Exchange Rate Issues in the Maldives

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Abstract

The Maldives has maintained an exchange rate policy since 1994 that pegs the Maldivian currency, the rufiyaa, to the United States (US) dollar. In small and open economies like the Maldives, the role of exchange rate is even more crucial as changes in exchange rates have a quick and a direct impact on the economic activities and the cost of living in the country. Yet no empirical studies exist on the exchange rate regime of the Maldives. Further, the Maldives lacks the basic tools to analyse the exchange rate of the country; for example, information on the real exchange rates (RERs) and effective exchange rates (EERs). Therefore, this study aims to develop a set of key indicators for exchange rate analysis; examine the main issues related to the exchange rate; and evaluate the appropriateness of the current exchange rate regime of the Maldives. It provides policy makers for the first time estimates of the main indicators of the exchange rate for the Maldives.

Since the basic indicators of exchange rate analysis do not exist for the Maldives, this study constructs indices for the nominal effective exchange rates (NEER), real effective exchange rate (REER) and the terms of trade (TOT). These indices facilitate the empirical analyses undertaken in this study. They would also be useful for the policy makers of the Maldives, to monitor the behaviour of the exchange rate in the country. To evaluate the performance and the appropriateness of the exchange rate peg in the Maldives, three specific issues related to the exchange rate are examined. They are: (i) equilibrium real exchange rate (ERER) and exchange rate misalignments; (ii) inflation dynamics and exchange rate pass-through (ERPT); and (iii) partial dollarization in the Maldives. The econometric techniques of cointegration and error-correction modelling (ECM) were employed to analyse these issues. The period of analysis was 1990–2010 and monthly data was used.

The estimation of the RER misalignments showed that the Maldives has experienced varying levels of misalignments over the last two decades, and the RER has

been substantially misaligned for a little over one-third of the period under analysis. The analysis of inflation demonstrated the importance of foreign prices, nominal exchange rates (NER) and monetary growth in explaining inflation in the Maldives. The ERPT in the Maldives was estimated to be very high and rapid, as expected, given the small and open economy. With regards to the partial dollarization in the Maldives, the economy remains highly dollarized even by international standards. However, unlike most other countries in which dollarization has been an outcome of macroeconomic instability, in the Maldives, dollarization is driven both institutional factors and the rapid development of the tourism sector. The high dollarization ratios also contribute towards the high ERPT estimated for the Maldives. The current exchange rate regime of the Maldives was assessed based on the empirical results from these three issues and the other determinants of exchange rate regime. The results from the quantitative framework and the exchange rate analysis of the issues examined in this study provided a compelling case for a pegged exchange rate regime for the Maldives. This study also assessed the option of adopting official dollarization as an alternative exchange rate regime for the Maldives. This was found not to be a viable option for the Maldives currently.

The present study provides for the first time a comprehensive investigation of the exchange rate regime in the Maldives and would be a useful resource for policy makers in managing the country's exchange rate policy.

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List of Acronyms

ADF	Augmented Dickey Fuller test
AIC	Akaike information criterion
BEER	Behavioural equilibrium exchange rate
CPI	Consumer price index
ECCU	Eastern Caribbean Currency Union
ECM	Error-correction model
ERER	Equilibrium real exchange rate
ERPT	Exchange rate pass-through
FEER	Fundamental equilibrium exchange rate
GDP	Gross Domestic Product
HP	Hodrick-Prescott filter
IFS	International Finance Statistics
IMF	International Monetary Fund
IRF	Impulse response functions
LOP	Law of one price
MA	Moving averages
MB	Macroeconomic balance
MMA	Maldives Monetary Authority
MVP	Minimum variance portfolio
NEER	Nominal effective exchange rates
NER	Nominal exchange rate
OCA	Optimum currency area
OLS	Ordinary least squares
PPI	Producer price index
PPP	Purchasing power parity
PTM	Pricing to market
REER	Real effective exchange rate
RER	Real exchange rate
SAARC	South Asian Association for Regional Cooperation
SIC	Schwarz information criterion
SIDS	Small island developing states
TOT	Terms of trade
TPI	Tourism price index
UAE	United Arab Emirates
UK	United Kingdom
US	United States
VAR	Vector auto regression
VECM	Vector error-correction model

Chapter 1 | Introduction

In its 'Article IV Consultation'[1] assessment of the Maldives in 2007, the International Monetary Fund (IMF) reported that the country's exchange rate was fundamentally misaligned (IMF, 2007). The Maldives was one of the first countries whose exchange rate was labelled 'misaligned' by the IMF, which was then working on a newly formulated framework for exchange rate surveillance of its member countries. The IMF's report had severe consequences for the Maldives. The country was in the midst of implementing several reconstruction projects following the 2004 Indian Ocean tsunami disaster. The government had to rely almost exclusively on external sources—mainly bilateral donors—for funding these projects. These external sources typically base their assessment of the Maldives's economy primarily on IMF reports, and any negative assessments by the latter were (and still are) treated very seriously. Following the IMF's report, several external donors re-evaluated and re-assessed the Maldives's requests for concessional loans and credit facilities, resulting in delays in approving new funding for the reconstruction projects.

The government of Maldives, of course, disagreed with the IMF report. Yet, it did not have a sound basis for refuting it. Most importantly, there were no estimates available for local authorities on real effective exchange rates (REER) and equilibrium exchange rates, which are needed to identify any misalignments of the exchange rates. Nor do any empirical studies exist on the implications of the exchange rates in the Maldives, either locally or internationally. Although the

[1] The International Monetary Fund (IMF) conducts bilateral discussions with her member countries, normally every year, under Article IV of the IMF's Articles of Agreement. The objective of this is to assess the macroeconomic and financial developments and policies of the country and prepare a staff report for discussion by the IMF Executive Board. This report, together with a summary of the Executive Board's discussion, is given to the member country. The IMF's reports on member countries are published, if approved by the member country.

government could not reject the IMF's findings in the absence of any empirical analysis of its real exchange rate (RER), the IMF rejected its own findings a year later. Following the 'Article IV Consultation' in 2008, the IMF admitted that its assessment of the Maldives's exchange rate was wrong and that the exchange rate was not misaligned (IMF, 2009b). This incident highlights the absence of essential exchange rate information and indicators for the Maldives. It also points to a broader problem of a lack of empirical research on important macroeconomic issues, including those relating to exchange rate.

