THE REAL EXCHANGE RATE AND ECONOMIC PERFORMANCE: INSIGHTS FROM THE MALAYSIAN EXPERIENCE

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of the author's knowledge, it contains no material previously published or written by another person, except where due reference is made in the text.

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Abstract

The real exchange rate (RER), theoretically defined as the relative price of tradable goods to non-tradable goods, plays an important role in economic performance and structural adjustment in developing and emerging market economies. However, the debate on the measurement of the RER, the economic impact of RER misalignment, and the role of RER in economic performance are far from settled. This thesis aims to contribute to this debate by undertaking an in-depth study of the Malaysian experience.

Following a state-setting survey of macroeconomic policy and performance of the Malaysian economy during 1960-2020 in Chapter 2, the thesis contains three core chapters written in the form of self-contained research essays. The analysis is based on a new dataset compiled from published and unpublished Malaysian sources and international databases. The Autoregressive Distributed Lag (ARDL) method is used in the econometric analysis. This method has the advantage of estimating long-run and short-run relationships between variables while minimising the possible endogeneity bias by reparametrising the model in error-correction form.

The first core chapter (Chapter 3) investigates the source of RER movements and assesses how much RER is misaligned from the relevant macroeconomic fundamentals. The comparative analysis of RER measurement undertaken at the outset of the empirical analysis suggests that the standard IMF index that does not distinguish between tradable and non-tradable production tends to overstate RER changes. The analysis based on a theoretically consistent RER index indicates that technological progress, capital inflows, and government interventions play a significant role in Malaysia's long-term RER movement. Meanwhile, the exchange rate regime choice influenced the RER movement in the short-term. Throughout the

period selected for analysis, the Malaysian economy experienced several episodes of RER misalignment, with undervaluation dominating the overall pattern.

Chapter 4 analyses the impact of RER misalignment on total economic and sectoral performance covering the years 1970 to 2018. The result indicates that overall misalignment does not have an impact on economic performance. However, RER undervaluation promotes economic growth with a significant positive impact of RER undervaluation on the tradable sector driving the outcome.

Chapter 5 examines the role of RER in export performance in the growing importance of global production sharing (GPS) and China's role in the global trade market. The export performance is analysed using panel data from 1992 to 2019, and the result indicated here is that RER depreciation promotes export performance in most product categories. Products exported within global production networks (GPNs) are found to be highly sensitive to the RER changes. The finding also demonstrates that China's rise in the global economy has had a significant negative impact on manufactured goods exported from Malaysia.

The key findings of the three core chapters and policy recommendations are summarised in the concluding chapter.

List of Acronyms

ADF	Augmented Dickey-Fuller
AFC	Asian Financial Crisis
AFTA	ASEAN Free Trade Agreement
APTA	ASEAN Preferential Trading Agreement
AIC	Akaike Information Criterion
APEC	Asia Pacific Economic Cooperation
ARDL	Autoregressive Distributed Lag
ASEAN	Association of Southeast Asian Nations
BNM	Bank Negara Malaysia
CPI	Consumer price index
CUSUM	Cumulative sum of recursive residuals
CUSUMSQ	Cumulative sum of squares of recursive residuals
DFE	Dynamic Fixed Effects estimator
DOLS	Dynamic Ordinary Least Squares
DOSM	Department of Statistics Malaysia
EPF	Employees Provident Fund
DOTS	Direction of Trade Statistics
EPU	Economic Planning Unit Malaysia
ERER	Equilibrium real exchange rate
FDI	Foreign direct investment
FMOLS	Fully Modified Ordinary Least Squares
FTZs	Free Trade Zones
FA	Final assembly
GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
GFC	Global Financial Crisis
GNI	Gross national income
GPN	Global production network
GPS	Global production sharing
HS	Harmonised System
KPSS	Kwiatkowski-Phillips-Schmidt-Shin

LOP	Law of one price
MG	Mean Group estimator
HICOM	Heavy Industries Corporation of Malaysia
ICT	Information, communications and telecommunications
IFS	International Financial Statistics
IMF	International Monetary Fund
MNE	Multinational enterprises
MOF	Ministry of Finance Malaysia
NEP	National Economic Policy
OPEC	Organization of the Petroleum Exporting Countries
PMG	Pooled Mean Group estimator
PP	Phillips-Perron
PPP	Purchasing power parity
P&C	Parts and components
RER	Real exchange rate
RM	Ringgit Malaysia
SIC	Schwarz Information Criterion
SITC	Standard International Trade Classification
TOT	Terms of trade
UNCTAD	United Nations Conference on Trade and Development
US	United States
WC	Washington Consensus
WDI	World Development Indicators
WTO	World Trade Organisation

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CHAPTER 1: INTRODUCTION

1.1 Purpose and scope

The real exchange rate (RER) occupies an important role in the policy debate on economic performance and structural adjustment in developing and emerging market economies. The RER, analytically defined as the relative price of tradable goods to non-tradable goods in the economy, is the principal equilibrating variable of a country's international trade and payments in response to macroeconomic disturbances. However, the debate on the RER measurement and the impact of RER misalignment, that is, its deviation over time from the level consistent with the relevant economic fundamentals, is far from settled. This thesis aims to inform this policy debate by undertaking an in-depth study of Malaysia's experience.

The role of the RER in economic growth and export performance has been studied extensively by researchers. However, due to data availability and the limitation of long-run time-series data, most of the existing research is dominated by cross-country analysis. By its very nature, such an analysis provides an average picture of the observed relationship across countries, ignoring the vast differences related to structural and institutional aspects and the quality of data among countries. Considering that every country is different from others in many ways, a government’s policymaking must go beyond that and build a sound empirical foundation by undertaking an in-depth study. Of course, it is hazardous to generalise from the experiences of a single nation, but the insights gained from an in-depth country case study provides valuable guidance for economic analysts in other countries.

The cross-country study has two fundamental limitations that cast doubt on its findings. First, the analysis is based on the homogeneity assumption in the observed relationship across countries, ignoring the fact that the structural features and institutional characteristics differ significantly between countries. Second, country analysis is fraught with danger due to the significant differences in nature and quality of data (Deaton, 1989; Srinivasan, 1994). Moreover, using cross-country regression to characterise the 'average' developing country is unlikely to offer meaningful results when data quality differs significantly between countries (Athukorala and Sen, 2002). Harrison (1995) highlights the possible bias outcome due to difficulties controlling for the unobserved country-specific difference. Rodrik (2012) and Easterly (2005) argue that much of the literature on policy recommendations derived from cross-national regressions is now debatable. Easterly (2005) emphasises that cross-country analysis does not really answer the underlying questions. Additionally, cross-country analysis is only for testing grounds to validate a generalisation, which is important for understanding economic phenomena. It is important to conduct an in-depth analysis for individual countries to inform policy debate, considering the underlying economic growth process and social, political, and institutional factors.

1.2 Why Malaysia?

Malaysia provides an ideal case study for this topic for several reasons. First, Malaysia experienced significant economic growth following structural reforms in the 1970s and 1980s. The economy has graduated from a low-income one to an upper-middle-income economy in the early 1990s, and the country's objective is to achieve a high-income economy[1] status. The country generally has had a very competent macroeconomic management under stable political conditions and very few economic crises. Malaysia’s economic development has been accompanied by a series of exchange rate policy changes. Malaysia has undergone several exchange rate regimes shifts since independence on 31 August 1957: the Currency Board system (1957-1971), the Bretton Woods system (1972-1973), the managed float system (1974-

[1] The policy known as Vision 2020 (launched on 28 February 1991 by the fourth Prime minister in his speech ‘Malaysia: The way forward’ at Malaysian Business Council) set out to achieve high-income status by 2020 (NEAC, 2009). No specific date has been mentioned in the subsequent five-year plan or any other documents.

1998), the fixed exchange rate system (1999-2005), and the managed float exchange rate system (2006-present). Despite the number of exchange rate policy shifts, the authors have paid little attention to considering this exchange rate policy change in their RER determinants analysis. Moreover, only a few studies provide information about the size of RER misalignment and its impacts on long-term economic growth. The degree of RER is critical in determining the extent to which RER is misaligned from its level consistent with economic fundamentals for policy design.

Second, the export-oriented manufacturing sector has played a vital role in the development process and structural transformation of the Malaysian economy. The ongoing process of global production sharing (GPS)[2]–the internationalisation of production by splitting production components beyond national borders within vertically integrated global industries–has significantly changed Malaysia's export structure that has existed since the early 1970s. This phenomenon has transformed traditional production methods, which entails producing products or goods from beginning to end within a single country to beyond borders trade of parts and components and final assembly within global production networks (GPNs). The changes in the global trade patterns make analysing export performance using the traditional approach less relevant. While the exchange rate is the main consideration, recent policy debates have raised concerns about China's growing role in the global economy. Some studies argued that China's rise poses a serious threat to export opportunities for Malaysia and other countries within GPNs. In light of this changing landscape, it is important to investigate how engagement in GPS and China's rise within GPNs affect the relationship between the RER and export performance.

[22] Also known as 'slicing the value chain' (Krugman et al., 1995), 'international production sharing' (Ng and Yeats, 2001) and 'vertical specialization' (Hummels et al., 2001)

Lastly, Malaysia's economic data are considerably good by the developing countries standard, providing an incentive for this study. Moreover, the availability of long time series data permits econometric analysis. Given that economic growth is a long-term phenomenon, it is important to investigate the evolution of the variable of interest in order to apply the findings to policy designs.

1.3 Preview

This study is organised in six chapters. Following this introductory chapter, Chapter 2 provides a policy backdrop and economic background of the Malaysian economy during 1960-2020. The next three chapters, written in the form of self-contained research essays, constitute the core of the thesis. Chapter 3 discusses the RER concept and measurement, examines the determinant of RER movements, and assesses the extent of RER misalignment. Chapter 4 explores the impacts of RER misalignment in economic growth. Chapter 5 investigates the role of RER and China's rise in export performance.

Chapter 2 is organised in six sections. The section begins with a brief background of Malaysia, followed by an overview of the exchange rate policy of Malaysia, which is provided in section 2.3. Section 2.4 discusses macroeconomic management, section 2.5 discusses the economic performance, and the last section is the conclusion. Since independence in 1957, Malaysia has undergone several changes in its exchange rate policy. The exchange rate level did not change until 1972, given that Malaysia previously was under the Currency Board system, and the Malayan Dollar (later changed to Ringgit Malaysia and used throughout this paper) was pegged to the Pound Sterling. The Ringgit Malaysia (RM) exchange rate variations became obvious when the RM floated on the foreign exchange market after the collapse of the Bretton Woods system in 1973. The RM is stable before mid-1997, however, it depreciated sharply and became highly volatile following the Asian Financial Crisis (AFC) in mid-

1997/1998. As a result, Malaysia moved to a fixed exchange rate system as part of a crisis management policy package. After seven years, the fixed exchange rate system was replaced by the managed float exchange rate system on 21 July 2005. The exchange rate fluctuations gradually increased under the new system and became more pronounced in recent years. Since the AFC, the country's exchange rate policy has gained considerable interest from policymakers and researchers. The country's exchange rate policy has been criticised. The rise in the foreign currency reserves and current account surplus has been related to government initiatives to boost export competitiveness through RER depreciation. In response to this perception, the government emphasised that they do not use the exchange rate as a competitive advantage, and the export competitiveness must be achieved by increased efficiency and productivity (BNM, 2001). The government further stated that there is no specific target for the RM exchange rate level, which is determined by market forces (BNM, 2020). In light of this debate, an investigation is needed to get a clear picture of the source of the RM exchange rate movements.

Chapter 3 begins with a discussion on the concept and measurement of the RER. Then, it undertakes an analysis of the source of RER movements and measures the extent to which RER is misaligned from the relevant macroeconomic fundamentals. According to the literature, real fundamental factors generally determine RER movements; however, other determinants such as the exchange rate regime and government intervention are also considered in this study. The long-run RER movement is expected to be influenced by changes in the macroeconomic fundamentals. Meanwhile, the short-run RER movement is predicted to be influenced by exchange rate regime shift. Given that the RER index has implications for the estimated result and will be used in further analysis, this section emphasises the theoretical aspect of RER index measurement. The derivation equilibrium RER and RER misalignment measurement are also discussed in detail in this chapter. This chapter adds to the existing literature in several ways. First, the analysis is conducted using the newly constructed RER index that is consistent with the theoretical concept of RER. Second, it focuses more on the role of exchange rate regime choice than real economic fundamentals. Third, the analysis covers a longer data span from 1960 to 2018, which is important to detect structural changes in the relationship between RER and its fundamental variables across the period. Lastly, this study uses the Autoregressive Distributed Lag (ARDL) approach to estimate the relationship between RER and its fundamental variables, which allows for both the long-run and short-run relationships. The ARDL method estimates the equation using variables in the form of level and difference with different lags, reducing the endogeneity problem.

Based on the comparative analysis of RER measurement between newly constructed RER index and IMF index, this chapter demonstrates that the standard IMF index which does not distinguish between tradable and non-tradable productions tends to overstate the RER changes. The empirical result of the RER equation using a newly constructed RER index–one which is consistent with the theoretical concept–indicates that technological progress, total capital inflows, and government intervention play an important role in the long-run RER movement. The result also demonstrates that capital inflows play a significant role in the RER movement, while government intervention only has a modest impact on the RER movement. The fixed exchange rate regime and government expenditure determine RER movements in the short-run. The degree of RER misalignment measured from this study also demonstrates that Malaysia has experienced several episodes of RER misalignment throughout the period, with undervaluation dominating the time pattern.

Chapter 4 investigates the effects of RER misalignment on economic performance. There are two alternative views on the impact of RER misalignment on economic growth. First, RER misalignment, regardless of its type (undervaluation or overvaluation), retards economic growth. Second, RER undervaluation fosters economic growth by promoting expansion in tradable output, while maintaining that RER overvaluation retards economic growth. To better understand the role of RER in the Malaysian economic growth process, an in-depth analysis is conducted within the standard growth model. The contribution of this study compared to the previous study is as follows. First, the RER misalignment used in the analysis is constructed based on the theory of RER determination in a small open economy. Second, the impact of RER misalignment on economic growth is investigated separately for tradable and non-tradable sectors in addition to the net impact on the overall economic performance. Third, it provides time-series evidence using a longer data span, allowing a more robust analysis by applying the ARDL method to distinguish the long-run and short-run effects.

The empirical result suggests that the overall RER misalignment has no impact on total economic performance. However, RER undervaluation has a differential impact on growth over and above the impact of RER misalignment and plays a significant role in the long-term growth process in Malaysia. The disaggregated analysis on tradable and non-tradable sectors suggests that the performance of the tradable sector drives the outcome of the overall economy.

Chapter 5 investigates the role of RER in export performance from 1992 to 2019. In light of recent developments in global trade patterns, the implication of RER on global production network (GPN) exports has been investigated. This chapter also brings to light how China's rise affects Malaysia's export performance. The relationship between RER and export performance is conducted on five different export categories, focusing on the impact on the manufacturing exports and segmented analysis on products exported within GPNs and non-GPN products. RER is expected to boost exports through international competitiveness; however, the role of RER in export is expected to diminish as the country becomes more involved in GPS. The novelty of this study is as follows. First, the analysis uses a newly constructed RER using the United States (US) import price index as a world price proxy for each product code and the use of Malaysian implicit deflator derived from disaggregated national income data as proxies for the domestic price. Second, the analysis is conducted on five different categories of products: total non-oil products, non-oil primary products, manufacturing products and decomposing the manufacturing products into GPN and non-GPN products. Third, the analysis incorporates the role of China in the export performance model. Fourth and lastly, it offers new empirical evidence of country-specific analysis using the panel data ARDL setting, which allows for long-run and short-run dynamics between variables to be examined.

The estimation results indicate that RER promotes long-term export performance in most product categories. RER plays a significant role in the export performance of GPN products, implying that country's specialisation within GPNs at the individual country level is responsive to changes in relative price. In most cases, China's rise reduces Malaysia's export performance. The GPN exports, in particular, faces more significant competition from China's rise compared to other products. The world demand, foreign direct investment, and supply factors are important for Malaysia's export expansion. Decomposition of RER into NER and relative price indicates that NER has no significant impact in export performance of all product categories. Meanwhile, relative price (measured in local currency) plays an important role to increase export product competitiveness.

To summarise, technological progress, capital inflows, and government interventions are important determinants of long-term RER movement in Malaysia. Meanwhile, an exchange rate choice plays a significant role in influencing the short-term RER movement in the short-term. Throughout the period, Malaysia experienced several episodes of RER misalignment, with undervaluation dominating the time pattern. However, this overall misalignment does not affect economic performance. On the other hand, the positive impact of RER undervaluation is found to outweigh the negative impact of overvaluation and hence promote economic growth, with tradable sector[3] driving the outcome. RER depreciation promotes export performance in most product categories, with GPN exports highly impacted by RER changes. The result also demonstrates that Malaysia faces competition due to the rise of China in the global economy. For the outcome of decomposing RER into nominal exchange rate (NER) and relative price, it is evident that NER has no significant impact on the export performance of all product categories. Nonetheless, the relative price plays a significant role in determining export product competitiveness, which is consistent with the emerging literature on the 'dominant currency paradigm'.

The key findings of the three core chapters and policy recommendations are summarised in the concluding chapter.

[3] It consists of three sectors: manufacturing, agriculture, forestry and fishing, and mining and quarrying. It should be noted that manufacturing sector constitute more than half of the tradable share in 2005-2018.

CHAPTER 2: MALAYSIAN ECONOMY: EXCHANGE RATE REGIME, MACROECONOMIC POLICY, AND PERFORMANCE

2.1 Introduction

This chapter provides an overview of Malaysia's exchange rate regime, macroeconomic policy management, and economic performance covering the years 1960-2020. The objective is to provide the context for the empirical analysis in the ensuing chapters. It focuses on the policy context and performance of the Malaysian economy which are directly related to the topic considered here. The chapter is organised into six sections. The next section provides a background of Malaysia. Section 2.3 presents an overview of the Malaysian exchange rate policy, and section 2.4 discusses macroeconomic management. Section 2.5 discusses economic growth performance, and the last section is the conclusion.

2.2 Background

Malaysia comprises 13 states and three federal territories, with about 32.5 million people and enriched with abundant natural resources. It is a multi-racial country with people from a variety of ethnic and cultural backgrounds. Malaysia's development policy since the early 1970s has mainly focused on achieving an economic balance between ethnic groups. The communal riots of 13 May 1969[4] shattered Malaysia's political and social stability, and undermined economic performance. This event led to affirmative action taken by the government which introduced the New Economic Policy (NEP) in 1970 to redress racial imbalances through national unity. NEP has two main objectives: eradicating poverty and restructuring the community by

[4] Disenchantment is on the rise among all segments of the population due to rising income inequality and economic imbalance between ethnic groups. The increase in urban unemployment, and differences in levels of education and language are among the emerging issues that have led non-Malays to question the extent of the economic policy has helped them.

eliminating ethnic identification through economic advances. The development strategy under the NEP focused on export-oriented industrialisation with a long-term goal of increasing the share of Bumiputera ownership of corporate capital. To support the country's export-oriented industries, the government established a well-developed infrastructure such as Free Trade Zones (FTZs) in Bayan Lepas in 1972 and further liberalised the investment and trade policy regime.

The policy thrust of the NEP was the continuation of an open-door colonial policy. Malaysia has long been one of the most open economies in developing countries (Sachs and Warner, 1995a; Athukorala, 2001)[5], particularly in trade, foreign direct investment (FDI), and labour (Hill, 2012). These policies have remained part of the country's development strategy. The country's trade openness is reflected in the ratio of total trade to GDP, which increased from 89.5 per cent in the early 1960s to 116.4[6] per cent in 2020. Malaysia is highly committed to promoting FDI into the country, and the country has actively shaped investment regimes, particularly in the 1980s and 1990s. The introduction of the Investment Incentives Act 1968, the development of FTZs in the early 1970s, and significant policy reforms in the late 1980s increased FDI in the country. Together with a stable macroeconomic environment, these policy initiatives have facilitated maintaining a conducive business climate and creating export and economic growth opportunities.

Malaysia's economic policy settings are relatively stable and consistent compared to other Asian countries (Hill, 2012)[7]. Malaysian population comprises three main ethnic groups: Bumiputera (69.6 per cent), Chinese (22.6 per cent) and Indians (6.8 per cent)[8]. In a multi-

[5]Among Asian economies, Malaysia has been classified as continuously open since independence. The classification was based on five characteristics: non-tariff barriers, average tariff black market, economic system, and level of monopoly on major exports.
[6] Data from the World Development Indicators, World Bank website.
[7] It is difficult to identify any significant changes in policy direction, much less the 'U-turns' observed, for example, in other major Asian countries such as China, Indonesia and Vietnam.
[8] Data for 2020 from DOSM website.

ethnic (and hence multicultural) country, ethnic harmony is crucial for the country's stability. Malaysia has inherited a pattern of ethnic and racial inequality and associated tensions since its independence. With the exception of the race riots that broke out on 13 May 1969, the government has been able to maintain stability and manage this kind of threat. Mature democracy and the country's ability to maintain political stability have increased the country's sovereign creditworthiness and restored investor confidence. This situation has helped the economy and increased its resilience in the face of major shocks.

2.3 Exchange rate regime

Malaysia's exchange rate regime since independence can be divided into four distinct periods: the currency board system[9], 1957 to 1971; Bretton Woods, 1972-1973; a managed float system, 1974-1998; a fixed exchange rate system, 1999-2005; and a managed float system, 2006 to the present day. Malaysia operated the Currency Board system since independence until 1972. As a Sterling Area member[10], the national currency[11] was pegged to the Pound Sterling at the rate of 2s 4d:1[12]. However, following the dismantling of the Sterling Area on 23 June 1972, the national currency was then pegged to the US dollar at M$2.82:1 effective on 24 June 1972 under the Bretton Woods system. Malaysia had only been part of this system for one year when the system collapsed in March 1973, and most of the major currencies were floated on the foreign exchange market.

[9] Malaysia first entered the Currency Board system in 1887 (Athukorala, P. 2001).
[10] The members of this system agreed to peg their currency to Sterling and hold a large portion of their foreign exchange reserves in Sterling. They also have a common exchange control with Britain to stabilise the pound. In return, each country enjoys freer trade and access to capital in Britain than other countries.
[11] At that time the national currency was known as the Malayan Dollar which later became the Ringgit Malaysia that is used throughout this paper.
[12] In November 1967, the sterling was devalued by 14.3 per cent, causing the Malayan Dollar to automatically devalue at the same rate to 2s 8.67d.

Malaysia moved to a floating exchange rate system on 21 June 1973, with the US Dollar as the main intervention currency[13]. At this time, Malaysia had a managed rather than a free-float regime (Yap and Teng, 2012). The float of the Ringgit Malaysia (RM) resulted in further appreciation of RM against currencies of its trading partner by an average of 12 per cent[14]. Under the new system, Bank Negara Malaysia (BNM) became responsible for ensuring the operation of the foreign exchange market was smooth and orderly. On 27 September 1975[15], the government decided to determine the national exchange rate on a basket trading partner currency. Since then, the country has operated under the managed float exchange rate system until the Asian Financial Crisis (AFC) hit the country in mid-1997.

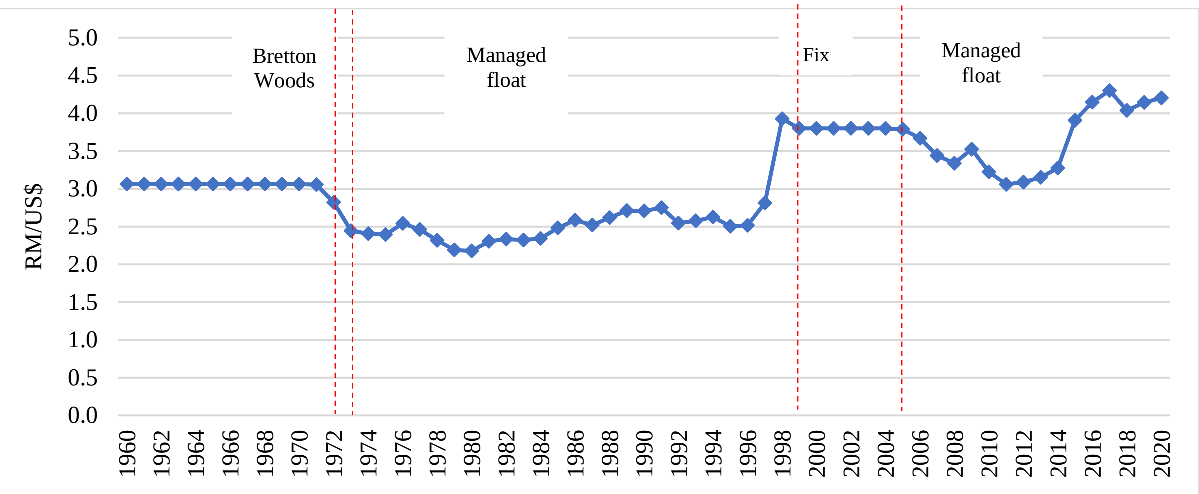
Malaysia shifted to a fixed exchange rate system following the onset of a currency crisis in mid-1997 (Athukorala, 2001; Mahani, 2002). The crisis began in Thailand and then spreads to other Asian economies such as Indonesia, South Korea, and Malaysia. It brought catastrophe to the financial system and economic activities of Malaysia and also other countries. Three years before the crisis, the Malaysian ringgit (RM) appreciated steadily, from RM2.62 per US$ in 1994 to RM2.52 per US$ in 1997. Despite having a relatively strong financial system and economic fundamentals, Malaysia was not immune to this currency crisis. RM reached a historically low at RM4.88 per US$ on 7 January 1998. A significant nominal exchange rate depreciation raises the cost of imported goods, resulting in inflation reaching 6.2 per cent in June 1998. Massive capital flight and excessive depreciation in the currency from RM2.81/US$ in 1997 to RM3.92/US$ in 1998 led the authorities to implement selective capital controls[16] on 1 September 1998 and a fixed exchange rate system on 2 September 1998. The aim was to prevent massive capital outflows and the speculation of the RM in the offshore markets. The

[13] At floor rate M$2.4805 = 1 unit US$
[14] Based on Economic Report, 1972/1973
[15] Not rigidly pegged to the basket with BNM intervention to smooth the fluctuation.
[16] The focus was a narrow one on short-term capital flows

RM was fixed at RM3.80/US$, representing a 34 per cent depreciation from the rate before the crisis. These policy measures are part of a recovery policy package to reduce exchange rate volatility while maintaining economic stability (BNM, 1999b).

Alongside other policy measures, Malaysia's economy began to recover, with improved economic indicators such as stock markets, GDP growth rate, capital inflows, and inflation rate. Some capital flow restrictions gradually loosened in February and August 1999, and by May 2001, most of the new restrictions on the capital flows were relaxed. Within two years, all capital flow restrictions were removed at successive stages; however, the fixed exchange rate regimes remain. After seven years of operating under the fixed exchange rate, RM was placed under a managed float exchange rate system effective from 21 July 2005, with the value of the RM determined by economic fundamentals (BNM, 2005). Under the new system, the RM is referenced to a basket of the major trading currencies and allowed to move based on market forces with BNM's intervention to moderate day-to-day fluctuation.

Figure 2.1 depicts the nominal exchange rate under various regimes. Currency movements remained relatively stable under the Currency Board and the floating systems, particularly before the AFC 1997/1998. It has remained stable since the adoption of the fixed exchange rate system between 1999 and 2005. Exchange rate variability began to increase following the reinstatement of the managed float exchange rate system, and the variations are widened in the wake of the Global Financial Crisis (GFC) in 2008/2009.



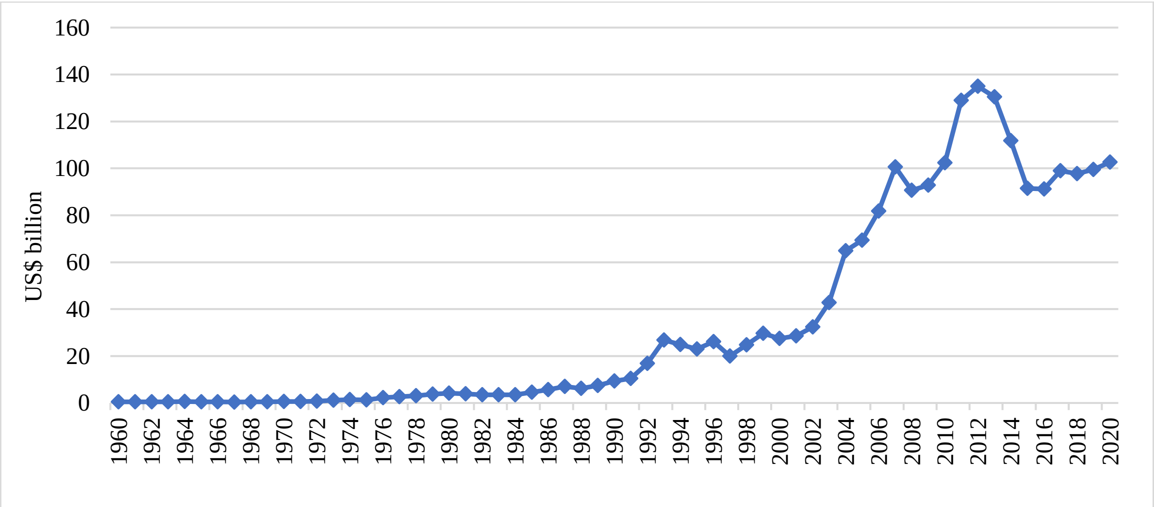
Source: Compiled from International Financial Statistics, IMF.

Figure 2.1: Malaysian nominal exchange rate during 1960-2020

RM appreciated between 1971 to 1980 from RM3.05/US$ to RM2.18/US$, with a slight depreciation in 1975. Starting in 1981, RM gradually depreciated from RM2.30/US$ to RM2.75/US$ in 1991. However, the exchange rate appreciated in 1992 and 1993 due to significant short-term capital inflows associated with capital account liberalisation. Following the implementation of selective exchange control measures in January and February 1994, the RM depreciated in 1994. The RM appreciated again in 1995 and 1996 before depreciating in 1997 and 1998 due to massive short-term capital outflows. During the managed float regimes from 1984 to 1998 and 2005 to 2020, the BNM intervened in the foreign exchange rate market to prevent excessive RM fluctuations.

Following the mid-1980s macroeconomic crisis, the government implemented significant policy reforms to promote exports and economic recovery, including a macroeconomic adjustment in 1986. RM was allowed to reflect the underlying trend of the economy, with BNM's intervention to smooth out excessive exchange rate fluctuation caused by deteriorating short-term capital inflows. Malaysia achieved a significant depreciation by around 25 per cent between 1987 and mid-1993 partly due to this policy, assisting the process of export-oriented industrialisation (Athukorala, 2001).

BNM plays a vital role in macroeconomic management in the country, particularly in maintaining exchange rate stability. BNM intervenes in the foreign exchange operation "…only to moderate day-to-day fluctuation in the value of the ringgit, and not to influence the underlying trend" (BNM, 1999a, p. 270). The BNM further emphasised that "…competitiveness needs to be achieved through efficiency and productivity gains rather than currency depreciation. As a matter of policy, Malaysia does not rely on the exchange rate to gain a competitive advantage…[t]rue competitiveness will be derived not from exchange rate flexibility but more from increasing efficiency, innovation, marketing strategies and providing quality products and services" (BNM, 2001). The BNM emphasised that attempts to achieve export competitiveness by accumulating international reserves might have adverse repercussions, including retaliatory measures from trade partners (BNM, 2020). Figure 2.2 below depicts the level of foreign exchange reserves in Malaysia.



Source: Author's computation using data from CEIC database, <https://www.ceicdata.com/en> and International Financial Statistics, IMF.

Figure 2.2: Malaysia's foreign exchange reserves during 1960-2020

Figure 2.2 depicts the level of foreign exchange reserves in Malaysia. Malaysia's foreign exchange reserves remained relatively low and stable from 1960 to the late 1980s, with only a minor change during this time. However, the pattern showed a significant upward trend after 1990, reflecting significant changes in capital inflows after the liberalisation of exchange control in the early 1990s. Malaysia's foreign reserves rose significantly between 1997 and 1999 and steadily increased after the AFC. From 2002 to 2012, Malaysia's foreign exchange reserves grew significantly, presumably due to repeated interventions by the authority in the foreign exchange market under the managed float system. It declined later from 2013 to 2020. Aizenman and Marion (2003), Bird and Rajan (2003), and Chang et al. (2017) have linked the continued reserve build-up in Asian countries to efforts to keep their currencies from appreciating.

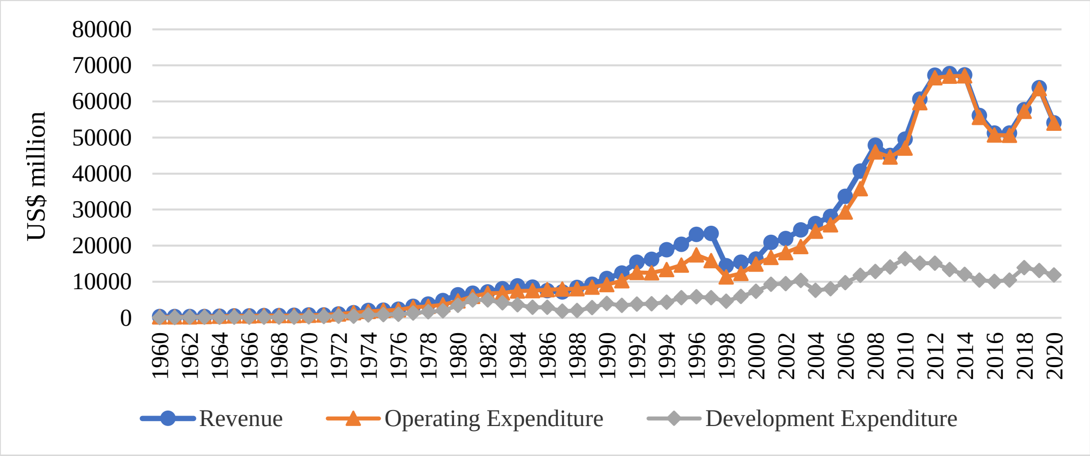
2.4 Macroeconomic policy

Malaysia's primary macroeconomic policy objectives are to promote sustainable economic growth by maintaining exchange rate and price stability while controlling inflation and strengthening external balances. Effective fiscal and monetary measures are critical in achieving this goal.

2.4.1 Fiscal policy

2.4.1.1 Government expenditure

The total Malaysian government spending can be divided into operating expenditure (OE) and development expenditure (DE). The OE is used to maintain the existing goods and services such as emoluments, subsidies, interest payment of government debt, pension and gratuities, suppliers and services, and grants and transfers. Meanwhile, the DE is spent on the productive sector to create goods and services, including defence and security, social services, and economic services. The pattern of government revenue and expenditure by categories is depicted in Figure 2.3.

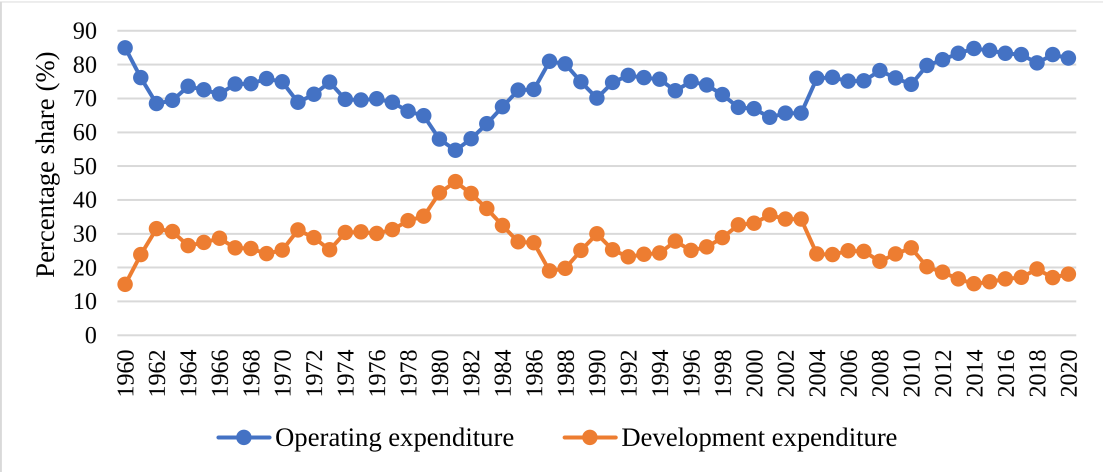


Source: Author's computation using data from Economic Report, various years and Ministry of Finance Malaysia website, <https://www.mof.gov.my/portal/ms>.

Figure 2.3: Federal government revenue and expenditure during 1960-2020

Government spending has risen over time and most notably since 1979. This pattern reflects the significant role of fiscal spending as a policy tool in achieving the government's development strategy goals. Except in 1986 and 1987, the overall OE is confined by revenue growth. In 1986 and 1987, OE exceeded revenue by 2.9 per cent and 11.2 per cent, respectively, causing the deficit to reach unsustainable levels. However, this imbalanced period was short-lived. The OE steadily increased before plummeting precipitously in 1997 during the AFC and in 2008 due to the GFC. OE remained stable from 2012 to 2014, then fell in 2015 and increased again after 2017. Malaysia's revenues have been severely impacted by the drop in global crude oil prices, resulting in a reduction in oil-related revenue, thereby decreasing government spending on OE. Nonetheless, OE spending remained within the revenue constraints.

The DE followed a similar pattern to OE until 1978. Between 1979 and 1981, the DE increased by 152 per cent, from US$2 billion to US$4.9 billion. The significant government's involvement in heavy industry projects resulted in DE increasing rapidly. Excessive government spending led the deficit-to-GDP ratio to reach a historical high of 16.7 per cent in 1982. As a result, the public debt to GDP share increased dramatically from 44 per cent in 1980 to 66.9 per cent in 1982. The growing fiscal imbalance and debt burden, combined with an economic slowdown in mid-1982, led the government to cut the budget in June 1982, resulting in less spending on DE the following year. The adverse impact of the macroeconomic crisis in the mid-1980s led the government to reimpose the fiscal constraints, and the development budget was significantly reduced in subsequent years. The DE rose steadily until 2003, with a slight decrease during the 1998 crisis. It was reduced in 2004 due to deficit control (Narayanan, 2012) and then increased in the following years. DE began to fall in 2011 and has remained low ever since due to fiscal adjustments to mitigate the problems caused by economic slowdowns. The ratio of OE and DE to total spending is illustrated in Figure 2.4.



Source: Author's computation using data from Economic Report, various years and Ministry of Finance Malaysia website, <https://www.mof.gov.my/portal/ms>.

Figure 2.4: Share of government expenditure by category during 1960-2020

The figure confirms that the OE dominates the pattern over time, with the average share of OE to total spending constituting more than 70 per cent until the early 2010s. However, from 2012 to 2020, the OE share steadily increased to more than 80 per cent. Meanwhile, the relative share of DE to total spending remains low throughout the period, below 30 per cent on average. The figure shows that the share of DE to total spending increased substantially between 1974 and 1981, but declined significantly after 1982. The DE's pattern before 1982 reflected the government's commitment to achieving the NEP target and long-term development planning for rapid growth and restructuring objectives (Narayanan, 1996). Meanwhile, the downward trend since 1982 reflects the government's desire to limit DE and reduce the overall budget deficit.

2.4.1.2 Revenue

The total revenue continues to increase rapidly over the years allowing flexibility to increase in spending. The government revenue rose from US$0.4 billion in 1960 to US$54.1 billion in 2020, primarily from tax revenue and non-tax revenue sources. Tax revenue represents more than two-thirds of total revenue and is generated from direct and indirect taxes. Non-tax revenue, on the other hand, accounts for nearly a third of total revenue. Petronas (i.e. Petroliam Nasional Berhad, a Malaysian oil and gas company) dividends and royalties account for a sizable portion of total non-tax revenue, making up for an average of 40.4 per cent. The five-year average share of tax to total tax revenue from 1960 to 2020 is shown in Table 2.1.

The data indicate that government revenue grew substantially owing to strong underlying economic fundamentals. The share of direct tax to total revenue increased significantly from 21.6 per cent in the 1960s to 52.1 per cent in the second half of the 2010s. Meanwhile, the share of indirect tax to total revenue decreased correspondingly from 54.7 per cent in the 1960s to 22 per cent in the late 2010s. Import and export duties were the main contributors to tax revenue in the 1960s; however, its contribution has fallen significantly over time, reflecting the country's trade liberalisation regime. Malaysia continued to reduce the import duty; for example, the government abolished or reduced import duties on nearly 600 items (mostly consumer goods) in 1993 (Narayanan, 1996). However, income tax has been the main contributor to the total tax revenue since 1974.

Almost one-fourth of total tax revenue in the 1960s originated from income tax, and the share has increased gradually over time as the economy grows and contributed more than half of the total revenue since the 2000s. Individual income tax was the primary source of total revenue until the mid-2010s, accounting for an average of 18.3 per cent of total revenue in the 1970s before declining to 13.8 per cent in the late 2010s. Company tax contributed only 7 per cent to total tax revenue in the 1970s but has risen significantly since then, from 9.2 per cent in the early 1990s to 27.7 per cent in the late 2010s. The rise in the company tax revenue reflects the significant role of the private sector in the economy. Petroleum revenue[17] contributes a sizable portion of the total revenue. From 1980 to 1988, its share of total revenue averaged 21.2 per cent and then rose to 35.1 per cent between 2006 and 2012. However, the share declined significantly in the following years as the price of crude oil dropped to only 5.9 per cent in the late 2010s.

Table 2.1: Share of tax revenue to total tax revenue (%)[1]

	1960-64[2]	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-20
Direct tax	21.6	27.2	28.2	36.9	39.8	37.6	39.4	46.5	49.7	50.2	55.3	52.1
Income tax	19.4	22.5	26.4	35.5	37.7	35.6	35.9	41.9	47.0	47.8	52.1	48.7
Individual	n.a	n.a	18.3	18.4	17.2	15.8	18.9	25.6	25.8	22.2	18.5	13.8
Companies	n.a	n.a	6.9	9.1	8.4	8.6	9.2	11.0	10.4	8.9	18.5	27.7
Petroleum	n.a	n.a	1.0	7.9	12.1	11.2	7.8	5.1	10.4	15.6	13.9	5.9
Others	2.2	4.7	0.2	0.0	0.0	0.0	0.0	0.2	0.4	1.1	1.1	1.3
Indirect tax	54.7	49.0	52.5	48.1	40.6	33.5	35.5	34.1	25.2	19.8	17.3	22.0
Export duties	17.3	12.5	13.6	16.8	12.3	6.8	4.3	1.5	1.3	1.6	1.0	0.5
Import duties	33.2[3]	33.0[3]	21.0	15.0	13.9	11.2	11.4	9.5	4.4	1.9	1.2	1.2
Excise duty	n.a	n.a	11.1	9.1	6.7	7.1	8.3	9.0	5.9	6.9	6.1	4.6
Sales tax	n.a	n.a	n.a	5.2	5.6	6.3	8.2	8.8	9.0	5.5	4.8	2.7
Service tax	n.a	n.a	n.a	0.2	0.4	0.4	1.0	2.2	2.5	2.2	2.7	2.1
Others	4.2	3.5	2.7	1.9	1.7	1.8	2.3	3.0	2.2	1.8	1.5	10.9
Tax Revenue	76.4	76.2	80.7	85.0	80.4	71.1	74.9	80.6	74.9	69.9	72.6	74.1
No tax-revenue	23.6	23.8	19.3	15.0	19.6	28.9	25.1	19.4	25.1	30.1	27.4	25.9

Note:
(1) The figures constitute a simple 5-year average.
(2) Data from 1960 to 1963 only for Peninsular Malaysia.
(3) Include excise and surtax.
n.a - data not available.

17 From petroleum tax, Petronas dividend, and petroleum royalties.

Source: Compiled from Economic Report, various years and Ministry of Finance Malaysia website, <https://www.mof.gov.my/portal/ms/>.

Over the years, Malaysia has made numerous efforts to improve revenues collection by focusing on tax collection, enforcement, and compliance. Apart from that, the government is actively pursuing efforts to reduce waste and revenue leakage. This initiative is crucial for improving efficiency and tax collection to carry out the country's socio-economic development agenda.

2.4.1.3 Budget deficit

Malaysia's fiscal balance has always been in deficit, except in 1960 and 1993-1997. Between 1960 and 2020, the overall budget deficit ranged between US$10 million and US$20.6 billion. The deficit was generally manageable (below 5 per cent on average) except in the early 1980s and 1986. The global economic slowdown in the early 1980s generated an external account imbalance, resulting in a large current account deficit in 1982 at 13.4 per cent of GDP. At the same time, expansionary fiscal policies to stimulate economic activity resulted in a high budget deficit to GDP of 15.7 per cent and 16.7 per cent in 1981 and 1982, respectively. The current account deficit combined with the fiscal deficit between 1981 and 1982 led to a ‘twin deficit’. The worsening fiscal situation led to the budget revision by the government in the second half of 1982 to maintain macroeconomic stability. Any development spending was cut while operating expenses increased in sync with the revenue growth. Consequently, the budget deficit fell to US$3 billion (9.8 per cent of GDP) in 1983, then to US$1.8 billion (6 per cent of GDP) in 1985.

However, the collapse of world commodities prices in the mid-1980s affected Malaysia's economy. The terms of trade deteriorated by 25 per cent between 1984 and 1986 (Athukorala, 2012). The sharp decline in tin and palm oil prices affects revenue, caused the overall deficit to rise again in 1986 to US$2.9 billion or 10.5 per cent of GDP in 1986. The economic slowdown also affected the new heavy industries[18], which the government had heavily funded. The federal government's burden was worsened by the additional debt repayment burden placed on these firms following the Japanese Yen's appreciation against the US Dollar after the Plaza Accord of 1985. To address these issues, the government reduced spending and implemented a major policy shift in the mid-1980s, focusing on the role of the private sector in the economy. These reforms involved gradual privatisation and restructuring of state-owned enterprises (Athukorala, 2001) and opened up the country to FDI[19].

Between the late 1980s and early 1993, the budget balance steadily improved as economic growth accelerated and the taxation system improved, leading to a surplus between 1993 and 1997. However, it again fell into a deficit of 1.8 per cent of GDP in 1998 due to the AFC. Sharp currency depreciation in 1997-1998 caused inflationary pressures and a contraction in aggregate demand, resulting in significant reductions in total tax revenue[20] at around 13 per cent. To restore macroeconomic stability and economic recovery, the government implemented an expansionary fiscal policy in 1998. The economy gradually recovered the following year, but the country's fiscal position remained stubbornly in deficit until the late 2010s.

Given that Malaysia's economy is a very open one,[21] it is vulnerable to external shocks. The United States (US) economic slowdown and global electronics downturn in 2001 ('the dot.com crash') affected Malaysia's exports. Implementation of fiscal stimulus to promote domestic sources and mitigate the external impact led to increased public spending and a

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[18] Heavy Industries Corporation of Malaysia (HICOM) is a public sector holding company founded in November 1980. The government funded a large share of the capital for the HICOM project (Athukorala, P. 2012). In 1986/1987, HICOM suffered a total loss of US$100 million.(Athukorala, 2012)

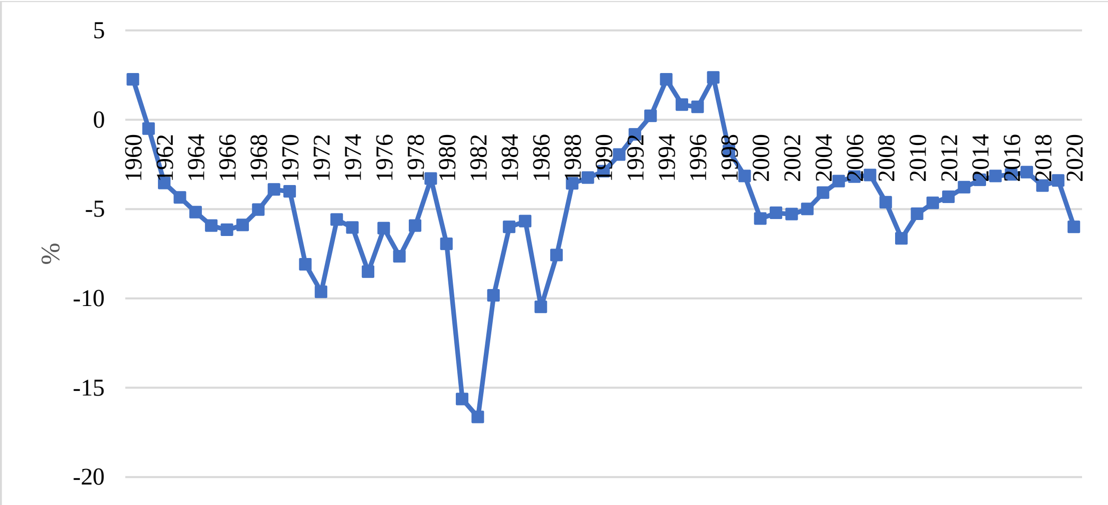
[19] The amendment of the Industrial Coordination Act 1975 and the introduction of the Promotion of Investment Act 1986. Changes to the Industrial Coordination Act 1975 eased the limit on the number of expatriates who could be employed in foreign affiliates (Athukorala, 2012).

