.134	0.662	0.134	0.001	0.179	0.149	0.166	0.035	0.044	0.122	0.187	0.312	0.290	0.214	0.428	0.343	0.603	0.211	0.285	0.362	0.294	0.220	0.186	0.090	0.073	0.074	0.101
S3-08138	21.336	24.694	30.195	28.633	29.927	27.126	24.556	22.809	24.759	24.552	22.514	24.652	29.016	35.345	26.000	22.338	17.724	20.287	18.377	16.402	13.586	15.973	14.005	11.212	11.921	15.194	15.523

S3-08139	0.011	0.020	0.017	0.012	0.017	0.064	0.352	0.374	0.370	0.159	0.185	0.017	0.030	0.002	0.012	0.020	0.009	0.040	0.163	0.273	0.046	0.121	0.151	0.025	0.091	0.242	0.081
S3-08142	0.069	0.178	0.152	0.144	0.083	0.080	0.038	0.031	0.016	0.013	0.222	0.108	0.131	0.274	0.415	0.326	0.309	0.326	0.245	0.287	0.119	0.127	0.216	0.160	0.223	0.326	0.397
S3-08195	0.007	0.005	0.005	0.009	0.016	0.012	0.009	0.018	0.033	0.050	0.037	0.034	0.058	0.031	0.015	0.009	0.019	0.016	0.010	0.026	0.020	0.007	0.006	0.006	0.079	0.062	0.006
S3-08199	0.045	0.055	0.063	0.091	0.106	0.117	0.108	0.178	0.170	0.187	0.174	0.175	0.268	0.387	0.335	0.304	0.280	0.262	0.349	0.307	0.198	0.227	0.233	0.244	0.310	0.342	0.341
S3-09101	0.305	0.271	0.294	0.292	0.302	0.342	0.288	0.246	0.230	0.195	0.197	0.276	0.431	0.501	0.425	0.288	0.315	0.354	0.529	0.461	0.546	0.755	0.431	0.422	0.466	0.456	0.587
S3-09811	0.465	0.588	0.702	1.002	0.328	0.204	0.087	0.043	0.024	0.050	0.063	0.066	0.033	0.039	0.038	0.012	0.024	0.008	0.021	0.014	0.047	0.180	0.141	0.076	0.072	0.061	0.087
S3-09813	0.011	0.001	0.008	0.052	0.013	0.008	0.119	0.045	0.020	0.021	0.012	0.032	0.115	0.128	0.084	0.026	0.023	0.108	0.071	0.021	0.034	0.021	0.024	0.013	0.017	0.018	0.015
S3-09814	0.011	0.001	0.008	0.052	0.013	0.008	0.119	0.045	0.020	0.021	0.012	0.032	0.115	0.128	0.084	0.026	0.023	0.108	0.071	0.021	0.034	0.021	0.024	0.013	0.017	0.018	0.015
S3-09843	0.011	0.020	0.035	0.072	0.000	0.023	0.011	0.009	0.025	0.005	0.012	0.016	0.052	0.047	0.022	0.015	0.035	0.012	0.014	0.018	0.024	0.026	0.037	0.050	0.064	0.073	0.068
S3-09891	0.121	0.382	0.633	0.820	1.171	1.383	1.350	1.190	1.056	1.011	0.724	0.608	0.792	0.775	0.578	0.408	0.381	0.361	0.354	0.389	0.560	0.669	0.566	0.537	0.609	0.794	0.926
S3-09893	0.127	0.174	0.164	0.209	0.312	0.307	0.308	0.308	0.457	0.402	0.426	0.435	0.551	0.441	0.813	0.692	0.636	0.715	0.596	0.546	0.411	0.546	0.463	0.395	0.476	0.589	0.610
S3-09894	0.485	0.757	0.722	0.780	0.822	1.112	1.057	1.295	1.130	0.959	0.883	0.842	1.228	1.601	1.384	1.418	1.222	1.201	1.680	1.492	1.799	2.344	2.115	1.837	2.623	3.012	2.842
S3-12232	0.000	0.002	0.008	0.000	0.001	0.013	0.077	0.098	1.455	1.707	0.468	0.662	2.174	3.675	3.200	1.778	1.508	1.325	1.375	1.314	1.226	1.193	0.981	0.850	0.816	0.132	0.042