The importance of research on the exchange rate of the Maldives is accentuated due to the fixed exchange rate regime that the country has had in place since 1994. Under this regime, the local currency, the rufiyaa, is pegged to the United States (US) dollar. Prior to 1994, the country followed a managed float, but the rufiyaa was still closely linked to the US dollar. The appropriateness of a fixed exchange rate regime, and its costs and benefits relative to flexible exchange rate regimes, remains one of the most debated and controversial topics in international economics. The conventional wisdom in the area of exchange rate is that exchange rate pegs are of short durability and countries should move towards more flexibility. However, recent literature suggests that some countries are better placed for a pegged exchange rate regime than a more flexible one, especially those countries with limited access to international financial markets (Husain, Mody, & Rogoff, 2005). Similarly, Frankel (1999, p. 3) states that 'no single currency regime is best for all countries, and that even for a given country it may be that no single currency regime is best for all time'. This is also evident from the different exchange rate regimes that countries around the world use in their management of exchange rate, and the changes in the regimes over time.

According to the IMF (IMF, 2009a), there are seven categories of exchange rate systems, varying from free floats to strongly fixed exchange rates (for example, monetary union). Of the 162 countries reported by the IMF, 52 countries are classified as having conventional fixed peg arrangements, which fix the currency to another currency or a basket of currencies. The consensus in the literature is that the exchange rate regime choice for a given country is dependent on the individual characteristics of a country, its linkages to the rest of the world and the period considered. This signifies the need for country-specific studies to evaluate and choose the most appropriate exchange rate regime for a country.

1.1 Aims and Scope of the Research

This study examines the issues related to the exchange rate and evaluates the appropriateness of the current exchange rate regime. Specifically, it aims to:

- Develop a set of indicators relevant for the exchange rate analysis in the Maldives
- Empirically analyse the main issues related to the exchange rate of the Maldives
- Evaluate the choice of exchange rate regime for the Maldives within an analytical framework in the context of the main issues analysed in the thesis and other macroeconomic and structural characteristics identified in the literature
- Provide an assessment of an alternative exchange rate regime option for the Maldives

To analyse the pegged exchange rate regime of the Maldives, an examination of the behaviour and developments of several issues related to the exchange rate is required. In the context of the Maldives, a thorough investigation of the following will provide valuable insight into the appropriateness of the current exchange rate regime, as well as a much-needed understanding of the issues related to the exchange rate. These issues are:

- Nominal effective exchange rates (NEER) and real effective exchange rates (REER)
- Equilibrium real exchange rates (ERER) and exchange rate misalignments
- Inflation determinants and exchange rate pass-through (ERPT)
- Degree and sources of dollarization

While the pegged exchange rate regime provides nominal exchange rate (NER) stability against the US dollar, it does not guarantee the stability of RERs. Moreover, the NER against other trading partners would also fluctuate, as the pegged exchange rate has a fixed parity only against the US dollar, while moving against the currencies of the rest of the trading partners. Therefore, it is important to monitor and assess the developments and trends in both NEER and REER. Effective exchange rates are the weighted average of the bilateral exchange rates of the trading partners, with the exchange rates of each country weighted by the importance of that country in a country's trade. In the case of the RERs, these are NERs deflated by some type of price or cost index, such as the consumer price index (CPI), producer price index (PPI) or unit labour costs.

The behaviour of the RER, especially the correct alignment of the RER, is important for the effectiveness of the exchange rate policy. The estimation of the ERER and its misalignment will provide important information on the behaviour of the RER. Exchange rate misalignments are defined as the sustained deviations (overvaluations or undervaluations) of the RERs from its equilibrium exchange rates. RER misalignments have serious consequences for developing countries. For example, sustained overvaluations of the exchange rate can lead to currency crises, while sustained undervaluations can overheat the economy (Siregar & Rajan, 2006).

It is also important to examine the inflation dynamics of a country and the ERPT (the extent to which changes in the exchange rate are reflected in domestic prices) in evaluating the suitability of the exchange rate regime. This is because, in small and open developing countries such as the Maldives, fixed exchange rate policies are often used to stabilise domestic prices and control inflation. The degree and speed of ERPT are important for the stability of domestic prices. If ERPT is high, a fixed exchange rate is required to maintain price stability in small and open economies.

High levels of partial dollarization also have implications for the choice of exchange rate regime, as this can undermine the effectiveness of monetary and exchange rate policy. Further, high levels of dollarization are associated with high levels of ERPT.

To achieve the above objectives, answers to the following questions will be provided.

- Are the RERs misaligned in the Maldives?
- What is the degree and speed of ERPT?
- What factors influence dollarization in the Maldives?
- Is the current exchange rate regime appropriate for the country?

This research contributes to a better understanding of the behaviour of the exchange rate and the choice of the exchange rate regime in the Maldives and facilitates further research in the area. As noted previously, there are no academic or policy studies on the exchange rate of the Maldives. One reason for the lack of studies on the country's exchange rate is the limited availability of macroeconomic data. Specifically, lack of data on NEER and REER for the Maldives precludes any empirical analysis of exchange rates for the country. These data are not compiled by the local authorities, nor are they available from international agencies such as the IMF, who usually compile such statistics for most countries. Therefore, this study constructed the monthly and annual effective exchange rate indices for the Maldives for the period 1990–2010. Given the importance of imports and tourism in the domestic economy and the marked difference in the trading partners with respect to trade in imports and tourism, NEER and REER were compiled with different trade weights. As such, NEER and REER weighted by country shares in total trade (goods and services), country shares in trade in import and country shares in tourism markets were compiled.