[20] This was due to a 34 per cent decrease in indirect tax revenue, primarily due to declines in sales tax, import and export duties, and excise duties.

[21] Average total trade to GDP remained at about 133.7 per cent throughout the years.

significant increase in the budget deficit in 2000-2002. The effectiveness of these policy measures is reflected in a gradual recovery in export demand and improvement in the overall balance of payments with a larger current account surplus of 12.1 per cent of GDP in 2003. In subsequent years, the share of budget deficit to GDP gradually shrank from 5.3 per cent in 2002 to 3.2 per cent in 2007.

The GFC in 2008/2009 was precipitated by a speculative bubble in the US housing market that caused devastating trade contraction in many countries, including Malaysia. The sharp decline in global commodity prices resulted in a contraction in export growth and lower revenues. The government responded by implementing a countercyclical fiscal policy with a stimulus package totalling RM67 billion (stimulus package of RM7 billion or US$2.1 billion in November 2008 and RM60 billion or US$17 in March 2009) or equivalent to 9.3 per cent of GDP, the largest in the Asia-Pacific region (Hill, 2012). The budget deficit increased dramatically by 26.1 per cent from US$ 10.7 billion (4.6 per cent of GDP) in 2008 to US$13.5 billion (6.7 per cent of GDP) in 2009, primarily due to an increase in DE of nearly 6 per cent. Nevertheless, spending on OE was reduced in 2009 as revenue waned. The deficit gradually decreased from US$13.9 billion in 2011 (4.7 per cent of GDP) to US$9.5 billion in 2015 (3.2 per cent of GDP). The lower oil price in 2015 affected the government's revenue and led to less government spending. The budget deficit declined continuously until 2017. It then increased dramatically to US$13.2 billion (3.7 per cent of GDP) in 2018 due to an increase in spending in 2020 in tandem with the increase in total revenue by 13 per cent. The deficit almost doubled to US$20.6 billion as a result of government efforts to stimulate the economy in response to the global COVID-19 pandemic. The ratio of total budget deficit to GDP is illustrated in Figure 2.5.



Source: Author's computation using data from Economic Report, various years and Ministry of Finance Malaysia.

Figure 2.5: Share of budget deficit to GDP during 1960-2020

Generally, the nature of a large fiscal deficit in Malaysia is relatively temporary. The high budget deficits of the 1980s, 2000, and 2009 were largely induced by the government's countercyclical[22] fiscal policy and not due to long-term commitment to OE and persistent reduction in revenues. Given that fiscal stimuli are mostly for development expenses, the ability to get a surplus is greater when economic activities recover. The most important feature of fiscal expansion in Malaysia is that it does not create a structural economic imbalance (Vijayaledchumy, 2003). The increase in government spending did not induce higher inflation or put pressure on the current account balance, as most spending was on projects with minimal import content (BNM, 1998).

2.4.1.4 Deficit financing

Malaysia's fiscal deficit has been financed predominantly from internal borrowing, with the share of external borrowing on average accounting for only about 5.6 per cent of deficit financing during 1970-2020 (Table 2.2). The source of internal borrowing mainly from

[22] Not caused by long-term structural rigidities due to locked-in operating expenditures or decline in revenues.

government securities, treasury bills, government investment issues, and house loan funds. Meanwhile, external borrowing was from concessional bilateral and multilateral sources (BNM, 1998; Athukorala, 2012). The government's ability to borrow can be demonstrated by the average share of total federal debt to the GDP, as shown in Table 2.2. The average share of the federal debt-to-GDP ratio increased significantly between the 1970s and 1980s. The federal debt-to-GDP ratio rose from 44.6 per cent in the first half of the 1970s to 62.2 per cent in the early 1980s, reaching a peak of 103.4 per cent in 1987. However, the average share of federal debt to GDP fell to 64.1 per cent in the first half of the 1990s. Between 2000 and 2020, the average federal debt-to-GDP ratio was reduced to an average of 47.6 per cent.

Table 2.2: Federal government debt position during 1970-2020[1]

Year	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-20
Total federal debt (US$ billion)	2.7	6.8	17.8	30.9	36.4	32.0	44.3	79.7	157.5	176.8
Internal debt (US$ billion)	2.2	5.3	12.2	20.9	28.4	27.4	36.3	73.6	152.0	170.9
External debt (US$ billion)	0.4	1.5	5.6	10.0	8.0	4.5	8.0	6.1	5.4	5.9
Internal debt/ Total federal debt (%)	83.2	78.3	70.2	67.2	78.1	85.7	82.1	91.8	96.5	96.7
External debt/ Total federal debt (%)	16.8	21.7	29.8	32.8	21.9	14.3	17.9	8.2	3.5	3.3
Total federal debt/ GDP (%)	44.6	48.2	62.2	93.9	64.1	36.4	42.1	42.7	51.4	53.3
Gross savings/GDP (%)	24.0	27.3	26.7	28.9	32.2	37.2	34.2	37.3	31.5	26.6
Broad money/ GDP (%)	47.8	72.3	93.4	126.7	91.4	123.7	131.7	127.7	135.5	128.3

Note:
(1) The figures constitute a simple 5-year average.
Source: Compiled from Ministry of Finance Malaysia website, https://www.mof.gov.my/portal/ms> and World Development Indicators, World Bank database,< https://data.worldbank.org/indicator/>.

Unlike most other developing countries, Malaysia's budget deficit has not resulted in higher inflation because it was not funded through central bank borrowing (Athukorala, 2001). Given the high savings rate and excess liquidity in the system, more than half of the deficit is financed mostly by issuing government securities. Between 1970 and 2004, government securities financed approximately 86 per cent of domestic debt. The contribution of securities to total domestic borrowing fell to 63.4 per cent between 2005 and 2020, with a growing share of government investment issues as a borrowing source. Government securities were mostly from the provident, pension, and insurance funds. The primary source of financing for economic development is the Employees Provident Fund (EPF)[23]. EPF accounted for half of all domestic borrowing in 1984. Thus, fiscal expansion did not result in structural imbalances in the economy since it was financed primarily through internal borrowing.

The government also committed to fiscal budget rules, the Federal Constitution, Financial Procedure Act, and the Loan (Local) Act 1959. Under the Loan (Local) Act 1959, borrowing is only permitted to fund development expenses[24]. The government also has set the rule that domestic and offshore borrowing ceiling must not be more than 55 per cent of GDP[25]. This commitment, combined with strong underlying fundamentals, has allowed the government to keep debt at a manageable level varied within 10.78 to 54.82 per cent from 1971 to 2013[26]. Except for the years 1986 -1987 and 1997-1998, the government remains committed to keeping the public debt[27] below the ceiling limit of 55 per cent of GDP. The overall deficit has been kept below 4 per cent of GDP, and the debt service remains low, at below 20 per cent. The Federal government budgetary position over the five-year average is reported in Table 2.3.

[23] EPF was founded in 1951 to manage compulsory savings for private-sector employees, and it is the largest compulsory savings institution operating in Malaysia.
[24] The fiscal stimulus introduced by the government to stimulate the economy during the AFC and the GFC is primarily concerned with development expenditure, so the potential to move to a surplus is greater when the economy recovers.
[25] Domestic ceiling is governed under the Loan (local) Act 1959 and the Government Funding Act, while the offshore borrowing ceiling is under External Loans Acts 1963. Issuance of conventional treasury bills is under the Treasury Bills (Local) Act 1946.
[26] Starting in 2014, the external debt term has been redefined and it now includes non-resident holdings of ringgit-denominated debt securities, non-resident deposits, trade credits provided by foreign trade counterparts and other debt liabilities (BNM, 2014). Given that two-thirds of the debt is ringgit-denominated debt securities held by non-residents, the country's external debt increased in the following years.
[27] Refers to the federal government's debt, not the total debt. Total debt includes private sector, government-linked companies, and non-financial public enterprises (NFPEs). These debts are excluded because they are not subject to government budgeting procedures or scrutiny.

Table 2.3: Federal government budgetary position during 1960-2020 (US$ million)[1]

Item	1960-04	1965-09	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-05	2010-14	2015-20
Total revenue	383	593	1,199	3,266	7,459	8,197	14,749	19,354	21,945	39,071	62,520	55,695
Current expenditure	324	568	1,148	2,780	6,380	7,986	11,602	14,313	18,712	36,311	61,487	55,266
Development expenditure	116	202	455	1,194	4,206	2,505	3,893	5,517	8,809	11,304	14,444	11,646
Total public sector expenditure	440	770	1,603	4,127	10,587	10,491	15,495	19,831	27,521	47,614	75,930	66,911
Overall surplus/deficit	-57	-174	-398	-829	-3020	-1928	-180	10	-5,197	-8,058	-12,917	-11,217
Surplus or deficit/GDP (%)	-2.3	-5.4	-6.7	-6.3	-11.0	-6.1	-0.6	-0.2	-5.0	-4.2	-4.3	-3.7
Total public debt/GDP (%)	n.a	n.a	44.6	48.2	62.2	93.9	64.1	56.6	42.1	42.7	51.4	53.3

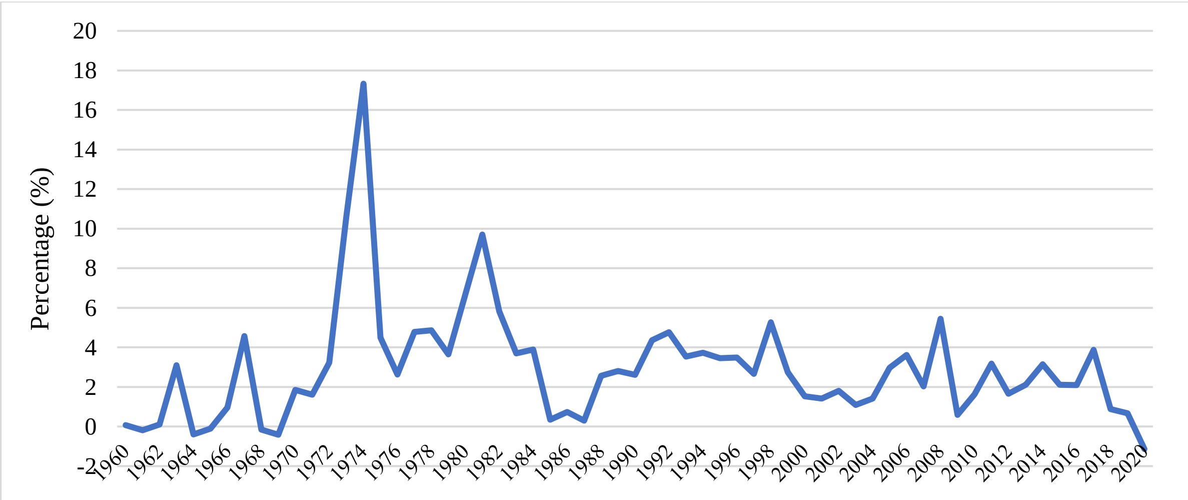
Note:
(1) The figures constitute a simple 5-year average.
n.a - data not available.
Source: Compiled from Department of Statistics Malaysia website, <https://www.dosm.gov.my/v1_/>, Economic Report, various years, Ministry of Finance Malaysia website, <https://www.mof.gov.my/portal/ms>.

2.4.2 Monetary policy

The Malaysian central bank (Bank Negara Malaysia, BNM) was established on 26 January 1959 under the Central Bank of Malaysia Ordinance 1958 (BNM, 1999a) to ensure monetary and financial stability to provide a favourable environment for long-term growth. The BNM has twofold monetary policy objectives: to attain price stability and exchange rate stability. These objectives were frequently emphasised during the early stages of development. Given that Malaysia is an open economy and highly integrated into the global market, low inflation and exchange rate stability are important for a stable economic growth environment.

2.4.2.1 Inflation

Throughout the years, Malaysia's government has continued its efforts to maintain price stability throughout the country. It is clearly demonstrated from long-term records of low inflation rates.



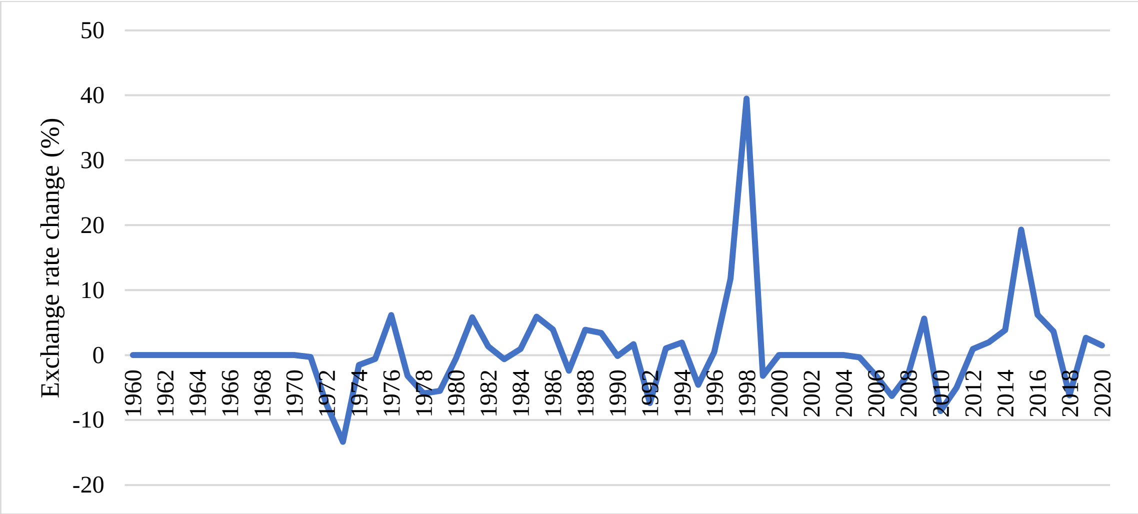
Source: Compiled from World Development Indicators, World Bank.

Figure 2.6: Malaysia: Inflation rate during 1960-2020

Figure 2.6 depicts the changing trends in Malaysian inflation rates from 1960 to 2020. Malaysia's inflation rate averaged 2.9 per cent over the years, and double-digit inflation rates were uncommon, except in the early 1970s when the oil price crisis hit and monetary instruments were insufficient in controlling the shocks (Hill, 2012). The 1973 global oil crisis caused high inflation of 17.3 per cent, while the global oil shocks in 1980 induced inflation to surge from 6.7 per cent in 1980 to 9.7 per cent in 1981. Inflation was slightly higher than the long-term average during the AFC and the GFC. The RM's depreciation of 28.3 per cent in late 1997 increased import prices, contributing to inflation, reaching a high of 5.3 per cent in 1998 and 5.4 per cent due to rising commodity and food prices during the GFC (BNM, 2010). Despite the high inflation during the AFC and the GFC, the rate was relatively mild compared to the oil shocks in 1974 and 1981. After the GFC in 2008, the inflation rate abated and remained low in successive years. Regardless of the number of episodes of high inflation brought about by external shocks, early corrective measures undertaken by the government resulted in a rapid return to price stability. In combination with other policy measures, price stability has contributed to the country's sustainable economic growth and structural change.

2.4.2.2 Exchange rate stability

Given that Malaysia heavily relies on the external sector for economic growth, exchange rate stability is one of the government’s policy priorities. This policy commitment can be illustrated in Figure 2.7.



Source: Author's computation using data from International Financial Statistics, IMF.

Figure 2.7: Malaysia: Annual change in the nominal exchange rate (RM/US$)

RM has been closely aligned with the US dollar over the last six decades except for two episodes of sharp RM depreciation. The first one occurred during the AFC between April 1997 and December 1998. The second took place during October 2014-December 2015 due to a sustained decline in global commodities prices and a strengthening US dollar (BNM, 2015). Strong international reserves and flexible exchange rates act as a buffer against external shocks.

Generally, the Malaysian exchange rate value is determined by market forces (BNM, 1999a). However, on certain occasions, BNM's intervention is necessary to smooth any excessive movement. For example, between 1992 and 1994, Malaysia experienced a large increase in net inflows of portfolio investment, primarily due to lower interest rates and liberalisation of exchange controls. This situation put pressure on RM appreciation, warranting BNM's intervention in the foreign market to stabilise the RM by restricting the short-term capital flows.

The BNM's interventions are critical in stabilising the currency during the AFC crisis. Speculative attack on Bhat Thai in mid-May 1997 put selling pressure on RM and resulted in a sharp RM depreciation of almost 50 per cent between the first week of mid-July and 7 January

1997 (Athukorala, 2012). RM depreciation led to inflationary pressures in the country due to an increase in the prices of imported goods. The massive capital outflows and depreciation of RM led the authority to impose selective capital controls on 1 September 1998 to limit massive short-term capital outflows and peg the currency at RM3.8 per US$ on 2 September 1998 for RM stability. Malaysia switched to a managed float system on 21 July 2005, warranting intervention of BNM in the foreign exchange market to avoid excessive fluctuations in the RM when required.

2.4.2.3 Exchange control

The exchange control system of Malaysia is relatively liberal. Malaysia experienced several distinct episodes of exchange control liberalisation after independence: in 1973, 1987, 1994, and 1998. Significant liberalisation of regulation and foreign exchange transactions with all countries began in 1973 in line with RM flotation in the foreign exchange market. Malaysia's exchange rate control was previously linked to the Sterling Area agreement. The dismantling of this arrangement on 23 June 1972 led Malaysia to adopt a non-discriminatory system of exchange control regulation on 8 May 1973 by redefining the ‘schedule territories’ (formerly referred to as the sterling area) under the Exchange Control Act 1953 to refer to Malaysia only (BNM, 1999a). In this way, regulations on current and capital transactions with all foreign countries were significantly liberalised.

The administration of exchange control policy in Malaysia is based on the belief that such measures should complement other monetary and fiscal policies to promote economic development (BNM, 1999a). The exchange control in 1987 was part of the adjustment process to address the large current account deficit in the early 1980s and economic slowdown. Apart from reducing government expenditure (to reduce imports), the liberalisation of several exchange control measures on 1 January 1987 aimed to reduce business operating costs and increase access to domestic credit, thereby allowing the economy to expand.

The selective exchange control in 1993-1994 served to address speculative short-term capital inflows. The large short-term capital inflows in 1992, rising from RM12 billion to RM13.9 billion in 1993 exceeded long-term capital inflows (which totalled around RM9.5 billion) (BNM, 1999a). This situation put a strain on the value of RM, leading BNM to implement several exchange control measures between January and February 1994 to avoid the pressure on currency appreciation and the effects of any reversal flow on the currency. This control mechanism was designed to be temporary and to limit speculative activity. The control measures were later lifted in stages beginning in August 1994.

A selective exchange rate control was implemented on 1 September 1998 to safeguard the economy against external shocks and restore financial stability (BNM, 1999a). Malaysia experienced a significant outflow of non-resident portfolio investment since June 1997, resulting in depreciation in RM. Between 1997 and 1998, net short-term capital outflows totalled around RM34.6 billion or 6.5 per cent of nominal national product (Beng and Ying, 2003). Consequently, the current account balance reversed dramatically from a deficit of 5.6 per cent of GDP on average between 1990 and 1997 to a surplus of 13.2 per cent in 1998. The massive capital outflow created a severe liquidity constraint for the corporate sector and put pressure on RM[28]. To restore market confidence, the government implemented a tight fiscal and monetary policy to stabilise the currency and restrain inflationary pressure. This effort, however, failed to support the RM exchange rate. As the crisis worsened and prolonged, an exchange control was imposed by the government on 1 September 1998, followed by a fixed exchange rate system on 2 September 1998. Unlike other countries, these measures were

[28] The depreciation of RM helped the trade balance account but was not enough to offset the decline in investment and consumption.

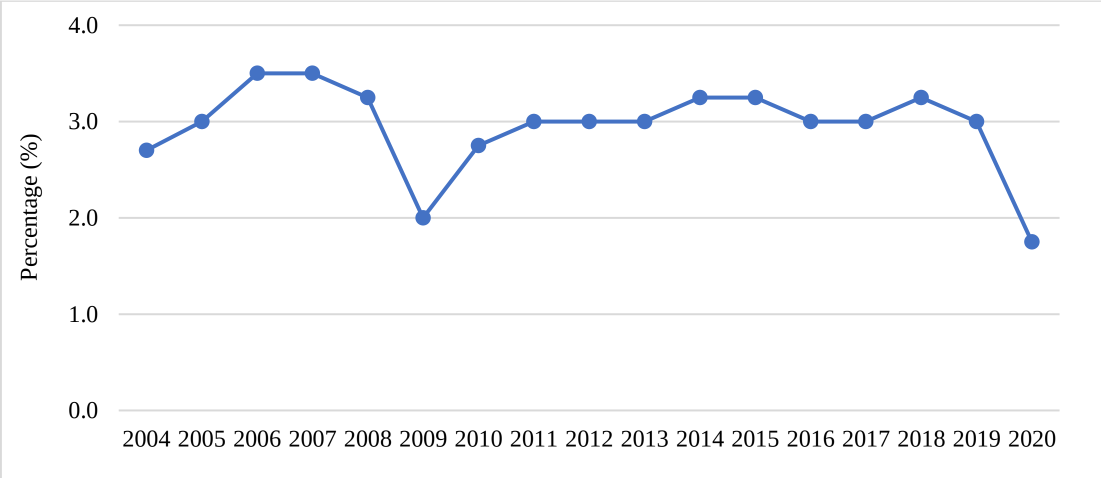
temporary and complemented the other macroeconomic policy to restore rapid adjustment and stabilisation (BNM, 1999a). The economy began to recover in the following years, and the exchange control measures were gradually lifted in stages.

2.4.2.4 Financial stability

The Malaysian government is committed to providing a sound and robust financial system for the country's economic and social development. BNM made various efforts to strengthen the financial system between 1960 and 1997, including creating basic infrastructure and the development of domestic banks in the 1960s. In the 1970s, other financial intermediaries such as merchant banks and development finance institutions were introduced, and the Act and regulations in 1978[29] were amended to empower BNM to regulate and supervise the commercial and merchant banks (BNM, 1999a). The regulatory and supervisory framework in the banking system was strengthened further in the 1980s. Financial stability became an additional monetary policy goal of the country after the AFC of 1997/1998. The banking and corporate sector was further strengthened by establishing three entities to address the bad debts that accumulated in the financial system and related corporate distress. The newly established entities were as follows: Danaharta (an asset management company) to acquire and manage non-performing loans; Danamodal (a banking and corporate recapitalising company) to recapitalise financial institutions with under a 9 per cent capital adequacy ratio; and CDRC (a Corporate Debt Restructuring Committee) to facilitate corporate restructuring through an out-of-court settlement. Other initiatives were implemented in addition to these measures to strengthen and stabilise the banking and system of the country after the crisis.

[29] The Banking Ordinance 1958 was amended and replaced by the Banking Act 1973.

To provide favourable macroeconomic fundamentals and increase the efficiency of monetary policy, the BNM implemented a new interest rate framework on 1 April 2004. This new framework included the introduction of the Overnight Policy Rate (OPR) and removal of base Lending Rate (BLR) ceiling and maximum lending spread of 2.5 percentage points above the BLR or cost of funds (BNM, 2004). The OPR is the minimum interest rate that banks can charge each other when borrowing money. It was introduced to replace the three-month interventions rate, and OPR served to reflect the monetary policy stance and a target rate for the day-to-day liquidity operations.



Source: Compiled from Bank Negara Malaysia website, <https://www.bnm.gov.my/-/monthly-highlights-and-statistics>.

Figure 2.8: Malaysia: Overnight Policy Rate during 2004-2020

The figure shows OPR trend changes throughout the period, but the policy rate is relatively stable after the GFC in 2009. The interest rate is revised quarterly by authorities based on the economic conditions and outlook, with the goal to improve the economy as much as possible. A lower OPR enables consumers and businesses to have access to money at lower borrowing costs, thus increasing expenses and investment leading to economic growth.

Maintaining financial stability became one of the country's primary policy objectives, as manifested in the Central Bank of Malaysia Act of 2009. This statute emphasises the monetary goals to promote monetary and financial stability by creating an environment conducive to economic expansion. BNM is continuing managing the exchange rate of RM as part of its effort to maintain monetary and financial stability. To provide more flexibility to the export-oriented industries and help the economic recovery, the government further liberalised the exchange rate policy by removing the conversion rule and a few other measures beginning on 15 April 2021. This initiative would strengthen Malaysia's position as a destination for foreign direct investment and a global supply chain hub. The outcome of all these macroeconomic policy measures is reflected in the economic performance of the country.

2.5 Economic performance

2.5.1 An overview of economic performance

Malaysia's economic performance from 1960 to 2020 was relatively impressive, with an average annual growth rate of 6.1 per cent. The economy registered a high growth rate between 1960 and 1974, with real GDP growth averaging around 7.4 per cent per year. However, economic growth fell to 0.8 per cent in 1975 due to the global oil price crisis, and it eventually contracted to -1.03 per cent in 1985 as a result of the macroeconomic crisis. Malaysia’s economic growth resumed in 1987, with an average annual growth rate of 4.9 per cent in the late 1980s. Economic growth was strong in the first half of the 1990s, at 9.3 per cent, raising people’s living standards. As a result, Malaysia's economy transformed from a lower-middle-income to upper-middle-income status in 1992. The macroeconomic indicators of Malaysia over a five-year average period are summarised in Table 2.4.

Table 2.4: Selected macroeconomic indicators of Malaysia [1]

Indicators	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-20	1960-20
Real GDP growth (%)	6.5	6.4	9.1	7.2[2]	6.9	4.9[3]	9.3	5.2[4]	5.5	4.1[5]	5.8	3.1	6.1
GDP Percapita (US$)	252.0	323.9	529.5	1,100.1	1,935.6	1,993.0	3,074.0	4,104.4	4,307.4	6,961.3	10,509.3	10,542.5	3,913.2
Employment (million person)	n.a	2.6[6]	3.4	4.6	5.2	6.0	7.1	8.4	9.6	10.5	12.9	14.6	8.4
Unemployment rate (%)	6.0	6.3[7]	7.8[8]	7[9]	4.1	6.6	4.1	2.9	3.4	3.4	3.1	3.5	3.9
Inflation	0.5	1.0	6.9	4.1	6.0	1.3	3.8	3.5	1.5	2.9	2.3	1.4	2.9
M3 growth (%)	6.8	15.4	26.9	20.2	18.9	11.1	16.6	13.1	9.5	9.7	8.9	4.3	13.4
Gross savings (% of GDP)	n.a	n.a	24.0	27.3	26.7	28.9	32.2	37.2	34.2	37.3	31.5	26.6	31.1
Gross investment (% of GDP)	15.9	16.6	22.4	24.9	34.8	26.6	37.2	35.4	24.4	21.6	24.6	23.6	25.6
Real interest rate (%)	n.a	4.0	4.0	2.2	7.2	9.9	5.7	5.9	2.8	1.8	1.5	3.5	4.4
Fiscal balance (% of GDP)	-2.3	-5.4	-6.7	-6.3	-11.0	-6.1	-0.6	-0.2	-5.0	-4.2	-4.3	-3.7	-4.6
Foreign reserves (USD' bil)	0.5	0.5	0.9	2.6	3.7	6.2	17.6	24.7	39.2	87.0	121.7	96.9	34.5
Export/GDP (%)	47.5	43.8	42.4	50.5	53.3	62.4	79.3	103.2	112.2	104.4	80.2	67.0	70.4
Import/GDP (%)	42.1	38.8	40.3	43.9	56.4	54.1	79.7	94.1	93.4	83.2	68.2	59.9	62.8
Import duties/Total import (%)	13.9	15.4	10.7	7.9	6.6	5.2	3.6	2.2	1.0	0.5	0.3	0.3	5.6
Current account balance (% of GDP)	-0.4	1.8	-2.3	1.7	-8.2	2.1	-5.3	1.8	9.8	15.7	6.8	3.0	2.2
Total external debt (% of GDP)	n.a	n.a	12.4	18.4	35.2	56.8	38.2	50.3	45.9	31.8	43.6	67.1	41.1
External debt service ratio (%)	n.a	n.a	n.a	3.5	8.5	14.8	6.6	6.5	6.1	4.6	10.1	11.6	8.1
Short term debt[10] (% of GDP)	n.a	n.a	n.a	n.a	n.a	2.9	7.0	10.5	7.5	9.0	19.4	27.6	13.3

Notes: n.a-data not available.
(1) The figures constitue a simple 5-year average.
(2) The growth rate in 1975 was 0.8 per cent (due to oil shock).
(3) The growth rate in 1985 was -1.03 per cent (due to macroeconomic crisis).
(4) The growth rate in 1998 was -7.4 per cent (due to the Asian financial crisis).
(5) The growth rate in 2009 was -1.5 per cent (due to the global financial crisis)
(6) For Peninsular Malaysia only. Data only in 1965, from Jomo (1990, Table 4.1, p. 79).
(7) Data in 1965 and for Peninsular Malaysia only (8) data in 1970, and (9) data in 1975 are from Jomo (1990, Table 4.1, p. 79).
(10) Debt maturing in a year or less.
Source: Compiled from Department of Statistics Malaysia, Ministry of Finance Malaysia, Economic Planning Unit Malaysia, Bank Negara Malaysia, International Financial Statistics, IMF, World Development Indicators, World Bank, CEIC database,< https://www.ceicdata.com/en>, and Labour Force Survey, various years.

Significant changes in Malaysia's economic policy from an agricultural to a manufacturing-based production, emphasis put on export orientation, and an open trade regime resulted in rapid economic growth. Export growth strongly contributed to the GDP growth of the country (Doraisami, 1996) and this reform was supported by macroeconomic stability (including maintaining a realistic real exchange rate) and infrastructural development (Athukorala and Menon, 1997). Malaysia encouraged FDI into the country by offering attractive incentives such as FTZs, tax allowances, and double tax deductions to promote exports. The degree of export orientation is increasing in tandem with economic growth. The export-to-GDP ratio increased slowly in the 1960s and 1970s, moderately in the first half of the 1980s, and dramatically after 1987. Between 1998 and 2007, the export-to-GDP ratio averaged 112.9 per cent, which was twice as high as it had been in the 1960s and 1970s. This increment is reflected in the increasing involvement of the country in the global economy. Malaysia's participation in global production networks (GPNs) is measured by the share of parts and components and final assembly traded within GPNs in total manufacturing export. It increased significantly from 65.1 per cent in 1988 to 79.6 per cent in 2000, and then recorded a modest decline reaching 65.9 per cent in 2020, presumably due to competition from other countries in the global market.

The remarkable economic performance was severely endangered by the AFC. The economy experienced negative growth of 7.4 per cent in 1998, which forced the government to formulate macroeconomic and financial sector policies to tackle the adverse impact of the crisis. As a result, the economy recovered quickly in 1999, but the average growth rate dropped to 4.5 per cent after the crisis. The GDP growth rate after the crisis was relatively lower than pre-crisis, averaging 5.1 per cent per annum between 1999 and 2019. The economy was then contracted by 5.6 per cent in 2020 due to the global COVID-19 pandemic.

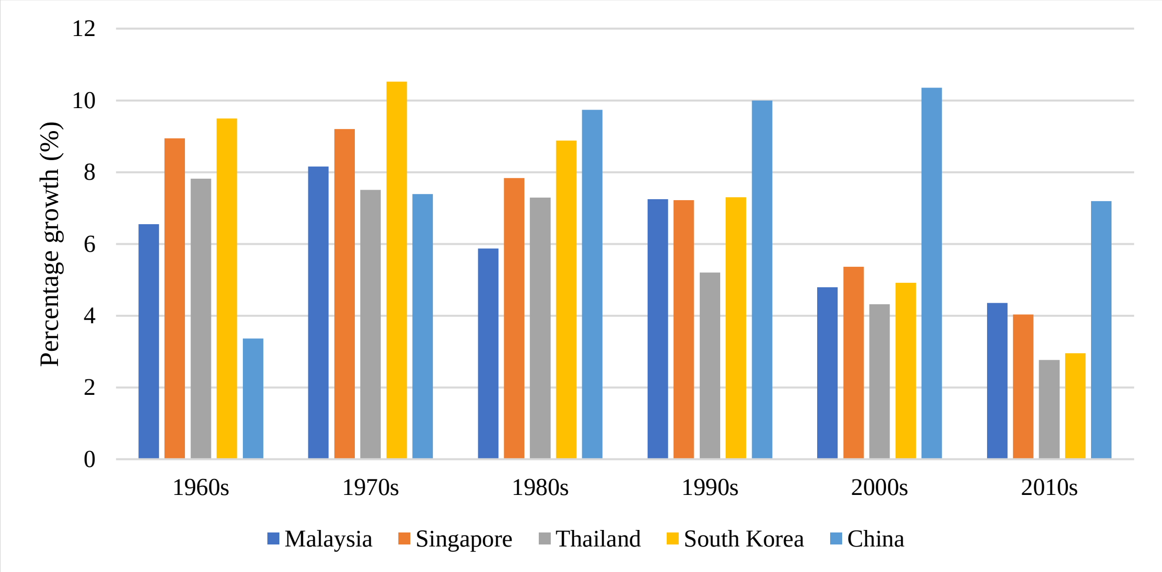
Malaysia's economic performance has been fuelled by a rapid increase in capital formation facilitated by low inflation and unemployment rates. There was a relatively low inflation rate by regional and developing country standards (Corden, 1996). The country's inflation rate throughout the period remained at around 3 per cent. Meanwhile, the unemployment rate was generally below 3.5 per cent and this has been the case since the mid-1990s. The country's capital formation increased significantly from 15.9 per cent in the early 1960s to more than 25 per cent in the late 2010s. Despite the increase in capital formation, it did not affect the balance of payments due to the high level of national savings. Between 1960 and 2020, the average domestic savings amounted to about 31.1 per cent of the GDP. During this period, the resource gap between savings and investment was financed through the current account balance, particularly from the net capital inflows. The current account recorded a deficit during the early 1970s and 1980s, reflecting large foreign capital inflows into countries, and it documented a surplus from the late 1980s until the 2010s. The foreign exchange reserves recorded a rapid accumulation from US$0.5 billion in the 1960s to US$121.7 billion in the first half of the 2010s and the level remained steady above US$90 billion in the following years. The rise in foreign exchange reserves since mid-2002 has been related to the authorities' effort to prevent the currency from appreciating (Koske, 2008).

2.5.2 Comparison with other Asian countries

For a comparative perspective, this paper has selected four high-growth Asian[30] economies: Singapore, Thailand, the Republic of Korea[31], and China. Malaysia has enjoyed sustained economic growth for almost six decades, with an average growth rate of 6.4 per cent throughout 1960-2020. With an exception in 1985, economic growth has risen consistently from the 1960s

[30] Singapore and South Korea are now successful high-income countries, while Malaysia's main competitors are China and Thailand.
[31] The Republic of Korea is also referred to as South Korea

to the mid-1990s. The average real GDP growth of Malaysia and comparisons are shown in Figure 2.9.



Source: Compiled from World Development Indicators, World Bank.

Figure 2.9: Average real GDP growth of Malaysia and its comparators

Malaysia's average real GDP growth in the 1960s and 1970s was relatively higher than in China but below that of South Korea, Thailand, and Singapore. Rapid development in the 1990s to 2010s enabled Malaysia to surge ahead of Thailand, South Korea, and Singapore, but lag behind China.

The average growth rates in GDP per capita of Malaysia and those of its comparators are presented in Table 2.5. GDP per capita growth for the country in the 1960s was 3.5 per cent, which was lower than Singapore, Thailand, and South Korea. The Malaysian real GDP per capita growth registered the highest rate in the 1970s, with an average growth rate of 5.6 per cent, which was higher than in Thailand and China but lower than in Singapore and South Korea. In subsequent years, the average real GDP per capita growth was lower than other countries, particularly in the 1980s and 2000s. However, in the 2010s, the average real GDP per capita growth was higher than in Singapore, Thailand, and South Korea. Based on the coefficient of variation, Malaysia's economic growth is relatively more volatile than South Korea and Thailand, reflecting the country's vulnerability to external shocks.

Table 2.5: Growth in per capita GDP[1] for Malaysia and its comparators during 1960-2020 (%)

Year	Malaysia	Singapore	Thailand	South Korea	China
1960s	3.5	6.4	4.6	6.7	1.2
1970s	5.6	7.5	4.8	8.6	5.3
1980s	3.1	5.6	5.3	7.5	8.2
1990s	4.5	4.1	4.0	6.1	8.8
2000s	2.7	3.0	3.6	4.1	9.7
2010s	2.9	2.8	2.4	2.5	6.6
Volatility	0.92	0.89	0.86	0.64	0.98

Note: (1) By decades.
Source: Author's computation using data from World Development Indicators, World Bank.

2.5.3 Structural change

The improvements in the country's income and living standards are attributed to the economy's structural shift from agriculture to manufacturing production. The primary sector played a significant role in Malaysia's economic activities during the early days of independence. Agriculture accounted for 40.5[32] per cent of total output in 1960, while manufacturing represented only 8.2 per cent. The export commodity was dominated by rubber and tin, which accounted for almost two-thirds of the total exports. Table 2.6 demonstrates that the economic structure has changed hugely over the years, reflecting the increasing role of manufacturing in the economy; meanwhile, agriculture has shrunk significantly. The decrease in the price of commodities and the economic downturn in 1985 led the government to launch an ambitious programme to diversify the economy and promote manufacturing as a growth sector. As a result, the share of manufacturing to GDP increased rapidly from 14.9 in the late 1980s to 22.7

[32] Data for Peninsular Malaysia only, from Jomo (1990, Table 3.4, p. 43)

per cent in the late 2010s. The remarkable changes in the economic structure are partly due to policy focusing on outward orientation and increasing participation in Malaysia's international fragmentation production activities. The services sector accounts for the lion's share of GDP; over the years, the services sector's share of GDP has progressively climbed from 32.9 per cent in the 1970s to 57 per cent in the late 2010s, and it remains the most significant contributor to output growth. The expansion of this services sector has been inextricably linked to the manufacturing sector's expansion (Ariff, 1991). The mining and quarrying sector's contribution to GDP has waned significantly over time, from 23.8 per cent in the first half of the 1970s to 8.4 per cent in the late 2010s. In contrast, the construction sector has experienced only minor changes in its share of economic expansion.

Table 2.6: Contribution to gross domestic product by sector during 1970-2020[1] (%)

Sector	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-20
Agriculture, forestry & fishing	30.8	28.3	24.5	22.7	17.6	12.1	10.9	10.2	9.3	7.7
Mining & quarrying	23.8	22.0	21.7	22.4	16.5	15.7	15.6	13.1	9.5	7.9
Manufacturing	10.2	12.3	13.2	14.9	20.2	23.0	24.5	24.4	22.8	22.7
Construction	2.3	2.8	3.3	3.7	4.7	5.4	4.0	3.4	4.1	4.7
Services	32.9	34.7	37.3	36.3	41.0	43.8	45.0	49.0	54.2	57.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: (1) The figures constitute a simple 5-year average.
Source: Compiled from Department of Statistics Malaysia and unpublished data from Economic Planning Unit Malaysia.

The expansion of manufacturing production has contributed to the rapid growth in exports which grew remarkably in the 1970s, and total export earnings rose from US$1.7 trillion in 1970 to US$234.1 trillion in 2020. In the 1970s, the average share of manufacturing products in total merchandise goods was around 13.2 per cent. Its export share increased rapidly from 37.1 per cent in 1986 to 80 per cent in 2001. However, between 2001 and 2020, manufacturing exports declined, with export shares varying between 54.2 per cent and 78.3 per cent of total exports. Manufacturing export products in the 1970s were mainly food, beverages and tobacco, wood, and basic metals. The country's export structure has changed over time in response to the changing patterns of international trade. Export orientation, measured by the total exports to GDP ratio, increased significantly to 121.3 per cent in 1999 up from 45.6 per cent in 1970 but gradually declined to 61.4 per cent in 2020. Although the export-to-GDP ratio has decreased, the current account balance has remained in surplus since 1998. The export composition has also shifted from simple electronics operations and products towards high-technology products such as televisions, radios, computers and cameras (Athukorala and Menon, 1997).

The rapid economic expansion has contributed to total employment. Before 1988, the country's unemployment rate was relatively high, reaching a peak of around 7.4 per cent in 1986. By 1992, the rate had fallen to 3.7 per cent, indicating that the country was at full employment (BNM, 1999a). The rate of unemployment fell further to 2.4 per cent in 1997. Between 1998 and 2020, the unemployment rate averaged at 3.4 per cent. The manufacturing sector contributed almost 10 per cent of total employment in the early 1970s, and the share rose dramatically to 22.8 per cent in the late 1990s before falling to 17 per cent in the late 2010s[33]. The increase of workers in manufacturing, particularly during the mid-1980s and early 1990s, was largely due to the relocation of foreign firms in the country and they hired local personnel. According to Athukorala and Menon (1996), export-oriented foreign investment contributes significantly to manufacturing employment. The share of the labour force by sector is shown in Table 2.7.

[33] Data are obtained from Labour Force survey, various years, and Department of Statistics Malaysia

Table 2.7: Share of employment by sector during 1970-2020[1] (%)

Sector	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-20
Agriculture, forestry & fishing	50.9	45.2	34.5	30.2	23.1	18.8	15.1	14.3	12.6	11.1
Mining & quarrying	2.4	2.1	1.2	0.6	0.5	0.4	0.3	0.4	0.6	0.6
Manufacturing	9.8	12.4	15.4	16.0	22.4	22.8	22.1	18.7	17.6	17.0
Construction	3.2	4.2	6.7	6.2	7.0	8.5	9.0	9.1	9.3	8.6
Services	33.7	36.1	42.1	47.0	47.0	49.5	53.5	57.5	60.0	62.6
Unemployment rate	7.5[2]	6.9[3]	4.1[4]	6.6	4.1	2.9	3.4	3.4	3.1	3.5

Notes:

(1) The figures constitute a simple 5-year average.

(2) Data in 1970, (3) data in 1975 from Jomo (1990, Table 4.4, p. 84).

(4) Data for 1982-84.

Source: Compiled from Economic Report, various years, Department of Statistics Malaysia website, <https://www.dosm.gov.my/v1_/> and Economic Planning Unit website, <https://www.epu.gov.my/en/socio-economic-statistics/economic-statistics/population-labour-force>.

In terms of poverty eradication, the government of Malaysia has achieved much. The poverty rate dropped from 49.3 per cent in 1970 to 6.8 per cent in 1997, falling further to 5.6 per cent by 2019, but increased to 8.4 per cent in 2020. The distribution income also improved over time with the increase in the per capita income. Per capita income increased from US$35.7 in 1970 to US$4,637.9 in 1997 and then US$10,401.8 in 2020. The Gini coefficient declined from 0.51 in 1970 to 0.41 in 2019, reflecting the fact that income inequality to some extent narrowed.

2.6 Conclusion

Malaysia's economic growth is relatively impressive by developing country standards, with an annual average GDP growth rate of 7.4 per cent in the two decades prior to the Asian financial crisis in 1997/1998 and 4.6 per cent during 2000-2020. Given that Malaysia highly relies on the external sector for its economic growth and is highly integrated into the global market, the macroeconomic policy is adjusted according to changes in the economic environment to maintain sustainable economic growth. The coordination between fiscal and monetary policies has helped to stimulate economic activities and achieve price stability. Furthermore, rapid economic growth and several changes in exchange rate policy indicate there is a strong link between exchange rates' stability and long-term economic performance.

CHAPTER 3: REAL EXCHANGE RATE: CONCEPT, MEASUREMENT, AND DETERMINANTS

Abstract

This chapter examines the determinant of real exchange rate (RER) movements during the period 1960-2018, distinguishing between the effects of exchange rate regime shifts and relevant economic fundamentals. The RER is measured using a methodology that better captures its analytical conception: the relative price of tradable goods to non-tradable goods. The RER equation is estimated using the Autoregressive Distributed Lag (ARDL) approach. Empirical evidence suggests that technological progress, total capital inflows, and government intervention are the main forces behind the RER movement in the long-run dynamics. Meanwhile, fiscal deficit and the fixed exchange regime choice determine RER movements in the short-run. This paper also highlights that Malaysia has experienced several episodes of RER misalignment throughout its post-independence history, with undervaluation dominating the pattern. Overall, the RER movements are aligned with crisis events and policy adjustments.

3.1 Introduction

The real exchange rate (RER) is defined as the relative price of tradable goods to non-tradable goods, and it is an important macroeconomic variable that determines growth and structural adjustment in an open economy. It is a key indicator of international competitiveness that captures incentives for allocating resources between tradable and non-tradable sectors of the economy (Edwards, 1989a). A depreciation of the RER represents an improvement in the production of tradable goods (both exports and import substitutes) compared to non-tradable goods. Meanwhile, a RER appreciation represents the deterioration in tradable goods production compared to non-tradable goods. The RER is, therefore, the principal equilibrating variable of a country's international trade and payments.

Numerous studies investigated the determinant factor of the RER movement. However, the existing literature is dominated by cross-country analyses, and the results are far from conclusive. Cross-country studies only provide an average picture of the countries covered, based on the homogeneity assumption in the observed relationships between nations, but it does not hold for at least two reasons. First, there are considerable differences between developing countries due to their varying structural, historical, economic, and institutional factors influencing the RER movement. Second, there are significant differences between countries in terms of the nature and quality of data.

The purpose of this study is to examine the long-run and short-run determinants of RER movement during 1960-2018 while taking account of different exchange regime shifts in the analysis. This study empirically tests whether changes in the exchange rate policy per se help to achieve the economy's international competitiveness (avoiding RER appreciation). This paper also further explores the extent of RER misalignment in Malaysia. RER misalignment is a concern here as it has been the focus of recent macroeconomic policy debates. By measuring the degree of RER misalignment using the RER index, which is consistent with the theoretical concept, this study contributes to the body of knowledge and addresses a gap in the literature.

Malaysia offers an ideal case study for three reasons. First, it has undergone several significant post-independence exchange rate regime shifts, and the RER's behaviour becomes one of the central roles for policy evaluation and policy design. Second, limited systematic empirical evidence informs policymakers about the determinants of the RER movement and the degree of RER misalignment in the country. Third and lastly, the availability of macroeconomic data is suitable by the developing standard permits for systematic time series investigation.

There are several Malaysian studies on this subject (surveyed in Chapter 3). This study has three novelty features compared to these studies. First, the analysis is conducted based on the newly constructed RER index, which is more consistent with the RER theoretical concept than the IMF index which has been widely used previously. Second, it focuses more on the role of exchange rate regime choice than real economic fundamentals. Finally, it covers a longer data span from 1960 to 2018 which is important if structural changes in the relationship between RER and its fundamental variables across the period are to be detected.

This paper is organised as follows. Section 3.2 provides a review of the literature on RER determinants. Section 3.3 focuses on RER definition and measurement. Section 3.4 explains the RER patterns, while the equilibrium of real exchange (ERER) rate is discussed in section 3.5. Section 3.6 discusses the model specification. Data sources and description of variables are covered in section 3.7. Meanwhile, the econometric method is noted in section 3.8. Section 3.9 summarises the analysis and discusses the results. The ERER and RER misalignment are estimated in section 3.10, and the last section summarises the key findings and policy implications.

3.2 Literature review

There is a sizeable literature that examines the determinant of RER movements[34] based on multi-country and cross-country analyses. Edwards (1988) examined 12 developing countries and concludes that RER responds to changes in import tariffs, terms of trade (TOT), government consumption expenditure, trade flows, and technological progress. In another study, Edwards (1989b) provided an empirical analysis of RER determination suggesting that TOT, capital inflows, government consumption, technology progress, trade policy, excess supply of domestic credit, and other factors influence the behaviour of RER. Using cointegration analysis, Elbadawi (1994) found that TOT, capital inflows, government consumption, technological progress, and an excess domestic supply have a long-run relationship with the RER behaviour in Chile, Ghana, and India. Meanwhile, Berg and Miao (2010) demonstrated that RER movement in developing countries is determined by technological progress, trade, net foreign assets, government consumption, investment, and trade openness.

Empirical evidence for emerging and industrial countries also suggests various factors determining RER movements. Lane and Milesi-Ferretti (2004) examined 64 industrial and developing countries, and found a strong relationship between RER and net foreign assets. Meanwhile, Banerjee and Goyal (2021) studied eight large emerging market countries, discovering that RER movements are determined by productivity, trade openness, government spending, financial development, dependence, sectoral relative price, and fiscal policy. Several studies demonstrated a strong link between the exchange rate regime and RER. Stockman (1983) studied 38 countries (including Malaysia) from 1957 to 1979 and found a strong association between the RER and the exchange rate regime. The author also highlights that

[34] See Edwards (1988), Bajo-Rubio et al. (2018), Mahraddika (2020), and Banerjee and Goyal (2021) for a review of the literature.

RER variability is more significant under the flexible exchange rate system than the pegged exchange rate system. Mussa (1986) also reported that RER behaves differently under different exchange rate regimes in a study of 16 advanced countries from 1957 to 1982. RER variability rises considerably under the floating exchange rate compared to fixed exchange rate regimes. Cermeño and Sanin (2015) studied the G7 and 17 Latin American countries from 1970 to 2010 and discovered that RER volatility is greater under the floats than under the pegs system.