S3-12239	0.047	0.036	0.233	0.614	0.993	1.091	0.939	1.429	2.038	1.428	0.549	0.652	0.649	0.676	0.615	0.695	0.922	0.545	0.998	1.080	0.934	1.116	1.000	1.065	2.441	2.631	2.444
S3-21199	0.352	0.189	0.162	0.171	0.107	0.139	0.189	0.197	0.752	0.582	0.501	0.674	1.588	0.467	0.307	0.292	0.447	0.315	0.267	0.307	0.283	0.340	0.414	0.344	0.645	0.541	0.505
S3-22211	0.005	0.006	0.010	0.012	0.027	0.017	0.019	0.040	0.077	0.029	0.033	0.055	0.036	0.035	0.027	0.088	0.120	0.145	0.068	0.079	0.096	0.023	0.027	0.038	0.119	0.020	0.000
S3-22212	0.034	0.001	0.005	0.023	0.017	0.003	0.006	0.005	0.015	0.039	0.068	0.095	0.026	0.039	0.045	0.131	0.085	0.108	0.098	0.036	0.083	0.031	0.047	0.039	0.020	0.012	0.004
S3-23121	21.620	4.967	4.780	3.168	2.188	1.949	1.524	1.302	1.450	1.601	1.323	0.880	0.414	0.555	0.371	0.204	0.377	0.276	0.143	0.147	0.127	0.066	0.389	0.083	0.269	0.456	0.365
S3-23125	22.086	11.660	14.054	13.394	14.035	14.138	14.155	13.424	12.967	13.553	13.132	14.129	16.401	16.026	13.771	12.616	14.070	15.943	13.915	8.243	6.244	6.964	5.729	3.794	3.046	4.608	5.183
S3-23129	17.053	5.881	5.290	5.514	4.537	4.198	3.184	2.767	2.800	2.167	1.625	1.504	1.099	0.831	0.539	0.410	0.374	0.218	0.196	0.217	0.224	0.175	0.153	0.115	0.227	1.016	1.279
S3-24502	0.958	1.173	1.088	1.756	2.250	2.560	2.137	2.046	2.445	2.577	1.992	2.603	3.179	2.853	2.148	1.488	1.575	1.854	1.723	1.474	1.158	1.447	1.288	1.148	1.179	1.036	1.087
S3-26331	0.263	0.174	0.121	0.478	0.397	0.582	4.439	3.175	2.544	2.211	1.292	0.548	1.102	1.270	0.433	0.802	0.687	1.194	1.551	0.500	0.128	0.223	0.223	0.042	0.029	0.029	0.190
S3-26339	0.383	0.461	0.382	0.466	0.462	0.423	0.622	0.666	0.660	0.711	0.669	0.992	0.957	1.208	0.757	0.597	0.890	0.906	0.588	0.782	0.705	0.961	0.857	0.555	0.724	0.856	0.209
S3-26863	0.102	0.131	0.377	0.348	0.446	0.945	0.707	0.573	0.702	0.818	0.751	0.470	0.289	0.284	0.391	0.408	0.213	0.536	0.517	0.734	0.513	0.323	2.060	0.424	0.733	1.024	1.109
S3-26873	1.158	1.130	1.387	1.368	0.743	1.005	1.054	0.922	1.238	0.918	0.706	0.359	0.087	0.303	0.201	0.207	0.216	0.463	0.786	0.528	0.699	0.625	0.328	0.515	0.668	1.302	1.419
S3-29115	0.164	0.131	0.112	0.217	0.314	0.068	0.059	0.028	0.034	0.030	0.067	0.014	0.007	0.017	0.014	0.022	0.050	0.019	0.010	0.039	0.021	0.015	0.031	0.045	0.096	0.139	0.092
S3-29195	0.115	0.222	0.244	0.412	0.158	0.173	0.190	0.281	0.306	0.306	0.263	0.286	0.393	0.393	0.332	0.336	0.357	0.348	0.311	0.265	0.153	0.149	0.205	0.180	0.117	0.130	0.135