Another key variable in the exchange rate analysis, especially equilibrium exchange rates analysis, is a country's terms of trade (TOT). Since this was also not available for the Maldives, monthly TOT indices were constructed for the period

1990–2010. As tourism is the main export of the country and merchandise exports are insignificant, TOT indices were constructed using tourism prices. The methodologies used for constructing these indices are clearly specified in this study and can be easily adopted by the Maldivian authorities for compiling future indices. It is hoped that the availability of these new indices will encourage further research on the exchange rate of the Maldives or the inclusion of the Maldives in international cross-country studies.

1.2 Exchange Rate Regime in the Maldives

The Maldives is a small island country, consisting of about 1,200 small islands spread across an area of 90,000 square kilometres in the Indian Ocean. The population of the Maldives is about 320,000, which is dispersed over 200 islands. The capital of the country is Malé, which is just over two square kilometres, but which hosts a population of over 100,000, making the island one of the most densely populated in the world. Of the uninhabited islands, 93 islands are developed as tourist resorts and a further 50 islands are currently in the process of development as resorts.

Exchange rate is one of the most important macroeconomic variables for small island developing economies like the Maldives, given the openness of the economy and its high degree of dependence on external trade, especially tourism. The Maldives has a fixed exchange rate regime, also known as a hard peg, whereby the local currency, the rufiyaa, is pegged to the US dollar. Since the adoption of the exchange rate peg in October 1994, the rufiyaa has been devalued twice: first in July 2001 (by 9 per cent) and again in April 2011 (by 19 per cent). Despite the exchange rate peg, the Maldives have a liberal capital account and there are no official exchange rate controls. Both residents and non-residents can freely import and export capital through the foreign exchange market. Residents do not require permission to maintain foreign currency accounts either at home or abroad and there is no distinction made between foreign national or non-resident accounts held with the banks operating in the Maldives. As regards the foreign direct investment in the country, investments require prior approval of the government and are charged an annual royalty, the amount of which is negotiated between the government and the investor. There are no restrictions on transferring the profits.

Exchange rate plays a significant role in the performance of the tourism sector and understanding the behaviour of the exchange rate and its relationship with tourism is important for the Maldives. The Maldivian economy is heavily dependent on tourism, with the sector accounting for 30 per cent of Gross Domestic Product (GDP), 90 per cent of foreign exchange earnings and 50 per cent of government revenue. Moreover, given the rapid and on-going expansion in tourism investment, private external debt is expected to rise sharply over the coming years, as a large part of the investment finances for resort development are expected to come from abroad due to the small domestic financial market. These developments further increase the dependence of the economy on one single sector—a sector that is highly vulnerable to external factors.

The above mentioned macroeconomic features of the economy combined with weak domestic economic fundamentals have led to internal as well as external imbalances in recent years. Since 2004, the current account deficit of the Maldives has deteriorated sharply, rising from less than 5 per cent of GDP prior to 2004 to a record high of 51 per cent in 2008. This has since come down to 31 per cent in 2010, but it is still considered very high. The large current account deficit is in parallel to the highly expansionary fiscal policy that has recently been pursued in the Maldives. As a result, the fiscal deficit as a percentage of GDP has climbed from less 5 per cent prior to 2004 to 17 per cent in 2008 and 31 per cent in 2009, before narrowing to 16 per cent of GDP in 2010. Moreover, inflation has also been high since 2005, edging up from 1 per cent in 2005 to 12 per cent in 2008. In 2009 and 2010, inflation lowered to 5 per cent and 6 per cent respectively. These macroeconomic imbalances put strain on the gross international reserves of the country, with a 22 per cent annual decline in 2008. As a result, the government had to seek balance of payment support from international sources to provide a much-needed boost to international reserves. This was necessary given the fixed exchange rate regime.

1.3 Structure of the Study

This study consists of eight chapters. Following on from this introductory chapter, Chapter 2 presents a review of the literature on the choice of the exchange rate regime in the Maldives to give a broad overview of the subject. This chapter identifies the various exchange rate regimes, discusses the issues relating to classification of exchange rate regimes and outlines recent trends in exchange rate regimes. This is followed by a brief analysis of the advantages and disadvantages of fixed versus flexible exchange rate regimes and a review of the empirical literature on the relationship between exchange rate regimes and macroeconomic performance. The chapter ends with a discussion of the determinants of the exchange rate regime choice commonly found in the literature. Note that literature relating to the topics addressed by Chapters 3 to 6 is discussed in those respective chapters. While these topics are inter-related, they are most effectively discussed independently.

Chapter 3 presents the real and NEER constructed for this thesis. As mentioned previously, effective exchange rates are important to the analysis of exchange rates. In the absence of such data for the Maldives, it was necessary to construct the real and NEER, to use them in the exchange rate analysis presented in the following chapters. With this in mind, only developments in the effective exchange rates are discussed in this chapter, without any in-depth analysis of the indices.

There are several measures of REER and various ways in which to construct them. The construction of REER begins with a measurement of the RER. The most commonly used measures of RERs are internal and external RERs. The external RER is based on the theory of purchasing power parity and is the NER of the home country adjusted for the price level between the home country and the foreign country. RER is also defined as the internal RER—the ratio of the domestic price of tradable to non-tradable goods[2] within a country (Edwards, 1989). There are different approaches used in measuring both external and internal RER. The most widely used three approaches of measuring external RER are the purchasing power parity theory; the Mundell-Fleming one composite good model; competitiveness in traded goods; and the less commonly used approach—relative labour cost in production (Hinkle & Montiel, 1999).