There are only a few country case studies compared to the sizeable number of multi-country studies. Empirical evidence suggested a positive shock of government expenditure, capital inflows, and the interest rate differential resulted in RER appreciation in Turkey (Agénor et al., 1997). Jongwanich (2008) demonstrated that government spending, technological progress, TOT, and openness were the key drivers of the RER movement in Thailand between 1970 and 2000. Edwards and Rigobon (2009) argued that restrictions on capital inflows caused the Chilean peso to depreciate in the 1990s. Bouraoui and Phisuthtiwatcharavong (2015) contended that TOT and international reserves determine the RER movement in Thailand. Bajo-Rubio et al. (2018) investigated the nexus between fiscal policy and RER in Spain, and emphasised how the composition of fiscal consolidation measures and the definition of RER are important in determining the impact on RER. A summary of findings is presented in Table A3.1 in the Appendix. Despite numerous studies on the subject, the evidence on Malaysia is limited.

Previous studies done on Malaysia are by Quadry et al. (2007), Koske (2008), Sidek and Yusoff (2009), Wong (2013) and Wong (2014), Dahalan et al. (2016), Wong (2018), and Shukri et al. (2021). Quadry et al. (2007) found that the differential in money supply and world crude oil price determine the RM movement against GBP during January 2010-January 2017. Koske (2008) discovered that trade openness, real GDP per capita, government consumption, non-tradable productivity, and net foreign assets determine RER movements from 1980 to

2006. Sidek and Yusoff (2009) discovered that productivity, government expenditure, and trade openness influence RER movements between 1991 and 2008. Wong (2013) and Wong (2014) demonstrated that productivity differential, interest rate differential, the real oil price, and reserve differential determine RER movements during 1971-2008. Dahalan et al. (2016) examined RER determinants from 1960 to 2016 and discovered that capital formation, capital flows, government expenditure, and openness level determine RER variations. The authors also highlight that the primary factor causing persistent variation in the RER is consumption expenditure. Wong (2018) examined the source of RER movements between 1971 and 2016 using the ARDL method, suggesting that productivity and reserve differentials are significant determinants of RER movements. Shukri et al. (2021) examined the determinant of RER movements of Malaysia from 1970 to 2019, and found inflation rate and income growth rate play a significant role in determining RER movement. A summary of the findings is presented in Table A3.2 in the Appendix.

Various conclusions have been drawn from the previous studies, and one possible factor for the mixed results is the lack of attention paid to the theoretical aspects of RER measurement. The previous studies measure the RER index in various ways and used different fundamental variables across studies. The methodological limitations in such research include inappropriate price index, the choice of weighting scheme in constructing RER index, and some studies use a bilateral RER index rather than a multilateral RER index to represent aggregate competitiveness. Sidek and Yusoff (2009), Koske (2008), and Dahalan et al. (2016) used the real effective exchange rate, which covered several trading partners. Meanwhile, other studies defined RER using the bilateral RER index (e.g. Wong, 2014, 2018; Shukri et al., 2021). Despite using the multilateral RER, Sidek and Yusoff (2009), and Koske (2008)[35] use the common price index which is the consumer price index (CPI), to represent both the foreign

[35] The author acknowledges the importance of using an appropriate price index, but they believe that using CPI allows for easier comparisons with previous studies.

price index and the domestic price (detailed discussion as in section 3.3). Some of these studies also have used data covering a short time span.

Selecting an appropriate price index that is consistent with the theoretical definition is vital in constructing the RER index to avoid conflicting results (Athukorala and Warr, 2002). Edwards (1989a) provides evidence that the multilateral RER can diverge significantly from bilateral RER when the major currencies are floated on foreign markets. Therefore, multilateral RER is more appropriate to represent aggregate competitiveness than bilateral RER. Edwards (1989a) and Elbadawi (1992) further emphasise that using a multilateral RER index in evaluating policy-related issues is critical to avoid drawing incorrect and misleading conclusions about a country's competitiveness.

The literature has also reached inconclusive results regarding the size of RER deviation from its level consistent with economic fundamentals. Naseem et al. (2010) assessed the RER misalignment in Malaysia using quarterly data from 1991 to 2003 demonstrated that the RER was undervalued between 1991-1992 and 1997-2003 and overvalued during 1993 to mid-1997 period. Sidek and Yusoff (2009) examined the RER determinants and misalignment from 1981 to 2008. They found that the Malaysian currency was overvalued between 14.7 and 33 per cent in the 1990s, and the average of RER misalignment was below 10 per cent after 1998. Koske (2008) assessed the equilibrium of the Malaysian RER using quarterly dataset and found persistent RER misalignment in Malaysia. The RM was overvalued by 14-17 per cent at the onset of the AFC, and a slight[36] depreciation and appreciation between 1980 and 2006 was evident. Lee and Azali (2005) examined the RER misalignment in ASEAN-5[37] countries from 1980 to 2003, reporting that Malaysia experienced a mild RER overvaluation of about 1 to 4 per cent before the currency crisis. Meanwhile, Jongwanich (2009) investigated the RER misalignment of eight Asian countries during 1995-2008 and discovered that real overvaluation

[36] Between 4 and 5 per cent
[37] These countries are Indonesia, Malaysia, The Philippines, Singapore, and Thailand

in Malaysia increased to around 10-15 per cent leading up to the AFC. Toulaboe (2017) investigated the magnitude of currency misalignments in eight Asian[38] economies from 1981 to 2013, discovering that RER mostly oscillated around its equilibrium values and no significant misalignments. The author also revealed that RER overvaluation reached 19 to 28 per cent before the AFC. Mahraddika (2020) estimated the RER misalignment for individual countries from 1980 to 2014 and discovered that Malaysia's currency was misaligned by around -13 and 18 per cent throughout the period. Shukri et al. (2021) estimated RER misalignment from a residual between actual and fitted values of exchange rates, and found that RM was misaligned between 0.02 and 0.33 per cent between 1988 and 2019.

Previous research has measured RER misalignment in various ways. For example, Naseem et al. (2010), Sidek and Yusoff (2009), and Mahraddika (2020) defined RER misalignment a deviation of the actual real exchange rate from its equilibrium path. Naseem et al. (2010) estimated the ERER using the Natural Real Exchange Rate approach, and the fundamental variables are government consumption, real interest rate differential, TOT, and productivity. Mahraddika (2020) employed the behavioural equilibrium exchange rate (BEER) approach and considered government expenditure, productivity, TOT, openness, NFA, real interest rate differential, domestic real interest rate, and financial sector openness as fundamental variables. Meanwhile, Sidek and Yusoff (2009) estimated the ERER using the BEER approach, with fundamental variables are productivity differential, government consumption, openness, and NFA. Koske (2008) compared the actual real effective exchange rate with the equilibrium rate derived from the estimated cointegrating vector to measure RER misalignment. Six fundamental variables considered are the value-added of tradable and non-tradable goods, NFA, TOT, openness, and government consumption. Jogwanish (2009) calculates the RER misalignment by comparing the long-run ERER to the actual with the

[38] China, Hong Kong, India, Indonesia, South Korea, Malaysia,Thailand, and Japan.

fundamentals considered are government spending, TOT, productivity, openness, and NFA. The fundamental determinants considered Toulaboe (2017) for measuring RER misalignment is government spending, NFA, investment, openness, productivity, and TOT.

3.3 RER measurement

Theoretically, RER is the relative price of tradable goods (P^T) to non-tradable goods (P^N) or RER=(P^T/P^N). Even though the RER concept is relatively straightforward, measuring it offers many challenges. These include finding the price proxies to represent the price index and determining the weighting scheme. Finding the appropriate price index to represent tradable and non-tradable goods has been one of the practical difficulties encountered by other studies in measuring RER. Dictated by the availability of data, the RER is defined here as nominal exchange rate adjusted by the relative price level of trading patterns and the domestic price level of the given country:

$$RER = NER \times P^w/P^d \quad (1)$$

where the nominal exchange rate index (NER) is the weighted average of the bilateral exchange rate of a given country and trading partners, P^w is the weighted-average foreign price index of trading partners, and P^d is the domestic price level of a given country.

Note that, $\overline{P}^d = \lambda\, \overline{p}^T + (1-\lambda)\, \overline{p}^N$, where λ is the share of tradable goods in total output or GDP. Therefore, equation (1) can be written as:

$$RER = [NER \times \overline{P}^w\,]/[\lambda\, \overline{p}^T + (1-\lambda)\, \overline{p}^N\,] \quad (2)$$

Under the assumption of approximate equality of NER x $\overline{P}^w$ with $\overline{p}^T$ the internal tradable price level. The RER then becomes RER = $1/[\lambda + (1-\lambda)(\overline{p}^N/\overline{p}^T)]$, a measurement whose movements are directly related to (P^T/P^N). In other words, equation (1) provides a reasonable proxy measure of the relative price of tradable goods (P^T) to non-tradable goods (P^N) or RER=(P^T/P^N) (Harberger, 2004).

The RER measurement of this study differs from the RER index used by IMF (the 'IMF-RER index') and earlier studies in several aspects. The IMF-RER index uses the CPI to measure both world price and domestic price. This practice is dictated by the fact that CPI is the only measure of the general price level available for most developing countries (Edwards, 1989a). Essentially P^w should, as far as possible, measure only the foreign tradable goods prices. However, the use of CPI to measure P^w is a major limitation of the IMF-RER index because trading partners' non-tradable price is not relevant for measuring the relative profitability of producing tradable goods in a given country (Harberger, 2004).

Conceptually, CPI and GDP deflator are simpler in terms of their price coverage of tradable and non-tradable goods. However, the GDP deflator is preferable to CPI as the denominator of RER for two reasons (Harberger, 2001, 2004). First, GDP deflator naturally has a broader, country-wide coverage than CPI. Second, the GDP deflator is presumably free of idiosyncratic movements compared to the CPI. The CPI has a broad coverage of non-tradable goods and services. Like most other developing countries, the CPI compilation in Malaysia is distorted by the use of control prices for many consumer goods (Cheng and Tan, 2002)[39]. The BNM (2015) also reports that about 17.4 per cent of items governed by the Price Control Act 1946, which was later replaced by the Price Control and Anti-Profiteering Act 2011. Given that the GDP deflator is derived from national accounts, this indicator is obviously less susceptible to political manipulations (Athukorala and Rajapatirana, 2003).

In estimating the RER for a given country, it is necessary to decide the choice of the trading partners and the weights assigned to each partner country based on the nature of its trade patterns. The country weights can be varies depending on choice. Thus the 'operational' form of the RER is:

[39]Cheng and Tan (2002) discovered that the Malaysian CPI covered a large number of control items; for example, in 1995, about 8.2 per cent of the total weights were subject to the Price Control Act, while 12 per cent were subject to supply control regulations.

$$\text{RER}= \prod_{j=1}^{n} \left(\frac{NER_{ijt} \times WPI_{jt}}{GDP\ def_{it}} \right)^{wj} \quad (3)$$

NER is the nominal exchange rate between the domestic currency (*i*) and foreign's currency (*j*) at time *t*, WPI is the wholesale price index[40] of the foreign country (*j*), and GDP *def* is the GDP deflator of the domestic country. *w* is the export share of *n* trading partners.

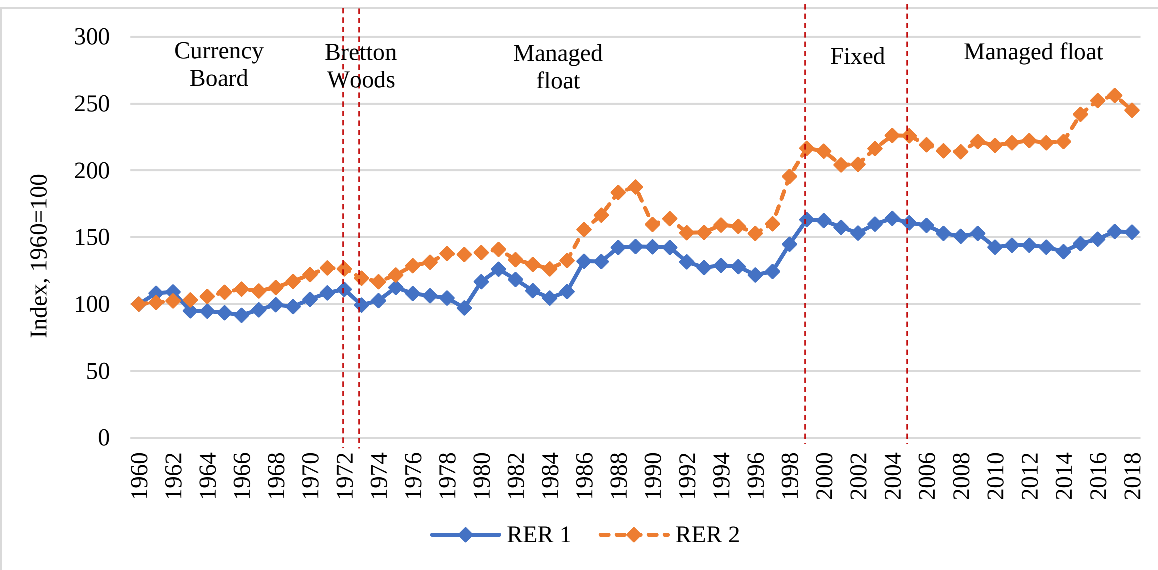
The RER index (equation 1) constructed in this study covers bilateral NER and WPI[41] relating to Malaysia's 20 major trading partners, who constitute 76 per cent of total exports. The base year for calculation is 2015. The list of countries with export weight is reported in Table A3.3 in the Appendix. For comparison, the IMF index is computed with the same country coverage and export weights. In the following discussion, the preferred RER index is denoted as RER1 and the IMF index is denoted as RER2.

Regarding the weighting schemes, various weight schemes are used in the literature to construct the NER and P^w index, such as export, import, or trade (sum of import and export). The trade weight is the simplest and widely used in the previous literature, including IMF. This study used export weight in constructing the NER and P^w index instead of import weight and trade weight. Export weight is preferable since it represents the country's competitiveness more appropriately than import or trade weights (Warr, 1986). As well, exports are less influenced by domestic trade policy compared to imports. The export weights are updated periodically (every ten years) rather than for the entire period under study to consider changes in trading partners during the period, as suggested by Hinkle and Montiel (1999).

[40] Average share from the 1960s to the 2010s
[41] The Producer Price Index is used in some countries.

3.4 RER patterns

Figure 3.1 depicts the preferred RER index (RER1)[42] and the IMF index (RER2)[43]. An increase in each index reflects a depreciation, while a decrease in each index reflects an appreciation.



Source: Author's computation using data from World Development Indicators, World Bank and International Financial Statistics, IMF.

Figure 3.1: RER patterns based on different price proxies

The figure draws interesting properties of the RER behaviour of Malaysia. First, both RER1 and RER2 experience a significant depreciation and appreciation over 59 years. Second, there was a clear structural break in 1998, possibly due to the fundamental macroeconomic changes. Lastly, the RER variability increases under the managed float exchange rate. The RER1 and RER2 directions were slightly different from 1960 to 1980 but had a similar pattern starting from 1981 until 1997. Both RER1 and RER2 had experienced depreciation in 1980 and 1981[44]; however, RERs began to appreciate consistently starting in 1982. Depreciation of RM couple with US dollar depreciation following the Plaza Accord in 1985 resulted in RER depreciation from 1986 until 1991, which gives significant weight to export competitiveness.

[42] RER1 = $\prod_{j=1}^{20}\left(\frac{NER_{ijt} \text{ x } WPI_{jt}}{GDP\ def_{it}} \right)^{wj}$

[43] RER2 = $\prod_{j=1}^{20}\left(\frac{NER_{ijt} \text{ x } CPI_{jt}}{CPI_{it}} \right)^{wj}$

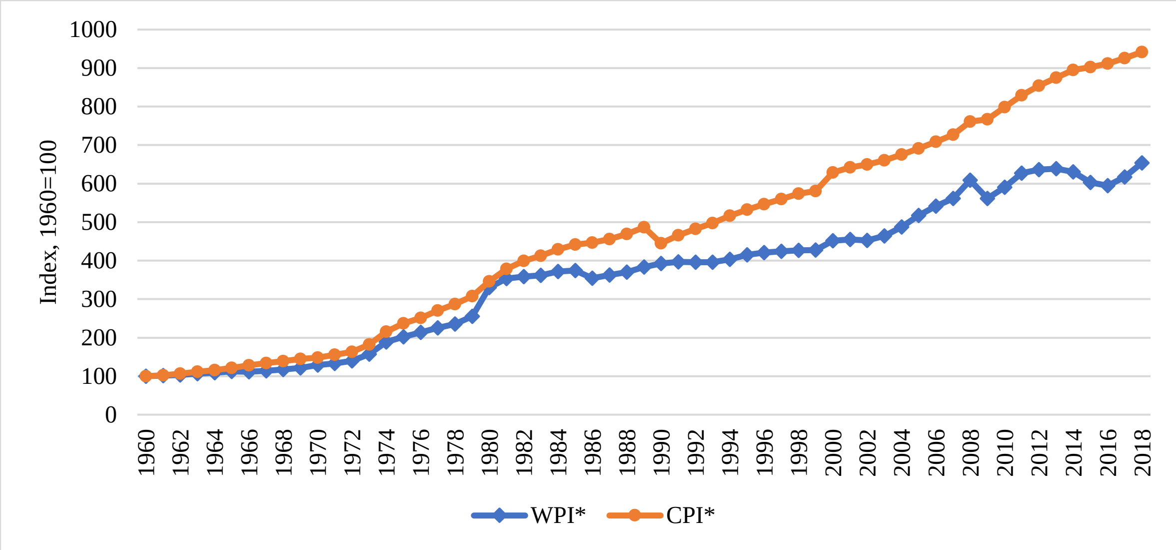
[44] This was due to the sharp fall in the commodity price in 1980.

The surge in the capital inflows, particularly the portfolio and direct investment in the early 1990s, led pressure to RERs to appreciate from 1992 until 1993. Both RERs experienced a slight depreciation in 1994 following capital inflows restrictions imposed by the authority in early 1994 to stabilise the exchange rate. RERs appreciated again from 1994 to 1996, then slowly depreciated in 1997 before worsening in 1998 and 1999 due to the AFC.

It is worth noting that the magnitude of the rate of depreciation RER2 is greater than RER1. The average rate of depreciation of RER1 is approximately 27.9 per cent over the entire period. Meanwhile, the RER2 depreciation rate is approximately 66.7 per cent. Both RER1 and RER2 movements were relatively stable under the Currency Board system during the 1960s compared to the fixed exchange rate period from 1999 to 2005. In all probability, the sharp depreciation in 1997/1998 induced a significant change in relative price. The RER shows significant variability during 1973-1998 and 2006-2018, attributed to the country's managed float exchange rate system. Noticeably, both RERs have experienced a significant depreciation after the AFC in 1997/1998 and remained depreciated at a higher level than pre-crisis levels. RER2 depreciation is relatively higher than RER1, and both RER movements have diverged after the crisis. Nevertheless, RER1 and RER2 show a similar pattern leading up to three crises: the mid-1980s recession, the AFC in 1997/1998, and the GFC in 2008/2009. RER appreciation accelerated during the period 1982-1984, 1995-1996, and 2006-2007. This pattern is consistent with Athukorala and Warr (2002), Koske (2008), and Jongwanich (2009), who found RM appreciation in real terms accelerated in the run-up to the crisis.

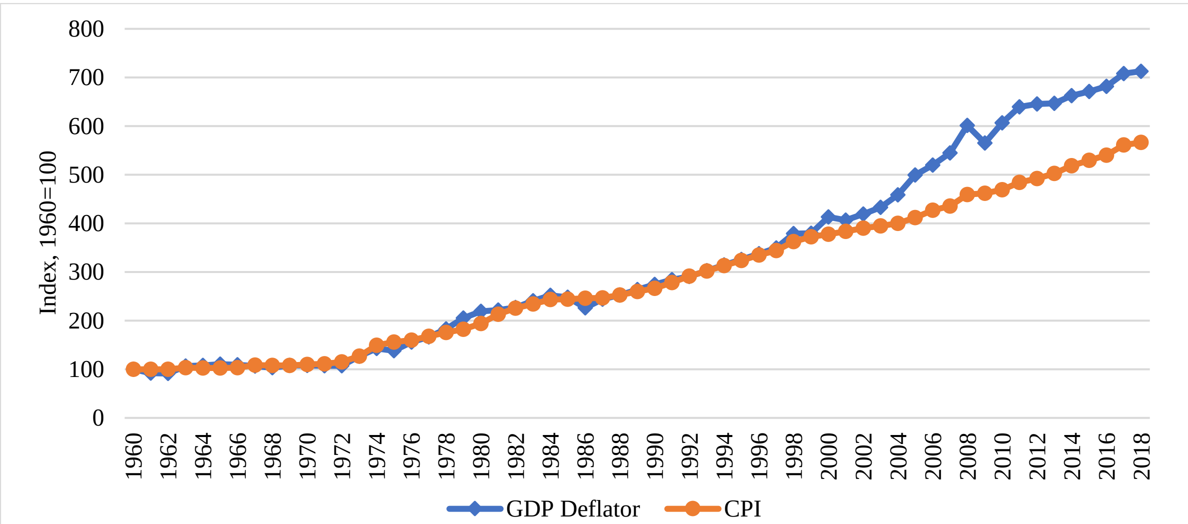
The pattern clearly shows that RER2 which uses the CPI to represent the foreign price index tends to overstate the improvement in the international competitiveness of the given country compared to RER1. Two possible reasons could induce this pattern. First, the foreign partner's WPI is lower than their CPI. Second, Malaysia's GDP deflator is larger than Malaysia's CPI.

For comparison purposes, the world's WPI and CPI is depicted in Figure 3.2, and Malaysia's GDP deflator and CPI is illustrated in Figure 3.3.



Source: Author's computation.

Figure 3.2: The world's WPI and CPI indices

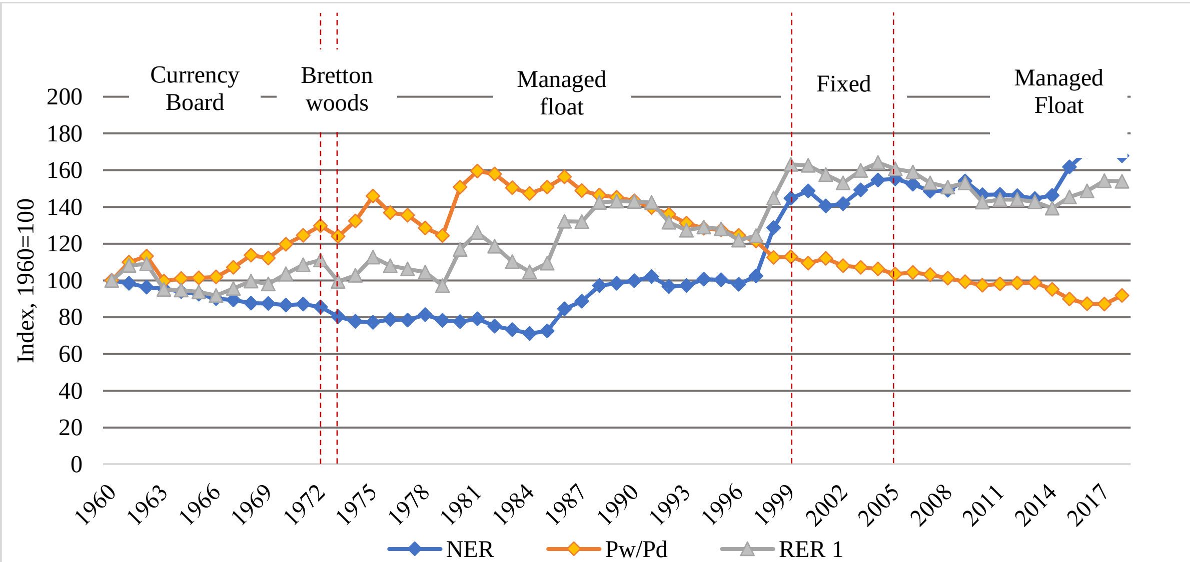


Source: Author's computation.

Figure 3.3: Malaysia's GDP deflator and CPI indices

Figure 3.2 demonstrates that the world's inflation rate measured by WPI is much lower than when measured by the CPI. Meanwhile, Malaysia's GDP deflator is much higher than its CPI. This trend clearly explained the significant variation in the depreciation rate between two different RER measurements (RER 1 and RER 2). It also suggests that the standard IMF index measurement tends to overstate the RER changes. This comparison demonstrates that the CPI is not an ideal proxy for foreign and domestic prices, and choosing an appropriate price index proxy is critical in the RER index construction. Consistent with the theoretical concept, the newly constructed RER index using the WPI price index as a proxy for foreign price and GDP deflator as denominators provide a reliable assessment of RM's competitiveness and hence the RER misalignment. Thereby, RER1 is the preferred measure of a country's international competitiveness.

To shed light on the underlying factors for the significant depreciation and appreciation patterns of RER1 in Figure 3.1, RER1 is decomposed into two components: nominal exchange rate (NER) and relative price (world price relative to domestic price). NER generally can be controlled by government policy directly or indirectly, for example, through exchange rate policy. A comparison of RER, NER, and relative price (P^w/P^d) of RER1 is depicted in Figure 3.4.



Notes:
NER is an export-weighted bilateral exchange rate index of 20 major export destinations.
P^w is an export-weighted WPI/PPI of 20 major export destinations.
P^d is the GDP deflator
RER = (NER x P^w/ P^d) – increase in RER1 refers to depreciation, decrease in RER1 refers to an appreciation
Source: Author’s computation using data from World Development Indicators, World Bank and International Financial Statistics, IMF.

Figure 3.4: Indices of NER, relative price (P^w/P^d) and RER for the period 1960-2018

Between 1960 and 2018, RER1 experienced several appreciation and depreciation episodes resulting from a significant change in the NER and the relative price. From 1960 to 1985, the Malaysian RER movement was shaped by relative price changes and NER appreciation. The domestic price level was relatively lower than the world price (P^w/P^d increase), and NER continued to appreciate. Changes in relative prices were counterbalanced by appreciation in the NER, contributing to the RER's depreciation. Between 1986 and 1988, the RER movement was driven by the NER movement rather than the relative price. Domestic prices increased faster than world prices during this period (decrease in P^w/P^d), while the NER depreciated significantly. More NER depreciation over the change in domestic price contributed to the depreciation of RER1. However, the pattern changed from 1988 to 1996. The domestic price rose steadily and was higher in comparison to the world price (decrease in P^w/P^d), while NER remained stable. A more significant increase in the domestic price over the NER contributed to the RER1 appreciation.

After 1997, the RER1 movement was largely influenced by the NER movement. NER depreciated sharply during the crisis and continued to depreciate, but at a slower rate until 2001. On the other hand, domestic prices continued to increase relative to world prices (decrease in P^w/P^d). Substantial NER depreciation outweighs domestic price increases, resulting in RER depreciation. From 2006 to 2008, NER began to appreciate before experiencing a sharp depreciation in 2009. From 2010 to 2014, NER appreciated and remained stable due to a steady increase in domestic prices (decrease in P^w/P^d), which resulted in RER appreciation. The pattern of NER has depreciated dramatically since 2015, and this continued until 2017. Domestic prices also increased significantly; a more significant NER depreciation than a relative price increase resulted in an RER depreciation. In 2018, the pattern changed when NER rose while domestic prices fell (increase in P^w/P^d). More NER appreciation over domestic price declines resulted in RER appreciation.

This pattern clearly shows that the exchange rate policy has helped the country to gain international competitiveness regardless of the relatively higher domestic price, particularly in the years following the AFC.

3.5 Equilibrium real exchange rate

The equilibrium real exchange rate (ERER) is the RER value that achieves both internal and external equilibrium simultaneously, given the sustainable value of relevant variables (Edwards, 1989a). Internal equilibrium is attained when the non-tradable goods market is clear, and the employment is at its natural rate. Meanwhile, external equilibrium is attained when the current account balance corresponds to a sustainable capital flows level. Unlike the traditional purchasing power parity (PPP)[45] approach which assumes that the exchange rate should equalise price across countries and thus an unchanged equilibrium RER throughout the period, RER defines as the relative price of tradable to non-tradable goods is not an immutable number. The latter is a function of fundamental economic variables, and its value tends to vary over time in response to economic disturbances.

This study adopted the single-equation method developed by Edwards (1989a), Elbadawi (1994), and Baffes et al. (1999) to estimate ERER. This method involves three steps: (i) estimate the long-run relationship between RER and its fundamentals; (ii) derive a sustainable fundamentals value that explains the long-run relationship between ERER and its fundamentals; and (iii) estimate the degree of RER misalignment–deviations of the RER from the steady-state level. According to this approach, the long-run relationship between RER and its real fundamentals can be described as follows:

$$RER^*_t = \beta'_t F_t^{\,s} \qquad (4)$$

[45] Based on the assumption that the exchange rate should equalise price across counties and assume unchanged equilibrium RER is evident throughout the period.

RER^*_t is the ERER at time t, β'_t is the vector of the coefficients of long-run parameters at time t. $F_t{}^s$ is the vector set of sustainable values for identified fundamental variables at time t. Estimation of β will involve an empirical estimation in the form of equation (4). RER^* and F^s will be replaced by the actual RER and actual value of fundamentals variables. This relationship can be captured in the following cointegration form:

$$RER^*_t = \beta'_t F_t + \varepsilon_t \qquad (5)$$

where ε_t is the error term, and it is assumed to be stationary and zero mean. If cointegration between *RER* and the identified fundamental variables exists, the parameters can be used to estimate β in equation 4. ERER can be estimated after determining β'_t and permanent value of $F_t{}^s$. Based on that, ERER delivers a steady-state of RER conditional of a vector of permanent values of the fundamental variables (Elbadawi, 1994; Baffes et al., 1999). The estimated ERER can then be used to calculate the RER misalignment by dividing the difference between the ERER and the actual RER by the ERER.

3.6 Model specification

The theoretical framework of this study is guided by Edwards (1989b) that encompasses Balassa-Samuelson effects, trade policy regime, government spending and capital inflows. The model is augmented by including the government intervention, monetary policy, and exchange rate regime in estimating the RER. The RER function can be written as follows:

$$RER_t = f\,(TFP, OPEN, CAPFLOW, RESERVE, DEFICIT, MGROW, DCB, DFIX) \qquad (6)$$

where RER is the real exchange rate, TFP denotes the technological progress to capture the Balassa-Samuelson effects, OPEN stands for trade openness to capture the trade policy, and

CAPFLOW is total capital inflows to capture the ‘Dutch disease’ effect of the capital inflows. The foreign exchange reserves (RESERVE), government spending (DEFICIT), and money supply growth (MGROW) were incorporated in the model to capture the influence of the government’s intervention, fiscal policy, and monetary policy, respectively. DCB is a dummy variable for the Currency Board system from 1960 to 1971, while DFIX is a dummy variable for the fixed exchange rate regime from 1999 to 2005. Equation (6) is enhanced by including two crisis dummy variables–DAFC and DGFC– in order to capture the AFC in 1997/1998 and the GFC in 2008/2009, respectively.

The relationship between RER and the listed fundamental variables are based on theoretical foundation and empirical work, and the expected sign for each variable is described further as follows.

a) Technological progress (-)

Technological progress (TFP) is measured by total factor productivity. It is incorporated to capture the Balassa-Samuelson effects. Balassa (1964) and Samuelson (1964) hypothesised that changes in technology are more rapid in tradable than non-tradable sector over time in a given country and across countries. The tradable price will be equalised across countries based on the law of one price (LOP). The LOP, however, does not apply to non-tradable sector. The non-tradable prices in a given country are determined by supply and demand. Given the scenario of no surplus labour and perfect labour mobility, an increase in productivity in the tradable sector will result in higher real wages in both sectors. Under the assumption that prices equal marginal cost, the non-tradable price will be increased. As LOP holds for tradable sector, it raises the relative price of non-tradable to tradable goods. In other words, an increase in productivity will exert downward pressure on the tradable price and upward pressure on the non-tradable price, resulting in real appreciation. Thus, the sign of TFP is expected to be negative.

b) Trade openness (-)

Trade openness (OPEN) is included to capture the trade policy of the country. There is no single measurement for trade openness indicators. Thus, literature has measured it in various ways based on the proxy choice. Many studies utilise total trade to GDP as an indicator of trade openness, assuming that countries with more liberal trade regimes have larger trade volumes. The limitation of this indicator is that it compares a different concept between gross and net. Total trade is measured in gross terms, while GDP is measured on a value-added basis. Variations in trade orientation are thus sensitive to changes in the import intensity of export output (Athukorala and Hill, 2010). The ratio of duty import to total import revenue is preferred as a trade openness indicator because it represents the implicit import tariff, which presumably better captures the country's policy regime. Theoretical studies predict an increase in export taxes and import tariffs (decrease in trade openness) will increase demand for non-tradable goods and increase non-tradable prices, leading to RER appreciation. In contrast, tax reduction and eliminating trade restrictions (increase in trade openness) will increase demand for tradable goods, leading to RER depreciation due to upward pressure on tradable goods prices. So the sign is expected to be negative.

c) Capital inflows (-)

Total capital inflows (CAPFLOW) measured by total capital inflows to GDP are included to capture the ‘Dutch disease’ effect of the capital inflows. Dutch disease is a phenomenon that results in increased foreign exchange inflows in the country. It can take many forms, including the discovery of a new natural resource, foreign aid, or large capital inflows. The previous study such as Athukorala and Rajapatirana (2003) have highlighted the importance of capital flows composition in explaining RER movement. However, due to the unavailability of data for a longer time coverage, this study only focused on total capital inflows. The surge in capital inflows will raise foreign exchange inflows and real income in recipient countries, resulting in increased additional demand for non-tradable goods (Corden and Neary, 1982). Given that the tradable goods price is determined by the international market and remains constant, the non-tradable goods price, on the other hand, is determined by supply and demand. Excessive demand for non-tradable goods increases their relative price to tradable goods, resulting in real appreciation of the RER. Based on this, the sign for CAPFLOW is expected to be negative.

d) Foreign exchange reserves (+)

Foreign exchange reserves (RESERVE) measured by the foreign exchange reserves level is included to capture the 'leaning against the wind'[46] intervention by the central bank in the foreign exchange market. Foreign exchange reserves are foreign currencies held by the central bank[47] and play a vital role as an emergency fund and maintain the currency at the desired level. An increase in the foreign exchange reserves reflects the country's capital flows and international trade. A sizeable literature has linked the movement of RER with the changes in the foreign exchange reserves. For example, Hoshikawa (2012) has demonstrated a long-run relationship between foreign reserves and the Japanese exchange rate. Aizenman and Marion (2003) and Bird and Rajan (2003) link the rise in reserve accumulation in Asian countries with an effort to keep their currencies from appreciating. Thus, the sign for RESERVE is expected to be positive.

[46]The purchase and selling of foreign currency against the domestic currency by authority to influence the exchange rate level (Sarno and Taylor, 2001). For example, when the RER appreciates, a government will purchase foreign currency, which leads to an increase in the foreign reserves and RER will depreciate. This activity is called a 'lean against-the-wind' intervention strategy.

[47] In the form of banknotes, treasury bills, deposits, bonds, and other government securities.

e) Government spending (-/+)

Government spending (DEFICIT) measured by the total government deficit to GDP is incorporated to capture the fiscal policy actions. The fiscal balance is used as an indicator for fiscal policy since it reflects the overall policy commitment change. Conventionally, a fiscal expansion will result in an appreciation of the RER. As government spending is more likely to be directed towards non-tradable goods, an increase in government spending (fiscal expansion) increases demand for non-tradable goods, thereby increasing the non-tradable goods price, resulting in RER appreciation. However, if the taxes are expected to increase to repay government debt, the disposable income will be reduced; hence, the aggregate demand will decline. The fall in demand will lead to a fall in the non-tradable goods price and lead to RER depreciation. Therefore, the sign for DEFICIT is expected to be negative or positive.

f) Money supply Growth (-)

The money supply growth (MGROW) is measured by broad money (M3) growth minus the GDP growth is included to capture the monetary policy actions. The expansionary policy reflected in increased money supply growth is expected to increase demand for domestic goods. It will exert upward pressure on the non-tradable goods price, resulting in inflationary pressure and an RER appreciation. Thus, the sign of MGROW is expected to be negative.

g) Exchange rate regime (-)

Two dummy variables representing the different exchange rate regimes[48] are included in the model and denoted as DCB and DFIX. The exchange rate regime classifications are based on the official declaration by authorities and from official documents[49]. The DCB dummy variable represents the currency board system. It takes a value of 1 from 1960 to 1971 and zero for the

[48] The regime classification based on the publicly announced policy by the relevant authority and official documents.
[49] See the BNM annual reports for 1998 and 2005.

managed float exchange rate. The DFIX dummy variable represents the fixed exchange rate system, and it takes a value of 1 for the period from 1999 to 2005, while it is zero for managed float exchange rate. Pegged exchange rates are often associated with RER appreciation rather than floating exchange rate regimes. Coudert and Couharde (2009) have related currency appreciation with a pegged exchange rate to the floating exchange rate. The sign for DCB and DFIX is therefore expected to be negative.

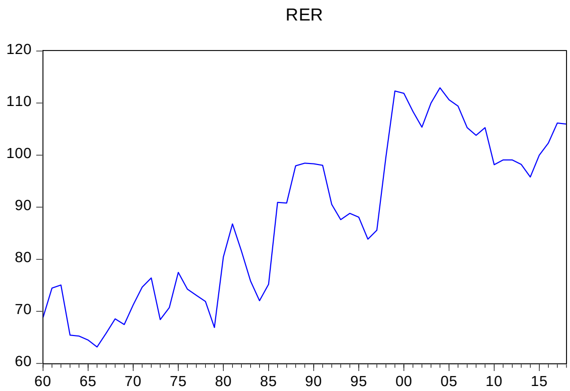
h) Crisis dummy (+)

Two crisis dummies are incorporated to capture the crisis impacts. DAFC is for the Asian Financial Crisis in 1997/1998 and takes a value of 1 from 1997 to 1998 and zero otherwise. DGFC for the Global Financial Crisis and takes a value of 1 from 2008 to 2010 and zero otherwise. External shocks and global economic conditions contributed to economic uncertainty, resulting in a sudden drop in currency values and RER depreciation. Therefore, the sign for DAFC and DGFC is expected to be positive.

3.7 Data sources and variable construction

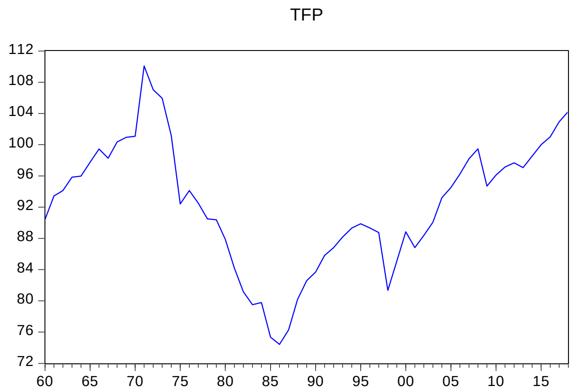
This paper estimates the RER function using annual data for 59 years from 1960 to 2018. Most data are obtained from the World Development Indicators (WDI), World Bank, International Financial Statistics (IFS), International Monetary Fund (IMF), the Penn World Table (PWT) 9.1, Department of Statistics Malaysia (DOSM), Ministry of Finance Malaysia (MOF) and Economic Planning Unit Malaysia (EPU). CAPFLOW are the only time-series data readily available for independent variables. Proxies will represent other fundamental variables that do not have readily available data. Selecting these proxies depends on data availability and data quality during the study period. The variable description and data source are described in Table A3.4 in the Appendix. All variables are set in an index and the percentage, except for foreign exchange reserves is set at US$ billion. The data is on an annual basis and expressed at that level. The time series plots for dependent and independent variables are shown in Figure 3.5:

a) RER



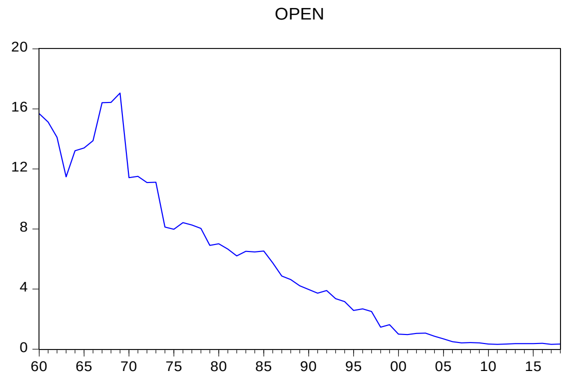
Note: RER is the real exchange rate

b) TFP



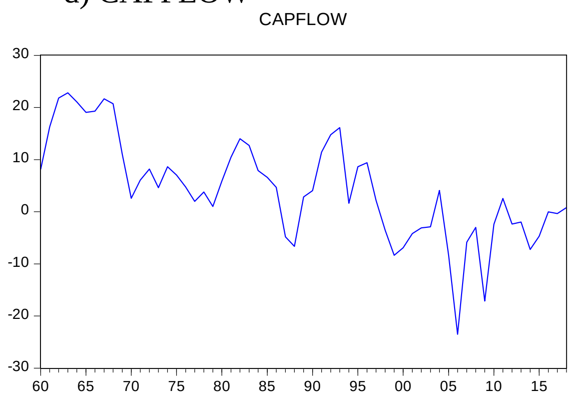
Note: TFP is the total factor productivity

b) OPEN



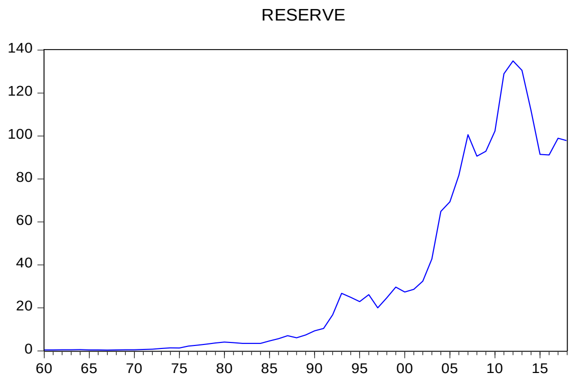
Note: OPEN is the ratio of duty import to total import

d) CAPFLOW



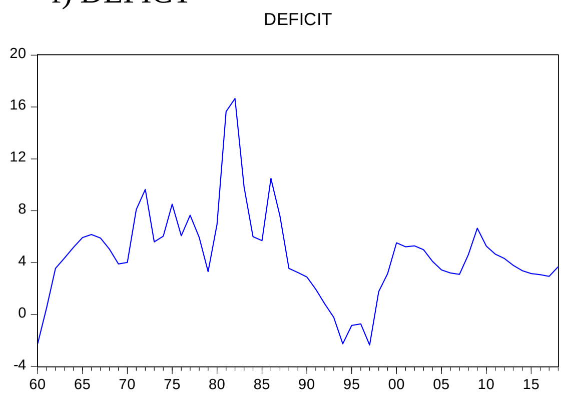
Note: CAPFLOW is the total capital inflows to GDP

e) RESERVE



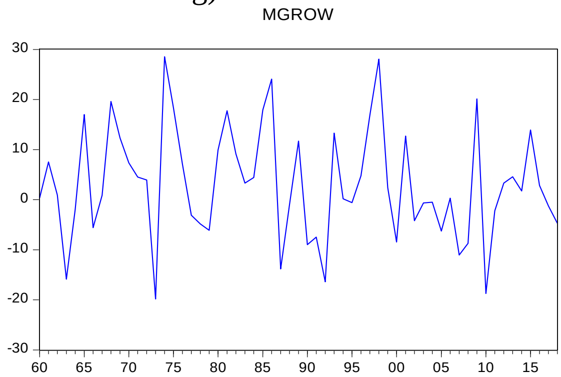
Note: RESERVE is foreign exchange reserves (in US$ billion)

f) DEFICIT



Note: DEFICIT is a total budget deficit to GDP

g) MGROW



Note: MGROW is broad money minus nominal GDP growth

Source: Author's computation.

Figure 3.5: Time series plot for variables

The descriptive statistics and correlation statistics between variables are reported in Tables 3.1 and 3.2 for reference. Overall, a correlation between the RER and most of the explanatory variables is as expected. The correlation between RER and other explanatory variables is relatively low, except for trade openness (OPEN) which is highly correlated with the RER at 0.88. The potential econometric issue that could arise is multicollinearity, and it will be empirically investigated when the model is estimated.

Table 3.1: Descriptive statistics

Variable	Measurement	Unit	Obs.	Mean	Median	Std. Dev.	Maximum	Minimum
RER	Real exchange rate	Index	59	87.7	88.1	15.7	112.9	63.2
TFP	Total factor productivity	Index	59	92.3	93.2	8.2	110.1	74.4
OPEN	Duty import/Total import revenue	%	59	5.7	4.2	5.2	17.1	0.3
CAPFLOW	Total capital inflows/GDP	%	59	4.3	4.1	9.7	22.8	-23.5
RESERVE	Foreign exchange reserves	US$ billion	59	32.3	7.4	41.9	134.9	0.4
DEFICIT	Budget deficit/GDP	%	59	4.6	4.4	3.5	-2.4	16.7
MGROW	Broad money growth minus nominal GDP growth	%	59	3.0	1.7	11.2	28.5	-19.8
DCB	Currency Board system, 1 for years 1960 to 1971	-	59	0.2	0.0	0.4	1.0	0.0
DFIX	Fix exchange rate system, 1 for years 1974 to 2018	-	59	0.1	0.0	0.3	1.0	0.0
DAFC	1 for years 1997- 1998, 0 otherwise	-	59	0.0	0.0	0.2	1.0	0.0

DGFC	1 for years 2008-2010, 0 otherwise	-	59	0.1	0.0	0.2	1.0	0.0

Source: Author's computation.

Table 3.2: Correlation statistics

	RER	TFP	OPEN	CAPFLOW	RESERVE	DEFICIT	MGROW	DUM_ BOARD	DUM_ FIX	DUM AFC	DUM_ GFC
RER	1.00										
TFP	-0.13	1.00									
OPEN	-0.88	0.20	1.00								
CAPFLOW	-0.74	0.04	0.73	1.00							
RESERVE	0.68	0.33	-0.71	-0.58	1.00						
DEFICIT	-0.17	-0.10	0.17	0.10	-0.19	1.00					
MGROW	-0.13	-0.16	-0.17	0.07	-0.17	0.12	1.00				
DCB	-0.63	0.43	0.84	0.61	-0.41	0.00	0.01	1.00			
DFIX	0.53	-0.12	-0.33	-0.33	0.09	0.01	-0.11	-0.20	1.00		
DAFC	0.06	-0.17	-0.14	-0.10	-0.04	0.26	0.24	-0.10	-0.07	1.00	
DGFC	0.22	0.13	-0.24	-0.28	0.35	-0.06	-0.10	-0.12	-0.08	-0.04	1.00

Source: Author's computation.

3.8 Estimation method

Equation (6) is assumed to have a linear relationship between RER and its fundamental variables, and the empirical specification of equation (6) can be modelled as follows:

$$RER = \alpha_o + \alpha_1\,TFP + \alpha_2\,OPEN + \alpha_3\,CAPFLOW + \alpha_4\,RESERVE + \alpha_5\,DEFICIT + \alpha_6\,MGROW + \alpha_7\,DCB + \alpha_8\,DFIX + \alpha_9\,DAFC + \alpha_{10}\,DGFC + \mu_t \quad (7)$$

Theoretically, the exchange rate regime and crisis variables are not the long-run fundamental variables; however, they may affect the short-run dynamics. While maintaining the consistencies of equations (1) and (2), these dynamic relationships can be captured by the Autoregressive Distributed Lag (ARDL)[50] approach. This empirical technique will be discussed further in the next section.

[50] This is based on the assumption that all variables are stationary I(0) or stationary at the first difference I(1) or a mixture of I(0) and I(1).

3.8.1 Unit root test

Estimation begins by checking the properties of the underlying variables in equation (7). It is vital to check the data properties to determine the integration order and ensure that it is not greater than one. The unit root test was conducted using a standard test: Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) methods. The properties check was complemented by the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The results in Table 3.3 below indicate that variables have different integration orders, which are a mixture of the integration order of zero (I(0)) and the integration order of one (I(1)). The ADF and PP tests result reveal that all variables are stationary at I(1) after taking the first difference and are significant at the 1 per cent level. The KPPS result confirms that the variables are a mixture of I(1) and I(0).

Table 3.3: Results for unit root tests

Variables	ADF (Constant)			PP (Constant)			KPPS (Constant)		
	Level	First Different	Integration order	Level	First Different	Integration order	Level	First Different	Integration order
RER	-1.277	-6.224	I(1)	-1.121	-6.592	I(1)	0.842	0.104	I(1)
TFP	-0.917	-6.452	I(1)	-1.293	-6.605	I(1)	0.183***	0.167	I(0)
OPEN	-1.641	-8.205	I(1)	-1.850	-8.638	I(1)	0.888	0.289	I(1)
CAPFLOW	-2.597**	-8.268	I(0)	-2.443	-8.496	I(1)	0.782	0.045	I(0)
RESERVE	-0.567	-4.942	I(1)	-0.068	-5.711	I(1)	0.748	0.266	I(1)
DEFICIT	-2.227	-8.022	I(1)	-3.260**	-8.079	I (0)	0.201***	0.360	I(0)
MGROW	-7.217***	- 9.881	I(0)	-7.207	-42.931	I(0)	0.173***	0.500	I(0)

Variables	ADF (trend)			PP (trend)			KPPS (trend)		
	Level	First Different	Integration order	Level	First Different	Integration order	Level	First Different	Integration order
RER	-3.680**	-6.166	I(0)	-2.781	-6.464	I(1)	0.107***	0.103	I(0)
TFP	- 0.878	-6.603	I(1)	-1.226	-6.647	I(1)	0.183	0.101	I(1)
OPEN	- 2.110	-8.287	I(1)	-2.095	-9.357	I(1)	0.214	0.113	I(0)
CAPFLOW	-4.012**	-8.230	I(0)	-4.118*	-8.430	I(0)	0.062***	0.045	I(0)
RESERVE	-2.166	-4.953	I(1)	-1.624	-4.704	I(1)	0.201	0.076	I(1)
DEFICIT	-2.554	-7.975	I (1)	-3.369*	-7.961	I(0)	0.100***	0.437	I(0)
MGROW	-7.288***	- 7.658	I(0)	-7.288***	-44.052	I(0)	0.057***	-0.500	I(0)

Notes: For the ADF test, Schwarz Information Criterion (SIC) is used with chosen optimal lag of 4.
***, is statistically significant at the 1% level, **, is statistically significant at the 5% level, and *, is statistically significant at the 10% level.
Source: Author’s computation.