S3-29196	0.016	0.014	0.016	0.010	0.020	0.015	0.027	0.130	0.249	0.149	0.319	0.335	0.544	0.387	0.138	0.130	0.068	0.057	0.100	0.066	0.061	0.084	0.084	0.125	0.109	0.384	0.014
S3-29199	0.001	0.003	0.010	0.017	0.012	0.027	0.011	0.021	0.010	0.011	0.001	0.007	0.005	0.007	0.015	0.003	0.008	0.021	0.045	0.001	0.001	0.008	0.002	0.004	0.001	0.059	0.000
S3-29231	0.627	0.639	0.771	0.747	0.070	0.064	0.064	0.035	0.027	0.052	0.017	0.023	0.075	0.139	0.092	0.099	0.123	0.068	0.087	0.058	0.024	0.043	0.064	0.037	0.035	0.037	0.004
S3-29232	17.467	6.152	3.855	5.314	4.209	3.926	5.740	6.364	8.291	6.781	7.850	6.340	2.464	1.590	1.265	0.389	0.492	1.184	1.351	0.723	0.765	1.261	1.483	0.933	1.644	2.516	1.714
S3-29239	0.084	0.064	0.105	0.105	0.001	0.002	0.086	0.069	0.019	0.089	0.023	0.038	0.036	0.046	0.002	0.000	0.011	0.010	0.007	0.015	0.279	0.486	0.223	0.075	0.113	0.442	0.382
S3-29242	0.001	0.003	0.009	0.045	0.027	0.014	0.007	0.015	0.026	0.035	0.044	0.033	0.056	0.058	0.035	0.039	0.019	0.032	0.005	0.012	0.027	0.025	0.019	0.034	0.034	0.027	0.106
S3-29252	0.007	0.000	0.004	0.001	0.002	0.001	0.001	0.004	0.010	0.002	0.004	0.010	0.003	0.000	0.000	0.001	0.005	0.012	0.009	0.016	0.005	0.003	0.009	0.011	0.002	0.004	0.003
S3-29254	0.003	0.001	0.001	0.001	0.004	0.003	0.002	0.005	0.006	0.014	0.005	0.007	0.003	0.009	0.008	0.002	0.003	0.005	0.003	0.003	0.003	0.001	0.002	0.001	0.008	0.002	0.001
S3-29259	0.034	0.035	0.032	0.008	0.007	0.045	0.023	0.020	0.001	0.069	0.020	0.007	0.018	0.027	0.022	0.007	0.082	0.053	0.070	0.042	0.066	0.061	0.030	0.024	0.039	0.021	0.088
S3-29294	0.007	0.011	0.024	0.033	0.028	0.025	0.033	0.014	0.015	0.012	0.008	0.005	0.004	0.014	0.006	0.008	0.004	0.004	0.029	0.009	0.010	0.008	0.006	0.002	0.008	0.029	0.009
S3-29296	0.005	0.003	0.006	0.006	0.013	0.004	0.032	0.005	0.033	0.026	0.019	0.019	0.021	0.016	0.016	0.065	0.073	0.089	0.090	0.095	0.136	0.187	0.086	0.037	0.029	0.072	0.077
S3-29299	0.710	0.496	0.503	0.209	0.216	0.317	0.269	0.119	0.112	0.103	0.075	0.064	0.084	0.061	0.062	0.067	0.114	0.159	0.133	0.160	0.494	1.381	2.074	3.134	4.122	3.994	5.619
S3-41111	0.014	0.012	0.009	0.019	0.006	0.027	0.034	0.041	0.337	0.288	0.177	0.410	0.163	0.143	0.080	0.098	0.132	0.081	0.027	0.016	0.182	0.206	0.214	0.324	0.140	0.557	0.182