Most empirical estimates of RER in developing countries are based on external RER, as estimations based on internal RER are difficult both conceptually and empirically (Hinkle & Nsengiyumva, 1999). This is because to construct internal RER, data on tradable and non-tradable goods are required and these are rarely available in developing countries. In the case of the Maldives, the non-tradable sector is small, as the economy is heavily dependent on imports. The size and composition of the tradable and non-tradable sectors based CPI statistics are discussed in this chapter. However, due to the unavailability of detailed time-series data on the CPI, it was not possible to construct separate price indices for tradable and non-tradables for the Maldives. Moreover, internal RER is an indicator of domestic resource allocation incentives in the home country. In contrast, external RER is a measure of external competitiveness of the home country relative to its main trading partners. Given that the Maldives is a small and highly open developing economy with limited non-tradable sectors, external RER measures are more important to analyse exchange rate movements. Therefore, the REER for the Maldives are based on the external RER definition. The methodology has been drawn from (Hinkle & Nsengiyumva, 1999), because their methodology has been shown to be appropriate for developing countries with data limitations, as is the case for the Maldives. The methodology used is discussed in detail in Chapter 3, including the derivation of trade weights and the choice of price or cost indices. The estimated indices include the bilateral RER of the Maldives

[2] The tradable sector comprises those goods and services that are imported or those that are domestically produced and that are in competition with imported goods, either in the domestic or international market. Non-tradable goods are those goods and services that are domestically produced and cannot be traded. Chapter 5 discusses this concept of tradable and non-tradable sectors in more depth.

against the major trading partners, as well as the effective exchange rates based on aggregate trade weights, imports weights, exports weights and tourism weights. The developments of these indices are also briefly discussed before concluding the chapter.

Chapters 4, 5 and 6 are the core empirical chapters of the thesis. Chapter 4 estimates the ERER for the Maldives and identifies the periods of exchange rate misalignments. There are several approaches to measure ERER and, as Driver and Westaway (2004) note, the ERER is sensitive to the model and methodology used. The theoretical as well as empirical approaches of measuring ERER are discussed in this chapter to identify a practical approach for the Maldives. While it is important to measure ERER using as many approaches as possible, data limitations constrain the use of different approaches for the Maldives. Therefore, only one approach is used in this study. This approach is based on the equilibrium exchange rate models used by Edwards (1988), Elbadawi (1994) and Baffes, Elbadawi and O'Connell (1999) for developing countries. This approach uses a single-equation reduced-form model and links the RER to a set of macroeconomic fundamentals.

As the macroeconomic time-series data are generally non-stationary, unit roots tests were conducted to test for stationarity. As expected, the tests indicated that the data are non-stationary, which precludes the use of ordinary least squares (OLS), as they produce spurious results in the presence of non-stationarity. Therefore, the econometric techniques of cointegration and error-correction modelling (ECM) are used to model the long-run determinants of REER and the short-run dynamics. The econometric methodology used in this study is discussed in Chapter 4. Using the long-run estimates of the REER and time-series decomposition techniques, the ERER are estimated for the Maldives for the period 1990–2010. The percentage deviation from the actual REER and the estimated ERER is then calculated as the real exchange misalignments. This is followed by a discussion of the different episodes of exchange rate misalignments.

Chapter 5 examines the inflation dynamics and identifies the degree and speed of the ERPT to inflation in the Maldives. Both theoretical as well as empirical literature suggests that fixed exchange rate regimes are associated with lower inflation rates. For this reason, in small and open developing countries such as the Maldives, fixed exchange rate policies are often used to stabilise domestic prices and control inflation. Given the importance of understanding the inflation process in the country, the objective of Chapter 5 is two-fold. The first objective is to examine the exchange rate and inflation relationship in the Maldives. The second is to identify other factors that drive inflation in the Maldives. In small open economies, foreign prices also play a significant role in influencing domestic inflation, as these countries are heavily dependent on imports and are price takers in international markets. Therefore, it is important to identify the relative role that the exchange rate plays in influencing inflation, compared to other factors, such as foreign prices. As in Chapter 4, this chapter uses the econometric techniques of cointegration and ECM to estimate the inflation model and ERPT for the Maldives.

In the Maldives, the US dollar is extensively used alongside the rufiyaa, and the dollar serves to fulfil the three basic functions of money—as a medium of exchange, a store of value and a unit of account. Therefore, both currency substitution (foreign currency used as a medium of exchange and unit of account) and asset substitution or financial dollarization (foreign currency used as a store of value) is highly prevalent in the country. The level of partial dollarization (often referred to as just dollarization) affects the effectiveness of both exchange rate and monetary policy in the country, and is an important determinant of the choice of exchange rate regime for the country. Against this background, Chapter 6 examines the partial dollarization process in the Maldives to identify the degree of dollarization and its main determinants in the country. The most common measure of dollarization is the ratio of foreign currency held by the residents (currency in circulation and foreign currency deposits held domestically and abroad) to total deposits, or some monetary aggregate, such as broad money. However, most of the empirical studies on dollarization use a narrower measure of dollarization by including only the foreign currency deposits held domestically in the dollarization measure. This is because the data on foreign currency in circulation and foreign currency deposits held abroad are not available and very difficult to estimate, especially for small countries like the Maldives. Therefore, this study also uses this narrow definition of dollarization. This chapter begins with a review of the literature on dollarization with a special focus on the definition, measurement, trends, determinants and consequences of dollarization. This is followed by an analysis of the extent of dollarization in the Maldives using different measures of dollarization. Again, the econometric analysis is conducted using cointegration analysis and ECM.

Chapter 7 presents an analytical framework to evaluate the appropriateness of the current exchange rate regime for the Maldives. This is a framework developed by Husain (2006), providing quantifiable indicators of exchange rate regime choice. The indicators include the optimum currency area (OCA) factors, financial factors and political factors. This analysis is further substantiated through other important determinants of exchange rate regime found in the literature. The appropriateness of the current exchange rate regime is discussed in view of the results from the analytical framework, together with the empirical findings from the preceding chapters on equilibrium exchange rates, inflation and ERPT, and partial dollarization. Chapter 7 also presents an assessment of an alternative exchange rate regime for the Maldives—the adoption of full dollarization. This chapter discusses the costs and benefits of adopting the US dollar as the legal tender in the Maldives, the preconditions for adopting official dollarization, and the operational and practical issues that the Maldives may face when adopting the US dollar as its national currency.