The overall results have confirmed that no variable is of integration of order 2. Given that the properties of the variable are a mixture of I(0) and I(1), the ARDL cointegration bounds testing test can be used to examine the existence of a long-run relationship between RER and its fundamental variables. According to Pesaran et al. (2001): there is cointegration between variables if the F-statistic is higher than the upper bound critical value; no cointegration if the F-statistic is less than the upper bound critical value; and inconclusive inference if the F-statistic fall between the lower and upper bound critical values. Narayan (2005) argued that the critical values provided by Pesaran et al. (2001) are for large sample sizes; hence, Narayan (2005) calculated critical values for small sample sizes. The F-statistic value for equation (7) is 4.32 and it is above the upper bound critical value generated by Narayan (2005). Accordingly, there is a long-run relationship between variables at the 5 per cent significance level.

Since there is a long-run relationship between variables, the ARDL model can be used to estimate equation (7). The equation in ARDL form is specified as follows:

$$\mathrm{RER}_t = \alpha_0 + \sum_{i=1}^{p} \partial_i \ RER_{t-i} + \sum_{i=0}^{q} \beta_i' F_{t-i} + \delta_1 DCB_t + \delta_2 DFIX_t + \delta_3 DAFC_t + \delta_4 DGFC_t + \mu_t \tag{8}$$

where RER_t is the dependent variable, p and q represent an optimal lagged length X_t is a vector of explanatory variables, ∂_i denotes the coefficient of the lagged dependent variable, β_i' stands for a coefficient vector, α_0 is constant and μ_t represents an error term. All variables were described previously.

The ARDL model is reparametrised into an error correction form to examine long-run and short-run relationships. The error correction form is written as follows:

$$\Delta RER_t = \phi\,[\mathrm{RER}_{t-1} - \lambda_i' F_{t-1}] + \sum_{i=1}^{p-1} \partial_i \Delta RER_{t-i} + \sum_{i=0}^{q-1} \beta_i' \Delta F_{t-i} + \delta_1 DCB_{,t} + \delta_2 DFIX_t + \delta_3\, DAFC_t + \delta_4\, DGFC_t + \mu_t \quad (9)$$

where $\phi = -(1 - \psi_i)$ is a speed of adjustment coefficient; $\phi < 0$ corresponds to the long-run stability (< 0), λ_i' is a long-run coefficient vector, $[\mathrm{RER}_{t-1} - \lambda_i' \mathrm{F}_{t-1}]$ denotes the error correction term (ECT), ∂_i and β_i' are the coefficients of the short-run dynamics.

The optimal lag length for ARDL was determined before estimation. The ARDL model is estimated using the Akaike Information Criterion (AIC) with one lag[51].

3.9 Results and discussion

Table 3.4 provides estimation results for RER equations. The finding for the long-run and short-run dynamic of equation (7) is reported in column (1). It is, however, inconsistent with theoretical viewpoints, and so several variables were dropped from the specification. The restricted model is then estimated, and the empirical result is reported in column (2). The result in column (2) is preferred for discussion because of its superior statistical properties, including the significance of coefficient, specification test, and consistency with theoretical viewpoints. The result of equation (7) is reported in column (1) for comparison purposes.

[51] There is no rigid rule in choosing the lags for annual data, so this study chooses optimal lag 1 as suggested by AIC and SIC.

Table 3.4: Long-run and short-run dynamic results of the RER equations

The dependent variable is RER

Independent variables	(1)	(2)
Adjustment coefficient	- 0.236***	- 0.273***
	(0.037)	(0.051)
Long-run coefficients		
TFP_{t-1}	-0.852*	-0.883**
	(0.486)	(0.355)
$OPEN_{t-1}$	0.114	-
	(1.827)	
$DEFICIT_{t-1}$	- 0.747	- 0.840
	(0.805)	(0.606)
$CAPFLOW_{t-1}$	-0.946*	-0.942***
	(0.480)	(0.345)
$RESERVE_{t-1}$	0.163	0.171**
	(0.121)	(0.066)
$MGROW_{t-1}$	0.580	-
	(0.372)	
Constant	166.788***	171.397***
	(40.266)	(32.547)
Short-run coefficients		
ΔTFP_{t}	0.154	-
	(0.176)	
$\Delta DEFICIT_{t}$	0.873***	0.970***
	(0.196)	(0.201)
DCB	- 0.546	0.635
	(1.005)	(1.049)
DFIX	3.225**	3.708**
	(1.317)	(1.396)
DAFC	1.552	1.957
	(2.528)	(2.621)
DGFC	-2.124	-3.229
	(1.907)	(2.020)
Bounds test	4.32***	4.27***
Adjusted R-squared	0.60	0.55
Durbin-Watson	1.80	1.69
Normality	2.77***	0.77***
Serial	0.64***	1.33***
Heteroscedasticity	0.59***	0.47***
Ramsey's test	0.88***	1.40***

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
The Bounds test refers to cointegration test statistics using the ARDL bounds test. Normality refers to *Jarque-Bera* for normal residual test statistics. Serial denotes the *Breusch-Godfrey LM* test statistics for no serial correlation. Heteroscedasticity is the *Breusch-Pagan-Godfrey* test statistics for no autoregression conditional heteroscedasticity. Ramsey's test is for no functional misspecification test statistics.
Source: Author's computation.

The coefficient of error correction term (ECT) or adjustment coefficient term for both equations is negative and statistically significant at 1 per cent, confirming the existence of a cointegrated relationship between variables. The size of ECT's coefficient is within the range of 0.23 and 0.27 per cent, and it indicates that the adjustment speed towards steady states takes about 2.6 years and 2.2[52] years to eliminate half of the exogenous shock, respectively.

The long-run coefficients of TFP, CAPFLOW, and DEFICIT in column (1) are as expected. However, the coefficient of OPEN and MGROW are found to have an opposite sign. Most variables are insignificant in regression, except for TFP and CAPFLOW. The result shows a negative relationship between TFP and RER, indicating a productivity improvement is negatively associated with RER appreciation. This result agrees with the Balassa-Samuelson hypothesis that a differential in productivity improvement between the sectors resulted in RER appreciation. As expected, an increase in capital inflows significantly led RER to appreciate. The coefficient of CAPFLOW is 0.95, which is the highest among other variables. The coefficient of OPEN and MGROW have a wrong sign and are statistically insignificant. Although the sign of DEFICIT is negative as expected, it is statistically insignificant.

The OPEN and MGROW are then excluded from the equation. The results of the restricted model are reported in column (2). The magnitude of the coefficient differs only marginally from the result of full specification in column (1). The long-run result shows that all variables have expected signs and are consistent with the theoretical and previous empirical evidence. Except for the DEFICIT, other variables in column (2) are statistically significant. The coefficient for TFP is negative and statistically significant, suggesting that higher productivity is negatively associated with an RER appreciation with the coefficient size is 0.84. This result is consistent with the Balassa-Samuelson hypothesis that productivity improvement in the tradable sector will reduce tradable goods price and exert upward pressure on the non-tradable goods price; thus, RER appreciates. These outcomes also corroborate the existing

[52] The calculation was estimated using the formula log $(1 - \alpha) = \log(1 - \beta)$ T, where α is the percentage, β is the estimated ECT. T represents the number of years required to clear exogenous shock through the automatic adjustment (Elbadawi, 2012).

evidence documented in several studies, such as Edwards (1989a), Cottani et al. (1990), Jongwanich and Kohpaiboon (2013), Schröder (2013), and Mahraddika (2020).

The sign of the coefficient of CAPFLOW is negative as expected and statistically significant at the 1 per cent level. The magnitude of the coefficient is 0.94, indicating that it has a larger impact on RER than other variables. This finding is in line with the Dutch disease hypothesis that large inflows of capital into the country will increase the country's income and demand for non-tradable goods; therefore, non-tradable goods price increase and RER appreciates. This finding can be related to the excessive currency appreciation in the early 1990s due to massive inflows, and massive outflows in the mid-1990s led to exchange rate depreciation. This result further supports the finding of work done by Edwards (1988), Shu (2002), Athukorala and Rajapatirana (2003), and Jongwanich and Kohpaiboon (2013) that found capital inflows lead to RER appreciation.

The RESERVE variable shows a positive sign suggesting that intervention by the authorities leads to RER depreciation. The magnitude of the coefficient is rather small at 0.17 and statistically significant at the 5 per cent level. This result provides modest support for the 'leaning against the wind' hypothesis. This finding is in line with the research by Aizenman and Marion (2003), Bird and Rajan (2003), and Chang et al. (2017), who linked the sustained reserve accumulation with the desire to keep currencies from appreciating (RER depreciation). So it indicates that government intervention plays a significant role in determining the RER movement. This finding seems to reflect the BNM's intervention in the foreign exchange market to keep the RM from fluctuating excessively. The sign of the DEFICIT coefficient is negative as expected but it is statistically insignificant.

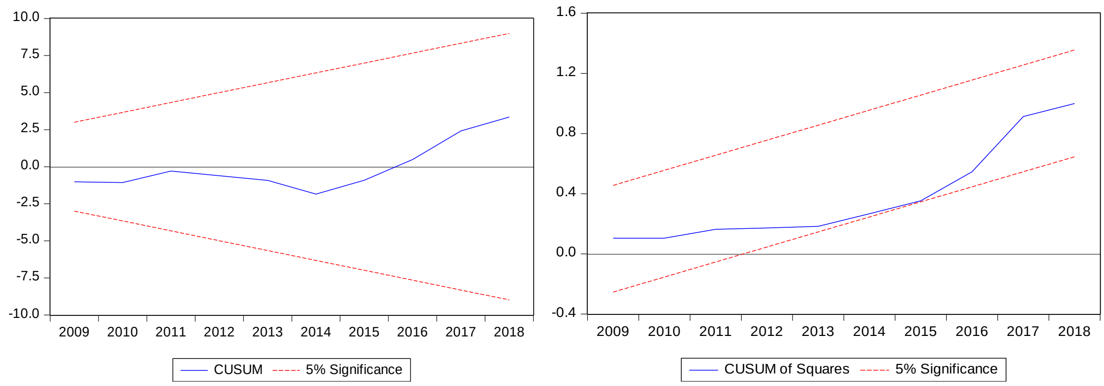
In the short-run, the RER movement was determined by the fixed exchange rate system and government spending. The coefficient of the DFIX turns positive and is statistically significant at the 5 per cent level. In other words, RER depreciates by 3.7 per cent higher during the fixed exchange rate period than during the managed float exchange rate period. This result indicates that the choice of exchange rate policy as part of capital-control-based crisis management assisted in keeping the RER depreciate and supporting the recovery process. This finding is consistent with Athukorala (2001), who noted that fixed exchange rates improved international competitiveness and contributed to rapid economic recovery. Meanwhile, the coefficient of DCB is found to have positive signs and is statistically insignificant, implying that exchange rate policy during the currency board system has no impact on RER movement.

The sign of the DEFICIT coefficient turns positive and is statistically significant in the short-run, indicating that higher government spending tends to depreciate RER. This result could be due to the Ricardian equivalent effect. Increased government spending excess of current and future taxes has an equivalent impact on the economy. As a result, households would increase their savings in anticipation of future increases in government taxes. Higher savings resulted in falling aggregate demand for non-tradable goods, causing RER depreciation.

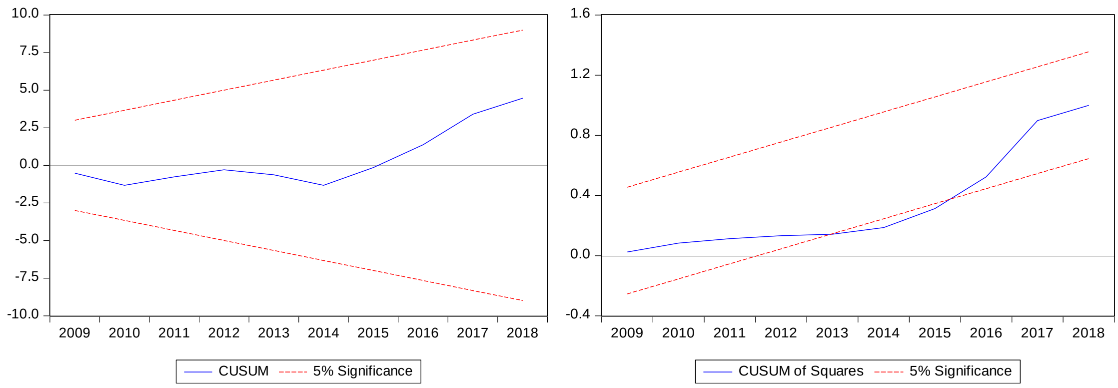
Surprisingly, the two dummy variables used to represent the major crises in the country have a different effect and are statistically insignificant. The DAFC is found to have a positive sign expected, reflecting the fact that RER depreciated higher during the AFC period than during normal times. Conversely, the DGFC coefficient is negative and statistically insignificant, suggesting that both AFC and GFC crises have no significant impact on RER movement in the short-run.

3.9.1 Diagnostic test

Both models satisfy the standard diagnostic test for normality, serial correlation, heteroscedasticity, functional form specification, and stability. These diagnostic tests verify that the model is sufficient to explain the behaviour of RER and its explanatory variables. The structural stability is examined using the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) test. The plots as shown in Figure 3.6. In general, the residuals of both models show no sign of structural instability, and it lies within or on the critical bound of the 5 per cent significance level. Despite the fact that the residuals of restricted model hit the lower bound from 2013 to 2015, most of the residual still lies within the critical bounds at the 5 per cent level of significance. One possible explanation could be the 2014/2015[53] external shock.



CUSUM and CUSUMSQ for equation (7)-column (1)



CUSUM and CUSUMSQ for restricted model-column (2)

Figure 3.6: Plots of CUSUM and CUSUMSQ

[53] A dummy variable to capture economic slowdown in 2014/2015 was included, but the issue still remains. In fact it caused a significant instability in CUSUM graph.

3.9.2 Robustness test

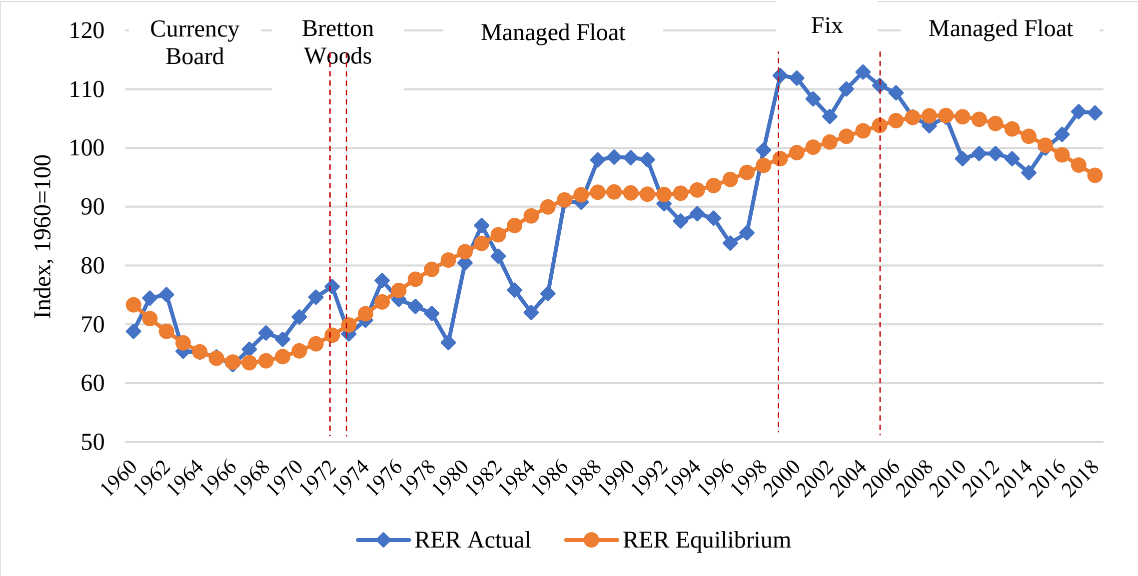
Several robustness tests are done to check the result reliability by adjusting lag structure and time horizon. The results are also robust to different samples and estimation methods. The lag length structure of the model specification is adjusted. When the lag length is set to 2, the sign and size of the coefficients of all explanatory variables remain unchanged, suggesting that the model is insensitive to the lag length choice. The time horizon of this study is also modified to cover the years 1970 to 2018. The sign of all variable coefficients remains unchanged, but the magnitude of the coefficient is slightly larger than the previous estimation. The significance level of TFP and RESERVE remain unchanged at 5 per cent, except for CAPFLOW becoming less significant (see Table A3.5 in the Appendix). So, it can be concluded that the result is insensitive to lag structure changes and time horizons.

This study also estimates the model using two alternative methods for robustness: the Fully Modified Least Squares (FMOLS) method and the Dynamic Ordinary Least Squares (DOLS) method. FMOLS (Phillips and Hansen, 1990) uses a semi-parametric approach to estimate the long-run parameter. It modifies OLS to remove the endogeneity bias from the regressor caused by cointegration. FMOLS also addresses the problems created by the long-run correlation between the cointegrating equation and stochastic regressor changes. It is also an efficient and unbiased estimator (Saboori et al., 2014). The DOLS (Stock and Watson, 1993) uses a parametric approach to estimate the long-run relationship between variables. DOLS eliminates the spurious regression problem and minimises endogeneity bias by adding leads and lags of the differenced cointegrated variables. Thus, the estimator generated by DOLS is asymptotically efficient and unbiased. The result of the FMOLS and DOLS methods reaffirm that productivity, capital inflows, and government intervention plays a significant role in the RER movement. Both results also suggest that capital inflows are the major factor influencing the RER movements, with government intervention playing a minor role. The results are reported in Tables A3.6 and A3.7 in the Appendix.

For comparison purposes, this study estimated the model using an alternative RER index constructed using the IMF index (RER2). The result is reported in Table A3.8 in the Appendix. The result is consistent with the main one; productivity, capital inflows, and government intervention contribute significantly to the RER movement. However, the magnitude of coefficient decreases, minimising the effect of productivity and capital inflows.

3.10 RER misalignment

RER misalignment is a deviation of actual RER from its consistent level with economic fundamental or equilibrium RER value. The estimation of RER misalignment first requires an estimation of an unobserved ERER. ERER is calculated using the long-run estimated coefficients of the RER equation in column (2) for given sustainable or permanent fundamental values. The Hodrick and Prescott (1997) (HP) filter is deployed to separate the relevant time series into cyclical and trend components, and these permanent components are referred to as a sustainable level (Elbadawi et al., 2012). The permanent values obtained from the HP filter are then substituted into the long-run estimated parameters of the RER equation. The actual RER is then compared to the estimated ERER to measure the extent of RER misalignment. The actual RER and ERER are depicted in Figure 3.7.



Source: Author's computation.

Figure 3.7: Actual RER and estimated ERER

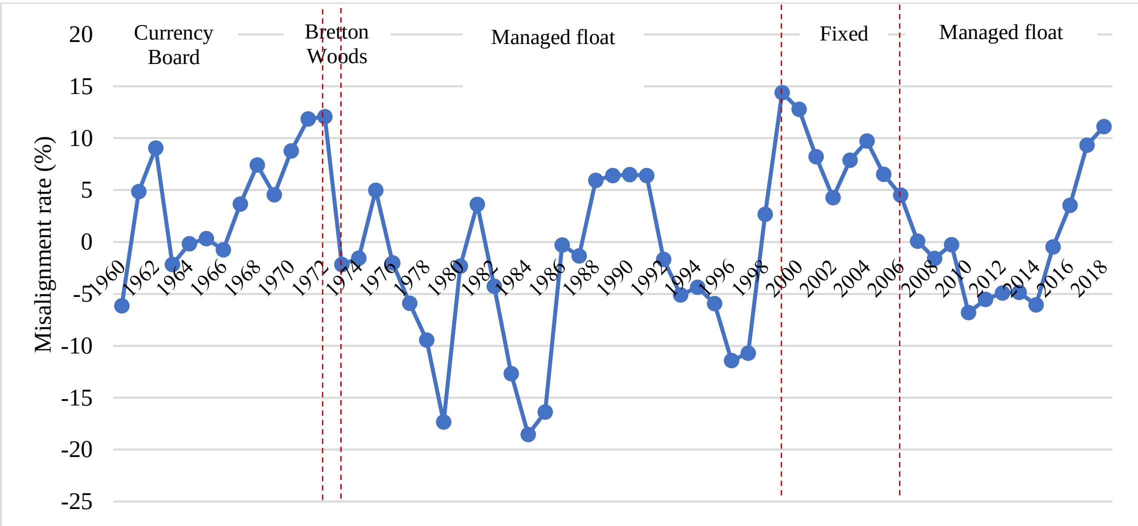
The figure shows the ERER is varied over the period reflecting the changes in the fundamental variables. This variability confirms that the ERER is time-varying or immutable, and it is in line with Edwards (1989a)[54] theoretical analysis. The difference between the actual RER and the estimated ERER value indicates a misalignment induced by changes in the economic fundamentals. The degree of RER misalignment (RERM) is calculated using the following formula:

$$\text{RERM} =[\frac{RER - ERER}{ERER}] \text{ x } 100$$

where RER is the actual value of the real exchange rate, ERER is the estimated equilibrium real exchange rate value. The negative sign of RERM indicates an overvaluation, implying that RER appreciates more than the equilibrium level. It also suggests that the country's international competitiveness maintains below the level consistent with economic fundamentals. Meanwhile, a positive sign indicates an undervaluation, implying that the RER depreciates more than its equilibrium value. The figure suggests that the country's international

[54] RER misalignment based on the historical comparison (PPP approach) may lead to erroneous result (Edwards, 1989a).

competitiveness maintains above the level consistent with economic fundamentals. Figure 3.8 depicts the RER misalignment movement derived from the ERER equation-based method.



Source: Author's computation using data from World Development Index, World Bank and International Financial Statistics, IMF.

Figure 3.8: RER misalignment

The figure shows that Malaysia has experienced several episodes of RER misalignment. RER undervaluation occurred during 1961-1972, 1975, 1981, 1988-1991, 1998-2007, and 2016-2018. Meanwhile, RER overvaluation was evident during 1973-1974, 1976-1980, 1982-1987, 1992-1997, and 2018-2014. The degree of RER misalignment ranges from -18.6 to 14.4 per cent, with an average rate of 6.2 per cent throughout the period.

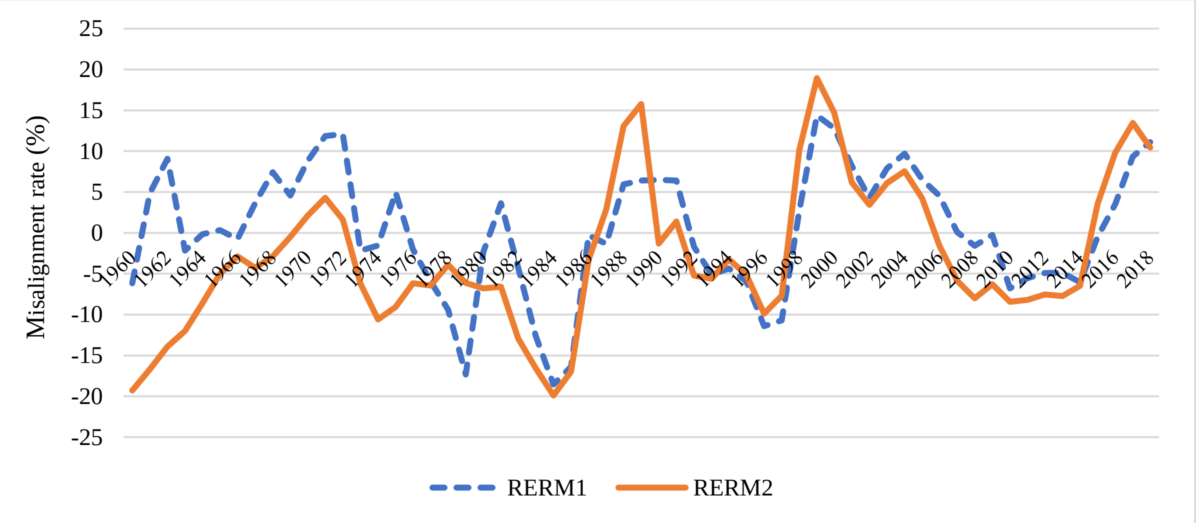
Under the Currency Board system, RER experienced a significant undervaluation, with an average rate of 5.6 per cent. The rate fell to 5.0 per cent under the Bretton Woods system (1972-1973). RM experienced several episodes of misalignment during the managed float system: RER overvaluation during 1976-1980 and 1982-1995, and RER undervaluation in 1975, 1981, and 1988-1991. RER overvaluation was accelerated during 1976-1979 and 1982-1985, reflecting an early signal before the oil crisis in the early 1980s and macroeconomic crisis in 1985/1986. RER was then undervalued, particularly between 1988 to 1991 at 6.31 per cent per year on average. This phenomenon may be related to major policy reforms implemented in countries following the mid-1980s macroeconomic crisis, including a currency adjustment. Following a crisis, the focus of industrialisation policy shifted to export orientation, and the exchange rate was allowed to depreciate to boost export performance.

Prior to the AFC crisis, the RER overvaluation rate accelerated, rising from 1.7 per cent in 1992 to 11.4 per cent in 1996. Following that, RER was undervalued at 2.7 per cent in 1998, but the rate significantly increased to 14.4 per cent in 1999. This undervaluation, attributed to the sharp depreciation of RM in 1998, led the government to implement an immediate policy response by pegging the RM against the US$ in September 1998. Neighbouring countries, such as Indonesia and the Philippines were also affected by the AFC and their currency experienced a significant depreciation. The crisis also resulted in many countries in Europe joining the European Union in 1999 and using what became known as the single Euro currency. The RM remained undervalued under the fixed exchange rate system until it was abandoned in July 2005. RER undervaluation rate decreased during the managed float exchange rate system, from 6.5 per cent in 2005 to 0.1 per cent in 2007; after that, it reverted to overvaluation from 2008 to 2015. RER was undervalued beginning in 2016, and the rate of undervaluation increased steadily from 3.5 per cent to 11.1 per cent in 2018.

It is important to highlight that RER exhibited similar characteristics before the crises. According to Krugman (1979), Frankel and Rose (1996), Kaminsky et al. (1998), and Kaminsky and Reinhart (1999), the RER overvaluation is an early warning indicator of currency crashes. Frankel and Saravelos (2012) also highlight the importance of RER overvaluation as a reliable predictor of economic crisis. Prior to the macroeconomic crisis in the mid-1980s, RER was persistently overvalued from 4.3 per cent in 1982 to 18.6 per cent in 1984. RER overvaluation also accelerated from 4.4 per cent in 1994 to 10.7 per cent in 1997 before the AFC in 1997/1998. The result of this study supports the previous view that RER overvaluation could be an important indicator of a country's vulnerability to currency speculation and crisis. This finding is consistent with Athukorala and Warr (2002), Jongwanich (2009), Toulaboe (2017), and Koske (2008), who found that the Malaysian currency was overvalued leading up to the AFC in 1997/1998. It can be concluded that Malaysia experienced several episodes of RER misalignment, and it was consistent with the country's crisis events and policy changes. Based on the magnitude of RER misalignment, it can be observed that Malaysia generally does not have a serious misalignment problem.

Although numerous studies have been conducted to assess the degree of RER misalignment in Malaysia, the results are incomparable due to differences in methodology, data coverage, and econometric techniques. For example, Mahraddika (2020) estimated RER misalignment for individual countries and revealed that Malaysian RER misalignment ranged from -13 to 18 per cent between 1980 and 2014. Koske (2008) estimated RER misalignment between 1980 and 2006, discovering that RM was overvalued by 14 to 17 per cent before the AFC crisis, and Malaysia experienced a slight depreciation and appreciation of 4 to 5 per cent after the crisis. Jongwanich (2009) estimated RER misalignment of ASEAN-5 countries from 1995 to 2008 and discovered that RER overvaluation in Malaysia was around 10 per cent to 15 per cent in the run-up to the AFC. The author also found that RER was undervalued after the AFC and it was less than 10 per cent in Malaysia. Sidek and Yusoff (2009) estimated RER misalignment for Malaysia during 1981-2008. They discovered that RM was overvalued by 14.7 to 33 per cent in the 1990s, and overall RER misalignment after 1998 is less than 10 per cent. Generally, most of these studies do not show a significant RER misalignment in Malaysia, except for Sidek and Yusoff (2009).

For comparison purposes, Figure 3.9 depicts the estimated RER misalignment using the newly constructed RER index (RERM1)[55] and an alternative RER misalignment (RERM2)[56] calculated using RER2.



Note: Positive observations indicate RER depreciation, while negative observations indicate RER appreciation.
Source: Author's computation based on data sources listed in the chapter.

Figure 3.9: RER misalignment based on two RER measurements

The figure suggests that undervaluation episodes dominate the time pattern of both RERMs. The RERMs reveal a contrasting pattern from 1960 to 1984. However, after 1985, the patterns of both RERMs are similar, with RERM2 having a higher degree of RER misalignment than RERM1. This scenario is consistent with Little et al. (1993), who employ CPI to measure foreign price index and find that it tends to overstate the RER depreciation. It can be stated here that the choice of price index is important in the RER index construction. Using an appropriate price index that is consistent with the theoretical RER definition is vital as it may

[55] RERM1=[RER1-$ERER_1$/$ERER_1$] *100, where $ERER_1$ is derived from the long-run coefficient of RER equation based on RER1
[56] RERM2=[RER2-$ERER_2$/$ERER_2$] *100, where $ERER_2$ is derived from the long-run coefficient of RER equation based on RER2

influence the size of estimated RER misalignment, and consequently may impact on the policy inferences.

3.11 Conclusion

This chapter investigated the determinants of the RER movement in Malaysia, focusing on the role of exchange rate regime shifts and changes in the relevant economic fundamentals from 1960 to 2018. The analysis begins with the RER measurement. A comparative analysis of the newly constructed RER index with the IMF index revealed that the IMF index tends to overstate the RER changes for two reasons. First, the world's inflation rate measured by the WPI is lower than CPI, and Malaysia's CPI is smaller than the GDP deflator.

Analysis of the RER equation, the evidence suggests that technological progress, total capital inflows, and government intervention are important factors influencing the RER movement in Malaysia. Total capital inflow is contributed significantly to high variation in the RER. Meanwhile, government intervention plays a modest role in influencing the RER movement. The choice of exchange rate policy does not seem to have had a significant impact on the RER movement. There is no clear association between the extent of RER overvaluation or undervaluation with a particular exchange rate regime.

There is also evidence that the RER has deviated in some years from the level consistent with economic fundamentals, but the rate of misalignment is relatively low. Malaysia has experienced several episodes of RER misalignment, with RER undervaluation dominating the time pattern. The acceleration of RER overvaluation in the run-up to the crisis event demonstrates the importance of monitoring the exchange rate level. This information is helpful for policymakers in avoiding currency crises and economic distortion by signalling the need for policy adjustment. Although RER misalignment is relatively minimal throughout the period, it should be avoided as it may compromise the economic performance. Recognising the

RER misalignment is crucial for policy design; ignoring the evidence of overvaluation will risk the currency and economic stability. Policy inconsistencies may contribute to the misalignment, and the relevant authority should take necessary steps to eliminate the source of RER disequilibrium. A prolonged misalignment, in particular, serves as a benchmark for assessing currency misalignment, which will affect economic performance. In this way, it is helpful to investigate further whether this RER misalignment affects Malaysia's economic performance.

Appendix

Table A3.1: Summary of findings of multi-country, cross-country, and specific-country analysis

Author	Coverage	Estimation technique	RER measurement	Findings
Edwards (1988)	Period 1965-1985 12 developing countries (including Malaysia)	Ordinary least squares (OLS) – Fixed effect	$RER=ExWPI^{us}/CPI^{d}$ E: Domestic currency/ /US$	Import tariffs, terms of trade (TOT), government consumption, capital flows, and technological progress determine the RER movement.
Cottani et al. (1990)	1960-1983 24 LDCs (including Malaysia)	OLS	$RER = E.xWPI^{us}/CPI$ or GDP deflator^{d} E=price of US in terms of domestic currency	TOT, income/trade ratio, capital flows, domestic credit, and time trend (to capture productivity) determine the RER variation.
Razin and Collins (1997)	1975 – 1992 93 countries: 20 developed countries 73 developing countries (including Malaysia)	Fixed effect	$RER=CPI^{d}/CPI^{w}$	Net trade to GDP, capital inflows, money growth, and TOT significantly determine the RER movement in less developed countries.
Husted and MacDonald (1999)	1974-1996 9 Asia/Pacific countries (including Malaysia)	Panel OLS – Fixed effect	ER=RM/Yen	Long-run relationships exist between exchange rates and money market.
Atukhorala and Rajapatirana (2003)	1985 -2000 8 Asian countries (including Malaysia) 6 Latin American countries	Two-stage least squares (TSLS)	$RER=NERxWPI^{w}/GDP$ deflator^{d}	The composition of capital flows is vital in determining the RER movement.
Lane and Milesi-Ferretti (2004)	1975-1996 64 industrial and (mostly) middle-income developing countries	DOLS	$RER=CPI^{d}/CPI^{w}$ CPI-based RER	A correlation exists between changes in RER and net foreign assets (NFA).
Lee and Azali (2005)	1981 – 2003 5 ASEAN countries (including Malaysia)	Johansen cointegration	Bilateral RER	Long-run relationships exist between RER, money supply, and income differential.
Berg and Miao (2010)	1950–2004 181 sample developed and developing countries	OLS - Fixed effect	RER=The ratio of the market exchange rate/ PPP conversion factor	Real GDP per capita, TOT, trade openness, government consumption, and investment determine RER movements.
Jongwanich and Kohpaiboon (2013)	2000-2009 9 Asian countries (including Malaysia)	General method of moments (GMM)	$RER=NERxWPI^{w}/CPI^{d}$	Productivity, government spending, trade openness, and TOT determine RER movements.
Schröder (2013)	Period 1970-2007 63 developing countries (including Malaysia)	DOLS	$RER=NERxCPI^{w}/CPI^{d}$	TOT, openness, and Balassa-Samuelson effects determine the RER movement in Malaysia.

Author	Coverage	Estimation technique	RER measurement	Findings
Ricci et al. (2013)	1980 – 2004 48 industrial countries and emerging market economies	DOLS	CPI-based index	TOT, productivity differential, NFA, government consumption, and trade control determine RER movements.
Daude et al. (2016)	2003 – 2011 18 emerging countries	DOLS & Error correction model	BIS database CPI-based index	NFA, openness, and productivity determine RER movements.
Mahraddika (2020)	1980-2014 60 developing countries	DOLS	RER= ExWPI/GDP deflator	Government expenditure, productivity, and trade openness determine RER movements in Malaysia.
Banerjee and Goyal (2021)	1995-2017 8 large emerging market economies	FMOLS & DOLS	RER= $NERxWPI^w/WPI^d$	Sectoral relative price, openness, and productivity, financial development determine RER movements.
Cheung et al. (2005)	Q2:1973 – Q4:2000 8 developed countries	Johansen cointegration test	ER= Domestic currency/US$	Combinations of model/specification/currency that work well in one period may not work well in another.
Feldstein (1986)	1973 – 1984 The United States	OLS - using IV procedure	RER=Number of German marks per Dollar adjusted for GNP level of two countries	Money growth and the expected future deficit determine the exchange rate movement.
Elbadawi (1994)	1967 – 1990 Chile, Ghana and India	Johansen cointegration test	RER=$CPI^{d/}/WPI^w$ xNER	TOT, capital inflows, and open trade regime determine RER movements.
De Gregorio, J. and H. Wolf (1994)	1970 to 1985 14 OECD countries	Simple regression	CPI-based index	Productivity growth and TOT determine the RER movement.
Faruqee, H (1995)	Period 1970-2007 The United States and Japan	Johansen Cointegration analysis	CPI-based Index & WPI-based Index RER: The currency-adjusted ratio of national price level	Sectoral productivity and NFA positions determine RER movements in the US. Productivity differential has a long-run relationship with RER Japan.
Agénor et al. (1997)	Q1:1987 - Q1:1995 Turkey	Vector Autoregression (VAR)	CPI-based index	Government spending and capital inflows led to real appreciation.
Nilsson (2004)	Q1:1982 - Q4: 2000 Sweden	Johansen cointegration test	RER= NERx CPI^w/CPI^d	TOT, NFA, productivity differential, and net foreign debt/ratio determine the RER movement.

Author	Coverage	Estimation technique	RER measurement	Findings
Lee (2007)	Jan 1980 – Dec 2003 South Korea	OLS	Bilateral nominal exchange rate	The exchange rate shock is more significant under the free-floating than under the limited flexibility regimes.
Edwards and Rigobon (2009)	Daily data from Jan. 1991 - Sep.1999 Chile	GARCH and ARCH	Actual exchange rate	Capital controls restrictions depreciate the exchange rate.
Ibarra (2011)	Q1:1988 - Q2:2008 Mexico	Error correction model & OLS	ER=US/Mexico	Capital inflows lead to appreciation.
Bouraoui and Phisuthtiwatcharavong (2015)	Monthly data 2004-2013 Thailand	Multiple linear regression	Bilateral RER THB/US$	TOT and international reserves impact the nominal exchange rate THB/US$.
Bajo-Rubio et al. (2018)	Q1:1995 -Q4:2016 Spain	DOLS	RER using CPI-based and import prices	The composition of fiscal consolidation and RER definition is vital in determining the effects on RER.

Table A3.2: Summary of findings of previous studies for Malaysia

Author	Coverage	Estimation Technique	RER	Findings
Quadry et al. (2007)	2010-2017	ARDL	Bilateral RER: RM/US$ and RM/GBP	Money supply and oil price determine the movement of RM/British Pound.
Chin et al. (2007)	Q1: 1981-Q3:2003	Johansen cointegration	Bilateral RER US$/RM	The exchange rate is cointegrated with its monetary fundamentals (money and income differential).
Koske (2008)	Q1:1980-Q1: 2006	Johansen cointegration	CPI-based index	Real GDP per capita, non-tradable productivity, openness, government consumption, and net foreign assets (NFA) determine RER movements.
Sidek and Yusoff (2009)	Q1:1991-Q1:2008	Johansen cointegration	CPI-based index	Productivity, trade openness, government expenditure, and NFA determine the RER movements.
Baharumshah et al. (2010)	Q1:1971: Q2:2004	Johansen cointegration	RM/US$, RM/Yen	The exchange rate is cointegrated with monetary variables.
Wong (2013)	1971-2008	ARDL	RER: RM/US$ x CPI^{us}/CPI^{d}	Productivity, real interest rate, reserve differentials, or real oil price determine RER movements.
Wong (2014)	1971-2008	ARDL and DOLS	RER: RM/US$ x CPI^{us}/CPI^{d}	Productivity, real interest rate, the real oil price, and reserve differentials determine RER movements.
Dahalan et al. (2016)	1960 - 2012	Johansen Cointegration test and DOLS	Multilateral RER	Capital formation, capital flow, government consumption, and openness determine RER variation.
Wong (2018)	1971–2016	ARDL	RER: RM/US$ x CPI^{us}/CPI^{d}	Productivity and reserve differentials determine RER movements.
Shukri et al. (2021)	1970 to 2019	ARDL	RER: RM/US$ x CPI^{us}/CPI^{d}	Found inflation rate and income growth rate determine RER movements.

Table A3.3: List of 20 trading partners

No	Trading partner	Export weights during period					
		1960s	1970s	1980s	1990s	2000s	2010s
1	Australia	0.03	0.02	0.02	0.02	0.04	0.05
2	Canada	0.02	0.01	0.01	0.01	0.01	0.00
3	France	0.02	0.02	0.01	0.01	0.01	0.01
4	Germany	0.03	0.04	0.04	0.04	0.03	0.03
5	India	0.01	0.02	0.03	0.02	0.03	0.05
6	Indonesia	0.01	0.00	0.01	0.02	0.03	0.05
7	Italy	0.03	0.02	0.01	0.01	0.01	0.01
8	Japan	0.22	0.23	0.23	0.15	0.12	0.12
9	South Korea	0.02	0.02	0.05	0.04	0.04	0.04
10	China	0.02	0.02	0.02	0.03	0.09	0.16
11	Netherlands	0.02	0.07	0.05	0.04	0.04	0.04
12	New Zealand	0.01	0.01	0.00	0.00	0.00	0.01
13	Pakistan	0.00	0.01	0.01	0.01	0.01	0.01
14	Philippines	0.02	0.01	0.02	0.01	0.02	0.02
15	Singapore	0.25	0.21	0.23	0.23	0.19	0.17
16	Spain	0.01	0.01	0.00	0.00	0.01	0.00
17	Taiwan	0.01	0.02	0.03	0.04	0.04	0.03
18	Thailand	0.01	0.01	0.03	0.04	0.06	0.07
19	United Kingdom	0.07	0.06	0.03	0.04	0.02	0.01
20	United States	0.17	0.18	0.17	0.23	0.20	0.11

Source: Author’s computation.

Table A3.4: Data sources and description of variables

Variable	Description	Data source
RER	The real effective exchange rate. RER is defined as the weighted average of Malaysia's export partners' WPI/PPI indices expressed in the domestic currency relative to the domestic prices index (proxy by the GDP deflator). RER= $\prod_{j=1}^{20}\left(\frac{NER_{ijt} \text{ x } WPI_{jt}}{GDP\ def_{it}}\right)^{wj}$	IFS, IMF The direction of Trade Statistics (DOTS), IMF WDI, World Bank
TFP	Index of TFP at constant price 2015	Penn World Table 9.1
OPEN	The ratio of duty import/total import revenue at current price and multiplied by 100	The Economic Report 1972/1973, MOF WDI, World Bank
CAPFLOW	Total capital inflows net divided by GDP at current price and multiplied by 100	The WDI report DOSM unpublished data, EPU
RESERVE	Foreign exchange reserves (in US$ billion)	CEIC database IFS, IMF
DEFICIT	Overall deficit or surplus divided by GDP at current price and multiplied by 100	The Economic Report 1972/1973, MOF EPU
MGROW	The difference between broad money growth (M3) and nominal GDP growth	WDI, World Bank

Table A3.5: Long-run and short-run dynamic results of the RER equation: Using dataset for 1970- 2018

The dependent variable is RER

Independent variable	Coefficient value
Adjustment coefficient	- 0.259***
	(0.053)
Long-run coefficients	
TFP_{t-1}	-1.103**
	(0.433)
$DEFICIT_{t-1}$	- 1.099
	(0.712)
$CAPFLOW_{t-1}$	-0.838**
	(0.406)
$RESERVE_{t-1}$	0.198**
	(0.075)
Constant	191.503***
	(40.03)
Short-run coefficients	
Δ $DEFICIT_t$	0.961***
	(0.214)
DCB	0.423
	(2.700)
DFIX	3.609**
	(1.415)
DAFC	1.635
	(2.689)
DGFC	-3.024
	(2.0384)
Bounds test	3.46*
Adjusted R-squared	0.58
Durbin-Watson	1.75
Normality	2.06***
Serial	0.65***
Heteroscedasticity[A]	0.40***
Ramsey's test	4.34*

Note: Number in parentheses ( ) is the standard error.

*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.

The Bounds test refers to cointegration test statistics using the ARDL bounds test. Normality refers to *Jarque-Bera* for normal residual test statistics. Serial denotes the *Breusch-Godfrey LM* test statistics for no serial correlation. Heteroscedasticity[A] is the ARCH test statistics for no autoregression conditional heteroscedasticity. Ramsey's test is for no functional misspecification test statistics.

Source: Author's estimation.

Table A3.6: Long-run results of the RER equation: The FMOLS model
The dependent variable is RER

Independent variable	Coefficient value
Long-run coefficients	
TFP	-0.622***
	(0.194)
$DEFICIT_t$	- 0.621
	(0.429)
CAPFLOW	-0.838***
	(0.189)
$RESERVE_t$	0.151***
	(0.047)
Constant	146.009***
	(17.450)
R-squared	0.69
Adjusted R-squared	0.68

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
Source: Author's estimation.

Table A3.7: Long-run results of the RER equation: The DOLS model
The dependent variable is RER

Independent variable	Coefficient value
Long-run coefficients	
TFP	-0.558***
	(0.170)
DEFICIT	-0.878*
	(0.441)
CAPFLOW	-1.080***
	(0.199)
$RESERVE_t$	0.198**
	(0.094)
Constant	141.213***
	(40.025)
R-squared	0.90
Adjusted R-squared	0.86

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
Source: Author's estimation.

Table A3.8: Long-run and short-run dynamic results of the RER equation: Using IMF index
The dependent variable is RER2

Independent variable	Coefficient value
Adjustment coefficient	-0.303*
	(0.063)
Long-run coefficients	
TFP_{t-1}	-0.443*
	(0.267)
$DEFICIT_{t-1}$	0.168
	(0.504)
$CAPFLOW_{t-1}$	-0.466*
	(0.238)
$RESERVE_{t-1}$	0.350***
	(0.053)
Constant	101.847***
	(24.107)
Short-run coefficients	
ΔRER_{t-1}	0.248**
	(0.111)
ΔTFP_{t}	0.188
	(0.165)
$\Delta DEFICIT_{t}$	-0.263
	(0.174)
$\Delta RESERVE_{t}$	0.113*
	(0.062)
$\Delta RESERVE_{t-1}$	-0.195**
	(0.063)
DCB	-1.002
	(0.969v
DFIX	4.127***
	(1.416)
DAFC	7.016***
	(2.173)
DGFC	-0.407
	(1.722)
Bounds test	3.44*
Adjusted R-squared	0.43
Durbin-Watson	2.20
Normality	1.11***
Serial	2.43*
$Heteroscedasticity^{A}$	2.93**
Ramsey's test	0.4***

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
The Bounds test refers to cointegration test statistics using the ARDL bounds test. Normality refers to *Jarque-Bera* for normal residual test statistics. Serial denotes the *Breusch-Godfrey LM* test statistics for no serial correlation. $Heteroscedasticity^{A}$ is the ARCH test statistics for no autoregression conditional heteroscedasticity. Ramsey's test is for no functional misspecification test statistics.
Source: Author's computation.

CHAPTER 4: REAL EXCHANGE RATE MISALIGNMENT AND ECONOMIC GROWTH

Abstract

The implications of real exchange rate (RER) misalignment–the deviation of the RER from the level consistent with the underlying economic fundamentals–for economic growth is a key concern of macroeconomic policy debate in developing countries. While mainstream economists consider RER misalignment retards economic growth through resource misallocations, there is an influential school of thought which believes that RER undervaluation promotes economic growth. This paper contributes to this debate through a case study of Malaysia during the period 1970 to 2018. It does this by constructing RER misalignment based on the theory of RER determination in a small open economy and employing the economic growth equation. The model is estimated using the Autoregressive Distributed Lag (ARDL) approach. It emerges that the overall RER misalignment does not affect the Malaysian economy. The positive effect of RER undervaluation outweighs the negative impact of RER overvaluation, contributing to long-term output performance. Sectoral analysis suggests that the performance of tradable sector determines the outcome.

4.1 Introduction

The real exchange rate (RER) misalignment–the deviation of RER from the level consistent with the underlying economic fundamentals–for economic growth has received considerable attention from policymakers and researchers. There are two opposing views on the impact of RER misalignment on economic growth: RER misalignment retards economic growth through resource misallocations and RER undervaluation promotes economic growth by improving international competitiveness. The first viewpoint is often referred to as the 'Washington Consensus' (WC) view, which contends that deviations in RER from its equilibrium level (RER misalignment) impedes economic growth (Williamson, 1990). The alternative viewpoint argues that RER undervaluation promotes economic growth, while RER overvaluation hinders growth (Rodrik 2008).

The available empirical evidence on the relationship between RER misalignment and economic growth[57] is dominated by cross-country analyses. Cross-country studies, naturally, provide a result relating the average relationship among the countries covered, based on the homogeneity assumption in the observed relationship across countries. This study aims to investigate the impact of RER misalignment on economic performance in Malaysia during the years 1970 to 2018. A disaggregated analysis of the tradable and non-tradable sectors is important because the net overall effect of the exchange rate may hide significant sectoral differences in the impact of macroeconomic policy.