S3-42111	0.102	0.107	0.225	0.336	0.073	0.223	0.063	0.235	0.374	0.199	0.251	0.244	0.159	0.377	0.277	0.090	0.188	0.167	0.134	0.049	0.031	0.018	0.047	0.057	0.084	0.107	0.166
S3-42119	1.653	1.379	1.003	1.923	1.143	1.987	2.206	2.591	2.898	2.405	3.062	3.461	5.310	4.230	2.324	1.971	2.620	2.508	2.462	2.632	1.952	3.354	2.859	2.355	3.090	3.298	3.787
S3-42142	0.000	0.001	0.001	0.027	0.001	0.003	0.006	0.011	0.003	0.012	0.004	0.005	0.004	0.004	0.005	0.002	0.001	0.003	0.009	0.006	0.009	0.004	0.004	0.005	0.013	0.010	0.042
S3-42179	0.582	2.335	1.810	0.801	0.726	0.506	0.956	0.627	0.340	0.252	0.564	0.873	0.583	0.591	0.325	0.435	0.896	0.836	0.687	0.707	0.439	0.594	0.579	0.544	0.626	0.692	0.723
S3-42229	20.932	26.896	31.887	34.365	36.991	36.640	31.812	30.811	30.048	30.240	32.586	30.688	35.463	37.886	29.894	27.801	25.203	25.959	23.321	20.924	18.626	21.427	18.627	16.222	15.483	16.887	14.498
S3-42231	17.678	3.659	4.186	0.846	1.410	0.944	1.694	0.904	0.859	0.769	1.205	2.015	1.233	1.159	1.007	1.253	1.536	1.633	2.178	1.138	1.190	0.971	0.400	0.722	0.902	0.477	1.025
S3-42239	4.558	3.957	5.285	3.784	4.909	4.910	2.200	2.852	1.787	1.272	1.267	1.892	2.935	3.092	5.798	7.413	7.730	8.594	6.184	6.391	4.283	6.300	4.840	4.276	4.122	4.370	5.069
S3-42241	21.520	22.834	24.606	23.486	12.781	9.631	4.802	3.516	6.607	1.533	8.265	7.300	2.378	6.178	3.849	6.117	6.117	5.390	3.753	5.097	3.747	4.302	3.588	4.626	6.985	11.494	14.270
S3-42249	17.432	24.388	29.636	31.705	34.885	37.439	34.430	31.933	36.243	35.012	30.761	28.274	34.501	41.859	32.774	32.604	28.220	29.217	28.349	22.311	20.149	23.819	21.096	16.623	12.227	12.005	11.529
S3-42299	0.013	0.118	0.252	0.066	0.503	0.227	0.925	0.351	0.354	0.584	0.548	0.096	0.667	0.902	0.648	0.223	0.165	0.139	0.080	0.512	0.389	0.365	0.414	0.210	0.253	0.347	0.399
S3-43121	0.013	0.018	0.045	0.123	0.020	0.007	0.067	0.064	0.027	0.033	0.159	0.113	0.035	0.086	0.068	0.009	0.010	0.005	0.008	0.081	0.036	0.650	0.592	0.517	0.737	0.364	0.630
S3-43131	5.370	4.738	5.464	5.602	7.950	7.143	8.374	8.369	13.084	13.183	10.114	14.577	17.043	16.812	14.680	14.083	14.266	15.938	15.560	13.484	10.988	12.360	10.590	8.659	8.394	9.957	10.332
S3-43133	1.449	2.060	3.889	3.757	3.158	6.454	5.069	4.097	7.478	8.755	5.984	2.996	1.796	3.226	2.152	3.746	3.333	4.867	3.879	4.590	2.200	2.799	2.997	1.771	1.668	2.163	2.102