Chapter 8 summarises the main findings of the research. The limitations of the study and some possible directions for future research are also briefly discussed to conclude the study.

Chapter 2 *Literature Review on the Choice of Exchange Rate Regime*

2.1 Introduction

The choice of the exchange rate regime has important implications for a small open economy. The type of exchange rate regime a country has affects the economic activities and trade in a country. Therefore, it is important to evaluate the exchange rate policies periodically to make sure the existing exchange rate regime in the country is consistent with its broader macroeconomic framework. It is widely recognised that the exchange rate regime that is appropriate for a country depends on country-specific characteristics and the choice may change with time (Frankel, 1999). Before analysing the specific issues related to the exchange rate in the Maldives and evaluating the current exchange rate regime in the country, it is important to begin with a review of the types of exchange rate regimes, their advantages and disadvantages, and the macroeconomic performance of countries under different exchange rate regimes. To evaluate the appropriateness of an exchange rate regime, it is also necessary to identify the theoretical underpinnings of the determinants of the exchange rate regime choice.

This chapter is organised as follows. Following this introduction, Section 2.2 briefly presents the various exchange rate regimes, discusses the issues relating to their classification and outlines recent trends. Section 2.3 analyses the advantages and disadvantages of fixed versus flexible exchange rate regimes, while Section 2.4 presents empirical evidence on the relationship between exchange rate regimes and macroeconomic performance. Section 2.5 discusses the leading theoretical perspectives on the choice of exchange rate regime and Section 2.6 concludes the chapter.

2.2 Classification of and Trends in Exchange Rate Regimes

2.2.1 Types of Exchange Rate Regimes

The literature on the choice of exchange rate regimes normally focuses on the dichotomy between flexible and fixed exchange rates. However, most countries, especially those in the developing world, pursue one of several intermediate regimes between the two extremes of fully flexible and fully fixed. Further, these intermediate regimes are followed with varying degrees of flexibility. Each exchange rate regime is classified according to the basis of flexibility it provides. In an independent float, the exchange rate is fully determined by the market with no government involvement. In contrast, in fixed exchange rate regimes, the authorities fix the exchange rate. The different exchange rate regimes are grouped into two broad categories and are described below, starting with the most rigid. These descriptions of the exchange rate regimes are drawn from the works of Corden (2002) and Frankel (2003).

Fixed exchange rate regimes

No separate legal tender (Currency union, Dollarization): These are the most rigid forms of exchange rate regimes, in which the member countries have a common exchange rate and monetary policy. In a monetary union, the member countries use a common currency or currencies, which are perfect substitutes and circulate freely among the member countries. They have a common central bank, and normally representatives of the member countries will be on the board of the central bank. The board members are able to have some influence over the conduct of exchange rate and monetary policies in the monetary union. Conversely, when a country adopts full dollarization by abandoning the use of its own currency and adopting the currency of another country, the adopting country has to accept the monetary policy of the country of the currency it has adopted. The main drawback of full dollarization is the loss of seigniorage, which is the revenue received by the government from printing money (Appleyard, Field, & Cobb, 2010). Adoption of full dollarization is discussed in more detail in Chapter 7.

Currency board: In a currency board, the exchange rate of the country is fixed by law to the currency of another country. The national currency is fully backed by foreign currency reserves and any change in these reserves would require an equal change in the money base. In a currency board, the country cannot have an independent monetary policy.

Conventional fixed peg: The exchange rate in a conventional peg is either fixed to a single major currency, such as the US dollar, or a basket of currencies of major trading partners. The monetary authority will be ready to defend the peg, although it is not committed to keep the pegged rate unchanged indefinitely. When misalignments of the exchange rates occur, the authorities will have the option to devalue, although if devaluations become too frequent, the credibility of the policy will be lost.

Pegged within bands: This is similar to a conventional peg, but has more flexibility in that the exchange rate is allowed to fluctuate within a specified narrow band.

Crawling peg: The exchange rate is pegged to another currency and the exchange rate is periodically adjusted in small amounts, at pre-announced rates or as a function of inflation differentials. The rate changes can be very frequent, even on a weekly basis.

Target zone or band: In this type of exchange rate regime, the authorities have a central rate around which the exchange rate is allowed to fluctuate, within a pre-announced target zone or band. The central rate itself is also adjustable. In some cases, this band may be narrow, while in other cases a wider band is used. The latter makes the exchange rate more flexible and increasing the independence of the monetary policy.

Flexible exchange rate regimes

Managed float: This is also known as a 'dirty float'. While exchange rates are determined by the market, authorities intervene in the market to smooth or moderate excessive fluctuations. This type of exchange rate regime gives the authorities the ability to intervene in the market when required, but there is no commitment to do so. This kind of exchange rate regime is often accompanied by a separate nominal anchor, such as an inflation target.

Independent float: This is the most flexible exchange rate regime, as the exchange rates are determined purely by market interactions. The authorities have full monetary policy independence, which can be used to influence the domestic economy.

The above list is not exhaustive, but does cover the regimes most commonly referred to in the literature. The literature does contain a few permutations of the above regimes that are worth mentioning. Frankel (2003) divides the target zone or band between the Bergsten-Williamson target zone (fundamental equilibrium exchange rate)—which is essentially a wider target band on either side of the ERER—and the Krugman–ERM target zone—which has a fixed nominal central parity. Yagci (2001) includes two additional regimes to the ones listed above, to emphasise degrees of flexibility. He identifies a lightly managed float, in which government interventions in the foreign exchange market are few and only occur to smooth out large exchange rate fluctuations. Further, he separates crawling bands into a crawling broad band and a crawling narrow band. The crawling broad band have a wider band within which the exchange rates are allowed to fluctuate, giving it greater flexibility. A crawling narrow band is more akin to the fixed exchange rate regimes.