Malaysia is an appropriate case study for the following reasons. First, during the period under study, Malaysia has undergone significant changes in the exchange rate regimes that underpinned its economic process. Second, exchange rate policy has been a central policy debate since the Asian Financial Crisis (AFC) that erupted in 1997/1998. Third and finally,

[57] See Edwards 1989a and 1989b, Rodrik, 2008 and Ribeiro et. al.,2020 for reviews of this literature.

Malaysia's economic data relating to macroeconomic performance is considered good by developing country standards, making econometric analysis possible.

The novelty of this study compared to others is as follows. First, the RER misalignment used in the analysis is constructed based on the theory of RER determination in a small open economy with a greater focus on the theoretical aspects. Second, the growth impact of RER misalignment is examined focusing on the differential impact on tradable and non-tradable sectors in addition to the net impact on overall economic performance. Third, the growth equation is systematically derived from the standard production function. Fourth and finally, it provides time-series evidence using a longer data span, allowing a more robust analysis than what previous studies did. This study complements other research that was based on multi-country and cross-country studies.

This study found that the overall RER misalignment does not affect the Malaysian economy. The positive impact of RER undervaluation outweighed the negative impact of RER overvaluation, resulting in a mild overall positive impact on long-term economic growth. The findings of tradable and non-tradable sector analyses indicated that the tradable sector performance entirely drove this outcome.

The remainder of the chapter is organised as follows. Section 4.2 reviews the existing literature on RER misalignment and economic growth. Section 4.3 presents the growth model and empirical specification. Section 4.4 provides the data sources and description of variables. Section 4.5 discusses the estimation method, and section 4.6 reports the result and discussion. Lastly, section 4.7 summarises the key findings and policy implications.

4.2 Literature review

The nexus between RER misalignments and economic growth has been studied extensively; however, the results are far from conclusive. There are two alternative views on the impact of

RER misalignment on economic growth. The mainstream view, which forms parts of the ‘Washington consensus’ (Williamson, 1990), holds that both RER overvaluation and RER undervaluation are associated with some sort of macroeconomic imbalance and bad for economic growth. RER overvaluation is associated with the loss of competitiveness may cause external imbalance hence reducing growth. RER undervaluation may result in internal imbalances and high inflation, limiting resources for domestic investment and lowering supply-side growth potential (Williamson, 1990). The second view, led by Rodrik (2008), makes a different argument about the relationship between RER misalignment and economic growth. The author argued that RER undervaluation promotes growth while RER overvaluation is bad for growth. This argument was encouraged by the East Asian economies’ success and China's economic performance, which partly related to the policy of deliberately undervaluing the exchange rate to promote export strategy.

The negative association between RER misalignment and economic performance has been well-established by many studies such as Ghura and Grennes (1993), Toulaboe (2006), Sallenave (2010), Schröder (2013), and Comunale (2017). Ghura and Grennes (1993) discovered that RER misalignment affected the economic performance of 33 Sub-Saharan African countries during 1972-1987. Toulaboe (2006) found a negative correlation between RER misalignment with the economic growth of 33 developing countries from 1985 to 1999. Sallenave (2010) investigated the effect of RER misalignment on G20 macroeconomic performance during 1980-2006 and discovered a negative association between RER misalignment and growth. Schröder (2013) examined the relationship between RER misalignment and economic growth in 63 developing countries between 1970 and 2007, and found that deviations from the RER's fundamental equilibrium reduce economic growth. This finding provides a strong case for keeping the RER closer to long-term equilibrium levels by providing empirical evidence that both RER undervaluation and overvaluation adversely affect long-term growth. Comunale (2017) examined 27 EU countries from 1994 to 2012 suggested that RER misalignment deters economic growth.

In recent years, a growing strand of literature has suggested a strong relationship between RER undervaluation and economic growth. A positive link between RER undervaluation and economic growth is well documented by Rodrik (2008), Eichengreen (2008), Berg and Miao (2010), Abida (2011), Razmi et al. (2012), Béreau et al. (2012), Vieira and Macdonald (2012), Elbadawi et al. (2012), Mbaye (2013), Levy-Yeyati et al. (2013), Vaz and Baer (2014), and Rapetti (2020). Berg and Miao (2010) and Razmi et al. (2012) revisited the empirical findings of Rodrik (2008), and they reached the same conclusion: undervaluation promotes growth, while overvaluation hinders growth. Mbaye (2013) analysed 72 countries between 1970 and 2008, and found that undervaluation promotes growth through total factor productivity. Habib et al. (2017), using panel data of 150 countries from 1970 to 2010, and found that a real appreciation (depreciation) reduces (raises) output growth. Rapetti (2020) conducted an empirical survey on different groups of countries (developed and developing) and different periods (1950-1984, 1985-2014). The author discovered that RER overvaluation hinders growth, while RER undervaluation promotes economic expansion.

RER misalignment can affect growth through various channels including competitiveness, capital accumulation, and total factor productivity. Undervaluations of RER will increase competitiveness by lowering export prices, import prices, and firm profits hence helps net exports grow and the economy grows as a whole. Undervaluation positively affects the tradable sector, which may boost economic growth (Rodrik, 2008). An undervalued exchange rate increases economic growth through the stock of capital increase in the economy (Mbaye, 2013). Glüzmann et al. (2012) suggest that an undervalued exchange increases the investment and the domestic saving rate, stimulating growth by increasing the capital accumulation. An undervalued exchange rate also promotes growth through the total factor productivity channel. A rise in the prices of tradable goods relative to non-tradable, thereby increasing the profitability of the tradable goods sector. The shift in production from non-tradable toward tradable goods (which are believed to be more productive) increases the economy's overall productivity (Mbaye, 2013). There is evidence that undervaluation has the potential to encourage exports and has an impact on growth through investments and technological change (Gala, 2008; Rodrik, 2008).

The important role of undervaluation in promoting growth in the tradable sector has been highlighted by some studies such as Rodrik (2008), Aizenman and Lee (2010), and Korinek and Servén (2016). In a major analysis covering 188 countries from 1950-2004, Rodrik (2008) demonstrates that RER undervaluation promotes economic growth in developing countries. RER undervaluation acts as a second-best mechanism to increase economic growth in developing countries that predominantly suffer from institutional weaknesses and market failure. Undervaluation impacts growth through the tradable sector, which is hampered by these distortions that prevent the country from attaining high growth. Korinek and Servén (2016) found that RER undervaluation through foreign reserve accumulation increases domestic tradable production. The contribution of the tradable sector to economic growth has been studied by Johnson et al. (2006) and Jones and Olken (2008). According to these authors, rapid growth in developing countries is linked to a reorientation of production towards manufacturers (tradable). Moreover, different sectors may react differently to changes in RER due to their varying degrees of openness and exposure to international trade (Bahmani-Oskooee and Aghdas, 2000; Kandil and Mirzaie, 2002). In a study on the impact of the devaluation on the United States (US) output, Gylfason and Schmid (1983) found that the Dollar’s devaluation has an expansionary impact on real output. However, different conclusions were reached when total output was segmented into different sectors.

This literature is mostly concentrated on multi-country and cross-country analyses. The evidence they report is useful for providing a background for the subject. Cross-country analysis, in particular, provides only a general picture of the relationship between interest variables based on the implicit assumption of homogeneity. However, this assumption does not hold due to differences in economic structure, institutional aspects, and data quality between economies. An in-depth analysis of an individual country is needed to complement these studies to build a sound empirical foundation to inform policy debates.

The relationship between RER misalignment and Malaysia's economic growth has been studied by Naseem and Hamizah (2013), Wong (2013), and Wong (2018). The empirical results are not conclusive. Naseem and Hamizah (2013) used quarterly data from 1991 to 2013 to explore the connection between RER misalignment and economic growth and found that RER misalignment promotes the latter. In contrast, Wong (2013) found that RER misalignment had a negative impact on economic growth from 1971 to 2008. Also, the author demonstrated that RER undervaluation stimulates economic growth, while RER overvaluation retards it. In other studies, Wong (2018) examined the nexus between RER and economic growth on the total economy and three sub-sectors (manufacturing, construction, and mining and quarrying) from 1971 to 2016 and found that RER misalignment reduces overall economic performance. The author also found that undervaluation promotes growth in the manufacturing sector, but RER misalignment has no impact on the construction, mining, and quarrying sectors.

The findings of previous Malaysian studies, however, may not be adequate to explain the impact of RER misalignment on economic performance for several reasons. Earlier studies mainly focused on overall economic analysis and did not consider the differential impact of RER misalignment on tradable and non-tradable sectors. The findings of previous studies should also be interpreted cautiously due to methodological limitations. The RER misalignment was derived from a common RER index that did not correspond to the theoretical

RER definition (as discussed in Chapter 3). They used a bilateral RER index rather than a multilateral RER index to represent aggregate international competitiveness.

4.3 The model

This study examined the impact of RER misalignment on long-run economic growth using a standard production function approach. The standard production function takes the following form:

$$Q(t) = A(t)K(t)^{\alpha}L(t)^{1-\alpha} \tag{1}$$

where Q is output, A is the technological progress, K is capital input, and L is labour input. The production function is assumed to have constant returns to scale where α and $1-\alpha$ are the share of capital and labour inputs used in the production. This study extends the standard production function by assuming RER misalignment affect output through A. That is:

$$A(t) = f(RERM(t), Z(t)) \tag{2}$$

where *RERM* is RER misalignment, and Z denotes other economic variables. This study assumes that RER misalignment reduces economic growth through resource misallocation. RER misalignment may generate distortions in the relative price of tradable to non-tradable goods, resulting in resource misallocation between tradable and non-tradable sectors, affecting productivity and hence distorting economic stability. Diving both sides of equation (1) by $L(t)$, the production function becomes:

$$\frac{Q(t)}{L(t)} = \frac{A(t)K(t)^{\alpha}L(t)^{1-\alpha}}{L(t)} \tag{3}$$

$$q(t) = A(t)k(t)^{\alpha} \tag{4}$$

Taking the logarithms of both sides and first differencing of equation (4) gives the following growth accounting equation:

$$\Delta\ In\ q(t) = \Delta\ ln\ A(t) + a\ \Delta\ ln\ k(t) \quad (5)$$

The notations q and k denote output per worker, and capital per worker, respectively.

The estimation equation is specified by augmenting the basic model (equation 1) by including trade openness, an interaction term for undervaluation, three interaction terms for RER misalignment and macroeconomic crises, and three crises dummy to capture macroeconomic crises experienced by the Malaysian economy. The full specification of the empirical growth in this study is as follows:

$$lnq_t = \beta_0 + \beta_1 lnk_t + \beta_2 RERM_t + \beta_3 lnOPEN_t + \beta_4(D * RERM_t) + \beta_5(D80s * RERM_t) + \beta_6(DAFC * RERM_t) + \beta_7(DGFC * RERM_t) + \beta_8 D80s + \beta_9 DAFC + \beta_{10} DGFC + e_t \quad (6)$$

where q is the dependent variable, measured by real gross domestic product per worker. The set of explanatory variables (with the expected signs in brackets) are:

k	(+)	The real net capital stock per worker
RERM	(-)	Real exchange rate misalignment
OPEN	(+)	Trade openness 2 alternative measurements: OPEN1–Total trade to GDP OPEN2–Duty import to total import revenue
D*RERM	(+)	An interaction term for undervaluation
D80s*RERM	(+)	An interaction term between RER misalignment and the macroeconomic crisis in the mid-1980s
DAFC*RERM	(+)	An interaction term between RER misalignment and the Asian Financial Crisis
DGFC*RERM	(+)	An interaction term between RER misalignment and the Global

		Financial Crisis
D80s	(-)	A dummy variable capturing the macroeconomic crisis in the mid-1980s: takes a value of 1 for 1985 and 1986 and zero for other years
DAFC	(-)	A dummy variable capturing the Asian Financial Crisis (AFC) : takes a value of 1 from 1998 until 2001 and zero for other years
DGFC	(-)	A dummy variable capturing the Global Financial Crisis (GFC) : takes a value of 1 from 2008 until 2010 and zero for other years

Total capital input is measured by the real net capital stock per worker (*k*). According to the theoretical growth model, more capital per worker in production results in more output per worker. Thus, the relationship between capital per worker and economic growth is predicted to be positive.

Trade openness (OPEN) captures the trade policy regime of the country. This study predicts that the more liberalised a country is, the more open it becomes, and economic growth tends to be more evident. There is no specific measure regarding trade openness indicators, and the literature measured it in various ways depending largely on data availability. This study used two alternative trade openness indicators: total trade to GDP (OPEN1) and duty import/total import revenue (OPEN2). Trade openness increases growth through technology improvement and production efficiency by exposure to competition in the international market. The more open countries tend to have a more exceptional ability to absorb technological advances generated from advanced nations than protectionist ones (Edwards, 1992). The positive link between trade openness and economic growth has been widely documented. Sachs and Warner (1995b) discover trade openness is an important variable for growth. Based on the

Sach-Warner index, Malaysia's economy has always been open since early post-colonial times. According to Grossman and Helpman (1990), Rivera-Batiz and Romer (1991), and Barro and Sala-I-Martin (1997), trade openness promotes long-term economic growth through disseminating technical knowledge of high-tech imports and spillover effects from FDI. Thus, the sign of OPEN1 is expected to be positive, while OPEN2 is expected to be negative.

D*RERM variable is an interaction term between RER misalignment and a positive dummy of RER undervaluation. D*RERM is included in the model to test if RER undervaluation has a differential impact on growth over and above the impact of RER misalignment. RER undervaluation is expected to boost international competitiveness and increase economic welfare, so the sign for D*RERM is expected to be positive.

From 1970 to 2018, Malaysia experienced three major crises: the macroeconomic crisis in the mid-1980s, the Asian financial crisis in 1997-1998, and the global financial crisis in 2008/2009. Three dummy variables (D80s, DAFC and DGFC) are included in the model to capture the negative impact of all three crises. The crisis source, the magnitude of the impact, and government policy response are relatively different for all three crises. Of these three crises, the global financial crisis's effect is predicted to be less severe as the authorities already imposed macroeconomic discipline after the Asian financial crisis (Athukorala, 2012). The economic crisis is expected to reveal itself as slow economic activity, so the sign for these dummy variables would be negative.

The model includes three interaction terms between RER misalignment and crisis to test whether RER misalignment promotes economic growth during the crisis. These variables are denoted as D80*RERM (interaction term between RER misalignment and the mid-1980s crisis), DAFC*RERM (interaction term between RER misalignment and the Asian financial crisis), and DGFC*RERM (interaction term between RER misalignment and the global financial crisis). According to Fornaro (2015), currency depreciation during a financial crisis provides a stimulus to sustain asset prices, collateral values, and access to the international credit market, improving economic welfare. Thus, the coefficient of these three variables is expected to be positive.

The model above is estimated for the aggregate economy and separately for the tradable and non-tradable sectors. Separate sector analysis is crucial because the involvement of these two sectors in international trade differs. Any changes in the price of goods are expected to have more impact on the tradable sector than non-tradable sector due to the high participation of the former in the global economy.

It is important to highlight the potential endogeneity of RER misalignment and other control variables when estimating the above model (i.e. the causality between exchange rate and economic growth). Although this is a well-known issue that has not been fully addressed in empirical works, the Autoregressive Distributed Lag (ARDL) approach technique could minimise an endogeneity problem (Nkoro and Uko, 2016). According to Pesaran (2015), sufficiently high lag-orders could minimise the endogeneity issue so long as the model's long-run properties are concerned.

4.4 Data sources and variable construction

The growth equation is estimated using annual data from 1970 to 2018. The year 1970 is used as a starting point due to the data availability. Malaysia has undergone several changes in its formation since independence. On 16 September 1963, the three former British colonies of North Borneo, Sarawak, and Singapore merged to form Malaysia, but in July 1965, Singapore withdrew from the union. Additionally, some sectoral data were only available starting in 1970. The data were obtained from various sources such as the World Development Indicators (WDI), World Bank, International Financial Statistics (IFS), International Monetary Fund (IMF), Department of Statistic Malaysia (DOSM), Ministry of Finance Malaysia (MOF), and

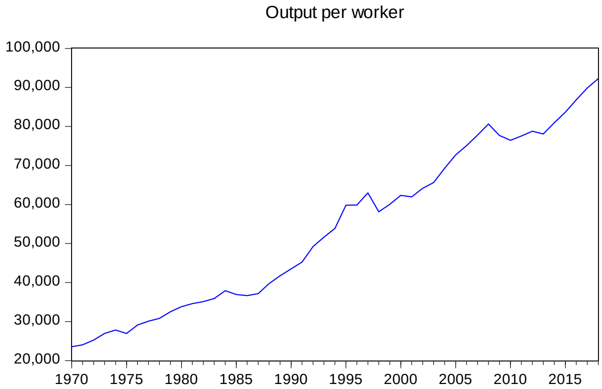
Economic Planning Unit Malaysia (EPU). The data is compiled from publications, unpublished data, official websites, and databases for the purposes of thoroughness. In the case of data not being readily available, some variables have to be derived using the proxies and follow the methodology used by previous literature. The sources of data and description of variables construction are described in Table 4.1.

Table 4.1: Data sources and description of variables

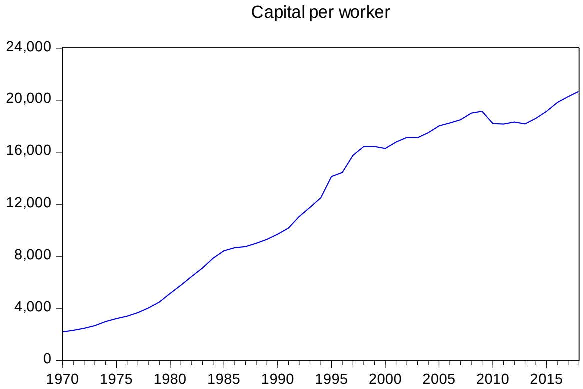
Variable	Description	Data source
q	Real GDP per worker is obtained by dividing real GDP output (RM million) at constant price 2015 to total employment.	DOSM and EPU
q^{T}	Total value-added of the tradable sector (RM million) at constant price 2015 (Tradable sector encompasses agriculture and related activities, manufacturing, and mining sectors).	DOSM and unpublished data from EPU
q^{NT}	Total value-added of the non-tradable sector (RM million) at constant price 2015 (Non-tradable sector encompasses services, utilities, and construction sectors).	DOSM and unpublished data from EPU
k	Capital per worker is measured by real net capital stock (RM million) divided by total employment.	DOSM and unpublished data from EPU
k^{T}	Capital per worker in the tradable sector is measured by real net capital stock (RM million) divided by total employment in the tradable sector.	DOSM and unpublished data from EPU
k^{NT}	Capital per worker in the non-tradable sector is measured by real net capital stock (RM million) divided by total employment in the non-tradable sector.	DOSM and unpublished data from EPU
L	Total employed persons or employment in total economy/sector.	DOSM Labour Survey various years.
RERM	Deviation of actual RER from equilibrium RER. RER misalignment is calculated using the following formula: RERM: $\frac{[RER - ERER]}{ERER}$	IFS, IMF WDI, World Bank
OPEN1	Trade openness is measured by total trade to GDP	WDI, World Bank
OPEN2	Trade openness is measured by total import duty revenue to total import value.	Economic Report (various years) MOF WDI, World Bank
D*RERM	Interaction term between RER misalignment and RER undervaluation. D takes a value of 1 for undervaluation and zero otherwise. RERM is RER misalignment value.	Author's computation
D80s*RERM	Interaction term between RER misalignment and the mid-1980s crisis. D80s takes a value of 1 for 1985-1986 and zero otherwise. RERM is RER misalignment value.	Author's computation
DAFC*RERM	Interaction term between RER misalignment and the Asian financial crisis. DAFC takes a value of 1 for 1998-2001 and zero otherwise. RERM is RER misalignment value.	Author's computation
DGFC*RERM	Interaction term between RER misalignment and the global financial crisis. DGFC takes a value of 1 for 2008-2010 and zero otherwise. RERM is RER misalignment value.	Author's computation

The distinction between the tradable and non-tradable output from total production output warrants an explanation. This study uses a similar method to Goldstein and Officer (1979) to delineate the tradable and non-tradable sectors from total GDP. Goldstein and Officer (1979) grouped manufacturing, agriculture and related activities, and mining and quarrying as a tradable sector. Other industries–construction; electricity, gas, and water; transport, storage, and communication; wholesale and retail trade; financial, insurance, and real estate services; government services; business services; and consumer services–were grouped as a non-tradable sector.

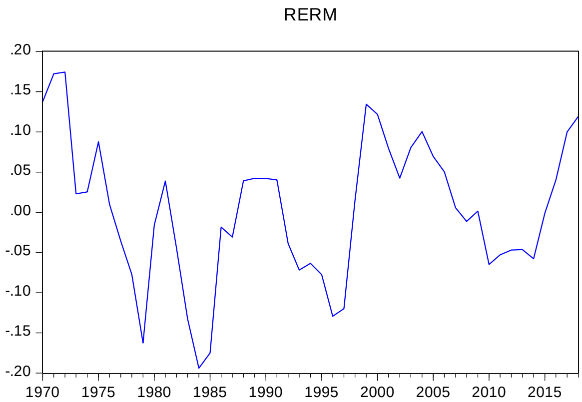
Figure 4.1 illustrates the time series plot of all variables in their original form. The RER misalignment pattern was discussed in Chapter 3 and will not be repeated here. The pattern of output per worker and net capital stock per worker shows a steady increasing trend from 1970 to 2018. The OPEN1 series reveals an upward trend until 1998 and a downward trend, reflecting global external shocks and policy changes; meanwhile, the pattern of OPEN2 shows a declining trend, reflecting continuous trade liberalisation.



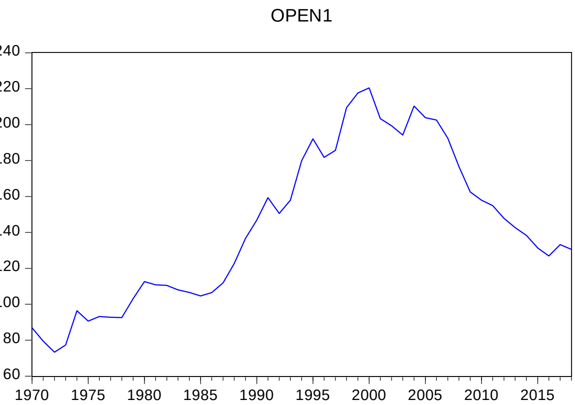
Notes: Real GDP/ Labour force (RM'mil)



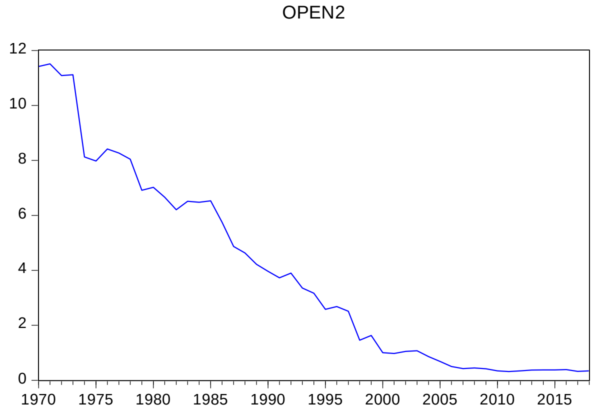
Notes: Real net capital stock/Labor force (RM' mil)



Notes: RER misalignment



Notes: Total trade/GDP x 100



Notes: Total duty import/import revenue x 100

Source: Author's computation.

Figure 4.1: Time series plot of variables

The descriptive statistics and correlation statistics between variables are reported in Tables A4.1 to A4.4 in the Appendix. Overall, the correlation between the total output and all the explanatory variables is as expected. The correlation between GDP and other variables was relatively low, yet the net capital stock and OPEN2 are highly correlated with GDP, with a correlation coefficient of 0.9 and 0.93, respectively. The potential econometric issue that would arise is multicollinearity, and it will be empirically investigated when the model is estimated.

4.5 Estimation method

The estimation of the growth equation started with the unit root test. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests served to check the stationarity of time series data and supplemented the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. Table 4.2 presents the unit root results.

Table 4.2: Results for unit root tests

Variables	ADF (Constant)			PP (Constant)			KPPS (Constant)		
	Level	First Different	Integration order	Level	First Different	Integration order	Level	First Different	Integration order
ln*k*	-3.413**	-2.650	I (0)	-4.154***	-2.629	I (0)	0.852	0.642	I (1)
$\ln k^{T}$	-3.515**	-5.764	I (0)	-3.419**	-5.830	I (0)	0.918	0.520	I (1)
$\ln k^{NT}$	-3.210**	-3.411	I (0)	-3.015**	-3.301	I (0)	0.775	0.582	I (1)
lnOPEN1	-1.462	-5.183	I (1)	-1.462	-5.183	I (1)	0.592*	0.458	I (0)
lnOPEN2	-0.153	-7.596	I(1)	-0.113	-7.596	I(1)	0.892	0.148	I(1)
RERM	-3.794***	-5.651	I (0)	-2.670*	-5.625	I (0)	0.106***	0.212	I (0)

Variables	ADF (trend)			PP (trend)			KPPS (trend)		
	Level	First Different	Integration order	Level	First Different	Integration order	Level	First Different	Integration order
ln*k*	-1.347	-4.208	I (1)	-0.716	-4.267	I (1)	0.233	0.059	I (1)
$\ln k^{T}$	-2.497	-6.569	I (1)	-2.488	-6.580	I (1)	0.195	0.078	I (1)
$\ln k^{NT}$	-0.982	-4.875	I (1)	-0.335	-4.871	I (1)	0.233	0.093	I (1)
lnOPEN1	-0.080	-5.723	I (1)	-0.141	-5.687	I (1)	0.203*	0.142	I (0)
lnOPEN2	-1.964	-7.508	I(1)	-1.918	-7.508	I(1)	0.157*	0.131	I(1)
RERM	-3.782**	-5.749	I (0)	-2.475	-5.974	I (1)	0.102***	0.104	I (0)

Note: For the ADF test, Schwarz Information Criterion is used with chosen optimal lag chosen of 4.
***is statistically significant at the 1% level, **is statistically significant at the 5% level, and * is statistically significant at the 10% level.
Source: Author's computation.

The ADF and PP test result confirms that these variables' integration order is a mixture of I(0) and I(1), and not higher than one. KPSS test also confirms this result. Based on these results, a cointegration test was conducted to check the long-run relationship between variables (Pesaran and Shin, 1999; Pesaran et al., 2001). A cointegration test is a powerful way to detect long-term equilibrium (Nkoro and Uko, 2016). A stable long-run relationship is vital to avoid spurious regression and meaningless results, and the ARDL bounds test is used to determine the long-run relationship between variables. The decision is based on the lower bound and upper bound critical values provided by Pesaran et al. (2001). If the F-statistic is greater than the upper bound critical value, indicated here is cointegration between GDP and explanatory variables. If the F-statistic is lower than the upper bound critical value, it indicates that there is no cointegration. If F-statistic fall within the upper and lower critical bound values, thus the decision is inconclusive.

The F-statistic value for all regressions is greater than the upper bound critical value and statistically significant at the 1 per cent level. It confirms that there is cointegration between variables. Thus, the analysis can proceed with the ARDL, which is preferable for several reasons. Firstly, it is applicable regardless if the regressors are purely 1(0) or I(1), or a mixture of I(0) and I (1). Secondly, it is a more robust estimation technique and suitable for a small sample size (Pesaran and Shin, 1999). Thirdly, it minimises the endogeneity problem. An appropriate selection of lag structure for ARDL could control the serial correlation of residuals and minimise endogeneity problems so long as the model's long-term properties hold (Pesaran et al., 2001; Pesaran, 2015).

The model specification of equation (6) is rewritten in the ARDL model and specified as follows:

$$\ln q_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \ln q_{t-i} + \sum_{i=0}^{q} \theta_i' X_{t-i} + \delta_1 D80s_t + \delta_2 DAFC_t + \delta_3 DGFC_t + \mu_{t_t} \quad (7)$$

where q is real output per worker, X is a vector of explanatory variables. p and q is the ARDL maximum lag order, α_0 is constant and μ_t is the error term.

Equation (7) is reparametrised in an error correction form to examine the short-run and long-run relationship among variables. The model takes the following form:

$$\Delta \ln q_{t} = \phi\left[\ln q_{t-1} - \lambda_i^{'} X_{t-1}\right] + \sum_{i=1}^{p-1} \partial_1 \Delta \ln q_{t-i} + \sum_{i=0}^{q-1} \beta_i^{'} \Delta X_{t-i} + \delta_1 D80s_t + \delta_2 DAFC_t + \delta_3 DGFC_t + \mu_t \qquad (8)$$

where $\phi = -(1 - \psi_i)$ is a speed of adjustment coefficient (< 0), λ_i' is a long-run coefficient vector, $\left[\ln q_{t-1} - \lambda_i' X_{t-1}\right]$ is error correction term (ECT), ∂_i and β_i' are the coefficients of the short-run dynamics.

The optimal lag selection for ARDL was determined[58] before estimation. The ARDL cointegration test was conducted with a maximum lag of two based on the Schwarz information criterion (SIC).

4.6 Results and discussion

4.6.1 Total economy analysis

Table 4.3 reports the results of the impact of RER misalignment on the total economy. Column (1) provides the estimation result without an interaction term for undervaluation (D*RERM) in the model regression. Meanwhile, column (2) provides the estimation result with D*RERM in the model regression. All equations in columns (1) and (2) passed the standard diagnostic test, namely serial correlation, heteroscedasticity, stability, and the functional form specification test. The result reported here is based on total trade to GDP (OPEN1) to represent

[58] The selection of appropriate lag length for variables under observation is crucial in the ARDL model to avoid non-serial correlation, as well as non-normality, and heteroscedasticity.

trade openness. The selection was made based on superior statistical properties, and the estimation using OPEN2 yields inconclusive results, presumably due to the collinearity issue (the result is reported in Table A4.5 in the Appendix).

Based on estimation, the empirical result in column (2) is preferred for discussion due to its statistical properties and consistency with the underlying theory. The following discussion will concentrate on the results reported in column (2), and the empirical results without the D*RERM variable also reported in column (1) for comparison purposes.

Table 4.3: Long-run and short-run dynamic results for the impact of RER misalignment on total economy

Dependent variable ln$q$

Independent variable	(1)	(2)
Adjustment Speed	-0.072***	-0.079***
	(0.008)	0.007
Long-run parameter		
lnk_{t-1}	0.813***	0.810***
	(0.173)	(0.155)
$RERM_{t-1}$	1.761***	-0.494
	(0.542)	(0.789)
$D*RERM_{t-1}$	-	3.835**
		(1.814)
$lnOPEN1_{t-1}$	-0.082	-0.109
	0.315	(0.273)
D80s*$RERM_{t-1}$	3.240**	2.439**
	(1.278)	(1.026)
$DAFC*RERM_{t-1}$	13.988*	10.938***
	(6.981)	(3.927)
Constant	4.002***	4.026***
	(1.277)	(0.873)
Short-run parameter		
$\Delta\ lnk_t$	0.636***	0.592***
	(0.093)	(0.089)
$\Delta\ lnk_{t-1}$	-0.335***	-0.314***
	(0.092)	(0.087)
$\Delta\ RERM_t$	-0.066	-
	(0.047)	
$\Delta\ D*RERM_t$	-	-0.069
		(0.074)
$\Delta\ lnOPEN1_t$	0.097**	0.081**
	(0.043)	(0.040)
$\Delta D80s*RERM_{t-1}$	-	1.140***
		(0.154)
$D80s$	0.001	-0.027**
	(0.014)	(0.012)
$DAFC$	-0.115***	-0.126***
	(0.015)	(0.014)
Bounds test	10.69***	11.65***
Adjusted R-squared	0.71	0.75
Durbin-Watson	1.88	2.01
Normality	1.64***	0.82***
Serial	1.98***	0.087***
Heteroscedasticity	0.53***	0.70***
Ramsey's test	2.12*	0.96***

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
The Bounds test refers to cointegration test statistics using the ARDL bounds test. Normality refers to *Jarque-Bera* for normal residual test statistics. Serial denotes the *Breusch-Godfrey LM* test statistics for no serial correlation. Heteroscedasticity is the *Breusch-Pagan-Godfrey* test statistics for no autoregression conditional heteroscedasticity. Ramsey's test is for no functional misspecification test statistics.
Source: Author's computation.

The coefficient of error correction term (ECT) or adjustment coefficient term is negative and statistically significant at 1 per cent, confirming the existence of a cointegrated relationship between variables. The size of ECT's coefficient is 0.08, indicating that the adjustment speed towards steady-states takes 8.31[59] years to eliminate half of the exogenous shocks.

Most explanatory variables in column (2) have expected signs and are statistically significant. RER misalignment variable has a negative sign; however, it is statistically insignificant. The coefficient of interaction term for RER undervaluation is positive as expected and statistically significant. An increase of RER undervaluation will increase the output per worker greater than RER overvaluation by 3.83 per cent. This result also indicates that the net impact of RER undervaluation promoting output per worker is equal to 3.34 per cent. This finding is in line with the hypothesis that RER undervaluation stimulates economic growth as suggested by Rodrik (2008), Abida (2011), Béreau et al. (2012), Vieira and Macdonald (2012), and Habib et al. (2017).

The sign for capital per worker's coefficient is positive and statistically significant at the 1 per cent level. An increase in capital stock per worker elevates output per worker of the total economy by 0.81 per cent and is statistically significant at 1 per cent. The coefficients of both interaction terms for RER misalignment and crisis are positive, implying that RER misalignment during a crisis helps to boost output per worker. The effect of RER misalignment during the macroeconomic crisis in the mid-1980s stimulated economic growth greater than the normal period by 2.44 per cent. Meanwhile, the RER misalignment during the Asian financial crisis raises the output per worker by 10.94 per cent. It suggests that exchange rate management can function as an important policy instrument for encouraging economic activity during a period of economic downturn.

[59] Estimated using the formula log (1 – *a*) = log (1 – *b*) T, where *a* is the percentage, meanwhile *b* is the estimated ECT. T represents the number of years required to clear exogenous shock through the automatic adjustment (Elbadawi, 2012).

In the short-run, capital per worker and trade openness contribute to output per worker expansion. A one per cent increase in capital stock per worker has a positive impact on output per worker by 0.59 per cent in the short run, but this impact virtually disappears in the long run. The coefficient of OPEN1 is positive and statistically significant, supporting the view that trade openness promotes growth. The coefficients of both crisis dummies, D80s and DAFC, are negative and statistically significant, suggesting that the macroeconomic crisis and the Asian financial crisis reduce total output per worker. The DGFC and DGFC*RERM variables are found to be statistically insignificant and produce an inconclusive result. Thus, they were excluded from estimation.

Based on this outcome, it can be concluded that the overall RER misalignment plays no significant role in explaining the country's long-term economic growth. However, RER undervaluation is found to have a positive impact on overall economic performance. Capital per worker has played a significant role in long-run and short-run economic performance and in the meantime, trade openness only promotes economic growth in the short- run.

4.6.2 Sectoral analysis

In a major study covering 188 countries from 1950-2004, Rodrik (2008) demonstrated that RER undervaluation promotes economic growth in developing countries. The author argues that RER undervaluation acts as a second-best mechanism for increasing tradable sector profitability and alleviating institutional weaknesses and product-market failures, resulting in rapid economic development. To contribute to the ongoing discussion, the impact of RER misalignment on output growth is analysed separately on tradable and non-tradable sectors. This study hypothesises that the impact of RER misalignment and other factors on output performance is expected to differ between tradable and non-tradable sectors due to different participation rates in international trade. The results are reported in Table 4.4.

The estimation results for the non-tradable sector are reported in column (1), and those for the tradable sector are in column (2).

Table 4.4: Long-run and short-run dynamic results for the impact of RER misalignment on non-tradable and tradable sectors

Independent variable	(1)	(2)
Adjustment coefficient	-0.047***	-0.383***
	(0.007)	(0.048)
Long-run coefficients		
lnk_{t-1}	1.685***	0.497***
	(0.548)	(0.020)
$RERM_{t-1}$	5.125	-0.713
	(3.160)	(0.439)
$D*RERM_{t-1}$	-5.182	2.011***
	(4.401)	(0.893
$lnOPEN1_{t-1}$	-0.925	0.242***
	(0.695)	(0.072)
$D80s*RERM_{t-1}$	-5.099	1.588*
	(5.430)	(0.953)
$DAFC*RERM_{t-1}$	25.965*	1.261*
	(13.668)	(0.708
Constant	-4.408	4.357***
	(4.195)	(0.274)
Short-run coefficients		
$\Delta\ lnq_t$	0.486***	-
	(0.080)	
$\Delta\ lnk_t$	1.084***	0.487***
	(0.091)	(0.073)
$\Delta\ lnk_{t-1}$	-0.744***	-0.279***
	(0.106)	(0.067)
$\Delta\ RERM_t$	-	0.310**
		(0.114)
$\Delta\ D*RERM_t$	-	-
$D80s$	-0.055***	0.041**
	(0.018)	(0.020)
$DAFC$	-0.130***	-0.096***
	0.021	(0.017)
Bounds test	5.45***	6.73***
Adjusted R-squared	0.75	0.79
Durbin-Watson	2.10	1.75
Normality	22.01	0.17***
Serial	1.81***	0.37***
Heteroscedasticity	1.76**	1.46***
Ramsey's test	0.28***	1.91***

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
The Bounds test refers to cointegration test statistics using the ARDL bounds test. Normality refers to *Jarque-Bera* for normal residual test statistics. Serial denotes the *Breusch-Godfrey LM* test statistics for no serial correlation. Heteroscedasticity is the *Breusch-Pagan-Godfrey* test statistics for no autoregression conditional heteroscedasticity. Ramsey's test is for no functional misspecification test statistics.
Source: Author's computation.

The coefficient of error correction term (ECT) or adjustment coefficient term is negative and statistically significant in all equations, indicating a cointegrated relationship between the explanatory variables and output growth. The size coefficient of ECT is 0.38 for the tradable sector and 0.05 for the non-tradable sector. It indicates that the adjustment speed towards steady-states takes 1.45 years to eliminate half of the exogenous shock in the tradable sector and 13.51 years in the non-tradable sector.

The result in column (1) indicates that RER misalignment and RER undervaluation have no significant impact on non-tradable output growth. The result suggests that only capital per worker and RER misalignment during the Asian financial crisis significantly impact the long-run output per worker performance. The sign for trade openness is contradicted to the initial hypothesis, but it is statistically insignificant. The result also suggests that the macroeconomic crisis and Asian financial crisis significantly reduced output per worker in the short-run. From this result, it can be concluded that the capital per worker is an important determinant in the long-term output performance of the non-tradable sector.

The estimation result for the tradable sector is reported in column (2). The signs for all variables are as expected. The long-run coefficient of the RERM is negative as predicted, but it is statistically insignificant. The D*RERM variable is positive and statistically significant, indicating that RER undervaluation improves long-term output per worker performance. An increase in RER undervaluation is expected to stimulate output per worker more than RER overvaluation by 2.01 per cent. This result also suggests the net impact of RER undervaluation on output per worker is equal to 1.3 per cent. The capital per worker has a positive sign as expected and is statistically significant at 1 per cent. A one per cent increase in capital per worker is associated with an increase in output per worker by 0.5 per cent. The coefficient of OPEN1 is positive and statistically significant at 1 per cent, indicating that a one per cent increase in trade openness is associated with a 0.24 per cent increase in output per worker.

The coefficients of both interaction term variables, D80*RERM and DAFC*RERM, are positive and statistically significant. This result demonstrates that RER misalignment during the macroeconomic crisis in the mid-1980s stimulates output per worker greater than at normal period by 1.59 per cent. Meanwhile, the RER misalignment increases output per worker during the Asian financial crisis is greater than during the normal period by 1.26 per cent. This finding suggests that exchange rate policy undervaluation help the recovery process in the tradable sector during the crisis.

In the short-run, RER misalignment and capital per worker positively impact output per worker performance with the coefficient size is 0.5 and 0.3, respectively. This result also suggests that the macroeconomic crisis increased output per worker, but the impact is modest (0.04). On the other hand, the AFC has a negative impact on output performance as expected, with the magnitude of impact is only 0.1 per cent.

These findings are broadly consistent with the theoretical evidence. There are significant differences between the size and the sign of the estimated coefficient for non-tradable and tradable sectors. RER undervaluation plays a significant role in promoting output performance in the tradable sector than other factors. This result also suggests a more open economy increases technology transfer and spillover, boosting output per worker in the tradable sector. Capital per worker played a significant role in the output expansion for both sectors; however, the impact is greater for the non-tradable sector than the tradable sector. This finding implies that greater capital use in non-tradable sector production than in tradable sector production, particularly services and construction, contributes to non-tradable expansion.

The overall pattern of the tradable result is similar to the finding of the total economy analysis. From these findings, it can be concluded that the tradable sector drives the impact of RER misalignment on overall economic performance. These findings therefore lend support to Rodrik (2008), Aizenman and Lee (2010), and Korinek and Servén (2016). A stable and competitive RER policy can produce learning-by-doing externalities in the tradable goods sector, which can compensate for institutional flaws and market failures through tradable production (Rodrik, 2008; Guzman et al., 2018).

4.6.3 Diagnostic test

All growth equations satisfy the standard diagnostic test for normality, serial correlation, heteroscedasticity, and the functional form specification test at the 1 per cent significance level. The plot of the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) are shown in Figures A4.1 to A4.3 in the Appendix. These plots suggest no evidence of structural instability in the residual of all models, and it lies within the 5 per cent confidence interval bands.

4.6.4 Robustness test

For result robustness, the model is estimated using the alternative method: the Dynamic Ordinary Least Squares (DOLS) method and the Fully Modified Least Squares (FMOLS) method. The DOLS introduced by Stock and Watson (1993) uses a parametric approach to estimate the long-run relationship between variables. This method allows for the mixed integration order of variables. DOLS addresses the spurious regression problem and reduces endogeneity bias by adding the leads and lags of the differenced cointegrated variables. FMOLS by Phillips and Hansen (1990) uses a semi-parametric approach to estimate the long-run parameter. It modifies OLS to remove the endogeneity bias from the regressor caused by cointegration. The overall result using the DOLS method differs slightly from the ARDL estimator, but nonetheless, the result of FMOLS is consistent with the ARDL estimator. It reaffirms the relationship between RER misalignment on output per worker in the total economy. The result is reported in Tables A4.6 and A4.7 in the Appendix. The empirical results for non-tradable and tradable sectors using the DOLS and FMOLS methods are consistent with the ARDL estimator. It confirms that RER misalignment and RER undervaluation have no impact on output per worker of non-tradable sector, and tradable sectors driving the impact of RER misalignment on economic growth. The result for this regression is reported in Table A4.8 to Table A4.11 in the Appendix.

There is an argument in the literature that RER misalignment impacts economic growth in a non-linear fashion. The empirical work by Razin and Collins (1999), Aguirre and Calderón (2005), and Conrad and Jagessar (2018) demonstrated a non-linear relationship between RER misalignment and economic growth. To test this hypothesis, this study added the squared terms of RER misalignment to the regression. The estimation results indicate that there is no evidence that RER misalignment, RER undervaluation, and economic growth have a non-linear relationship. The result is reported in Table A4.12 in the Appendix.

For comparison, the growth model in this study was estimated using an alternative RER misalignment which derived from the IMF index[60]. The overall result is relatively consistent with the initial ARDL estimator; however, there is a significant difference in the size of the estimated coefficient. Both RER misalignment and RER undervaluation do not play a significant role in total output per worker growth. The empirical results for the tradable and non-tradable sectors are quite similar to the initial results, implying that RER misalignment has no effect on output per worker; meanwhile, RER undervaluation is important for the output per worker expansion. Capital per worker is important for both the tradable and non-tradable sectors (see estimates reported in Tables A4.13 and A4.14 in the Appendix). The initial result using the newly constructed RER index is preferable due to its consistency with the theoretical viewpoint and is thus reported in this chapter.

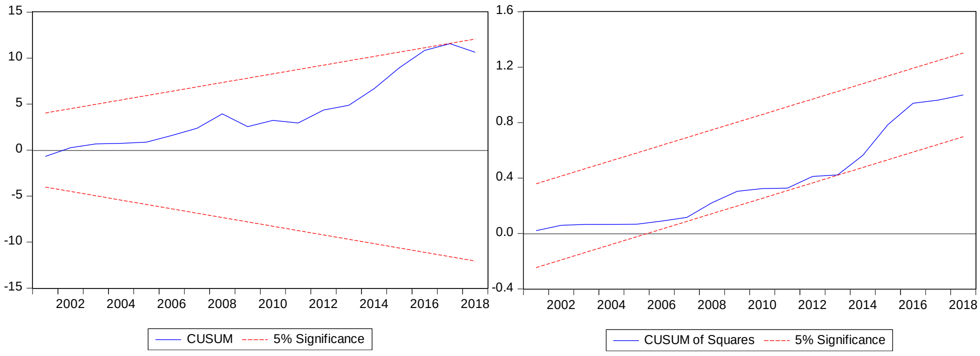
[60] The alternative RER misalignment is estimated using the formula, RERM2=[RER2-$ERER_2$/$ERER_2$], where RER2= $\prod_{j=1}^{20}\left(\frac{NER_{ijt} \text{ x } CPI_{jt}}{CPI_{it}} \right)^{wj}$

4.7 Conclusion

This chapter has investigated the impact of RER misalignment on economic growth in Malaysia during the years 1970 to 2018. The growth equation is estimated for the total economy as well as the tradable and non-tradable sectors to better capture the RER misalignment and growth relationship. While the Washington Consensus views that RER misalignment should be avoided as it hurts economic performance, recent evidence suggests that undervaluation fosters economic growth. From the empirical results, it can be concluded that the overall RER misalignment has no impact on Malaysia's economic performance. RER undervaluation, on the other hand, tends to stimulate economic growth. The disaggregated analysis conducted on the tradable and non-tradable sectors suggests that the performance of the former entirely has driven this outcome. Also, capital per worker is an important determinant of overall economic and sectoral performance. It is evident that economies with liberalised trade policies facilitate economic expansion.

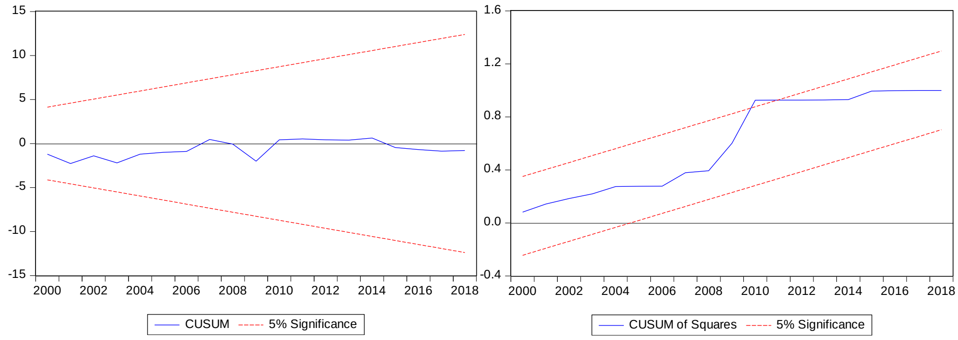
This finding suggests that RER undervaluation can serve as a second-best policy to promote the tradable sector and enhance economic performance because its impact is greater in magnitude than RER overvaluation. RER undervaluation can be achieved through nominal exchange rate depreciation, overall macroeconomic management that reduced domestic prices relative to the foreign prices, or through a combination of these two. The policy challenge in designing a long-term macroeconomic policy is ensuring that episodes of overvaluation do not outnumber those concerning undervaluation. The government is also encouraged to continue liberalising investment, trade policies and improving the quality of institutions to foster long-term economic growth.

Appendix



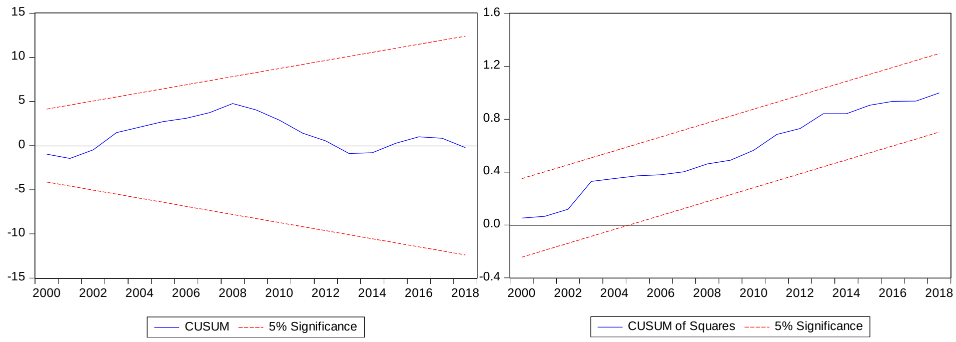
Source: Author's estimation

Figure A4.1: Plots of CUSUM and CUSUMSQ: Total economy



Source: Author's estimation

Figure A4.2: Plots of CUSUM and CUSUMSQ: Non-tradable sector



Source: Author's estimation.