Note: Highlighted cells in red colour denote the Revealed Comparative Advantage (RCA) index greater than one.

Appendix C: List of 40 Agricultural Products based on SITC Revision 3 (3-Digits Code)

No.	Product Code	Name of Agriculture Products
1.	S3-011	Meat of bovine animals, fresh, chilled or frozen
2.	S3-012	Other meat and edible meat offal, fresh, chilled or frozen
3.	S3-016	Meat, edible meat offal, salted, in brine, dried or smoked
4.	S3-022	Milk and cream and milk products other than butter or cheese
5.	S3-024	Cheese and curd
6.	S3-034	Fish, fresh (live or dead), chilled or frozen
7.	S3-035	Fish, dried, salted or in brine; smoked fish (whether or not cooked before or during the smoking process); flours, meals and pellets of fish, fit for human consumption
8.	S3-036	Crustaceans, molluscs and aquatic invertebrates, whether in shell or not, fresh (live or dead), chilled, frozen, dried, salted or in brine; crustaceans, in shell, cooked by steaming or boiling in water, whether or not chilled, frozen, dried, salted or in brine; flours, meals and pellets of crustaceans or of aquatic invertebrates, fit for human consumption
9.	S3-037	Fish, crustaceans, molluscs and other aquatic invertebrates, prepared or preserved, n.e.s.
10.	S3-042	Rice
11.	S3-045	Cereals, unmilled (other than wheat, rice, barley and maize)
12.	S3-047	Other cereal meals and flours

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix C continued

No.	Product Code	Name of Agriculture Products
13.	S3-048	Cereal preparations and preparations of flour or starch of fruits or vegetables
14.	S3-054	Vegetables, fresh, chilled, frozen or simply preserved (including dried leguminous vegetables); roots, tubers and other edible vegetable products, n.e.s., fresh or dried
15.	S3-056	Vegetables, roots and tubers, prepared or preserved, n.e.s.
16.	S3-057	Fruit and nuts (not including oil nuts), fresh or dried
17.	S3-058	Fruit, preserved, and fruit preparations (excluding fruit juices)
18.	S3-059	Fruit, juices (including grape must) and vegetable juices, unfermented and not containing added spirit, whether or not containing added sugar or other sweetening matter
19.	S3-061	Sugars, molasses and honey
20.	S3-062	Sugar confectionery
21.	S3-071	Coffee and coffee substitutes
22.	S3-072	Cocoa
23.	S3-074	Tea and maté
24.	S3-075	Spices
25.	S3-081	Feeding stuff for animals (not including unmilled cereals)

Source: Tabulated based on the UN Comtrade Database, 2015.

Appendix C continued

No.	Product Code	Name of Agriculture Products
26.	S3-091	Margarine and shortening
27.	S3-098	Edible products and preparations, n.e.s.
28.	S3-122	Tobacco, manufactured (whether or not containing tobacco substitutes)
29.	S3-211	Hides and skins (except furskins), raw
30.	S3-222	Oil-seeds and oleaginous fruits of a kind used for the extraction of “soft” fixed vegetable oils (excluding flours and meals)
31.	S3-231	Natural rubber, balata, gutta-ercha, guayule, chicle and similar natural gums, in primary forms (including latex) or in plates, sheets or strip
32.	S3-245	Fuel wood (excluding wood waste) and wood charcoal
33.	S3-263	Cotton
34.	S3-268	Wool and other animal hair (including wool tops)
35.	S3-291	Crude animal materials, n.e.s.
36.	S3-292	Crude vegetable materials, n.e.s.
37.	S3-411	Animal oils and fats
38.	S3-421	Fixed vegetable fats and oils, “soft”, crude, refined or fractioned
39.	S3-422	Fixed vegetable fats and oils, crude, refined or fractioned, other than “soft”
40.	S3-431	Animal or vegetable fats and oils, processed; waxes; inedible mixture or preparations of animal or vegetable fats or oils, n.e.s.

Source: Tabulated based on the UN Comtrade Database, 2015.