2.2.2 De jure Exchange Rate Regimes versus De facto Exchange Rate Regimes

Until recently, most literature on exchange rate regimes utilised the classification provided by the IMF in its Annual Report on Exchange Rate Arrangments and

Exchange Rate Restrictions (AREAER). Until 1999, the IMF based their classifications on the officially announced policies of the countries in question[3]—the de jure exchange rate regime. However, it has long been recognised that the de jure exchange rate regime (the stated exchange rate policy) does not necessarily correspond to the de facto exchange rate regime (the actual exchange rate regime in practice). Such behaviour has been termed 'fear of floating' (Calvo & Reinhart, 2002) and has been found to be more prevalent in emerging economies. 'Fear of floating' is when countries, while proclaiming to have adopted a floating exchange rate regime, continue to maintain their exchange rate within a narrow band with respect to some anchor currency. The main reason for doing this is to avoid large swings in exchange rates, as the authorities often perceive depreciations or devaluations as having detrimental effects on the balance sheets, especially when they have large foreign currency denominated debt or high levels of partial dollarization. The 'fear of floating' phenomenon in developing countries has arisen from the belief that volatility in the exchange rate adversely affects trade and that there is a high ERPT to domestic prices (Calvo & Reinhart, 2000).

In addition, it has been observed that some countries that officially have pegged exchange rate regimes frequently change its parity. This is called 'fear of pegging' (Levy-Yeyati & Sturzenegger, 2003b). Genberg and Swoboda (2005) use a simple matrix, as shown in Table 2.1, to evaluate the performance of each classification of exchange rate regime.

Table 2.1: Fear of floating and fear of pegging

		De Facto Classification	
		Fixed	Floating
De Jure Classification	Fixed	A	B
	Floating	C	D

Source: Genberg and Swoboda (2005, p. 134)

[3] Member countries of the IMF are obliged to report their exchange rate regimes and any changes that they make to their exchange rate policies to the IMF.

In Table 2.1, C represents 'fear of floating' countries and B represents 'fear of pegging' countries. A and D are countries for which the de jure is the same as the de facto regime. Countries that fall into these two categories are few (Genberg & Swoboda, 2005).

The identification of de facto exchange rate regimes has been the subject of many studies, as this has proven to be a complex task. Some of the more prominent studies include Ghosh, Gulde, Ostry and Wolf (1997), Ghosh, Gulde and Wolf (2002), Levy-Yeyati and Sturzenegger (2001b), Reinhart and Rogoff (2004) and Shambaugh (2004). The methodologies used in these studies have also been reviewed by Tavlas, Dellas and Stockman (2008). While these methodologies vary, they can be categorised into two groups: mixed de jure–de facto approaches and pure de facto approaches. The first group used the IMF de jure exchange rate regimes as a basis and corrected or revised them based on several factors, such as judgment, development in parallel markets, exchange rate volatility, NER changes and their variances, and rate of inflation, among others. Conversely, the pure de facto approaches did not use the de jure exchange rate regime classifications and constructed de facto exchange rate regimes independently.

Since 1999, the exchange rate regime classifications of the IMF have also been partially based on the de facto policies of countries, rather than relying solely on the de jure exchange rate regime classifications. One of the most widely used de facto classification systems is the 'natural classification' of Reinhart and Rogoff (2004). They divide exchange rate regimes into five broad categories—fixed, limited flexibility, managed floating, freely floating and freely falling—and 14 subcategories. They use data on all IMF member countries, with some data dating back to 1946. According to their study, during the period 1970–2001, 45 per cent of the de jure pegs were de facto managed or freely floating and 53 per cent of the de jure managed floats were de facto pegs or crawling pegs.

While these approaches provide an alternative to the de jure exchange rate regime classifications, these studies have several limitations. They include data issues, definition issues relating to role of monetary policy, role of judgment, missing observations and coding methodologies (Tavlas et al., 2008). Consequently, the various alternative de facto exchange rate classification systems show little consistency with one another, as also noted by Frankel and Wei (2008) and Bleaney and Francisco (2007a). Even with these limitations, these de facto classifications reflect actual exchange rate regimes more accurately than de jure classifications. Therefore, most recent empirical literature on exchange rate regimes uses some form of de facto exchange rate regime classification system.

2.2.3 Trends in Exchange Rate Arrangements

The most recent and comprehensive classification of de facto exchange rate regimes is available from the IMF's publication AREAER (IMF, 2010). The de facto exchange rate regime classifications based on AREAER as of April 2010 for the IMF's member countries are given in Table 2.2.

Table 2.2: De facto classification of exchange rate regimes, 2010

Exchange rate regime	No. of countries
No separate legal tender	10
Currency board	13
Conventional peg	68
Pegged within bands	3
Crawling peg	8
Crawling band	2
Managed floating	44
Independently floating	40
Total	188

Source: Data compiled from AREAER 2010 (IMF, 2010)

The most common form of exchange rate regime, as shown in the Table 2.2, is a conventional peg, with 68 countries having pegged exchange rate regimes. Of these 68 countries, 37 peg their currency to the US dollar. There are 44 countries with managed floats and 40 that have independent floats. The IMF classifies the 16 countries of the European Monetary Union as having independent floats.

Following the currency crises of the 1990s and early 2000s, a new conventional wisdom on exchange rate regime emerged. This was the bipolar view[4] of the exchange rate regimes (also known as the hollowing out of intermediate regimes, vanishing or missing middle and corner solutions). The bipolar view asserts that the intermediate regimes between hard pegs and independent floats are not sustainable and that countries will gradually move to the polar ends of the exchange rate spectrum. According to Summers (2000, p. 8):

> The choice of appropriate exchange rate regime, which, for economies with access to international capital markets, increasingly means a move away from the middle ground of pegged but adjustable fixed exchange rates towards the two corner regimes of either flexible exchange rates or a fixed exchange rate supported, if necessary, by a commitment to give up altogether an independent monetary policy.