Figure A4.3: Plots of CUSUM and CUSUMSQ: Tradable sector

Table A4.1: Descriptive statistics

Variable	Measurement	Unit	No. Obs.	Mean	Median	Std. Dev.	Max.	Min.
q	Real total gross domestic product per worker	RM billion	49	53.9	53.9	21.1	92.2	23.6
k	Real net capital stock per worker	RM billion	49	12.0	12.5	6.2	20.7	2.2
q^{T}	Real value-added per worker in the tradable sector	RM billion	49	67.9	59.3	32.1	122.1	23.2
k^{T}	Real net capital stock per worker in the tradable sector	RM billion	49	85.0	63.4	67.4	236.2	8.1
q^{NT}	Real value-added per worker in the non-tradable sector	RM billion	49	44.2	46.9	17.1	79.0	21.8
k^{NT}	Real net capital stock per worker in the non-tradable sector	RM billion	49	150.1	176.7	59.1	224.9	47.4
RERM	RER misalignment	% (in decimal)	49	0.0	0.0	0.1	0.2	-0.2
D*RERM	An interaction term for undervaluation	% (in decimal)	49	0.0	0.0	0.1	0.2	0.0
OPEN1	Total trade to GDP	%	49	143.4	138.3	43.3	220.4	73.4
OPEN2	Duty import revenue to total import value	%	49	3.9	3.2	3.5	11.5	0.3
D80s*RERM	An interaction term for RER misalignment and macroeconomic crisis dummy	% (in decimal)	49	0.0	0.0	0.0	0.0	-0.2
DAFC*RERM	An interaction term for RER misalignment and AFC dummy	% (in decimal)	49	0.0	0.0	0.0	0.1	0.0
DGFC*RERM	An interaction term for RER misalignment and GFC dummy	% (in decimal)	49	0.0	0.0	0.0	0.0	-0.1
D80s	Takes a value of 1 for the years 1985 and 1986, 0 otherwise	-	49	0.0	0.0	0.2	1.0	0.0
DAFC	Takes a value of 1 for the years 1998-2001, 0 otherwise	-	49	0.1	0.0	0.3	1.0	0.0
DGFC	Takes a value of 1 for the years 2008 - 2010, 0 otherwise	-	49	0.1	0.0	0.2	1.0	0.0

Source: Author's computation.

Table A4.2: Correlation statistics: Total economy

Variable	*q*	*k*	RERM	D* RERM	OPEN1	OPEN2	D80s* RERM	DAFC* RERM	DGFC* RERM	D80s	DAFC	DGFC
q	1.00											
k	0.98	1.00										
RERM	0.05	0.04	1.00									
D*RERM	-0.07	-0.06	0.86	1.00								
OPEN1	0.65	0.76	0.10	0.02	1.00							
OPEN2	-0.93	-0.97	0.03	0.17	-0.80	1.00						
D80s*RERM	0.13	0.09	0.30	0.12	0.14	-0.12	1.00					
DAFC*RERM	0.09	0.19	0.33	0.40	0.44	-0.20	0.04	1.00				
DGFC*RERM	-0.18	-0.17	0.11	0.12	-0.07	0.17	-0.03	0.04	1.00			
D80s	-0.17	-0.12	-0.23	-0.15	-0.18	0.13	-0.77	-0.05	0.03	1.00		
DAFC	0.10	0.22	0.29	0.31	0.48	-0.23	0.05	0.87	0.05	-0.06	1.00	
DGFC	0.30	0.28	-0.08	-0.19	0.13	-0.26	0.04	-0.07	-0.64	-0.05	-0.08	1.00

Source: Author's computation.

Table A4.3: Correlation statistics: Non-tradable

	q^{NT}	k^{NT}	RERM	D*RERM	OPEN1	OPEN2	D80s* RERM	DAFC* RERM	DGFC* RERM	D80s	DAFC	DGFC
q^{NT}	1.00											
k^{NT}	0.83	1.00										
RERM	0.06	0.00	1.00									
D*RERM	-0.05	-0.08	0.86	1.00								
OPEN1	0.59	0.90	0.10	0.02	1.00							
OPEN2	-0.89	-0.95	0.03	0.17	-0.80	1.00						
D80s*RERM	0.16	0.07	0.30	0.12	0.14	-0.12	1.00					
DAFC*RERM	0.08	0.31	0.33	0.40	0.44	-0.20	0.04	1.00				
DGFC*RERM	-0.18	-0.13	0.11	0.12	-0.07	0.17	-0.03	0.04	1.00			
D80s	-0.21	-0.09	-0.23	-0.15	-0.18	0.13	-0.77	-0.05	0.03	1.00		
DAFC	0.09	0.35	0.29	0.31	0.48	-0.23	0.05	0.87	0.05	-0.06	1.00	
DGFC	0.28	0.22	-0.08	-0.19	0.13	-0.26	0.04	-0.07	-0.64	-0.05	-0.08	1.00

Source: Author's computation.

Table A4.4: Correlation statistics: Tradable

	lnq^{T}	lnk^{T}	RERM	D*RERM	OPEN1	OPEN2	D80s* RERM	DAFC* RERM	DGFC* RERM	D80s	DAFC	DGFC
q^{T}	1.00											
k^{T}	0.96	1.00										
RERM	0.06	0.09	1.00									
D*RERM	-0.06	-0.03	0.86	1.00								
OPEN1	0.64	0.45	0.10	0.02	1.00							
OPEN2	-0.93	-0.85	0.03	0.17	-0.80	1.00						
D80s*RERM	0.11	0.11	0.30	0.12	0.14	-0.12	1.00					
DAFC*RERM	0.07	0.00	0.33	0.40	0.44	-0.20	0.04	1.00				
DGFC*RERM	-0.19	-0.18	0.11	0.12	-0.07	0.17	-0.03	0.04	1.00			
D80s	-0.14	-0.14	-0.23	-0.15	-0.18	0.13	-0.77	-0.05	0.03	1.00		
DAFC	0.07	0.00	0.29	0.31	0.48	-0.23	0.05	0.87	0.05	-0.06	1.00	
DGFC	0.33	0.29	-0.08	-0.19	0.13	-0.26	0.04	-0.07	-0.64	-0.05	-0.08	1.00

Source: Author's computation.

Table A4.5: Long-run and short-run dynamic results of the impact of RER on the total economy: Using OPEN2

Dependent variable ln*q*

Independent variable	(1)	(2)
Adjustment coefficient	-0.025***	-0.062***
	(0.003)	0.006
Long-run coefficients		
lnk_{t-1}	1.790	0.925
	(4.244)	(0.753)
$RERM_{t-1}$	5.020	-0.240
	(13.725)	(1.030)
$D*RERM_{t-1}$	-	4.037
		(4.836)
$lnOPEN2_{t-1}$	0.563	0.111
	(2.217)	(0.381)
$D80s*RERM_{t-1}$	9.193	3.074
	(25.822)	(3.883)
$DAFC*RERM_{t-1}$	27.853	12.601
	(84.769)	(16.146)
Constant	-5.079	2.475
	(37.465)	(6.763)
Short-run coefficients		
$\Delta\ lnk_{t}$	0.658***	0.609***
	(0.092)	(0.089)
$\Delta\ lnk_{t-1}$	-0.458***	-0.382***
	(0.095)	(0.090)
$\Delta\ RERM_{t}$	-0.058	-
	(0.049)	
$\Delta\ D*RERM_{t}$	-	-0.085***
		(0.076)
$\Delta\ DAFC*RERM_{t}$	0.920***	1.095***
	(0.149)	(0.155)
$D80s$	0.002	-0.027**
	(0.014)	(0.013)
$DAFC$	-0.102***	-0.119***
	(0.014)	(0.014)
Bounds test	10.08***	10.67***
Adjusted R-squared	0.70	0.74
Durbin-Watson	2.18	2.15
Normality	4.01***	2.20***
Serial	1.05***	0.17***
Heteroscedasticity	0.29***	0.29
Ramsey's test	1.25***	0.47***

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
The Bounds test refers to cointegration test statistics using the ARDL bounds test. Normality refers to *Jarque-Bera* for normal residual test statistics. Serial denotes the *Breusch-Godfrey LM* test statistics for no serial correlation. Heteroscedasticity is the *Breusch-Pagan-Godfrey* test statistics for no autoregression conditional heteroscedasticity. Ramsey's test is for no functional misspecification test statistics.
Source: Author's computation.

Table A4.6: Long-run impact of RER misalignment on the total economy: The DOLS model
The dependent variable is ln*q*

Independent variable	Coefficient value
Long-run coefficients	
lnk_{t-1}	0.536***
	(0.109)
$RERM_{t-1}$	-0.672
	(0.981)
$D*RERM_{t-1}$	2.077
	(1.668)
$lnOPEN1_{t-1}$	-0.082
	(0.188)
$D80s*RERM_{t-1}$	6.979***
	(1.962)
$DAFC*RERM_{t-1}$	-3.255**
	(1.478)
Constant	6.326***
	0.438
R-squared	0.99
Adjusted R-squared	0.97

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
Source: Author's estimation.

Table A4.7: Long-run impact of RER misalignment on the total economy: The FMOLS model
The dependent variable is ln*q*

Independent variable	Coefficient value
Long-run coefficients	
lnk_{t-1}	0.689***
	(0.060)
$RERM_{t-1}$	0.433
	(0.490)
$D*RERM_{t-1}$	0.371
	(0.886)
$lnOPEN1_{t-1}$	-0.261*
	(0.140)
$D80s*RERM_{t-1}$	1.955**
	(0.893)
$DAFC*RERM_{t-1}$	-0.94
	(0.915)
Constant	5.765***
	(0.374)
R-squared	0.94
Adjusted R-squared	0.94

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
Source: Author's estimation.

Table A4.8: Long-run impact of RER misalignment on the non-tradable: The DOLS model

The dependent variable is $\ln q^{NT}$

Independent variable	Coefficient value
Long-run coefficients	
lnk_{t-1}	0.805**
	(0.375)
$RERM_{t-1}$	-0.221
	(2.012)
$D*RERM_{t-1}$	1.731
	(3.465)
$lnOPEN1_{t-1}$	-0.401
	(0.538)
$D80s*RERM_{t-1}$	12.003***
	(3.652)
$DAFC*RERM_{t-1}$	-4.009
	(2.911)
Constant	3.143
	(2.090)
R-squared	0.94
Adjusted R-squared	0.87

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
Source: Author's estimation.

Table A4.9: Long-run impact of RER misalignment on the non-tradable: The FMOLS model

The dependent variable is $\ln q^{NT}$

Independent variable	Coefficient value
Long-run coefficients	
lnk_{t-1}	1.046***
	(0.215)
$RERM_{t-1}$	1.022
	(0.982)
$D*RERM_{t-1}$	-0.102
	(1.78)
$lnOPEN1_{t-1}$	-0.590
	(0.352)
$D80s*RERM_{t-1}$	3.505*
	(1.805)
$DAFC*RERM_{t-1}$	-1.565
	(1.818)
Constant	1.209
	(1.232)
R-squared	0.78
Adjusted R-squared	0.74

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
Source: Author's estimation.

Table A4.10: Long-run impact of RER misalignment on the tradable: The DOLS model
The dependent variable is $\ln q^{T}$

Independent variable	Coefficient value
Long-run coefficients	
lnk_{t-1}	0.428***
	(0.020)
$RERM_{t-1}$	0.137
	(0.266)
$D*RERM_{t-1}$	1.184**
	(0.512)
$lnOPEN1_{t-1}$	0.314***
	(0.042)
$D80s*RERM_{t-1}$	0.487
	(0.680)
$DAFC*RERM_{t-1}$	-2.435***
	(0.483)
Constant	4.830***
	(0.154)
R-squared	0.999
Adjusted R-squared	0.997

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
Source: Author's estimation.

Table A4.11: Long-run impact of RER misalignment on the tradable: The FMOLS model
The dependent variable is $\ln q^{T}$

Independent variable	Coefficient value
Long-run coefficients	
lnk_{t-1}	0.503***
	(0.012)
$RERM_{t-1}$	0.040
	(0.176)
$D*RERM_{t-1}$	0.583*
	(0.317)
$lnOPEN1_{t-1}$	0.204***
	(0.040)
$D80s*RERM_{t-1}$	-0.109
	(0.317)
$DAFC*RERM_{t-1}$	-0.837**
	(0.330)
Constant	4.470***
	(0.134)
R-squared	0.991
Adjusted R-squared	0.990

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
Source: Author's estimation.

Table A4.12: Long-run and short-run dynamic results for the impact of RER misalignment on the total economy: Non-linear relationship

The dependent variable is ln$q$

Independent variable	Coefficient value
Adjustment coefficient	-0.074***
	(0.007)
Long-run coefficients	
lnk_{t-1}	0.823***
	(0.164)
$RERM_{t-1}$	2.042
	(3.790)
$RERM2_{t-1}$	12.674
	(21.926)
$D*RERM_{t-1}$	-2.860
	(6.838)
$D*RERM2_{t-1}$	14.103
	(19.241)
$lnOPEN1_{t-1}$	-0.071
	(0.307)
$D80s*RERM_{t-1}$	2.425
	(1.611)
$DAFC*RERM_{t-1}$	13.866**
	(5.832)
Constant	3.818
	(1.038)
Short-run coefficients	
$\Delta\ lnk_{t}$	0.563
	(0.089)
$\Delta\ lnk_{t-1}$	-0.277
	(0.088)
$\Delta\ RERM_{t}$	-
$D*RERM_{t-1}$	-0.512
	(0.078)
$\Delta\ lnOPEN1_{t}$	0.1123
	(0.040)
D80s	-0.031
	0.012
DAFC	-0.136
	(0.015)
Bounds test	8.82***
Adjusted R-squared	0.75
Durbin-Watson	2.03
Normality	2.10***
Serial	0.09***
Heteroscedasticity	0.72***
Ramsey's test	0.82***

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
The Bounds test refers to cointegration test statistics using the ARDL bounds test. Normality refers to *Jarque-Bera* for normal residual test statistics. Serial denotes the *Breusch-Godfrey LM* test statistics for no serial correlation. Heteroscedasticity is the *Breusch-Pagan-Godfrey* test statistics for no autoregression conditional heteroscedasticity. Ramsey's test is for no functional misspecification test statistics.
Source: Author's computation.

Table A4.13: Long-run and short-run dynamic results for the impact of RER misalignment on the total economy: Using alternative RER index

Dependent variable: ln$q$

Independent variable	Coefficient value
Adjustment coefficient	-0.056***
	(0.006)
Long-run coefficients	
lnk_{t-1}	0.496**
	(0.199)
$RERM_{t-1}$	0.020
	(0.014)
$D*RERM_{t-1}$	0.003
	(0.028)
$lnOPEN1_{t-1}$	0.168
	(0.439)
$D80s*RERM_{t-1}$	0.035
	(0.032)
$DAFC*RERM_{t-1}$	0.139**
	(0.067)
Constant	5.882
	(1.480)
Short-run coefficients	
$\Delta\, lnk_t$	0.638***
	(0.096)
$\Delta\, lnk_{t-1}$	-0.473***
	(0.100)
$\Delta\, RERM_t$	-0.0003
	(0.0005)
$D80s$	-0.006
	(0.015)
$DAFC$	-0.160***
	(0.020)
Bounds test	8.13***
Adjusted R-squared	0.67
Durbin-Watson	2.05
Normality	6.44*
Serial	0.70***
Heteroscedasticity	0.58***
Ramsey's test	2.68***

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.

The Bounds test refers to cointegration test statistics using the ARDL bounds test. Normality refers to *Jarque-Bera* for normal residual test statistics. Serial denotes the *Breusch-Godfrey LM* test statistics for no serial correlation. Heteroscedasticity is the *Breusch-Pagan-Godfrey* test statistics for no autoregression conditional heteroscedasticity. Ramsey's test is for no functional misspecification test statistics.

Source: Author's computation.

Table A4.14: Long-run and short-run dynamic results for the impact of RER misalignment on non-tradable and tradable sectors: Using alternative RER index

Dependent variable	$\ln q^{NT}$	$\ln q^{T}$
Independent variable	(1)	(2)
Adjustment coefficient	-0.045***	-0.447***
	(0.007)	(0.053
Long-run coefficient		
lnk_{t-1}	1.171**	0.430***
	(0.433)	(0.023)
$RERM_{t-1}$	0.032	-0.003
	(0.029)	(0.002)
$D{*}RERM_{t-1}$	-0.020	0.012***
	(0.041)	(0.005)
$lnOPEN1_{t-1}$	-0.632	0.332**
	(0.685)	(0.070)
$D80s{*}RERM_{t-1}$	-0.037	0.015**
	(0.057)	(0.005)
$DAFC{*}RERM_{t-1}$	0.232**	0.007*
	(0.114)	(0.004)
Constant	0.261	4.679***
	(2.723)	(0.197)
Short-run coefficient		
$\Delta\ lnq_{t}$	0.566***	-
	(0.084)	
$\Delta\ lnk_{t}$	0.961***	0.470***
	(0.094)	(0.073)
$\Delta\ lnk_{t-1}$	-0.897***	-0.314***
	(0.115)	(0.066)
$\Delta\ RERM_{t}$	-	-0.003***
		(0.001)
$\Delta\ lnOPEN1_{t}$	-	-0.036
		(0.061)
$\Delta\ lnOPEN1_{t-1}$	-	-0.293***
		(0.065)
D80s	-0.038**	0.046**
	(0.018)	(0.020)
DAFC	-0.179***	-0.125***
	(0.031)	(0.019)
Bounds test	4.22***	7.40***
Adjusted R-squared	0.72	0.74
Durbin-Watson	2.25	1.79
Normality	8.58*	0.87
Serial	5.57	0.18***
Heteroscedasticity	1.18***	0.68***
Ramsey's test	0.28***	6.54*

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
The Bounds test refers to cointegration test statistics using the ARDL bounds test. Normality refers to *Jarque-Bera* for normal residual test statistics. Serial denotes the *Breusch-Godfrey LM* test statistics for no serial correlation. Heteroscedasticity is the *Breusch-Pagan-Godfrey* test statistics for no autoregression conditional heteroscedasticity. Ramsey's test is for no functional misspecification test statistics.
Source: Author's computation.

CHAPTER 5: REAL EXCHANGE RATE AND EXPORT PERFORMANCE

Abstract

This chapter examines the role of international competitiveness as measured by RER in Malaysia's export performance. The analysis focuses on how the country's engagement in manufacturing production networks and China's rise have impacted export performance. Export functions are estimated using a panel dataset of merchandise exports covering the period 1992-2019. Exports are disaggregated into products that are exported within global production networks (GPNs) and non-GPN products. The Autoregressive Distributed Lag (ARDL) approach estimates the long-run and short-run relationships between RER and exports. The findings support the important role of RER in exports. The country's participation within GPNs seemed to increase the impact of RER in export performance. This result also supports the view that China's rise in the global economy adversely affects Malaysia's ability to export products, with GPN products facing greater competition from China's rise compared to other products. World demand, foreign direct investment, and supply factors, on the other hand, promote Malaysia's exports.

5.1 Introduction

The purpose of this chapter is to examine the impact of international competitiveness as measured by the real exchange rate (RER) in Malaysia's export performance. The empirical analysis aims to test two hypotheses: (a) the sensitivity of exports to RER changes differs between manufactured goods exported within global production network (GPN) products and other conventional products; and (b) China's rise undermines Malaysia's export performance. To test these hypotheses, export functions are estimated using a panel dataset from 1992 to 2019 for five major export categories, with GPN exports delineated from manufacturing exports.

Malaysia is widely considered one of the most successful export-oriented industrialised developing countries. The country was a leading exporter of rubber and tin during the colonial era and early years of independence, and more recently, palm oil. The country's export structure has dramatically shifted from primary commodities to manufactured goods underpinned by a decisive shift in economic policy towards outward orientation and increased involvement in global production sharing (GPS) [61]. GPS–the internationalisation of production by splitting production components beyond national borders within vertically integrated global industries–has altered the production structure in many developing countries. It creates new opportunities for specialisation within the GPNs. Malaysia's participation in the GPS began in 1972 with the relocation of some low-assembly activities from US multinational enterprises (MNEs) (Athukorala and Kohpaiboon, 2015). Since then, the country's specialisation within GPNs has grown significantly, making up for more than two-thirds of manufacturing exports; as a result, Malaysia has emerged as a major and successful participant in the GPNs (Athukorala, 2016). However, these export dynamics have declined in recent years. The share of GPN in total

[61] Also known as 'slicing the value chain' (Krugman et al., 1995), 'international production sharing' (Ng and Yeats, 2001) and 'vertical specialization' (Hummels et al., 2001)

manufacturing exports fell from around 80 per cent in 2000 to 66.5 per cent in 2019, partly due to high commodity prices, including processed natural resource products and the rise of China as a major player as the final assembly centre in the world. The share of China's exports to the world's total exports increased significantly from 2.4 per cent in 1988 to 13.7 per cent in 2019[62]. This rapid acceleration of China as a major trading partner has raised serious ramifications for other countries' export-related opportunities.

Increased participation in GPNs could have implications, particularly the role of RER as an export determinant, and China's rise may also affect countries' exports. This issue has attracted numerous researchers to study the subject, and the results are mixed. Furthermore, cross-country analysis dominates the literature, and it assumes that countries have similar economic and institutional structures, which is unrealistic. Cross-country analysis only captures the general relationship between variables of interest. Based on these limitations, an in-depth study of individual countries' experiences is vital for policy design. Only a few studies have been done on Malaysia on this theme. Most previous studies have not examined the impact of RER on GPN products, and neither did they consider China's rise in their trade performance analyses. Given that a structural shift in the global trade pattern results from countries' participation in GPS, this approach of analysing the trade performance is less relevant (Jones and Kierzkowski, 2001a; Helpman, 2011; Athukorala, 2016). Standard trade analysis also may result in misleading inferences due to a country's growing involvement in global production yet having to face the threat of China's exports competition (Athukorala and Yamashita, 2006; Athukorala, 2009).

Malaysia provides an interesting case study of this subject for several reasons. First, the country has undergone rapid growth and dramatic structural transformations from agriculture to manufacturing-based exports, and Malaysia plays a pivotal role in GPS. Second, the

[62] The calculation is based on data of the SITC Rev.3 from the UN Comtrade database.

country's exchange rate policy is often cited as a contributory factor to its export-oriented success. Lastly, the empirical evidence related to export determinants of trade fragmentation in Malaysia is still limited. Segregation analysis by product categories will contribute to the policy debate on the impact of RER in export performance.

This chapter contributes to the existing literature in five ways. First, the analysis uses the newly constructed RER series for these product categories, which employs the US import price indices as proxies for the world price and the Malaysian implicit deflator derived from disaggregated national income data as proxies for the domestic price. The US import price indices are based on actual transaction prices obtained directly from foreign trade and therefore are not subject to the limitations of unit value indices widely used in trade flow analysis (Lipsey et al., 1991; BLS, 1997). Second, empirical analysis is done on different categories of exports (total non-oil products, non-oil primary products, manufacturing products) and decomposes manufacturing products into GPN products and non-GPN products. Third, this study incorporates the implications of China's rise in the export performance analysis. Fourth, this study uses a genuine trade price index[63] at the disaggregated level and adequately covers the study period. Fifth and lastly, it offers new empirical evidence garnered from a country-specific analysis, considering the different aspects of structure and institutions of the country compared to a cross-country investigation. To the best of the author's knowledge, this is the first study to explore the impact of RER in export performance, specifically focusing on different export categories considering the export dynamism of the GPN products and non-GPN products, and the implications of China's rise in Malaysia's exports.

This chapter is organised as follows. Section 5.2 presents a literature survey on the relationship between RER and export performance. Section 5.3 covers a brief policy context. The export performance and trade patterns are presented in section 5.4. Model specification is

[63] These price indices are based on actual foreign trade transaction prices (BLS, 1997).

explained in section 5.5. The source of data, variable construction and data segregation are discussed in section 5.6, and the estimation method is clarified in section 5.7. Section 5.8 reports the results and discussion, and lastly, section 5.9 summarises the key results and policy recommendations.

5.2 Literature review

The relationship between RER and export performance has been studied extensively. RER depreciation is widely associated with export improvement. Empirical evidence from multi-country analysis by Balassa (1990), Arslan and Van Wijnbergen (1993), Sekkat and Varoudakis (2000), Fang et al. (2006), Jongwanich (2009), Freund and Pierola (2012), Eichengreen et al. (2014), Ahmed et al. (2017), Palazzo and Rapetti (2017), and Xie and Baek (2020) concludes that RER depreciation promotes export growth. Evidence from individual country-based analysis by Campa (2004), Das et al. (2007), Thorbecke and Smith (2010), Greenaway et al. (2012), and Paudel and Burke (2015) suggest that RER appreciation reduces exports. In contrast, studies by Abeysinghe and Yeok (1998), Wilson and Tat (2001), Wilson (2001), Bernard and Jensen (2004), and Greenaway et al. (2010) argue that the exchange rate has no impact on exports.

Most of the above studies analyse trade performance using a standard approach based on countries producing trade goods entirely in one country. In this modern era of rapid technological advances and innovation in transportation and communications, firms can separate their production stages, thus allowing different tasks to be done in other countries. Previous findings may no longer be adequate to understand the dynamics of a country's exports. The growing importance of GPS in global manufacturing trade has altered the global economy's trade structure and has several implications for the role of RER as an export determinant factor. In light of this changing landscape, a standard trade analysis may produce misleading inferences and incorrect conclusions about economic integration through trade (Athukorala and Yamashita, 2006; Athukorala, 2011; Athukorala and Menon, 2015).

There are two opposing viewpoints regarding the implications of growing GPS for the sensitivity of trade flows to relative price changes. The first point of view is that GPS makes trade flows more sensitive to relative price changes (Obstfeld, 2001). The relocation of production facilities in other countries increases firms' substitutability response, allowing firms to respond quickly to price changes by shifting the production tasks to other countries and switching the source of production inputs (between domestic and imported input) (Obstfeld, 2002). Additionally, better information increases firms' response to cost differentials and the substitutability of production inputs (Rauch and Trindade, 2003).

On the other hand, the second viewpoint argues that growing participation in GPS tends to reduce trade flows sensitivity with the changes in international prices (Jones, 2000; Arndt and Kierzkowski, 2001; Burstein et al., 2008). This argument is based on two premises. The first is the limited substitutability of parts and components. Production facilities in different countries normally specialise in different production stages. Thus, the task cannot be easily substituted with other countries. Second, the high cost of establishing service links and production operations in other countries is evident. As a result, business decisions become less sensitive to relative price and cost changes.

Only a few studies have explored the relationship between RER and export performance in light of GPS growing importance in global trade. Athukorala and Suphachalasai (2004), Arndt and Huemer (2007), Jongwanich (2010), Athukorala and Khan (2016), Ahmed et al. (2017), and Sato et al. (2020) demonstrated a weak relationship between RER and export performance. Athukorala and Suphachalasai (2004) examined the role of RER in Thailand's export of manufactured products and four sub-categories using a dataset from 1995 to 2003. They found that elasticity varies significantly across the four sub-categories, with machinery and transport equipment having the lowest RER elasticity. Arndt and Huemer (2007) examined the impact of international production sharing between the United States (US) and Mexico between 1989 and 2002, emphasising that cross-border sharing of production reduces trade responsiveness to exchange rate movements. In other words, trade parts and components are not sensitive to RER changes. Jongwanich (2010) estimated the performance for three different export categories in eight economies in East and Southeast Asian countries from 1993 to 2008, and found that rapid diversification to assembly/component specialisation tends to weaken the link between RER and export performance. Athukorala and Khan (2016) examined the impact of the GPS on the price elasticity of international trade using panel data from 1990 to 2007. They found that parts and components are less sensitive to relative price changes than final goods. Ahmed et al. (2017) investigated the impact of the RER on manufacturing exports in 46 countries from 1992 to 2012 and discovered that the more participation there is in the global production process, then RER elasticity of real manufacturing exports diminishes. Using monthly dataset from 2001 to 2018, Sato et al. (2020) examined the effect of RER appreciation on exports for nine[64] Asian countries and confirmed that the degree of RER effect declines as the global value chains increase.

China's current rise in the global economy has raised considerable attention among policymakers and researchers in recent years. The negative impact has been documented by Greenaway et al. (2008), Jenkins and Edwards (2015), Módolo and Hiratuka (2017), Baiardi and Bianchi (2019), and Heid et al. (2021). Greenaway et al. (2008) examined the impact of China's export growth on Asian countries' exports to third markets between 1990 and 2003. They found that China's growth reduces Asian neighbours' exports to the global market, with the effects being more pronounced for high-income Asian exporters[65]. Jenkins and Edwards (2015) examined the effect of China's competition on South African manufactured exports

[64] China, Japan, Indonesia, South Korea, Malaysia, the Philippines, Singapore, Taiwan, and Thailand
[65] For example, South Korea, Singapore, and Japan

during 1997-2010, and they found that China crowded out of all types of manufactured export goods with the largest impact on low-technology products. Módolo and Hiratuka (2017) examined the impact of China's exports expansion on developing countries during 2000-2009, and they asserted that China's competition undermined the exports, especially in emerging Asian countries. Baiardi and Bianchi (2019) examined the determinants of China's textile exports to Asian countries during 2001-2016, and they found a negative association between China's rise and export growth. Heid et al. (2021) assessed the impact of competition from China on Spanish firms' export performance from 1997 to 2016, and they found that China's competition reduces export revenue.

The positive impact of China's rising exports has been noted by Athukorala (2009) and Athukorala (2011). Athukorala (2009) found that China's exports expansion created new opportunities for other East Asian countries to specialise in the production of GPN products between 1992 and 2005. Later on, Athukorala (2011) reaffirmed a positive relationship between East Asia and China by analysing the dynamic of GPS and network trade in East Asia from 1992 to 2007.

The ambiguous impacts of China's export growth on a country's exports have been documented by Ahearne et al. (2003), Eichengreen et al. (2007), Kong and Kneller (2016), and Pham et al. (2017). Ahearne et al. (2003) examined what China's exports growth meant for eight Asian countries from 1981- 2001, and found it had little effect. They suggest that the relationship between China and emerging Asia countries is a competitive one for specific products, but a complementarity one at the aggregate level. Eichengreen et al. (2007) analysed China's growth in the exports of other Asian countries during 1990-2003, demonstrating that its exports positively affected exports of high-income Asian countries[66] and middle-income[67]

[66] These were Japan, Singapore, and South Korea.
[67] Malaysia and the Philippines.

countries but reduced the exports of low-and middle-income Asian countries[68]. Pham et al. (2017) looked at the effects of Chinese exports on competitors in the high-tech sector from 1993 to 2012. They found that while China's exports displaced those of other developing and emerging economies[69], they were complementary to high-tech exports of advanced economies[70].

Even though the growing importance of GPS to the economy is well documented, there is limited research on the impact of RER in Malaysia’s exports, particularly the implications of RER for GPN exports and the impact of China’s rising exports. Earlier studies on Malaysia were conducted by Doraisami (2004), Wong and Tang (2011), Bahmani-Oskooee and Harvey (2011), Wong (2017), and Wong (2019), who examined the link between RER and export performance. These studies used a standard approach to examine the effect of RER variability and volatility in Malaysia’s exports, and the results were mixed.

Wong and Tang (2011) examined the effects of exchange rate volatility on the semiconductors exports from 1990 to 2001 and found RER variability reduces exports. Bahmani-Oskooee and Harvey (2011) investigated the trade flow between Malaysia and the US using disaggregated trade data by industry during 1971-2006. They noted that exchange rate volatility significantly affects most industries in the short-run, with some industries being positively and negatively affected in the long-run. Wong (2019) examined the effect of exchange rate volatility on Malaysia's bilateral total export and on sub-categories of individual Standard International Trade Classification (SITC) product exports with China, Singapore, Japan, South Korea, and the US using monthly data from 2010 to 2016. It was found that RER volatility impacts Malaysia's export. Kam (2015) investigated the determinants of international fragmentation production in Malaysia using the information, communications and

[68] Bangladesh, Cambodia, Pakistan and Sri Lanka.
[69] Malaysia, Singapore,Thailand and Vietnam.
[70] Japan, OECD countries, and South Korea.

telecommunications industries data from 1990 to 2008. It emerged that income and domestic prices have a conditional effect on trade flow.

Most of the literature on Malaysia analysed export performance based on the traditional concept of horizontal specialisation (except for Kam, 2015) and has not considered China's rise in their analysis. In terms of methodology, the RER index in these studies was constructed using a variety of methods. Some studies pay less attention to key theoretical aspects when constructing the RER index. Given this context, this chapter investigates the impact of RER in Malaysia's export performance by separating manufacturing exports into GPN and non-GPN products, also taking into account China's rise in the world economy in trade analysis. This chapter uses a newly constructed RER index based on the US price import index of each product to represent the world price, while Malaysia's implicit deflator at disaggregated category represents the domestic price index.

5.3 Policy context

Malaysia's export structure during early independence primarily focused on primary commodities such as rubber and tin, which constituted about 69.1 per cent of total exports in 1960. Exported products have diversified over time, and the share of rubber and tin exports dropped significantly to 25 per cent in 1975. The focus shifted to palm oil, timber, petroleum, and manufactured goods, and these products accounted for 60 per cent of total exports. In 1987, manufactured goods had surpassed other products as the largest export category, accounting for 45 per cent of total exports. The share of manufactured goods increased steadily throughout the years, reaching nearly 85 per cent of total exports in 2019.

The changes in the country's export structure were underpinned by the liberalisation in economic policy and the implementation of development strategies in the early 1970s, which emphasised a more export-oriented strategy. Malaysia's economy has been open since the colonial era, and the open-door trade regime and investment policy were continued after independence. Government policy in the early 1960s favoured mild import substitution industrialisation strategies. However, unlike most other developing countries, Malaysia's industrialisation policy was implemented without imposing direct import restrictions and establishing state-owned enterprises (Lim, 1992). The import tariff was the main instrument for promoting domestic manufacturing (Ariff, 1991; Lim, 1992; Alavi, 1996). The industrialisation strategy shifted to export-oriented in the late 1960s with the introduction of the Investment Incentive Act 1968. This legislation set out to encourage manufactured exports by improving the investment climate in the country through targeted incentives. Tax incentives included pioneer status, export incentives, investment tax credit, locational incentives, labour utilisation relief, and hotel incentives (Karunaratne and Abdullah, 1978).

The macroeconomic imbalances in the mid-1980s resulted in significant policy reforms. The government placed a greater emphasis on the private sector's involvement in the economy and an outward-oriented strategy. The reforms witnessed a significant change in the tariff, investment, and labour markets. Along with tariff reductions, also removed were quantitative import restrictions and foreign portfolio investment restrictions. The government also introduced the Promotion of Investment Act 1986 on 1 January 1986 to replace the Investment Incentives Act 1968. It is part of the policy reform to promote investment by offering generous incentives to the private sector and relaxing some ethnic restrictions on company ownership. The labour-market reforms helped Malaysia become a more cost-competitive and attractive location for internationalised production strategies. A well-developed infrastructure, good governance, and a skilled workforce created a favourable environment for investment and business activities.

The Asian Financial Crisis (AFC) in 1997/1998 halted economic growth. The massive short-term capital outflow and a sharp depreciation of national currency paved the way for introducing selective capital control measures and a fixed exchange rate policy. The capital control was only imposed on short-term flows; meanwhile, profit remittance and repatriation of capital related to the FDI continued to flow freely. With the various measures put in place to ensure macroeconomic and financial stability, the long-term government's commitment to open to trade and investment remained.

Malaysia continued with the export-oriented industrialisation policy after the crisis. Since then, the government has continued to liberalise trade policies and provide various investment incentives. Malaysia is also actively involved in the multilateral and bilateral trade cooperation at the international level and has been a member of the General Agreement on Tariffs and Trade (GATT), the World Trade Organization (WTO), the ASEAN Preferential Trading Agreement (APTA), the ASEAN Free Trade Agreement (AFTA), and the Asia Pacific Economic Cooperation (APEC). As part of its commitment, the tariff structure of Malaysia has been subjected to major changes and the average tariff rate further reduced.

5.4 Export performance

5.4.1 Trends

The country's total merchandise export[71] earnings increased significantly from US$2 billion in 1970 to more than US$237 billion in 2019. This increase has been underpinned by significant shifts in exports changing from primary commodities towards manufactured goods. The proportion of total manufactured goods in total net oil exports increased from around 6 per cent in the 1960s to more than 80 per cent in the late 1990s and has remained around that level since then (Table 5.1). The total value of exports increased significantly from US$1.3 billion in the late 1960s to more than US$200 billion in the 2010s. The total net exports of oil (referred to as total non-oil exports) value also increased, from US$1.2 per cent in the 1960s to US$185.3 in

[71] Based on data SITC 0 – SITC 9 from the UN Comtrade database.

the second half of the 2010s. The average share of total non-oil exports to the world's non-oil exports steadily increased from 0.7 per cent in the 1960s to 1.5 per cent in the second half of the 1990s. The global financial crisis in 2008 and economic slowdown in 2015 hampered export performance, resulting in a drop to 1.2 per cent in the 2010s. The export growth pattern exhibited an upward and downward trend with minor fluctuations between 1964 and 1994, and the export growth has steadily declined since 1995.

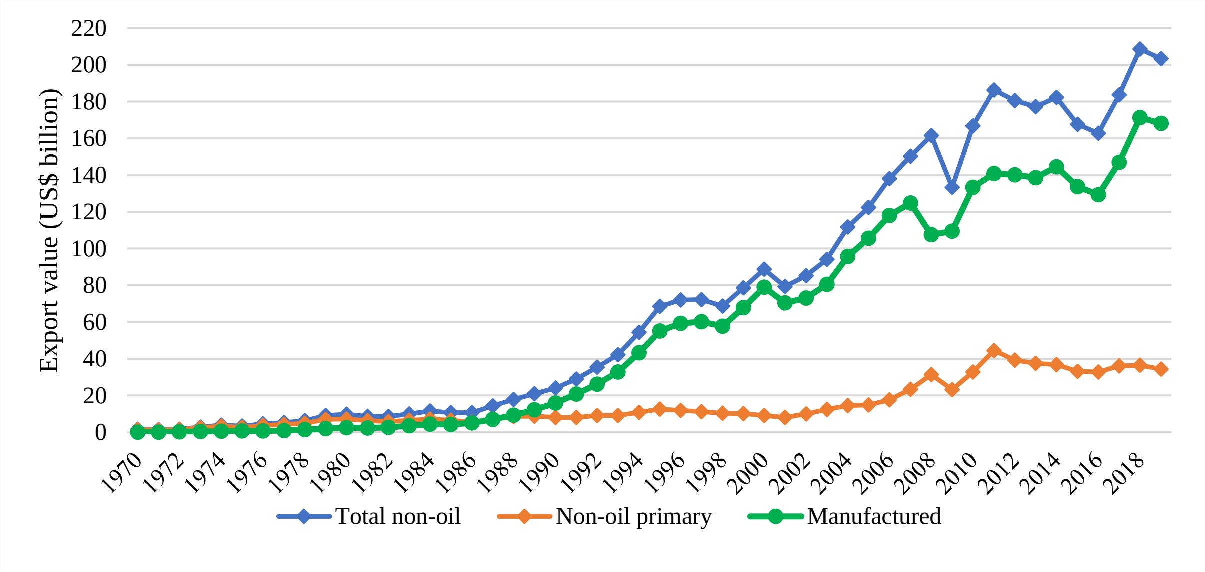
Table 5.1: Key indicators of Malaysia's export performance[1]

Year	Value of total exports (US$ billion)	Value of total non-oil exports in (US$ billion)	Share of Malaysia's non-oil exports in world non-oil exports (%)	Share of manufacturing in total non-oil exports from Malaysia (%)	Export growth (%)
1965-69	1.3	1.2	0.7	5.9	8.7
1970-74	2.5	2.3	0.6	10.5	23.8
1975-79	6.7	5.7	0.6	19.5	20.0
1980-84	13.5	9.7	0.7	31.2	5.5
1985-89	18.7	14.9	0.7	49.3	13.7
1990-94	42.1	37.1	1.1	73.7	21.1
1995-99	77.6	72.0	1.5	83.3	8.2
2000-04	102.1	91.9	1.5	86.9	7.8
2005-09	166.3	141.1	1.3	80.7	4.2
2010-14	222.7	178.6	1.2	78.1	6.9
2015-19	217.8	185.3	1.2	80.8	2.6

Note: (1) The figures constitute a simple 5-year average.
Source: Compiled from the UN Comtrade database, <https://comtrade.un.org/db/dqQuickQuery.aspx?>.

5.4.2 Commodity composition of manufactured exports

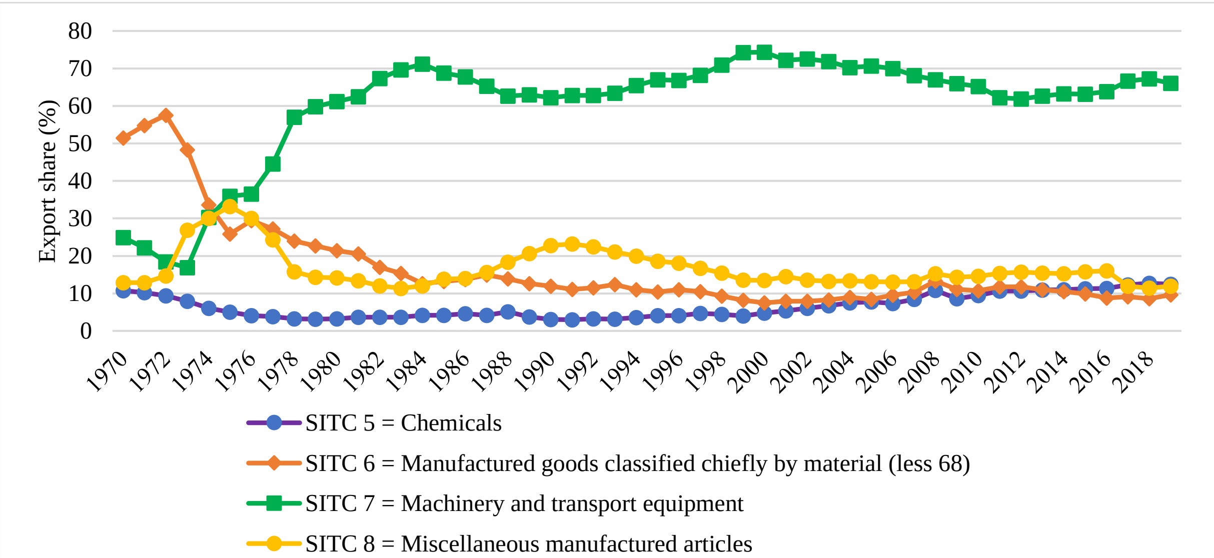
In the 1960s, Malaysia's total exports were dominated by agriculture-based products. The composition of exported goods has changed, with manufactured products making up the majority of total non-oil exports (Figure 5.1).



Source: Compiled from the UN Comtrade database, <https://comtrade.un.org/db/dqQuickQuery.aspx?>.

Figure 5.1: Malaysia's exports: Total non-oil, non-oil primary and manufactured products

The breakdown of total manufacturing exports into subcategories: chemicals and related products (SITC 5); manufactured goods classified chiefly by material (SITC 6); machinery and transport equipment (SITC 7); and miscellaneous manufactured articles (SITC 8) are depicted in Figure 5.2 below.

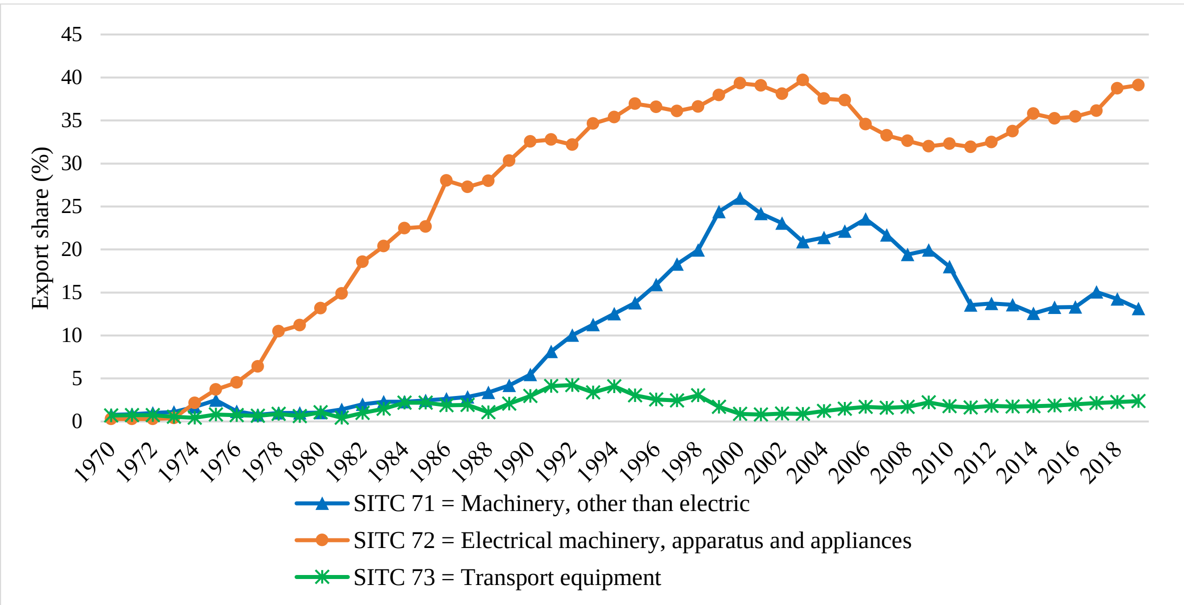


Source: Author’s computation based on data from the UN Comtrade database, <https://comtrade.un.org/db/dqQuickQuery.aspx?>.

Figure 5.2: Share of sub-category products in total manufacturing exports

Figure 5.2 depicts the changes in the export composition of subcategory products within total manufacturing. In 1970, the share of total manufacturing exports was dominated by SITC 6, which accounted for 51.5 per cent, followed by SITC 7, SITC 5, and SITC 8, with their shares being 24.9 per cent, 11.3 per cent, and 10.8 per cent, respectively. Altogether they constitute two-thirds of the total non-oil exports. However, after 1975, SITC 7 grew rapidly and became the most dynamic component, dwarfing SITC 6 and SITC 8 exports. By 2019, the share of SITC 7 had climbed up to 66.0 per cent of total manufacturing exports; meanwhile, SITC 5, SITC 6, and SITC 8 altogether accounted for only 34 per cent of total manufacturing exports.

The export patterns clearly demonstrate that Malaysia's export components are heavily concentrated in the SITC 7, indicating the dominance of outsourcing activity in the manufacturing sector. Figure 5.3 depicts the breakdown of SITC 7 into machinery and others (SITC 71), electrical machinery, apparatus and appliances (SITC 72), and transport equipment (SITC 73).



Source: Author’s computation based on data from the UN Comtrade database, <https://comtrade.un.org/db/dqQuickQuery.aspx?>.

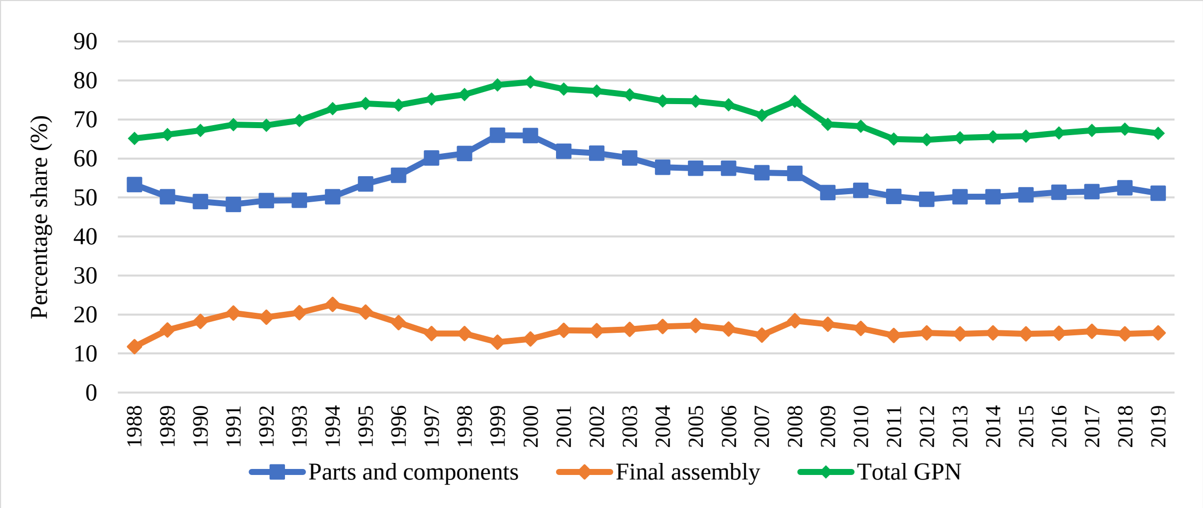
Figure 5.3: Share of three sub-category products in total non-oil exports

Within SITC 7, the export component is heavily concentrated in SITC 72. The proportion of SITC 72 exports has increased rapidly from only 3.7 per cent in 1975 to 39.3 per cent in 2000. With an exception of 2008, the share began to decline in 2001 but remains above 30 per cent of total non-oil exports. SITC 71 also shows a similar pattern, rising in 1976 from 0.7 per cent to 26.0 per cent in 2000 before declining to 13.1 in 2019. The share of SITC 73 remains the smallest with the accounted share only below 5 per cent for the period. The rapid growth of exports within SITC 7 products reflects the growing importance of international product fragmentation (Jones and Kierzkowski, 2001b; Athukorala, 2005).