As almost all of the countries that experienced currency crises in the 1990s had some form of intermediate exchange rate regime, proponents of the bipolar view claim that intermediate regimes are crisis prone. Therefore, they argue that in the face of increased global financial integration, countries will need to adopt a rigidly fixed exchange rate regime or completely float their currency. The literature suggests that, since the 1990s, the number of countries with intermediate regimes has declined, while the number of countries with pure floats and hard pegs has increased. Fischer (2001) showed that the number of emerging market countries with intermediate regimes decreased from 21 in 1991 to 14 in 1999, and that for developing countries, this fell from 62 in 1991 to 48 in 1999. However, these results are problematic, as Fisher used de jure exchange rate regimes in his study. Similar studies using de facto classifications (for example, Benassy-Quere (1999); Bubula & Otker-Robe, (2002); Rogoff, Husain, Mody, Brooks and Oomes, (2004) found no evidence to support the bipolar hypothesis.

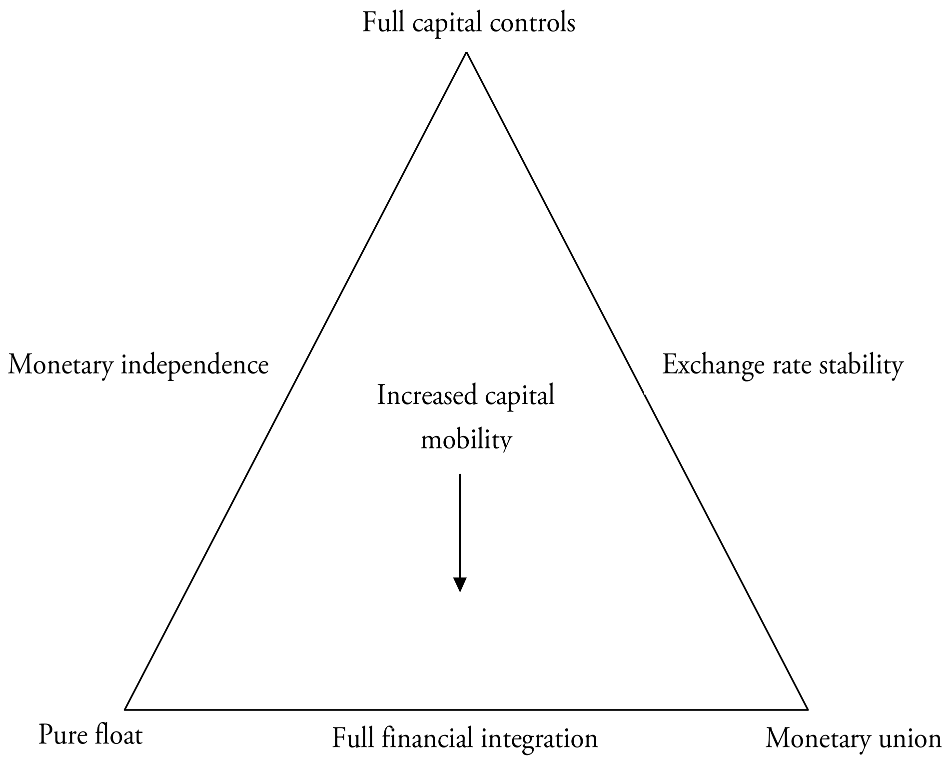
Husain et al. (2005), using the 'natural classification' of exchange rate regime for three groups of countries (advanced, emerging and developing countries), found

[4] The main proponents of the bipolar view are Eichengreen (1994), Crockett (1993), Fischer (2001) and Summers (2000).

that intermediate exchange rate regimes were the most common form of exchange rate regime in the emerging market economies. Further, he found that the number of emerging market economies moving towards the polar extremes, as predicted by the bipolar view, was very small.

According to Frankel (1999), the hypothesis of the bipolar view stems from the principle of impossible trinity. This principle states that a country cannot pursue exchange rate stability, monetary independence and full financial integration simultaneously. For example, if the country is integrated into world financial markets, which is increasingly the case for the emerging market countries, it is not possible for a country to pursue both exchange rate flexibility and an independent monetary policy. If the country wants to pursue these two goals, the only option is to impose capital controls. This is demonstrated in the following diagram, Figure 2.1.

Figure 2.1: Impossible trinity



Source: Frankel (1999, p. 8)

Figure 2.1 show that if a country adopts full capital controls, it can have exchange rate stability and monetary independence. However, if there is greater capital mobility and the country is financially integrated, it is necessary to choose a pure float. This allows for monetary independence and financial integration. The other option is to choose a monetary union, in which case the country can have exchange rate stability and full financial integration, but has to sacrifice monetary independence. Since most countries are becoming more financially integrated, the only valid choices are those at the bottom of the triangle—a pure float or a monetary union. However, Frankel (1999, p. 8) argues that 'even under perfect capital mobility there is nothing to prevent the country from choosing an intermediate solution in between floating and monetary union'.

The exchange rate regime choices for small island developing economies differ substantially compared to other developing countries. This is due to the different economic and structural characteristics of these economies. In analysing the exchange rate regime of the Maldives, it is important to look at the choices made by countries comparable to the Maldives. For this purpose, the small island developing states (SIDS), as classified by the United Nations Conference on Trade and Development (UNCTAD), will be used. Table 2.3 shows the de facto exchange rate regimes of these countries, as classified by the IMF.

Table 2.3: De facto exchange rate arrangements of small island developing states, 2010

Exchange rate regime	No. of countries
No separate legal tender	5
Currency board	6
Conventional peg	10
Pegged within bands	1
Crawling peg	0
Crawling band	0
Managed floating	5
Independently floating	0
Total	27

Source: Data compiled from AREAER 2010 (IMF, 2010, p. 10)

As seen in Table 2.3, most of the countries have a fixed exchange rate arrangement, with the majority (10 out of 25) having conventional pegged exchange rate regimes. The US dollar is the most common anchor currency for the fixed exchange rate arrangements (IMF, 2010). While there are no independent floats, five of the SIDS countries have managed exchange rate regimes.