5.4.3 Global production sharing and manufacturing exports

This section uses data compiled from the UN Comtrade database based on SITC Revision 3[72] (Rev. 3) to get a clear picture of Malaysia's involvement in GPNs. The delineation of GPN products from the standard trade data is done using the classification system developed by Athukorala (2014). This system has expanded the product coverage of the original classification developed by Yeats (2001) based on SITC Rev 3., and further disaggregated GPN products into parts and components (P&C) and final assembly (FA). Yeats' (2001) product list only covered P&C. The variations in product categories are the limitations in classifying GPN and non-GPN products. This study classifies the GPN and non-GPN products according to the method proposed by Athukorala (2014) and Athukorala (2019), which captures both parts and components and final assembly using SITC data at a 5-digit level. Given that GPN products capture both parts and components and final assembly, this classification better reflects the country's involvement in the global value chains. The product list is given in Table A5.1 in the Appendix.

[72] Data is only available starting in the year 1988.



Source: Author's computation using data from the UN Comtrade database, <https://comtrade.un.org/db/dqQuickQuery.aspx?>.

Figure 5.4: Share of GPN products in total manufacturing exports

The figure demonstrates that the share of total GPN products increased steadily from 65 per cent in 1988 to 79.6 per cent in 2000. This upward pattern reflects Malaysia's reliance on international product fragmentation as part of its export strategy (Athukorala, 2005). Decomposition of the total GPN products is into P&C and FA products show that P&C accounts for a sizable portion of total manufacturing. P&C accounted for 65.8 per cent of total manufacturing exports in 2000, up from 49.0 per cent in 1990. In contrast, the FA share of total manufacturing exports steadily decreased from 18.3 per cent in 1990 to 13.7 per cent in 2000. Since 2001, the share of total GPN exports has steadily declined, mainly due to a decrease in P&C exports. The decline in P&C exports is attributed to the transition from standard assembly and testing to more advanced activities in the manufacturing process such as product design, oversight functions, and technology-intensive tasks (Kam, 2015). On the other hand, the FA share increased slightly from 16 per cent in 2001 to 15.3 per cent in 2019. This pattern demonstrates that, despite the increasing importance of China as the final assembly centre, Malaysia seems to maintain its position as the region's assembly hub.

The product composition of GPN trade over a five-year average period is summarised in Table 5.2. The figure clearly shows that most GPN products are highly concentrated on the SITC 71, SITC 75, SITC 76, SITC 77, SITC 78, SITC 87, and SITC 88, with an average share of more than 90 per cent of total GPN exports. Throughout the period, the average GPN exports value increased significantly from US$7 billion in the late 1980s to US$100.2 billion in the late 2010s. However, the share of GPN exports in total manufacturing exports has fallen from 77 per cent in the first half of the 2000s to 66.7 per cent in the late 2010s. This presumably reflects competition from other countries in the international product fragmentation.

Table 5.2: Composition of GPN exports[1] (% and US$)

Product[2]	1988-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-19
Total GPN products							
Chemicals and related products (5)	0.9	0.2	0.8	0.6	1.0	1.6	1.7
Manufactured goods classified chiefly by material (6)	0.5	0.4	0.4	0.4	0.5	0.8	0.8
Power-generating machinery and equipment (71)	1.7	1.8	1.5	1.2	0.8	0.7	0.7
Specialised industry machinery (72)	0.8	0.5	0.4	0.5	0.8	1.6	2.2
Metalworking machinery (73)	0.0	0.0	0.1	0.1	0.1	0.2	0.2
General industrial machinery (74)	0.7	0.9	0.9	0.9	1.2	1.5	1.6
Office machines and automatic data-processing machines (75)	2.2	13.1	24.8	30.0	29.7	18.9	13.6
Telecommunications and sound equipment (76)	26.2	31.0	23.6	19.2	14.8	13.9	10.1
Electrical machinery, apparatus, and parts (77)	8.5	8.5	8.3	9.4	10.2	12.7	13.2
Transistors, valves (776)	50.5	32.4	32.2	32.3	33.3	37.3	43.9
Road vehicles (78)	0.9	1.4	1.1	0.8	1.4	2.0	1.9
Other transport equipment (79)	3.6	5.9	2.9	0.7	1.5	1.4	1.9
Prefabricated buildings, fittings (81)	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Furniture, beddings, and furnishings (82)	0.2	0.3	0.2	0.2	0.2	0.2	0.2
Scientific equipment (87)	1.5	1.4	1.1	2.2	3.3	5.9	6.9
Photographic apparatus, watches, and clocks (88)	1.7	2.2	1.7	1.5	1.1	1.2	1.0
Miscellaneous manufactured goods (89)	0.1	0.1	0.0	0.1	0.1	0.1	0.1
Total (%)	100	100	100	100	100	100	100
US$ million	7,016.7	19,452.4	45,384.7	61,169.0	86,271.2	92,482.8	100,209.1

Note:
(1) The figures constitute a simple 5-year average.
(2) Standard International Trade Classification (SITC) codes are given in brackets.
Source: Author's computation using data at the 5-digit level of the SITC Rev.3 and Rev. 4 from the UN Comtrade database, <https://comtrade.un.org/db/dqQuickQuery.aspx?>.

5.4.4 The rise of China

China's export performance has been remarkable since a major trade reform during 1979 and 1980. The policy shift has resulted in FDI increasing dramatically from US$57 million in 1980 to US$3.5[73] billion in 1990. Further trade policy changes and liberalised investment in the 1990s resulted in FDI increasing significantly from US$37.5 in 1995 to US$72.4 billion in 2005, and then to US$141.2 billion in 2019. This substantial FDI has contributed to China's manufacturing exports growth (Tang and Zhang, 2016). China's economy has become more integrated into the global economy after joining the WTO on 11 December 2001, and its exports have continued to soar. The ratio of China's exports to total world exports increased dramatically from 1.2 per cent in 1988 to 4.4 per cent in 2001 and later to 13.7 per cent in 2019. Total Chinese exports increased significantly to US$2,494.2 billion in 2019, up from US$266.1 billion in 2001.

The rapid growth of China's exports and its role as a major trading partner in the late 1980s raised serious policy concerns, particularly in Southeast Asia and other Asian countries, that China would threaten their trade and export opportunities. Initially, Chinese competition was mainly related to standard light manufactures. However, the rapid participation of China in the GPS with the relocation of MNEs from Southeast Asia to China increased the 'China fear' throughout the region[74]. This situation led to serious concerns regarding the potential erosion of Southeast Asia's role in the GPN (Athukorala and Kohpaiboon, 2015).

[73] The data reported in the paper is extracted from the UNCTAD database, <https://unctadstat.unctad.org/EN/>.
[74] This is due to the emergence of China in the global market for labour-intensive manufactured goods.

5.5 Model specification

This study investigates the impact of RER on Malaysia's export performance using a reduced-form model of the export equation with certain explanatory variables based on the previous research (e.g. Goldstein and Khan, 1985; Bushe et al., 1986; Arndt and Huemer, 2007; Jongwanich, 2010). The model is enhanced by adding other variables such as China's rise, time trend and dummy variable. The model can be specified as follows:

$$EXP_{it} = f\,(RER, WD, CHINA, FDI, TREND, DGFC, DAFC) \quad (1)$$

$$(+) \quad (+) \quad (-/+) \quad (+) \quad (+) \quad (-) \quad (-)$$

where EXP is total exports to the world measured at constant (2000) US dollar. RER is the real effective exchange rate that represents international competitiveness. WD denotes the world demand to capture any changes in the market conditions, CHINA stands for China's exports share in the international market. FDI is for foreign direct investment, and it captures the impact of foreign investment inflows on export supply capability. TREND denotes the time trend to capture the other possible factor affecting export supplies. DGFC and DAFC are dummy variables to capture the global financial crisis and Asian financial crisis shocks. The variable for RER and WD is used in the natural logarithm except for CHINA, FDI, TREND and two crisis dummies. Thus, the RER and WD coefficients can be interpreted as elasticity terms. The notations *i* and *t* denote product and time, respectively.

The export equation is estimated for Malaysia's exports by segmenting the analysis into different categories: total non-oil exports, non-oil primary exports, and manufacturing exports. The last is disaggregated into GPN export and non-GPN exports. The descriptions and expected signs for variables are discussed further as follows.

a) Real exchange rate

The real exchange rate (RER) variable (relative price of world export price to domestic producer price) represents international competitiveness. A rise (fall) in RER indicates an improvement (deterioration) in the international competitiveness of Malaysian exports. The positive link between RER and export growth has been established by numerous studies, including Sekkat and Varoudakis (2000), Eichengreen (2008), Rodrik (2008), Haddad and Pancaro (2010), Freund and Pierola (2012), and Ahmed et al. (2017). Therefore, the sign for RER is expected to be positive. As discussed earlier, the magnitude of the coefficient on the RER variable can differ between GPN exports and non-GPN exports. However, whether the degree of elasticity of exports with respect to changes in RER is larger or smaller compared to that of non-GPN exports is an empirical issue.

b) World demand

World demand (WD) is included to capture the changes in global market demand for Malaysian exports. Since there is no readily available data on world demand, WD is measured by the total value of world imports. The greater the world market demand, the higher the total of Malaysian exports. Thus, the sign for WD is expected to be positive.

c) China's rise

China's rise (CHINA) variable is included to capture the overall impact of China as the major export destination in export performance. China's rise is measured by the ratio of the value of imported goods from China to the total world's imports. China's rise as a major trading partner in the early 1990s raised concerns among policymakers that it would shrink their export opportunities. The negative association between China's increasing export shares and export performance has been argued by Heid et al. (2021), Baiardi and Bianchi (2019), Módolo and

Hiratuka (2017), Jenkins and Edwards (2015), and Greenaway et al. (2008). However, there is a counter-argument that China complements rather than competes with other countries (Athukorala, 2009). Thus, the sign for CHINA could be negative or positive.

d) Foreign direct investment

Foreign direct investment (FDI) is measured by the ratio of FDI inflows to GDP. FDI is expected to play an important role in manufacturing exports through technology transfer and providing marketing channels in addition to directly expanding the production capacity and knowledge transfer. FDI is particularly important for a country in expanding exports by joining GPNs because much of GPN trade takes place through inter-firm linkages within GPNs. The positive link between FDI and export growth has been established by numerous studies such as Tang and Zhang (2016), Anwar and Nguyen (2011), and Aitken et al. (1997). FDI inflows can improve a country's ability to diversify its export basket (Harding and Javorcik, 2012). It is argued that the presence of multinational enterprises (MNEs) in a country can shape the composition of exported goods by engaging in more sophisticated or higher value-added products. The spillover effects from MNEs can improve the structure of a small or medium-sized business. Barry and Kearney (2006), Wei and Liu (2006), Abraham et al. (2010), and Bournakis (2021) provide evidence of positive spillover of FDI to the host country. Therefore, the sign for FDI is expected to be positive.

e) Time trend

The time trend (TREND) is included in the model to account for other potential supply factors such as supplies, skills, technological changes, trade logistics, and infrastructure that affect the supply curve to shift over time. Based on this, the sign of the TREND is expected to be positive.

f) Crisis dummy

Dummy variables for the Asian Financial Crisis (DAFC) and the Global Financial Crisis (DGFC) were included in the regression to capture the impact of these external shocks in export performance. The crisis is expected to hurt exports, so the sign for these two crisis dummies is expected to be negative.

5.6 Data sources and variable construction

The empirical analysis is conducted based on a dataset covering the years 1992 to 2019. It depends on the availability of the US import price index data at 2-digit at a disaggregated level. The year 2019 was chosen as the endpoint to avoid disruptions in export flows in the aftermath of the global COVID-19 pandemic of 2020/2021. The US import price indices were obtained from the US Bureau of Labor Statistics, and it is available at 2-digit Harmonised System (HS) codes. The conversion of HS product codes to the SITC Rev.3 is classified using a correspondence table provided by the UN Trade Statistics[75].

The export data is extracted from the UN Comtrade database[76] at the 2-digit level of the SITC Rev. 3 and Revision 4 (Rev.4). In 2007, the UN Comtrade data reporting system shifted from SITC 3. to Rev. 4, but Malaysia's reporting system of Rev. 4 only started in 2009. To capture significant differences in product classification at the disaggregated level, the export dataset for 1992-2008 was from Rev. 3; meanwhile, the export dataset for 2009-2019 was from Rev. 4.

The analysis covers non-oil exports data rather than total merchandise exports. The exclusion of oil products from the analysis is important for policy design. The price and supply of these products to the world market are influenced by the Organization of the Petroleum

[75] See https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp.
[76] See https://comtrade.un.org/db/dqQuickQuery.aspx?.

Exporting Countries (OPEC). It has little to do with the changes of RER. Moreover, the price fluctuations in oil and gas products may lead to significant export changes. Meanwhile, the total non-oil exports are segmented into non-oil primary and manufacturing products. Later manufacturing products were disaggregated into GPN and non-GPN products. The identification of GPN products is based on product list as suggested by Athukorala (2014). Seven product categories are identified as GPN products: power-generating machinery and equipment (SITC 71), office machines and automatic data-processing machines (SITC 75), telecommunications and sound recording equipment (SITC 76), electrical machinery, apparatus, and parts (SITC 77), road vehicles (SITC 78), scientific equipment (SITC 87), and photographic apparatus, watches and clocks (SITC 88). These GPN products constitute more than 90 per cent of Malaysia's total GPN exports to the world. It is reasonable to assume that none of these products is completely made from beginning to end in one country (Krugman, 2008; Athukorala, 2011).

The disaggregation of exports is important to see whether the effect of RER in exports varies by product categories. The details of export categories and number of products are presented in Table 5.3.

Table 5.3: Description of export category

Category of export	**Product Code**	**Number of Products**
Total non-oil products	SITC products at two-digit levels (SITC 0 to SITC 8, less SITC 3)	33
Non-oil primary products	SITC products at two-digit levels (SITC 0, 1, 2, 4 and 68)	7
Manufacturing products	SITC products at two-digit levels (SITC 5,6 (minus 68),7 and 8)	26
GPN products	SITC 71, 75, 76,77, 78, 87, 88	7
Non-GPN products	Manufacturing products at two-digit levels minus GPN products (SITC 71, 75, 76,77, 78, 87, 88)	19

Source: Author's computation.

The 2-digit level product categories were selected based on the availability of the US import price index, and they cover more than 80 per cent of total non-oil products. The GPN products classification in this study incorporates both P&C and FA goods.

For econometric analysis, the total non-oil exports and other export product categories were transformed into a constant (2000) US$ export. Given the US's dominance in determining trade prices, the US import price index is an appropriate proxy for representing export world price in the RER index construction. The data to measure WD and CHINA variables is extracted from the UN Comtrade database, while data for FDI inflows is obtained from the United Nations Conference on Trade and Development (UNCTAD) database[77]. Details concerning the source of data and variables construction are given in Table 5.4.

[77] See https://unctadstat.unctad.org/EN/.

Table 5.4: Data sources and description of variables

Variable	**Description**	**Data source**
EXP	Total exports at constant (2000) US$ is measured by the total value of Malaysia's exports to the world (in RM), divided by the exchange rate (RM/US$) in 2000.	Data of the SITC Rev. 3 and SITC Rev. 4 from the UN Comtrade. IFS, IMF
WD	World demand at constant (2000) US$ is measured by the total value of world's imports from the world (in RM million), then divided by exchange rate (RM/US$) in 2000.	Data of the SITC Rev. 3 and SITC Rev. 4 from the UN Comtrade. IFS, IMF
RER	Real exchange rate is calculated separately for product categories using the formula: (i) Total non-oil exports: $RER = (RM/US\$) \times \left[\frac{\text{USA import price index for each product}}{\text{Implicit deflator for agriculture and manufacturing}}\right]$ (ii) Non-oil primary exports: $RER = (RM/US\$) \times \left[\frac{\text{USA import price index for each product}}{\text{Implicit deflator for agriculture}}\right]$ (iii) Manufacturing/GPN/Non-GPN exports: $RER = (RM/US\$) \times \left[\frac{\text{USA import price index for each product}}{\text{Implicit deflator for manufacturing}}\right]$ where implicit deflator is calculated using the formula: $Deflator = \left[\frac{\text{Nominal value-added of manufacturing/agriculture}}{\text{Real value-added of manufacturing/agriculture}}\right] \times 100$	US Bureau of Labor Statistics IFS, IMF WDI, World Bank EPU
NER	Nominal exchange rate= (RM/US$) x 100	IFS, IMF
RP	Relative price= $\left[\frac{\text{USA import price index for each product}}{\text{Implicit deflator for manufacturing/agriculture}}\right] \times 100$	The US Bureau of Labor Statistics WDI, World Bank EPU
CHINA	China's shares in total export to the world is measured by: $\left[\frac{\text{Total value of world's imports from China}}{\text{Total value of world's imports from the world}}\right]$	Data of the SITC Rev. 3 and SITC Rev. 4 from the UN Comtrade.
FDI	Foreign direct investment is measured by the ratio of total FDI inflows to GDP at current prices	UNCTAD database WDI, World Bank

The descriptive statistics and correlations statistics between variables are reported in Tables A5.2 to A5.11 in the Appendix.

5.7 Estimation method

The export equation is estimated using the ARDL approach. Before proceeding with this approach, the property of the data series is tested using a combination of the methods employed by Harris and Tzavalis (1999) and Levin et al. (2002), which is applicable to balanced panel data. The Harris and Tzavalis (1999) test is appropriate for total non-oil export category as the data characteristic has a larger number of products (N) than the period (T) of N > T. Levin-Lin-Chu test is appropriate for other product categories (as T>N) with balanced panel dataset. The result of the unit root for both panel data set are reported in Tables A5.12 and A5.13 in the Appendix.

The unit root result indicated that panel data series are mixed stationarity–combining an integration order of zero (I(0)) and integration order of one (I(1)). Given the different orders of stationarity, the analysis can proceed with the ARDL approach. The advantages of the dynamic panel method ARDL are as follows. This approach is applicable when variables set are purely stationary or non-stationary series or a mixture of integration order I(0) and I(1). It also provides a more dynamic relationship by measuring the long-run and short-run dynamics. An appropriate selection of lag structure for ARDL could control the serial correlation of residuals (Pesaran et al., 2001) and endogeneity problems. According to Pesaran (2015), sufficiently high lag-orders can be immune to the problem of endogeneity so long as the model's long-term properties are concerned.

The empirical specification of the export equation (1) in ARDL with one period lag[78] takes the following form:

[78]It is common practice to use the one-period lag for annual data; this is also consistent with the optimal lag length suggested by the Schwarz information criterion (SIC).

$$lnEXPt_{it} = \mu_{it} + \alpha_1 lnRER_{it} + \alpha_2 lnWD_{it} + \alpha_3 CHINA_{it} + \alpha_4 FDI_{it} + \alpha_5 TREND_{it} + \alpha_6 ln\,EXP_{it-1} + \alpha_7 lnRER_{it-1} + \alpha_8 lnWD_{it-1} + \alpha_9 CHINA_{it-1} + \alpha_{10} FDI_{it-1} + \alpha_{11} DGFC_{it} + \alpha_{12} DAFC_{it} + \varepsilon_{it} \quad (2)$$

and the error-correction form as follows:

$$\Delta\, lnEXP_{it} = \varphi_i\,(lnEXP_{t-1} - \delta'_i X_{i,t-1}) + \gamma'_{it}\Delta X_{it} + \mu_{it} + \varepsilon_{it} \quad (3)$$

where Δ is the first difference, the δ is the long-run coefficients, γ is the short-run coefficients, and $\varphi_i = -(1-\lambda_i)$ denotes the parameter of adjustment towards the long-run equilibrium $(\varphi i < 0)$. $[lnEXP_{t-1} - \delta'_i X_{i,t-1}]$ is error correction term (ECT). X stands for the matrix of explanatory variables. μ_{it} is a constant, and ε_{it} represents the error term. For a long-run relationship to exist, it requires $\varphi_i \neq 0$. If φ is a negative sign and statistically significant, it indicates the existence of a long-run cointegrating relationship between variables.

The export equation is estimated using three alternative methods within the ARDL framework, which allows for potential parameter heterogeneity in the panel dataset. These methods are the Mean Group estimator (MG), Pooled Mean Group estimator (PMG), and Dynamic Fixed Effects estimator (DFE). These methods make different assumptions on the long-run and short-run parameters. The MG estimator separates group equations for each group and allows for coefficient heterogeneity in the long-run and short-run. The PMG estimation allows the intercept, error variance to differ across groups but constrains long-run coefficients to be identical. PMG is an intermediate estimator between MG and DFE. The DFE estimator imposes constraints on the short-run and long-run coefficients for across groups to be identical and allows panel-specific intercept.

The most efficient and consistent estimator among these three alternative methods is selected using the Hausman test. This test was proposed by Hausman (1978) to compare two estimators, which are θ_1 and θ_2. The null hypothesis is that θ_2 is an efficient (and consistent) estimator of the actual parameter. If the test fails to reject the null hypothesis, the value θ_2 will be chosen. Meanwhile, if the null hypothesis is rejected, then the value θ_1 will be chosen.

5.8 Results and discussion

5.8.1 The role of RER in exports

The Hausman test result indicates that DFE is the most efficient and consistent estimator for all equations among these estimators. The estimation results for exports of total non-oil, non-oil primary, manufacturing, GPN, and non-GPN products are reported in Table 5.5.

Table 5.5: The role of RER in exports by product categories

Dependent variable:	Total non-oil	Non-oil primary	Manufacturing	GPN	Non-GPN
lnEXP_w	(1)	(2)	(3)	(4)	(5)
Adjustment coefficient	-0.132***	-0.118***	-0.132***	-0.103***	-0.156***
	(0.013)	(0.030)	(0.015)	(0.027)	(0.019
Long-run coefficients					
lnRER_{t-1}	0.640***	0.905*	0.616**	1.604*	0.368
	(0.204)	(0.541)	(0.239)	(0.933)	(0.242)
ln$WD_{w\ t-1}$	0.484**	-0.126	0.598***	1.202**	0.535**
	(0.205)	(0.639)	(0.224)	(0.550)	(0.231)
$CHINA_{w\ t-1}$	-3.392***	-3.507	-3.548***	-4.114**	-2.269***
	(0.845)	(8.898)	(0.913)	(1.922)	(1.081)
FDI_{t-1}	7.734**	10.043	7.437**	19.055*	5.567
	(3.126)	(6.874)	(3.665)	(10.995)	(3.537)
TREND	0.060***	0.120**	0.047***	0.022	0.051***
	(0.016)	(0.051)	(0.018)	(0.045)	(0.019)
Short-run coefficients					
Δ *ln*RER	0.063	-0.107	0.194**	0.243	0.192*
	(0.065)	(0.087)	(0.089)	(0.164)	(0.108)
Δ *ln*WD_w	0.838***	0.985***	0.745***	0.741***	0.740***
	(0.050)	(0.085)	(0.061)	(0.124)	(0.071)
Δ $CHINA_w$	-0.825*	5.185*	-0.936*	-0.773	-0.722
	(0.495)	(2.913)	(0.519)	(1.241)	(0.589)
Δ FDI	1.194***	2.101**	0.954**	1.584*	0.864*
	(0.406)	(0.841)	(0.451)	(0.911)	(0.527)
DGFC	0.058***	0.104***	0.044**	0.049	0.044**
	(0.015)	(0.032)	(0.017)	(0.034)	(0.021)
DAFC	-0.078***	-0.077*	-0.075***	-0.074	-0.072**
	(0.021)	(0.040)	(0.024)	(0.047)	(0.028)
Constant	0.588*	0.980	0.481	-0.780	0.786**
	(0.303)	(0.695)	(0.342)	(0.841)	(0.393)
Number of observations	891	189	702	189	513
Number of products	33	7	26	7	19
Model	DFE	DFE	DFE	DFE	DFE
Hausman test PMG versus DFE (Chi^2 p-values)	0.977	1.00	0.950	0.962	0.999

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
Source: Author's estimation.

The error correction term (ECT) or adjustment coefficient term is negative and statistically significant at the 1 per cent level. It suggests the existence of a long-run relationship between variables. That coefficient across all equations is within the range of -0.12 to -0.16. It implies that the adjustment towards steady-state takes 3.6 years to 5.4[79] years to eliminate half of the exogenous shock. The speed of adjustment varies marginally across product categories, with manufacturing products have a higher speed of adjustment than non-oil primary products. Within the manufacturing products, the GPN products move more slowly towards the long-run equilibrium compared to non-GPN products, implying that the GPN products' response is slower than non-GPN products when an exogenous shock occurs. This is relevant given the nature of GPN product manufacture that firms tend to respond slowly to shocks once they have: firstly, invested substantially in domestic production facilities; and secondly, established the information link (Rangan and Lawrence, 1999).

All variables' coefficients have the expected sign. The key interest variable, RER, is positively associated with the long-run export performance for total non-oil, non-oil primary, manufacturing, and GPN products. In the short run, RER has a positive impact and is statistically significant only in manufacturing products and non-GPN products. The size of the long-run coefficients of RER for total non-oil, non-oil primary, manufacturing, and GPN products are 0.64, 0.9, 0.62, and 1.6, respectively. The much larger RER coefficient for GPN products indicates the country's specialisation within GPNs is sensitive to changes in international price. This finding lends support to the view that globalisation of production processes enables firms to switch between domestic and imported inputs, shift tasks across borders, or adjust procurement processes quickly when prices change, as postulated by Obstfeld (2001b).

The upshot is that avoiding RER overvaluation is far more important for export success under the GPS than export performance based on the traditional horizontal specialisation at the individual country level. This is the case even if GPN trade is less sensitive to relative price change at the global level.

[79] Estimated using the formula log $(1 - a)$ = log $(1 - b)$ T, where a is the percentage, meanwhile b is the estimated ECT. T represents the number of years required to clear exogenous shock through the automatic adjustment (Elbadawi, 2012).

The long-run coefficient of the CHINA variable, which measures the impact of China's rise is statistically significant with the negative sign in all export equations except for the non-oil primary products. This result indicates that China's export growth reduces exports in the total non-oil, manufacturing, GPN and non-GPN products. The magnitude of the CHINA coefficient is between 2.27 and 4.11 and statistically significant between the 1 and 5 per cent levels. The coefficient of CHINA is the highest for GPN products (4.11), followed by manufacturing products (3.55), total non-oil products (3.39), and non-GPN products (2.27). This result suggests that the rise of China has a greater effect on GPN exports than on other export categories. These findings further support the idea that China's export growth crowds out other countries' export opportunities. The result also suggests that China is not competing with Malaysia in non-oil primary exports in the long run. However, the CHINA variable is positively associated with non-oil primary exports in the short-run. This result implies that China's rise is complementary rather than competitive for total non-oil primary exports, but this is only temporary. The result is relevant given that China does not pose a threat to the export of primary products.

The world demand is positively associated with export growth as expected, and it is statistically significant in most cases. The magnitude of the WD coefficient is between 0.48 and 1.2, with the larger coefficient for GPN products. The high magnitude of the coefficient implies that GPN exports are highly responsive to the changes in the world market condition. This finding clearly represents the nature of GPN products, which are heavily influenced by global market conditions rather than domestic exporter incentives (Athukorala and Suphachalasai, 2004). In the short-run, the WD variable is statistically significant in all export categories at the 1 per cent level. In most cases, the magnitude of the WD coefficient is much larger in the short-run than in the long-run, suggesting that the significant effect of global demand conditions in export performance is a short-run phenomenon.

On the supply side, FDI is positively associated with the long-run export performance of total non-oil, manufacturing and GPN products with the respective coefficient sizes of 7.7, 7.4, and 19.06. In the short-run, FDI has positively impacted the export performance of all export products. This finding supports the initial hypothesis that FDI increases export expansion through technology transfer, spillover effects, and advances in technology. The coefficient size of FDI is much larger in the GPN products than other products, implying the significant role of FDI in GPN specialisation as predicted.

The TREND variable representing the other supply factors is positively associated with long-run export performance in most cases. Surprisingly, this variable has no significant impact on GPN products. The size of the coefficient is modest, between 0.05 and 0.12. The difference in coefficient size between the five export categories is only marginal, with total non-oil primary products having a larger coefficient size than other product categories. In addition, the result shows that the TREND coefficient is much smaller in size when compared to other variables. Thus, it provides modest support for the view that supply factors such as trade-related logistics, infrastructure support, and business environment are important in facilitating total non-oil, primary, manufacturing, and non-GPN product exports growth.

Two crisis dummies, DGFC and DAFC variables, are statistically significant in most export equations. The DGFC is positively associated with export expansion. Meanwhile, the DAFC is negatively associated with export growth. The magnitudes of both crisis coefficients are modest, suggesting the crisis has a minor impact on export performance.

5.8.2 The role of NER and relative price in exports

There has been an interesting debate in recent literature regarding the 'dominant currency paradigm' (Gopinath et al., 2010; Gopinath et al., 2020). It is argued that in the case of 'dollar denomination' in exports, NER is expected to have no impact on them. Hence, relative price changes can be important for export performance irrespective of changes in the exchange rate. In light of this debate, the RER index is decomposed into NER and relative price (RP) to test whether the export varies with NER and RP changes. The results of the DFE estimator of all regressions are reported in Table 5.6.

Table 5.6: The role of NER and relative price in exports by product categories

Dependent variable:	Total non-oil	Non-oil primary	Manufacturing	GPN	Non-GPN
*ln*EXP$_w$	(1)	(2)	(3)	(4)	(5)
Adjustment coefficient	-0.133***	-0.121***	-0.132***	-0.115***	-0.157***
	(0.014)	(0.030)	(0.016)	(0.029)	(0.020)
Long-run coefficients					
*ln*NER $_{t-1}$	0.490	0.475	0.592	0.660	0.391
	(0.413)	(0.920)	(0.478)	(1.064)	(0.482)
*ln*RP $_{t-1}$	0.667***	0.968*	0.632**	2.664**	0.381
	(0.211)	(0.557)	(0.249)	(1.203)	(0.250)
*ln*WD$_{w\ t-1}$	0.498**	-0.060	0.590**	1.623***	0.514**
	(0.209)	(0.634)	(0.230)	(0.600)	(0.235)
*ln*CHINA$_{w\ t-1}$	-3.345***	-3.558	-3.538***	-2.869	-2.269**
	(0.843)	(8.762)	(0.914)	(1.853)	(1.081)
FDI $_{t-1}$	6.474	6.683	6.775	9.251	5.247
	(4.217)	(9.071)	(4.927)	(11.569)	(4.889)
TREND	0.060***	0.116*	0.048***	0.014	0.053***
	(0.016)	(0.051)	(0.018)	(0.041)	(0.019)
Short-run coefficients					
Δ *lnN*ER	0.033	-0.089	0.133	0.211	0.117
	(0.093)	(0.184)	(0.109)	(0.195)	(0.132)
Δ *ln*RP	0.074	-0.106	0.257**	0.285	0.267**
	(0.072)	(0.090)	(0.107)	(0.243)	(0.127)
Δ *ln*WD$_w$	0.841***	0.988***	0.748***	0.780***	0.736***
	(0.050)	(0.086)	(0.061)	(0.140)	(0.072)
Δ CHINA$_w$	-0.814*	5.288*	-0.963*	-0.847	-0.766
	(0.497)	(2.936)	(0.522)	(1.246)	(0.597)
Δ FDI	1.077**	1.926**	0.821	1.076	0.726
	(0.469)	(0.955)	(0.527)	(1.032)	(0.623)
DGFC	0.055***	0.099**	0.041**	0.041	0.041*
	(0.017)	(0.034)	(0.019)	(0.035)	(0.023)
DAFC	-0.073***	-0.087*	-0.054*	-0.089	-0.045
	(0.027)	(0.054)	(0.031)	(0.061)	(0.037)
Constant	0.259	0.635	0.127	-2.351*	0.531
	(0.378)	(0.844)	(0.429)	(1.330)	(0.500)
Number of observations	891	189	702	189	513
Number of products	33	7	26	7	19
Model	DFE	DFE	DFE	DFE	DFE
Hausman test PMG versus DFE (Chi^2 p-values)	0.999	1.00	0.990	0.995	0.999

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
Source: Author's estimation.

The error correction term (ECT) or adjustment coefficient term is negative and statistically significant across all regressions. It suggests the existence of a long-run cointegrating relationship between variables. The size of the ECT's coefficient is within -0.12 to -0.16 range, and it suggests that the adjustment towards steady-state takes 3.6 to 5.4[80] years to eliminate half of the exogenous shock.

The sign for interest variable NER is statistically insignificant in all regressions even though it has a positive sign as expected. This is most likely due to the dollar's dominance in exports, as hypothesised by Gopinath et al. (2010) and Gopinath et al. (2020).

The coefficient of the RP variable is positive and statistically significant across all export products except for non-GPN products. The size of the coefficient varies between 0.63 and 2.66, and this indicates that GPN products are highly sensitive to changes in RP with a magnitude of the coefficient is 2.66, followed by non-oil primary products (0.97), total non-oil products (0.67), and manufacturing products (0.63). This finding reaffirms that GPN products are sensitive to RP relative price changes. It is relevant given the nature of GPN products which have production facilities stationed in various countries allowing firms to respond quickly to changes in relative prices. An increase in RP (measured in domestic currency) will boost the export competitiveness of final assembly products, resulting in increased exports. Surprisingly, the magnitude of the non-oil primary products' coefficient is higher than manufacturing products, which contradicts the conventional wisdom that primary exports are less responsive to prices than manufacturing exports. By nature, primary products rely heavily on locally sourced raw materials (Jongwanich, 2010).

The results of the NER and RP effects on export performance are consistent with the emerging literature of the 'dominant currency paradigm'. Under the dominant currency paradigm, firms establish export prices in a dominant currency (most frequently the dollar) and

[80] Estimated using the formula log (1 – a) = log (1 – b) T, where a is the percentage, while b is the estimated ECT. T represents the number of years required to clear exogenous shock through the automatic adjustment (Elbadawi, 2012).

rarely change them; therefore, exchange rates become insignificant for export performance. Given that the export price is expressed in dollar domination and is virtually unchanged, an increase in the RP (measured in domestic currency) improves export competitiveness.

The overall result indicates no significant changes in other variables when the RER is decomposed into NER and RP. Also reaffirmed here is that an increase in China's export shares negatively impacts export growth in most equations. The world demand, foreign direct investment, and other supply factors are positively associated with the export expansion.

5.8.3 Robustness test

For robustness check, export equations were estimated using an alternative RER index which is constructed using the consumer price index (CPI) to present the domestic price index[81] while maintaining the US price import index as a proxy for the world price. CPI is chosen because it is widely used in literature as a proxy for the domestic price index. The results are reported in Tables A5.14 to A5.15 in the Appendix. The result indicates that RER depreciation improves the long-run export performance in most cases and GPN products are highly sensitive to international price changes. It reaffirms that China's rise hurts Malaysia's exports. The result also suggests that NER does not affect exports in all equations; meanwhile, the RP is positive and statistically significant in most cases. The overall result is basically consistent with the initial result. However, the initial result that was obtained using the implicit deflator is preferred and is therefore reported here. This is because it better captures the domestic price index at product category and is less susceptible to political manipulation than CPI.

[81] The alternative RER index is constructed using the formula: $RER = [RM/US\$ \times \frac{\text{US import price index}}{\text{CPI}}]$

A sensitivity test was also conducted using another alternative RER index[82] constructed using the standard RER measurement method[83]. The result is reported in Tables A5.16 and A5.17 in the Appendix. The coefficient of RER is positive and statistically significant only for aggregate exports and non-GPN products; meanwhile, RER does not have an impact on GPN products. The result indicates that China' rise reduces export opportunities. Other export determinant factors such as world demand, foreign direct investment, and other supply factors are positively associated with exports and statistically significant in most cases. Indicated here is that NER and RP variables have no significant impact on exports for all equations except in total non-oil products. In conclusion, changing the RER index has affected the significance of the coefficients of variables. However, using the US import price index as a proxy for world price produces a meaningful result, so it is reported here.

The results from the DFE estimator were also assessed using two alternative methods: the Dynamic Ordinary Least Squares (DOLS)[84] and Fully Modified Ordinary Least Squares (FMOLS)[85]. The result of DOLS is reported in Tables A5.18 and A5.19 in the Appendix. The result indicates that RER depreciation only improves the long-term export performance of total non-oil and manufacturing products, and it has no significant impact on GPN products. China's rise is negatively associated with export performance in most cases. Other variables such as WD and TREND have a positive sign and are statistically significant in most cases. The result confirms that the NER variable is insignificant in all regressions, while the RP has a positive impact on export performance and is statistically significant in most cases. The results for FMOLS are reported in Tables A5.20 and A5.21 in the Appendix. The FMOLS method

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[82] An alternative RER index is constructed specifically for product categories, such as total non-oil, primary, and manufacturing products. Analysis of GPN and non-GPN products uses the RER index for manufacturing as these products are part of manufacturing.

[83] RER is defined as the weighted average of WPI/PPI indices of 20 export partners expressed in the domestic currency relative to the domestic price index (measured by the implicit deflator for agriculture/manufacturing).
The formula is written as follows:
RER= $\prod_{j=1}^{20} \left(\frac{NER_{ijt} \; x \; WPI_{jt}}{Implicit \; Deflator_{it}} \right)^{wj}$

[84] Introduced by (Stock and Watson, 1993)

[85] The first used in a study by (Phillips and Hansen, 1990) to provide the best possible estimates of cointegrating regressions.

produces almost identical results with the DFE estimators, particularly in regard to the impact of RER, CHINA, NER, and RP on long-term export performance.

As an alternative for GPN products, the global value chain indicator can be constructed using data from the UNCTAD-Eora database and used as the dependent variable. However, the data from this database is based on the Input-Output table. The I-O linkages only capture vertical specialisation on the input side of the production process. Due to its nature, it tends to miss out on final assembly components (Patunru and Athukorala, 2021). The UNCTAD classifications also are mixed-up parts and components with the standard, intermediate goods (like iron and steel) and miss out on final assembly (Athukorala and Talgaswatta, 2016). Thus, the robustness check was not conducted using alternative data.

5.9 Conclusion

This chapter has investigated the role of international competitiveness as measured by the RER in export performance in Malaysia, emphasising the differential impact of manufacturing exports within global production networks (GPNs) and non-GPN exports and the implications of China's rise in export performance. While the previous study did not consider the growing importance of GPN in the export structure and the implications of China's rise on Malaysia's export performance, this study adds to the literature by addressing the pertinent issues.

Analysis of five different export categories using a panel dataset from 1992 to 2019 indicated that RER has a more significant impact on GPN products than other product categories, implying that the growing participation in the GPS increased the export sensitivity to changes in international prices. There is also evidence that Malaysia faces competition from China's export growth in most cases, with GPN products suffering more than other product categories. Among the export determinant factors, FDI and China's rise seems to have a sizable impact on exports compared to other factors. The analysis suggests that RER, world demand, China's rise and other supply factors play an important role in export performance, particularly for total non-oil and manufacturing products. The GPN exports are mainly influenced by foreign direct investment, China's rise, RER and world demand. This finding opens an opportunity for further studies to assess the impact of RER in GPN exports by segmenting into P&C and FA products to better understand the nature of GPN products.

When the RER is decomposed into NER and RP, the result indicates that NER has an insignificant impact in all equations. The RP is found to have a positive impact on long-term export performance in most cases. This provides additional evidence that the RP (measured in domestic currency) determines the long-term international competitiveness of Malaysia's exports. It is consistent with the 'dominant currency paradigm' as highlighted in emerging literature (Gopinath et al., 2010; Gopinath et al., 2020). As most trade is invoiced using the US$ ('the dominant currency'), bilateral exchange rates are irrelevant for determining export performance.

This study offers some policy recommendations for Malaysia. First, different products respond differently to the changes in RER and other determinant factors. This finding suggests that the relationship between RER and export performance is based on aggregated data should be interpreted cautiously. Policymakers need to consider the differences in product categories when designing the right policy and procedure related to trade. Second, besides maintaining a competitive exchange rate, Malaysia can use various non-price competition tools to boost export performance, particularly trade-related logistics, which helps reduce service link costs in the growing importance of GPS. This recommendation is based on the establishment of overseas production and service links involving a high fixed cost, and the importance of low service link cost has been highlighted by Athukorala and Menon (2010), Kam (2015), and Athukorala and Talgaswatta (2016). Third, the government should strengthen its efforts to attract new investment by encouraging innovation in manufacturing to produce more technologically advanced products to gain a non-price competitive advantage in global markets over export competitors. Malaysia is one of the main players in the GPNs. Given the rise of China as a premier assembly hub in the global market, Malaysia has to maintain its role by attracting more new investment and promoting technological advancement in production. In doing so, Malaysia will be able to expand its export opportunities in the face of China's dominance of the global economy. Fourth and lastly, since most trade transactions are paid for in only a few currencies, policymakers should be aware of the implications of currency dominance in exported goods. When the currency prices are unchanged, neglecting currency domination in export products may not lead to more exports being possible.

Appendix

Table A5.1: List of parts and components

No	Product code	Description	No	Product code	Description
1	58291	Cellular plastic sheet	54	66491	Edge worked sheet glass
2	58299	Non-cellular plastic sheet	55	66591	Laboratory/hygienic glassware
3	59850	Doped chemicals (electronic)	56	66599	Other glass articles, n.e.s.
4	61120	Composition leather	57	69551	Band saw blades
5	62141	Unhard.vulc. rubber tube not reinforced	58	69552	Steel circular saw blade
6	62142	Unhard.vulc. metal-reinforced rubber tube	59	69553	Circular saw blades, n.e.s.
7	62143	Unhard.vulc. textile-reinforced rubber tube	60	69554	Chain saw blades
8	62144	Unhard.vulc n.e.s-reinforced rubber tube	61	69555	Straight saw blades for metal
9	62145	Unhard.vulc rubber tube + fitting	62	69559	Saw blades, n.e.s.
10	62921	Conveyor/etc belts v	63	69561	Cutting blades for machines
11	62929	Conveyor/etc belts, n.e.s.	64	69562	Carbide tool tips etc.
12	62999	Uh non-cell rub articles	65	69563	Rock-drilling tools
13	65611	Narrow woven pile fabric	66	69564	Parts to insert in tools
14	65612	Narrow woven elastic fab	67	69680	Knives and blades, n.e.s.
15	65613	Narrow woven fabric, n.e.s.	68	69915	Base metal vehicle fitment
16	65614	Narrow bonded fabrics	69	69933	Base metal buckles etc.
17	65621	Woven textile labels, etc.	70	69941	Iron/steel/springs, etc.
18	65629	Non-woven textile label, etc.	71	71191	Parts of boilers 711.1
19	65631	Gimped yarns	72	71192	Parts n.e.s. boiler equipment of 711.2
20	65632	Braids/trimmings, etc.	73	71280	Parts for turbine
21	65641	Tulles, net fabrics	74	71311	Aircraft piston engines
22	65642	Mechanical lace	75	71319	Parts, n.e.s. of the aircraft piston engines
23	65643	Hand-made lace	76	71321	Reciprocating internal combustion piston engines <1000cc
24	65651	Embroidery, no-visible ground	77	71322	Reciprocating internal combustion piston engines <1000cc
25	65659	Embroidery n.e.s.	78	71323	Diesel etc engines
26	65711	Needleloom/stitch-bonded felt	79	71332	Marine spark-ignition engines n.e.s.
27	65712	Felt n.e.s. not impregnated	80	71333	Marine diesel engines
28	65719	Felt impregnated etc.	81	71381	spark-ignition piston engines n.e.s.
29	65720	Non-woven fabrics, n.e.s.	82	71382	Diesel engines n.e.s.
30	65731	Gum etc coated textiles	83	71391	Parts n.e.s. spark-ignition engines
31	65732	Plastic coated textiles	84	71392	Parts n.e.s. diesel engines
32	65733	Rubberized textiles, n.e.s.	85	71441	Turbojets
33	65734	Coated/impregnated textiles, n.e.s.	86	71449	Reaction engines n.e.s.
34	65735	Textile wall coverings	87	71481	Turbo-propellers
35	65740	Quilted textile products	88	71489	Other gas turbines n.e.s.
36	65751	Twine/cordage/rope/cable	89	71491	Parts n.e.s.turbo-jet/prop
37	65752	Knotted rope/twine nets	90	71499	Parts n.e.s. gas turbines
38	65759	Articles of cordage, n.e.s.	91	71610	Electric motors <37.5w
39	65761	Felt hat bodies/forms	92	71620	DC motor(>37w)/generator
40	65762	Hat bodies, n.e.s.	93	71631	AC, AC/DC motors >37.5w
41	65771	Textile wadding, n.e.s. etc.	94	71651	Generating sets with piston engines
42	65772	Textile wicks/mantle etc	95	71690	Parts n.e.s motors/generator
43	65773	Industrial textiles, n.e.s.	96	71819	Parts n.e.s hydraulic turbine
44	65781	Textile covered rubber cord	97	71878	Nuclear reactor parts
45	65785	Coated hi-tenacity synth yarn	98	71899	Parts n.e.s. of engines n.e.s.
46	65789	Rubber/plasticized, n.e.s.	99	72119	Agric machine (7211) parts
47	65791	Textile hose-piping etc.	100	72129	Parts n.e.s. of machinery of 7212
48	65792	Machinery belts, textiles, etc.	101	72139	Parts n.e.s. dairy machinery
49	65793	Tyre cord fabric	102	72198	Parts wine/etc machines
50	66382	Friction material and articles thereof	103	72199	Parts n.e.s. agric machines
51	66471	Tempered safety glass	104	72391	Bucket/grab/shovels
52	66472	Laminated safety glass	105	72392	Bulldozer etc blades
53	66481	Vehicle rear-view mirror	106	72393	Boring/sink machinery parts

Table: A5.1 (continued)

No	Product code	Description	No	Product code	Description
107	72399	Parts n.e.s earth-moving machine	165	74593	Rolling machine parts
108	72439	Sew machine needles/furniture parts	166	74597	Automatic vending machines
109	72449	Parts n.e.s textile machines	167	74610	Ball bearings
110	72461	Auxiliary weave/knit machine	168	74620	Tapered roller bearings
111	72467	Weaving loom parts/accessories	169	74630	Spherical roller bearing
112	72468	Loom/knitter etc parts/accessories	170	74640	Needle roller bearings
113	72488	Parts for leather machines	171	74650	Cylindrical roller bearings n.e.s.
114	72491	Washing machine parts	172	74680	Ball/roller bearings n.e.s.
115	72492	Textile machinery parts n.e.s.	173	74691	Bearing ball/needle/roll
116	72591	Paper manufact. machine parts	174	74699	Ball etc bearing part n.e.s.
117	72599	Paper product machine parts	175	74710	Pressure reducing valves
118	72635	Printing type, plates, etc.	176	74720	Pneumatic/hydraulic valves
119	72689	Parts n.e.s of bookbind machine	177	74730	Check valves
120	72691	Type-setting machine parts	178	74740	Safety/relief valves
121	72699	Printing press parts	179	74780	Taps/cocks/valves n.e.s.
122	72719	Cereal/dry legm machine parts	180	74790	Tap/cock/valve parts
123	72729	Indus food proc machine parts	181	74810	Transmission shafts
124	72819	Parts n.e.s of tools of 7281	182	74821	Ball/roll bearing housing
125	72839	Parts n.e.s of machinery of 7283	183	74822	Bearing housings n.e.s.
126	72851	Glass-working machinery part	184	74839	Articulated link chain parts
127	72852	Plastic/rubber machine part	185	74840	Gears and gearing
128	72853	Tobacco machinery parts	186	74850	Flywheels/pulleys/etc.
129	72855	Parts n.e.s., machines 7284	187	74860	Clutches/shaft coupling/etc
130	73511	Tool holder/self-opening die-heads	188	74890	Gear/flywheel/clutches part
131	73513	Metal machine tools work holder	189	74920	Metal clad gaskets
132	73515	Dividing head/special attachments	190	74991	Ships propellers/blades
133	73591	Parts n.e.s metal rmvl tools	191	74999	Machine parts non-electrical n.e.s.
134	73595	Parts n.e.s metal non-rmvl tool	192	75230	Digital processing units
135	73719	Foundry machine parts	193	75260	Automatic data processing (ADP) peripheral units
136	73729	Roll-mill parts n.e.s rolls	194	75270	ADP storage units
137	73739	Metal weld/solder eq parts	195	75290	ADP equipment n.e.s.
138	73749	Parts gas welders etc.	196	75910	Copy machine parts/accessories
139	74128	Furnace burner parts	197	75991	Typewriter parts/accessories n.e.s.
140	74135	Parts of equipment 741.31-34	198	75993	Dupl/addr. machine parts etc.
141	74139	Electrical furnace/oven parts	199	75995	Calculator parts/accessories.
142	74149	Parts refrigerators equipment	200	75997	ADP equip parts/accessories
143	74155	Air-conditioners n.e.s.	201	76211	Motor vehicles radio/player
144	74159	Air-conditioner parts	202	76212	Motor vehicles radio rec only
145	74172	Generator parts	203	76281	Other radio/record/play
146	7419	Parts industrial heat/cool equipment	204	76282	Clock radio receivers
147	74220	Piston engine fuel/water pump	205	76289	Radio receivers n.e.s.
148	74291	Pump parts	206	76432	Radio transceivers
149	74295	Liquid elevator parts	207	76481	Radio reception equipment n.e.s.
150	74363	Engine oil/petrol filter	208	76491	Telephone system parts
151	74364	Engine air filters	209	76492	Sound reprod. equipment parts
152	7438	Parts for fans/gas pumps	210	76493	Telecomm equipment parts n.e.s
153	74391	Parts for centrifuges	211	76499	Parts etc. of sound equip
154	74395	Parts filters/purifiers	212	77111	Liquid dielectric transformers
155	74419	Parts n.e.s of trucks and tractors	213	77119	Other electrical transformers
156	74443	Jacks and hoists, hydraulic	214	77125	Inductors n.e.s.
157	74491	Parts for winches/hoists	215	77129	Parts n.e.s electric power machinery
158	74492	Lift truck parts	216	77220	Printed circuits
159	74493	Lifts/skip hoists/escalators parts	217	77231	Fixed carbon resistors
160	74494	Lifting, handling and other parts n.e.s.	218	77232	Fixed resistors n.e.s.
161	74519	Parts n.e.s of tool of 7451	219	77233	Wire-wound variable resistors
162	74529	Packing etc machinery parts n.e.s.	220	77235	Variable resistors n.e.s.
163	74539	Weighing machine/parts n.e.s.	221	77238	Elect resistor parts
164	74568	Spraying machinery parts	222	77241	High voltage fuses

Table: A5.1 (continued)

No	Product code	Description
223	77242	Auto circuit breaker<72kv
224	77243	Other auto circuit breakers
225	77244	Hi-voltage isolating switch
226	77245	Limiter/surge suppressors etc.
227	77249	Hi-volt equipment n.e.s.
228	77251	Fuses (electrical)
229	77252	Automatic circuit breaker
230	77253	Protecting electrical circuit n.e.s.
231	77254	Relays (electrical)
232	77255	Other switches
233	77257	Lamp holders
234	77258	Plugs and sockets
235	77259	El connect equipment n.e.s.<1000v
236	77261	Switchboards etc <1000v
237	77262	Switchboards etc >1000v
238	77281	Switchboards etc unequip
239	77282	Switchgear parts n.e.s.
240	77311	Winding wire
241	77312	Co-axial cables
242	77313	Vehicle etc ignition
243	77314	Electrical conductor n.e.s.<80v
244	77315	Electrical conductor n.e.s.80-1000
245	77317	Electrical conductor n.e.s. >1000v
246	77318	Optical fibre cables
247	77322	Glass electrical insulators
248	77323	Ceramic electrical insulators
249	77324	Other electrical insulators
250	77326	Ceramic electrical insulators fittings n.e.s.
251	77328	Plastic electrical insulation fitting n.e.s.
252	77329	Other electrical insulation fitting n.e.s.
253	77423	X-ray tubes
254	77429	X-ray etc parts/access.
255	77549	electric shaver/etc parts
256	77579	Parts domestic electromechanical equipment
257	77589	Electrothermic appliances part
258	77611	TV picture tubes colour
259	77612	TV picture tubes monochr.
260	77621	TV camera tubes etc.
261	77623	Cathode-ray tubes n.e.s.
262	77625	Microwave tubes
263	77627	Electronic tubes n.e.s.
264	77629	Electronic tube parts n.e.s.
265	77631	Diodes exclude photosensitive diodes
266	77632	Transistors <1watt
267	77633	Transistors >1watt
268	77635	Thyristors/diacs/triacs
269	77637	Photo-active semiconductor
270	77639	semiconductor n.e.s.
271	77641	Digital monolith integrated units
272	77643	Monolithic integrated units n.e.s.
273	77645	Hybrid integrated circuits
274	77649	Integrated circuits n.e.s.
275	77681	Piezo- electric crystals, mounted
276	77688	Piezo-electric assembly parts
277	77689	Electronic component parts n.e.s.
278	77812	Electric accumulators
279	77817	Primary batt/cell parts
280	77819	Elec accumulator parts
281	77821	Elec filament lamps n.e.s.
282	77822	Elec discharge lamps n.e.s.
283	77823	Sealed beam lamp units
284	77824	Ultra-v/infra-r/arc lamp
285	77829	Parts n.e.s. of lamps of 7782
286	77831	Ignition/starting equipment
287	77833	Ignition/starting parts
288	77834	Vehicle’s electrical light/etc. equipment
289	77835	Vehicle’s electrical light/etc. part
290	77848	Hand electric-mechanical tool part
291	77861	Fixed power capacitors
292	77862	Tantalum fixed capacitors
293	77863	Aluminium electrolyte capacitors
294	77864	Ceramic dielectric capacitors single layer
295	77865	Ceramic dielectric capacitors multi-layer
296	77866	Paper/plastic capacitors
297	77867	Fixed capacitors n.e.s.
298	77868	Variable/adjustable capacitors
299	77869	Electrical capacitors part
300	77871	Particle accelerators
301	77879	Parts electrical equipment of 778.7
302	77881	Electro-magnets/devices
303	77882	Electrical traffic control equipment
304	77883	Electrical traffic control parts
305	77885	Electrical alarm parts
306	77886	Electrical carbons
307	77889	Electrical parts of machinery n.e.s.
308	78410	Motor vehicles chassis fitted with engine
309	78421	Motor car bodies
310	78425	Motor vehicle bodies n.e.s.
311	78431	Motor vehicle bumpers
312	78432	Motor vehicle body parts n.e.s.
313	78433	Motor vehicle brake/part
314	78434	Motor vehicle gearboxes
315	78435	Motor vehicle drive axle etc.
316	78436	Motor vehicle non-drive axles
317	78439	Other motor vehicle parts
318	78535	Parts/accessories motorcycles
319	78536	Parts/accessories inv carriage
320	78537	Parts/accessories cycles etc.
321	78689	Trailer/semi-trailer parts
322	79199	Rail/tram parts n.e.s.
323	79291	Aircraft props/rotors
324	79293	Aircraft under-carriages
325	79295	Aircraft/helicopters parts n.e.s.
326	79297	Air/space craft part n.e.s.
327	81211	Radiators, parts thereof
328	81215	Air heat/distributors equipment
329	81219	Parts of boilers
330	81380	Portable lamp parts
331	81391	Glass lighting parts
332	81392	Plastic lighting parts
333	81399	Lighting parts n.e.s.
334	82111	Aircraft seats
335	82112	Motor vehicle seats
336	82119	Parts of chairs/seats
337	82180	Furniture parts
338	84552	Girdles/corsets/braces

Table: A5.1 (continued)

No	Product code	Description
339	84842	Headgear plaited
340	84848	Parts for headgear
341	87119	Binocular/telescope parts/accessories
342	87139	Electron/etc different parts
343	87149	Microscope parts/accessories
344	87199	Parts/access for 8719
345	87319	Gas/liq/elec. meter parts
346	87325	Speed indicators and tachometers, etc.
347	87329	Meter/counter parts/accessories
348	87412	Navigation instrument parts/accessories
349	87414	Survey instrument parts/accessories
350	87424	Parts n.e.s. of the instrument of 8742
351	87426	Measurement/check instrument parts/accessories
352	87439	Fluid instrument parts/accessories
353	87454	Mechanical tester parts/accessories
354	87456	Thermometer etc. parts/accessories
355	87461	Thermostats
356	87463	Pressure regulators/etc.
357	87469	Regulators/controller instrument parts/accessories
358	87479	Elec/rad meter parts/accessories
359	8749	Instrument parts/accessories n.e.s.
360	88112	Photo flashbulbs/etc.
361	88113	Photo flashlight equipment
362	88114	Camera parts/accessories
363	88115	Flashlight parts/access
364	88123	Movie camera pa parts/accessories
365	88124	Movie projector parts/accessories
366	88134	Photo instrument n.e.s. parts/accessories
367	88136	Photo, cine. lab equipment
368	88422	Spectacle frame parts
369	88431	Camera/etc objective lens
370	88432	Objective lenses n.e.s.
371	88433	Optical filters
374	88439	Mounted opt elements n.e.s.
375	88571	Instrument panel clocks/etc.
376	88591	Watch cases and case parts
377	88592	Watch straps/bands metal
378	88593	Watch strap/band non-metal
379	88597	Clock cases and case parts
380	88598	Clock/watch movement/un-assembled
381	88599	Clock/watch parts n.e.s.
382	89121	Cartridges rivet gun etc.
383	89129	War munitions/parts
384	89191	Pistol parts/accessories
385	89195	Shotgun/rifle parts n.e.s.
386	89199	Military weapon part n.e.s.
387	89281	Labels paper, paperboard
388	89395	Plastic furniture fittings
389	89423	Doll parts/accessories
390	89865	Recorded tapes w4-6.5mm
391	89867	Recorded tapes w>6.5mm
392	8989	Musical instrument parts/accessories
393	89935	Lighter parts/accessories
394	89949	Parts n.e.s. umbrella/canes
395	89983	Buttons/studs/snaps/etc.
396	89985	Slide fasteners
397	89986	Slide fastener parts

Source: The products list is based on the Rev.3 compiled from the UN Comtrade database.

Table A5.2: Descriptive statistics and correlation statistics: Total non-oil exports (RER)

Variable	Unit	Obs	Mean	Std.Dev.	Min	Max
EXP_w	US$ million	924	2.86	6.80	0.01	74
RER	Index	924	90.68	24.29	44.78	223.87
WD_w	US$ billion	924	217	265	5.952	2100
$CHINA_w$	Ratio	924	0.13	0.14	0.001	0.61
FDI	Ratio	924	0.04	0.02	0.006	0.09
TREND	-	924	14.50	8.08	1	28
DGFC	1 for years 2008-2010, 0 otherwise	924	0.11	0.31	0	1
DAFC	1 for years 1997-1998, 0 otherwise	924	0.07	0.26	0	1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) EXP_w	1.000							
(2) RER	-0.208	1.000						
(3) WD_w	0.721	-0.261	1.000					
(4) $CHINA_w$	0.178	-0.279	0.134	1.000				
(5) FDI	-0.139	0.018	-0.271	-0.209	1.000			
(6) TREND	0.201	-0.098	0.425	0.311	-0.676	1.000		
(7) DGFC	0.013	-0.126	0.041	0.075	-0.273	0.150	1.000	
(8) DAFC	-0.054	0.057	-0.114	-0.099	0.142	-0.275	-0.096	1.000

Source: Author's computation.

Table A5.3: Descriptive statistics and correlation statistics: Non-oil primary exports (RER)

Variable	Unit	Obs	Mean	Std.Dev.	Min	Max
EXP_w	US$ million	196	0.91	1.35	0.01	9
RER	Index	196	81.80	18.35	41.91	144.95
WD_w	US$ billion	196	91.70	83.05	5.95	409
$CHINA_w$	Ratio	196	0.04	0.03	0.001	0.11
FDI	Ratio	196	0.04	0.02	0.006	0.09
TREND	-	196	14.50	8.10	1	28
DGFC	1 for years 2008-2010, 0 otherwise	196	0.11	0.31	0	1
DAFC	1 for years 1997-1998, 0 otherwise	196	0.07	0.26	0	1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) EXP_w	1.000							
(2) RER	0.163	1.000						
(3) WD_w	0.643	0.221	1.000					
(4) $CHINA_w$	0.143	-0.224	0.482	1.000				
(5) FDI	-0.225	-0.122	-0.353	-0.180	1.000			
(6) TREND	0.452	-0.060	0.590	0.243	-0.676	1.000		
(7) DGFC	0.025	-0.181	0.065	0.033	-0.273	0.150	1.000	
(8) DAFC	-0.120	-0.048	-0.155	-0.082	0.142	-0.275	-0.096	1.000

Source: Author's computation.

Table A5.4: Descriptive statistics and correlation statistics: Manufacturing exports (RER)

Variable	Unit	Obs	Mean	Std.Dev.	Min	Max
EXP_w	US$ million	728	3.38	7.54	0.01	74
RER	Index	728	93.35	24.72	52.09	256.68
WD_w	US$ billion	728	250	286	8.18	2100
$CHINA_w$	Ratio	728	0.15	0.15	0.003	0.61
FDI	Ratio	728	0.04	0.02	0.006	0.09
TREND	-	728	14.50	8.08	1	28
DGFC	1 for years 2008-2010, 0 otherwise	728	0.11	0.31	0	1
DAFC	1 for years 1997-1998, 0 otherwise	728	0.07	0.26	0	1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) EXP_w	1.000							
(2) RER	-0.195	1.000						
(3) WD_w	0.716	-0.206	1.000					
(4) $CHINA_w$	0.137	-0.165	0.050	1.000				
(5) FDI	-0.148	-0.020	-0.290	-0.242	1.000			
(6) TREND	0.208	-0.041	0.454	0.361	-0.676	1.000		
(7) DGFC	0.013	-0.102	0.043	0.089	-0.273	0.150	1.000	
(8) DAFC	-0.057	0.088	-0.121	-0.115	0.142	-0.275	-0.096	1.000

Source: Author’s computation.

Table A5.5: Descriptive statistics and correlation statistics: GPN exports (RER)

Variable	Unit	Obs	Mean	Std.Dev.	Min	Max
EXP_w	US$ million	196	8.78	12.80	0.18	74
RER	Index	196	83.83	16.75	52.09	112.86
WD_w	US$ billion	196	456	423	32.69	2100
$CHINA_w$	Ratio	196	0.14	0.13	0.003	0.50
FDI	Ratio	196	0.04	0.02	0.006	0.09
TREND	-	196	14.50	8.10	1	28
DGFC	1 for years 2008-2010, 0 otherwise	196	0.11	0.31	0	1
DAFC	1 for years 1997-1998, 0 otherwise	196	0.07	0.26	0	1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) EXP_w	1.000							
(2) RER	-0.305	1.000						
(3) WD_w	0.674	-0.405	1.000					
(4) $CHINA_w$	0.363	-0.615	0.237	1.000				
(5) FDI	-0.217	0.396	-0.367	-0.336	1.000			
(6) TREND	0.275	-0.749	0.570	0.533	-0.676	1.000		
(7) DGFC	0.010	-0.305	0.038	0.114	-0.273	0.150	1.000	
(8) DAFC	-0.075	0.324	-0.152	-0.164	0.142	-0.275	-0.096	1.000

Source: Author’s computation.

Table A5.6: Descriptive statistics and correlation statistics: Non-GPN exports (RER)

Variable	Unit	Obs	Mean	Std.Dev.	Min	Max
EXP_w	US$ million	532	1.39	1.67	0.01	11
RER	Index	532	96.85	26.23	56.56	256.68
WD_w	US$ billion	532	174	157	8.18	778
$CHINA_w$	Ratio	532	0.16	0.15	0.004	0.61
FDI	Ratio	532	0.04	0.02	0.006	0.09
TREND	-	532	14.50	8.09	1	28
DGFC	1 for years 2008-2010, 0 otherwise	532	0.11	0.31	0	1
DAFC	1 for years 1997-1998, 0 otherwise	532	0.07	0.26	0	1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) EXP_w	1.000							
(2) RER	0.005	1.000						
(3) WD_w	0.791	0.013	1.000					
(4) $CHINA_w$	0.091	-0.099	-0.015	1.000				
(5) FDI	-0.301	-0.119	-0.360	-0.212	1.000			
(6) TREND	0.506	0.123	0.565	0.307	-0.676	1.000		
(7) DGFC	0.053	-0.060	0.069	0.081	-0.273	0.150	1.000	
(8) DAFC	-0.138	0.037	-0.151	-0.100	0.142	-0.275	-0.096	1.000

Source: Author's computation.

Table A5.7: Descriptive statistics and correlation statistics: Total non-oil exports (NER and RP)

Variable	Unit	Obs	Mean	Std.Dev.	Min	Max
EXP_w	US$ million	924	2.86	6.80	0.01	74
NER	Index	924	90.59	14.31	65.91	113.17
RP	Index	924	102.46	30.99	47.91	258.46
WD_w	US$ billion	924	217	265	5.95	2100
$CHINA_w$	Ratio	924	0.13	0.14	0.001	0.61
FDI	Ratio	924	0.04	0.02	0.006	0.09
TREND	-	924	14.50	8.08	1	28
DGFC	1 for years 2008 - 2010, 0 otherwise	924	0.11	0.31	0	1
DAFC	1 for years 1997-1998, 0 otherwise	924	0.07	0.26	0	1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) EXP_w	1.000								
(2) NER	0.142	1.000							
(3) RP	-0.253	-0.482	1.000						
(4) WD_w	0.721	0.275	-0.378	1.000					
(5) $CHINA_w$	0.178	0.162	-0.344	0.134	1.000				
(6) FDI	-0.139	-0.749	0.493	-0.271	-0.209	1.000			
(7) TREND	0.201	0.599	-0.460	0.425	0.311	-0.676	1.000		
(8) DGFC	0.013	-0.052	-0.111	0.041	0.075	-0.273	0.150	1.000	
(9) DAFC	-0.054	-0.037	0.067	-0.114	-0.099	0.142	-0.275	-0.096	1.000

Source: Author's computation.

Table A5.8: Descriptive statistics and correlation statistics: Non-oil primary exports (NER and RP)

Variable	Unit	Obs	Mean	Std.Dev.	Min	Max
EXP_w	US$ million	196	0.91	1.35	0.01	9
NER	Index	196	90.59	14.34	65.91	113.17
RP	Index	196	92.00	23.07	52.05	164.86
WD_w	US$ billion	196	91.70	83.05	5.95	409
$CHINA_w$	Ratio	196	0.04	0.03	0.001	0.11
FDI	Ratio	196	0.04	0.02	0.006	0.09
TREND	-	196	14.50	8.10	1	28
DGFC	1 for years 2008 - 2010, 0 otherwise	196	0.11	0.31	0	1
DAFC	1 for years 1997-1998, 0 otherwise	196	0.07	0.26	0	1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) EXP_w	1.000								
(2) NER	0.231	1.000							
(3) RP	-0.015	-0.468	1.000						
(4) WD_w	0.643	0.348	-0.053	1.000					
(5) $CHINA_w$	0.143	0.146	-0.313	0.482	1.000				
(6) FDI	-0.225	-0.749	0.449	-0.353	-0.180	1.000			
(7) TREND	0.452	0.599	-0.483	0.590	0.243	-0.676	1.000		
(8) DGFC	0.025	-0.052	-0.157	0.065	0.033	-0.273	0.150	1.000	
(9) DAFC	-0.120	-0.037	-0.015	-0.155	-0.082	0.142	-0.275	-0.096	1.000

Source: Author’s computation.

Table A5.9: Descriptive statistics and correlation statistics: Manufacturing exports (NER and RP)

Variable	Unit	Obs	Mean	Std.Dev.	Min	Max
EXP_w	US$ million	728	3.38	7.54	0.01	74
NER	Index	728	90.59	14.31	65.91	113.17
RP	Index	728	105.31	30.84	55.22	295.75
WD_w	US$ billion	728	250	286	8.18	2100
$CHINA_w$	Ratio	728	0.15	0.15	0.003	0.61
FDI	Ratio	728	0.04	0.02	0.006	0.09
TREND	-	728	14.50	8.08	1	28
DGFC	1 for years 2008 - 2010, 0 otherwise	728	0.11	0.31	0	1
DAFC	1 for years 1997-1998, 0 otherwise	728	0.07	0.26	0	1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) EXP_w	1.000								
(2) NER	0.152	1.000							
(3) RP	-0.253	-0.465	1.000						
(4) WD_w	0.716	0.296	-0.353	1.000					
(5) $CHINA_w$	0.137	0.187	-0.271	0.050	1.000				
(6) FDI	-0.148	-0.749	0.464	-0.290	-0.242	1.000			
(7) TREND	0.208	0.599	-0.418	0.454	0.361	-0.676	1.000		
(8) DGFC	0.013	-0.052	-0.089	0.043	0.089	-0.273	0.150	1.000	
(9) DAFC	-0.057	-0.037	0.098	-0.121	-0.115	0.142	-0.275	-0.096	1.000

Source: Author’s computation.

Table A5.10: Descriptive statistics and correlation statistics: GPN exports (NER and RP)

Variable	Unit	Obs	Mean	Std.Dev	Min	Max
EXP_w	US$ million	196	8.78	12.80	0.18	74
NER	Index	196	90.59	14.34	65.91	113.17
RP	Index	196	95.74	29.09	55.22	164.79
WD_w	US$ billion	196	456.00	423.00	32.69	2100
$CHINA_w$	Ratio	196	0.14	0.13	0.003	0.50
FDI	Ratio	196	0.04	0.02	0.006	0.09
TREND	-	196	14.50	8.10	1	28
DGFC	1 for years 2008 - 2010, 0 otherwise	196	0.11	0.31	0	1
DAFC	1 for years 1997-1998, 0 otherwise	196	0.07	0.26	0	1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) EXP_w	1.000								
(2) NER	0.229	1.000							
(3) RP	-0.333	-0.696	1.000						
(4) WD_w	0.674	0.385	-0.501	1.000					
(5) $CHINA_w$	0.363	0.266	-0.568	0.237	1.000				
(6) FDI	-0.217	-0.749	0.775	-0.367	-0.336	1.000			
(7) TREND	0.275	0.599	-0.874	0.570	0.533	-0.676	1.000		
(8) DGFC	0.010	-0.052	-0.210	0.038	0.114	-0.273	0.150	1.000	
(9) DAFC	-0.075	-0.037	0.220	-0.152	-0.164	0.142	-0.275	-0.096	1.000

Source: Author's computation.

Table A5.11: Descriptive statistics and correlation statistics: Non-GPN exports (NER and RP)

Variable	Unit	Obs	Mean	Std.Dev.	Min	Max
EXP_w	US$ million	532	1.39	1.67	0.01	11
NER	Index	532	90.59	14.32	65.91	113.17
RP	Index	532	108.84	30.75	64.07	295.75
WD_w	US$ billion	532	174	157	8.18	778
$CHINA_w$	Ratio	532	0.16	0.15	0.004	0.61
FDI	Ratio	532	0.04	0.02	0.006	0.09
TREND	-	532	14.50	8.09	1	28
DGFC	1 for years 2008 - 2010, 0 otherwise	532	0.11	0.31	0	1
DAFC	1 for years 1997-1998, 0 otherwise	532	0.07	0.26	0	1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) EXP_w	1.000								
(2) NER	0.291	1.000							
(3) RP	-0.174	-0.396	1.000						
(4) WD_w	0.791	0.356	-0.207	1.000					
(5) $CHINA_w$	0.091	0.163	-0.204	-0.015	1.000				
(6) FDI	-0.301	-0.749	0.367	-0.360	-0.212	1.000			
(7) TREND	0.506	0.599	-0.269	0.565	0.307	-0.676	1.000		
(8) DGFC	0.053	-0.052	-0.049	0.069	0.081	-0.273	0.150	1.000	
(9) DAFC	-0.138	-0.037	0.058	-0.151	-0.100	0.142	-0.275	-0.096	1.000

Source: Author's computation.

Table A5.12: Unit root test result using the Harris-Tzavalis (1999) method

Total Non-oil	Level		Ist Difference	
Variable	Constant	Constant and Trend	Constant	Constant and Trend
EXP_w	1.003	0.818	-0.068***	0.084***
RER	0.913	0.770	0.049***	0.094***
WD_w	1.017	0.730	-0.019***	0.197***
$CHINA_w$	0.971	0.970	0.340***	0.448***
FDI	0.641***	0.469 ***	-0.348***	-0.348***
NER	0.846 ****	0.793	0.158***	0.197***
Relative_price	0.906	0.826	0.092***	0.124***

Note: ***, ** and * are significant at the 1%, 5%, and 10% levels, respectively, for rejection of the null hypothesis of panels containing unit root.
Source: Author's computation.

Table A5.13: Unit root test result using the Levin et al. (2002) method

Variable	Level		Ist Difference	
	Constant	Constant and Trend	Constant	Constant and Trend
Non-oil primary				
EXP_w	4.840	-0.854	-5.378***	-4.614***
RER	-1.856**	-1.763**	-1.763***	-6.726***
WD_w	4.615	-1.841**	-9.442***	-5.121***
$CHINA_w$	-1.419*	-1.913**	-9.242***	-7.747***
FDI	-4.860***	-4.761***	-11.718***	-9.271***
NER	-1.881**	-0.677	-8.696***	-7.098***
RP	-3.703***	-3.592***	-8.757***	-4.620***
Manufacturing				
EXP_w	6.819	-0.616***	-17.921***	-15.860***
RER	-1.070	1.689	-16.823***	-14.593***
WD_w	4.913	-4.466***	-17.467***	-13.946***
$CHINA_w$	-1.563*	0.416	-5.996***	-6.246 ***
FDI	-9.366***	-9.175***	-22.583***	-17.868***
NER	-3.625***	-1.304***	-16.759***	-13.680***
RP	-11.801***	-0.776***	-12.878***	-9.088***
GPN				
EXP_w	2.725	0.095	-11.002***	-10.382***
RER	-0.575	2.435	-7.117***	-6.365***
WD_w	2.595	-1.761**	-9.900***	-7.662***
$CHINA_w$	-3.610**	1.421	1.016***	-1.0388
FDI	-4.860***	-4.761***	-11.718***	-9.271***
NER	-1.881***	-0.677	-8.696***	-7.098***
RP	-7.846***	0.324	-5.907***	2.310
non-GPN				
EXP_w	6.308	-0.815	-14.195***	-12.204***
RER	-0.918**	0.466	-15.342***	-13.194***
WD_w	4.1738	-4.169***	-14.432***	-11.674***
$CHINA_w$	-6.126	-0.367	-7.485***	-7.039***
FDI	-8.007***	-7.843***	-19.305***	-15.274***
NER	-3.099***	-1.115	-14.327***	-11.694***
RP	-8.906***	-1.108***	-11.550***	-10.407***

Note: ***, ** and * are significant at the 1%, 5%, and 10% levels, respectively, for rejection of the null hypothesis of panels containing the unit root. The maximum lag length selected is four based on AIC.
Source: Author's computation.

Table A5.14: The role of RER in exports by product categories: Alternative RER measurement (CPI)

Dependent variable: $lnEXP_w$	Total non-oil	Non-oil primary	Manufacturing	GPN	Non-GPN
	(1)	(2)	(3)	(4)	(5)
Adjustment coefficient	-0.133***	-0.119***	-0.134***	-0.105***	-0.158***
	(0.014)	(0.030)	(0.015)	(0.028)	(0.019)
Long-run coefficients					
$lnRER_{t-1}$	0.657***	0.977*	0.708***	1.631*	0.476*
	(0.211)	(0.599)	(0.241)	(0.980)	(0.248)
$lnWD_{w\ t-1}$	0.433**	-0.385	0.529**	1.054**	0.468***
	(0.207)	(0.687)	(0.223)	(0.536)	(0.234)
$CHINA_{w\ t-1}$	-3.428***	-3.174	-3.495***	-4.130**	-2.259**
	(0.838)	(8.748)	(0.892)	(1.909)	(1.063)
FDI_{t-1}	7.824**	6.866	9.017**	21.538*	6.777*
	(3.103)	(6.387)	(3.669)	(11.548)	(3.531)
TREND	0.061***	0.116**	0.056***	0.042	0.057***
	(0.016)	(0.048)	(0.018)	(0.047)	(0.019)
Short-run coefficients					
$\Delta\ lnRER$	0.076	-0.249**	0.205**	0.172	0.243**
	(0.073)	(0.120)	(0.093)	(0.171)	(0.114)
$\Delta\ lnWD_w$	0.821***	1.102***	0.715***	0.708***	0.698***
	(0.055)	(0.103)	(0.065)	(0.127)	(0.077)
$\Delta\ CHINA_w$	-0.815*	4.692	-0.894*	-0.775	-0.695
	(0.495)	(2.903)	(0.513)	(1.239)	(0.582)
Δ FDI	1.197***	2.251***	1.084**	1.646*	1.025*
	(0.395)	(0.754)	(0.461)	(0.965)	(0.536)
DGFC	0.054***	0.103***	0.042**	0.043	0.043**
	(0.015)	(0.030)	(0.017)	(0.034)	(0.021)
DAFC	-0.079***	-0.062	-0.081***	-0.065	-0.084***
	(0.022)	(0.040)	(0.026)	(0.051)	(0.030)
Constant	0.660**	1.277	0.524	-0.643	0.822**
	(0.299)	(0.684)	(0.337)	(0.831)	(0.388)
Number of observations	891	189	702	189	513
Number of products	33	7	26	7	19
Model	DFE	DFE	DFE	DFE	DFE
Hausman test PMG versus DFE (Chi^2 p-values)	0.978	1.00	0.971	0.982	0.999

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
Source: Author's estimation.

Table A5.15: The role of NER and RP in exports by product categories: Alternative RER measurement (CPI)

Dependent variable: lnEXP$_w$	Total non-oil	Non-oil primary	Manufacturing	GPN	Non-GPN
	(1)	(2)	(3)	(4)	(5)
Adjustment coefficient	-0.134***	-0.120***	-0.135***	-0.119***	-0.159***
	(0.014)	(0.030)	(0.016)	(0.030)	(0.020)
Long-run coefficients					
lnNER $_{t-1}$	0.575	0.686	0.655	0.752	0.479
	(0.418)	(0.993)	(0.470	(1.033	(0.477)
lnRP $_{t-1}$	0.676***	0.975	0.750***	2.900**	0.522**
	(0.216)	(0.601)	(0.250	(1.290	(0.255)
lnWD$_{w\ t-1}$	0.435**	-0.314	0.512**	1.446***	0.427*
	(0.211)	(0.687)	(0.227	(0.555	(0.237)
lnCHINA$_{w\ t-1}$	-3.403***	-3.096	-3.473***	-2.705	-2.261**
	(0.837)	(8.707)	(0.885	(1.837	(1.054)
FDI $_{t-1}$	7.075*	4.838	8.274*	12.744	6.325
	(4.178)	(9.134)	(4.811	(11.146	(4.776)
TREND	0.062***	0.110**	0.058***	0.044	0.061***
	(0.016)	(0.049)	(0.018	(0.042	(0.019)
Short-run coefficients					
Δ lnNER	0.045	-0.199	0.132	0.174	0.144
	(0.095)	(0.195)	(0.108)	(0.195)	(0.131)
Δ lnRP	0.095	-0.261**	0.315***	0.148	0.394***
	(0.085)	(0.124)	(0.121)	(0.282)	(0.143)
Δ lnWD$_w$	0.818***	1.110***	0.701***	0.729***	0.665***
	(0.056)	(0.105)	(0.066)	(0.133)	(0.080)
Δ CHINA$_w$	-0.808*	4.790*	-0.908*	-0.859	-0.728
	(0.496)	(2.923)	(0.515)	(1.241)	(0.587)
Δ FDI	1.103**	2.207**	0.930*	1.282	0.835
	(0.460)	(0.913)	(0.527)	(1.028)	(0.621)
DGFC	0.052***	0.101**	0.037**	0.035	0.036
	(0.016)	(0.033)	(0.019)	(0.035)	(0.022)
DAFC	-0.073***	-0.078	-0.058**	-0.079	-0.050
	(0.027)	(0.053)	(0.030)	(0.058)	(0.036)
Constant	0.297	0.834	0.125	-2.411*	0.518
	(0.374)	(0.828)	(0.422)	(1.399)	(0.491)
Number of observations	891	189	702	189	513
Number of products	33	7	26	7	19
Model	DFE	DFE	DFE	DFE	DFE
Hausman test PMG versus DFE (Chi^2 p-values)	0.999	1.00	0.998	0.998	0.999

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
Source: Author's estimation.

Table A5.16: The role of RER in exports by product categories: Standard RER measurement

Dependent variable: $lnEXP_w$	Total non-oil	Non-oil primary	Manufacturing	GPN	Non-GPN
	(1)	(2)	(3)	(4)	(5)
Adjustment coefficient	-0.122***	-0.115***	-0.124***	-0.094***	-0.152***
	(0.013)	(0.031)	(0.015)	(0.027)	(0.019)
Long-run coefficients					
$lnRER_{t-1}$	1.767**	0.389	1.394	-3.057	1.913*
	(0.804)	(0.872)	(1.172)	(3.110)	(1.144)
$lnWD_{w\ t-1}$	0.428*	0.136	0.481*	1.355*	0.390
	(0.233)	(0.644)	(0.266)	(0.709)	(0.260)
$CHINA_{w\ t-1}$	-4.706***	-4.209	-4.460***	-6.055***	-2.775**
	(0.866)	(9.383)	(0.937)	(2.055)	(1.108)
FDI_{t-1}	12.369***	10.289	9.703**	10.115	9.186**
	(4.247)	(11.111)	(4.455)	(11.468)	(4.248)
TREND	0.062***	0.096*	0.045**	0.018	0.048**
	(0.017)	(0.054)	(0.019)	(0.047)	(0.019)
Short-run coefficients					
$\Delta\ lnRER$	0.070	-0.009	0.168	0.008	0.198
	(0.110)	(0.114)	(0.171)	(0.344)	(0.201)
$\Delta\ lnWD_w$	0.842***	0.970***	0.754***	0.736***	0.755***
	(0.049)	(0.089)	(0.063)	(0.141)	(0.071)
$\Delta\ CHINA_w$	-1.079**	4.985*	-1.051**	-1.383	-0.757
	(0.496)	(2.985)	(0.511)	(1.219)	(0.588)
Δ FDI	1.456***	2.532**	0.933**	0.696	1.058*
	(0.445)	(1.048)	(0.475)	(0.904)	(0.561)
DGFC	0.052***	0.092***	0.035**	0.032	0.038*
	(0.016)	(0.034)	(0.018)	(0.034)	(0.021)
DAFC	-0.058**	-0.079*	-0.059**	-0.077	-0.050*
	(0.022)	(0.045)	(0.025)	(0.048)	(0.029)
Constant	-0.005	0.930	0.187	1.160	-0.064
	(0.457)	(0.821)	(0.594)	(1.116)	(0.702)
Number of observations	891	189	702	189	513
Number of products	33	7	26	7	19
Model	DFE	DFE	DFE	DFE	DFE
Hausman test PMG versus DFE (Chi^2 p-values)	0.999	1.000	0.989	0.882	1.000

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
Source: Author's estimation.

Table A5.17: The role of NER and RP in exports by product categories: Standard RER measurement

Dependent variable: $lnEXP_w$	Total non-oil	Non-oil primary	Manufacturing	GPN	Non-GPN
	(1)	(2)	(3)	(4)	(5)
Adjustment coefficient	-0.122***	-0.115***	-0.124***	-0.093***	-0.153***
	(0.013)	(0.031)	(0.015)	(0.027)	(0.019)
Long-run coefficients					
$ln\text{NER}_{t-1}$	1.713**	-0.296	1.384	-3.315	2.001
	(0.875)	(1.374)	(1.310)	(3.470)	(1.271)
$ln\text{RP}_{t-1}$	2.338*	1.178	0.943	-6.529	2.382
	(1.232)	(1.530)	(1.904)	(5.149)	(1.848)
$ln\text{WD}_{w\ t-1}$	0.453*	0.267	0.477*	1.280*	0.387
	(0.242)	(0.667)	(0.271)	(0.730)	(0.262)
$ln\text{CHINA}_{w\ t-1}$	-4.710***	-3.906	-4.452***	-6.028***	-2.798**
	(0.871)	(9.378)	(0.941)	(2.083)	(1.109)
FDI_{t-1}	11.083**	10.356	11.123*	19.472	8.158
	(4.951)	(11.168)	(6.843)	(18.175)	(6.477)
TREND	0.065***	0.110*	0.046**	0.028	0.047**
	(0.018)	(0.059)	(0.019)	(0.049)	(0.019)
Short-run coefficients					
$\Delta\ ln\text{NER}$	0.132	0.037	0.122	-0.247	0.254
	(0.156)	(0.199)	(0.227)	(0.437)	(0.267)
$\Delta\ ln\text{RP}$	0.111	0.050	0.112	-0.246	0.237
	(0.144)	(0.164)	(0.284)	(0.535)	(0.336)
$\Delta\ ln\text{WD}_w$	0.843***	0.984***	0.756***	0.738***	0.751***
	(0.053)	(0.098)	(0.064)	(0.144)	(0.072)
$\Delta\ \text{CHINA}_w$	-1.085**	5.101*	-1.058**	-1.297	-0.736
	(0.496)	(3.022)	(0.514)	(1.232)	(0.593)
Δ FDI	1.417***	2.530	1.003*	1.006	1.012
	(0.463)	(1.057)	(0.572)	(1.092)	(0.676)
DGFC	0.050***	0.098***	0.037*	0.044	0.035
	(0.016)	(0.035)	(0.019)	(0.036)	(0.023)
DAFC	-0.063**	-0.089*	-0.056*	-0.054	-0.055
	(0.025)	(0.050)	(0.029)	(0.057)	(0.035)
Constant	-1.324	0.491	-0.344	4.105	-1.791
	(0.980)	(1.180)	(1.548)	(2.886)	(1.837)
Number of observations	891	189	702	189	513
Number of products	33	7	26	7	19
Model	DFE	DFE	DFE	DFE	DFE
Hausman test PMG versus DFE (Chi^2 p-values)	0.999	1.000	0.984	0.997	1.000

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and * is statistically significant at the 10% level.
Source: Author's estimation.

Table A5.18: The role of RER in exports by product categories: The DOLS model

Dependent variable: $lnEXP_w$	Total non-oil	Non-oil primary	Manufacturing	GPN	Non-GPN
	(1)	(2)	(3)	(4)	(5)
Long-run coefficients					
lnRER	0.283**	0.099	0.410***	0.595	0.201
	0.116	0.229	0.139	0.399	0.157
$lnWD_w$	0.854***	0.859***	0.815***	1.064***	0.791***
	0.111	0.268	0.123	0.239	0.141
$CHINA_w$	-1.371***	-2.422	-1.491***	-1.286	-0.991
	0.482	4.414	0.522	0.862	0.684
FDI	0.130	4.592	-1.167	-1.168	-0.761
	1.486	2.828	1.723	3.707	1.884
TREND	0.032***	0.037*	0.034***	0.004	0.039***
	0.009	0.021	0.010	0.019	0.011
R-squared	0.959	0.954	0.960	0.953	0.954
Adjusted R-squared	0.958	0.951	0.958	0.950	0.952

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
Source: Author's estimation.

Table A5.19: The role of NER and RP in exports by product categories: The DOLS model

Dependent variable: $lnEXP_w$	Total non-oil	Non-oil primary	Manufacturing	GPN	Non-GPN
	(1)	(2)	(3)	(4)	(5)
Long-run coefficients					
lnNER	-0.199	-0.299	-0.123	-0.100	-0.236
	0.206	0.387	0.239	0.460	0.267
lnRP	0.392***	0.213	0.538***	1.682****	0.293*
	0.121	0.243	0.144	0.561	0.161
$lnWD_w$	0.923***	0.883***	0.899***	1.495***	0.839***
	0.112	0.265	0.124	0.279	0.141
$CHINA_w$	-1.284***	-2.470	-1.464***	-0.409	-1.057
	0.475	4.354	0.512	0.876	0.675
FDI	-2.650	2.180	-4.188**	-5.860	-3.355
	1.766	3.377	2.023	3.917	2.264
TREND	0.030***	0.038***	0.032***	-0.001	0.038***
	0.009	0.021	0.010	0.018)	0.011
R-squared	0.961	0.955	0.961	0.957	0.955
Adjusted R-squared	0.959	0.952	0.959	0.956	0.953

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
Source: Author's estimation.

Table A5.20: The role of RER in exports by product categories: The FMOLS model

Dependent variable: $lnEXP_w$	Total non-oil	Non-oil primary	Manufacturing	GPN	Non-GPN
	(1)	(2)	(3)	(4)	(5)
Long-run coefficients					
lnRER	0.410***	0.265	0.542***	0.866**	0.295**
	0.099	0.202	0.116	0.348	0.123
$lnWD_w$	0.731***	0.786***	0.672***	1.022***	0.664***
	0.094	0.234	0.102	0.210	0.110
$CHINA_w$	-1.506***	-2.416	-1.762***	-1.284*	-1.522***
	0.410	4.001	0.435	0.758	0.544
FDI	0.914	6.374**	-0.947	0.607	-0.700
	1.278	2.591	1.451	3.265	1.509
TREND	0.044***	0.048**	0.047***	0.012	0.052***
	0.007	0.018	0.008	0.017	0.009
R-squared	0.962	0.955	0.962	0.953	0.957
Adjusted R-squared	0.961	0.952	0.960	0.951	0.955

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
Source: Author's estimation.

Table A5.21: The role NER and RP in exports by product categories: The FMOLS model

Dependent variable: $lnEXP_w$	Total non-oil	Non-oil primary	Manufacturing	GPN	Non-GPN
	(1)	(2)	(3)	(4)	(5)
Long-run coefficients					
lnNER	-0.201	-0.266	-0.122	-0.087	-0.283
	0.170	0.332	0.193	0.394	0.204
lnRP	0.513***	0.416*	0.655***	2.180***	0.389***
	0.102	0.214	0.120	0.506	0.126
$lnWD_w$	0.783***	0.779***	0.738***	1.508***	0.696***
	0.095	0.231	0.103	0.250	0.110
$CHINA_w$	-1.418***	-2.378	-1.739***	-0.288	-1.614***
	0.404	3.937	0.426	0.773	0.533
FDI	-3.553**	2.222	-5.700***	-7.391**	-4.949***
	1.498	3.013	1.690	3.500	1.784
TREND	0.042***	0.051***	0.045***	0.007	0.052***
	0.007	0.018	0.008	0.016	0.008
R-squared	0.963	0.956	0.963	0.957	0.958
Adjusted R-squared	0.961	0.953	0.961	0.955	0.956

Note: Number in parentheses ( ) is the standard error.
*** is statistically significant at the 1% level, ** is statistically significant at the 5% level and
* is statistically significant at the 10% level.
Source: Author's estimation.

CHAPTER 6: CONCLUSION

6.1 Introduction

This thesis aims to contribute to the sparse case study-based literature on economic performance and structural adjustment in developing and emerging market economies through an in-depth time-profile study of Malaysia. Following the introductory chapter that spelt out the purpose and scope of the topic, Chapter 2 presented an overview of the country's policy context. The three central chapters (Chapters 3, 4, and 5), which form the core of the thesis, addressed three selected issues concerning the real exchange rate (RER) debate in the form of self-contained research essays.

Chapter 3 examined the determinants of the RER movement in Malaysia using time series data from 1960 to 2018. This chapter begins with a discussion of the measurement of RER index, equilibrium RER (ERER), and RER misalignment. The source of variation in RER is examined using the newly constructed RER index, which is consistent with the theoretical RER definition and the analysis focussing on the impact of exchange rate regime shifts. Next, the ERER is derived from the long-run coefficient parameter obtained from the RER equation and is used to measure the extent of RER misalignment in Malaysia.

Chapter 4 investigated the implications of RER misalignment for Malaysia's economic growth using the standard growth model, emphasising the contemporary debate on RER undervaluation compared to the overall misalignment. The analysis is conducted on the total economy and separately for tradable and non-tradable sectors. Then, in Chapter 5, the impact of RER in export performance is investigated with an emphasis on the differential impact of manufacturing exports within global production network (GPN) exports and non-GPN exports, and the role of China’s rise in Malaysia’s exports using a panel dataset from the period 1992 to

2019. The analysis has been conducted on the five different export categories to determine whether they respond differently to export determinants.

The econometric analysis in all three core chapters was undertaken using the Autoregressive Distributed Lag (ARDL) method, which has become the workhorse of time-series and panel data analysis. This approach has the advantage of estimating long-run and short-run relationships between variables while minimising the possibility of endogeneity bias. This is done by reparametrising the model in an error-correction form.

6.2 Findings

Based on comparative analysis on newly constructed RER index and IMF index, Chapter 3 demonstrates that standard widely used IMF index tends to overstate exchange rate changes for two reasons. The world's inflation rate measured by the WPI is lower than CPI, and Malaysia's GDP deflator is higher than its CPI. In developed countries, the CPI is naturally higher, but this is not the case in Malaysia, where the CPI is distorted in comparison to the GDP deflator. Analysis result of the RER equation indicates that technological progress and capital inflows lead to RER appreciation. Meanwhile, government intervention leads to RER depreciation. Notably, the capital inflows have a sizeable impact on RER movements compared to other factors; meanwhile, the government intervention has only a modest impact on RER movements. This finding is consistent with the BNM's direct measures in the foreign exchange rate market to avoid excessive RM fluctuation. Contrary to prediction, the result for the fixed exchange rate regime indicates a positive relationship with RER movement, suggesting that RER is more depreciated during the fixed exchange rate regime than during normal times. The estimated ERER shows that it varies over time in response to changes in the fundamental variables. The RER misalignment measured in this study found that Malaysia had several episodes of RER misalignment, with undervaluation dominating the overall time pattern.

The findings for the analysis of exchange rate misalignment and economic growth (Chapter 4) suggest that RER misalignment has no significant impact on long-term economic growth, but RER undervaluation promotes overall economic growth. It implies that the positive growth impact of RER undervaluation is greater than the negative impact of RER overvaluation. The findings also highlight the importance of capital per worker and open trade policy for higher economic growth. The result of the sectoral analysis indicates that RER undervaluation promotes output in tradable sector. This finding is consistent with the recent empirical evidence that RER undervaluation affects long-term economic performance through tradable sector. One of the limitations of this study is that it does not set any threshold point for undervaluation and overvaluation, which affect economic performance. Future research can improve the result by estimating the threshold point for undervaluation and overvaluation.

As expected, the results of Chapter 5 suggest that international competitiveness as measured by the RER is significantly associated with the export performance of total non-oil, non-oil primary, manufacturing, and GPN products. RER has a sizeable impact on the GPN product exports implying that specialisation within GPNs at the individual country level is responsive to changes in international price. The findings reveal that China's growing role in the global economy has undermined Malaysia's exports, with GPN product exports facing greater competition from China compared to other product categories. World demand, foreign direct investment, and other supply factors are equally important in boosting exports' performance in most cases. The RER index was decomposed into nominal exchange rate (NER) and relative price components for further investigation. The outcome was that NER has no significant impact on the export performance of all product categories. On the other hand, relative price is positively correlated with export growth and statistically significant in most product categories. These findings are consistent with the current literature on the 'dominant currency paradigm'. In the case of currency dominance in exports, exchange rate changes have no impact on export performance. Relative price (measured in domestic currency) plays a significant role in determining export products' competitiveness.

Overall, this study contributes significantly to current knowledge, both theoretically and empirically. The findings highlight that it is critical to construct the RER index in accordance with the theoretical definition to avoid misleading inference. The RER misalignment, measured based on the constructed RER index, provides a better understanding of the exchange rate level and how it affects Malaysia's overall economic performance. This study also highlights the importance of maintaining a competitive exchange rate for export expansion. It also provides a piece of evidence to support the current debate about the US dollar's dominance in international transactions. Lastly, there is strong evidence that China's rise is a competitor than a complement to Malaysia's export.

6.3 Policy implications

Several policy recommendations can be drawn from the findings of these three core chapters. Chapter 3 highlights that the use of the IMF index tends to overstate the exchange rate changes. Thus, using an appropriate price index in RER index construction is vital for policy analysis to avoid misleading inferences. Based on the econometric analysis of the RER equation, capital inflows are found to have a greater impact on the long-term RER movement than other determining factors. The result can be interpreted from two perspectives. First, RM appreciation may become inevitable if capital inflows persistently increase. Second, the net capital inflows can be considered a policy tool for maintaining exchange rate stability. Based on this result, policymakers need to maintain a stable macroeconomic environment with low inflation in order to minimise RER appreciation. Also highlighted is the fact that the fixed exchange rate regime positively impacted the RER movement from 1999 to 2005. During this period, the choice of exchange rate regime significantly contributed to currency depreciation and economic recovery. These findings imply that policymakers can rely on the exchange rate policy to stimulate the economy. The estimated ERER shows a time-varying pattern, and any changes in economic fundamentals will affect the ERER movement. Therefore, policymakers should consider the potential RER misalignment when designing the policy related to the exchange rate. Finally, distinguishing between tradable and non-tradable goods prices is critical in RER construction to prevent overstating RER changes.

Although overall RER misalignment does not seem to affect economic performance, there appears to be room to use RER undervaluation as the second-best policy to promote tradable sector growth. RER undervaluation can be achieved in several ways, including nominal exchange rate depreciation, maintaining stable macroeconomic management that reduces domestic prices relative to foreign prices, or through a combination of these two. Maintaining a competitive real exchange rate is important to promote export performance. Given the dominant role of the US$ in international transactions (the 'dominant currency phenomenon'), policies aimed at domestic price movement (net of exchange rate changes) have the potential to improve export performance compared to changes in the nominal exchange rate. Finally, continuous efforts should be made to provide a conducive investment environment for domestic and foreign investors to make Malaysia a profitable exporters destination. This effort is much more important for export success within GPNs compared to the promotion of traditional exports. This initiative could help increase export capacity and move up the value chain in the face of competition from China.

This study makes several recommendations for future research. Given that capital inflows significantly impact the RER movement, future research can look into how different types of capital flows affect the RER movement to help policymakers design an appropriate policy recommendation. A further investigation to identify the determinants of RER misalignment is also warranted to strengthen the main findings documented in Chapter 3.

Although the magnitude of RER misalignment is modest (Chapter 4), a prolonged misalignment seems to adversely impact on economic performance. Future research can explore the threshold point at which misalignment affects performance. The results of Chapter 5 can be explored further by investigating the impact of RER on GPN products using the Standard International Trade Classification dataset at the 5-digit level and segmenting analysis into parts and components and final assembly products. This will help to understand the nature of the GPN products and strengthen the findings. To summarise, there is always room to build on and improve the findings of the thesis by employing alternative model specifications, measurement of variables, and econometric techniques.

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