2.3 Fixed versus Flexible Exchange Rate Regimes

The fixed versus flexible exchange rate regimes has been a long-standing debate among economists. The literature on the comparison of the two extremes, and on the intermediate regimes, is extensive and ever increasing. The main advantage of a fixed exchange rate regime is that it provides a credible nominal anchor to control inflation. In contrast, the main advantage of a flexible exchange rate regime is that it allows monetary policy independence. The choice between a flexible and a fixed exchange rate is seen as a trade-off between exchange rate stability and flexibility.

Milton Friedman (1953) pioneered the case for flexible exchange rates in the early 1950s, at a time when the fixed but adjustable exchange rate system of Bretton Woods was gaining ground. Friedman argued that flexible exchange rates were the only means of achieving the economic objectives of prosperity and free and unrestricted world trade. This was a significant deviation from the traditional view that flexible exchange rate regimes were destabilising, stemming from the belief that market forces might bring about periods of 'overreaction and bandwagon effects' that would distort the foreign exchange market (Nurkse, 1944). In contrast to Friedman, but more along the lines of Nurkse, Einzig (1970) argued that flexible exchange rates would likely be subjected to speculative attacks and destabilise the exchange rate. While the arguments continued for and against the flexible exchange rate regimes, the developed countries started adopting flexible exchange rate regimes in the aftermath of the collapse of the Bretton Woods system in the early 1970s. Currently the debate between the fixed and flexible exchange rate regimes has been in the context of developing countries.

2.3.1 Advantages of Fixed Exchange Rate Regimes

Provides a transparent and credible nominal anchor: When a government announces a fixed exchange rate and gives a credible commitment to maintain the peg, the private sector will perceive inflation to be low in the future. Economic agents will then set their prices and wages based on their expectations of low inflation in the future (Frankel, 1999). This enables the government to achieve low inflation at any given level of output. Moreover, for high-inflation countries with credibility issues, pegging the exchange rate to the currency of a low-inflation country allows them to 'piggy-back' on the monetary policy and 'inflation-fighting credibility' of that disciplined anchor country to bring inflation down (Isard, 1995).

Reduces foreign currency risks: Some proponents of fixed exchange rates argue that floating exchange rates lead to high exchange rate variability and create risk and uncertainty about future exchange rates. This is expected to influence international trade and investment negatively. However, as Frankel (1999) argues, this risk can be eliminated, even when exchange rates are floating, by hedging the exchange rate risk or through forward markets or other financial instruments that are now common. Unfortunately, in small developing countries, financial markets are not well developed and availability of financial instruments is limited. Empirical evidence on the relationship between exchange rate variability and international trade is discussed in Section 2.4.4.

Provides fiscal discipline: Since the viability of a fixed exchange rate regime depends on sound fiscal policy, it is argued that a government cannot afford to be lax with their fiscal policy and monetise their deficits. This is because lax fiscal policy creates balance-of-payments difficulties and exhausts the international reserves of a country. Therefore, the argument is that a government fearing that lax fiscal policy may lead to a collapse of the exchange rate regime in the short term,—which would be economically and politically costly—will be more disciplined with their fiscal policy (Moosa, 2005).

2.3.2 Disadvantages of Fixed Exchange Rate Regimes

Loss of independent monetary policy: A country that fixes the exchange rate of their currency to another loses their ability to use an independent monetary policy. Interest rates are also closely tied to those of the anchor currency country and, as a result, the authorities cannot control domestic money supply. With the loss of monetary policy independence, a country cannot respond to domestic shocks that arise independently from the country of the anchor currency (Mishkin, 1998).

Vulnerability to currency crises: It has been seen that, especially in countries subject to large capital flows, the pegged exchange rate regimes are more susceptible to speculative attacks and currency crises. The major currency crises of the 1990s stemmed from some form of a soft pegged exchange rate regime, showing that even if all other macroeconomic fundamentals are strong, a soft peg in an integrated global economy is highly vulnerable (Duttagupta, Fernandez, & Karacadag, 2005).

Need for a large pool of foreign reserves: To maintain a fixed exchange rate, the government will need to hold a large amount of foreign reserves. This is not an easy task for small developing countries, who have very limited and volatile sources of foreign currency income. For these countries, holding adequate foreign currency reserves imposes a huge opportunity cost in the form of lost investment project opportunities. In addition, these reserves do not earn much interest (as they have to be placed in very safe and easy to access funds) and the country needs to borrow at much higher interest rates for its investment projects (Appleyard et al., 2010). In this context, the opportunity cost of holding foreign reserves is often much higher than the interest earnings that a country receives on its foreign reserves.

2.3.3 Advantages of Flexible Exchange Rate Regimes

Monetary policy independence: In a floating exchange rate regime, a country can pursue an independent monetary policy. If a country is faced with an external or domestic disturbance, monetary policy can be used to steer the domestic economy and prevent the economy from going into a recession. More importantly, under a floating exchange rate, the country is be able to choose an optimum point on its short-run Phillips curve, if shocks are demand-side shocks (Appleyard et al., 2010).

Absorption of external shocks: A floating exchange rate has a better absorption mechanism to external shocks, and exchange rate flexibility buffets the country against large external real shocks. This is one of Friedman's (1953) main arguments for floating exchange rates. He argued that as domestic prices are sticky, flexible exchange rates would allow relative prices to adjust more quickly and be less costly to the economy.

2.3.4 Disadvantages of Flexible Exchange Rate Regimes

Exchange rate variability and volatility: Flexible exchange rate regimes are often associated with exchange rate fluctuations and volatility. As discussed earlier under the advantages of fixed exchange rates, uncertainty about exchange rates involves a cost to traders and investors.

Speculation: Under a flexible exchange rate regime, currency traders usually speculate in the market, which may lead to great instability in small and thin currency markets. In countries with small, under-developed financial markets with low daily turnover, exchange rate can be radically influenced by the relative power of few speculators.

The advantages and disadvantages of fixed versus flexible exchange rate regimes alone do not indicate the best exchange rate regime for a country. Rather, the best system depends on the specific characteristics and circumstances of a country. This is further discussed in Section 2.5.

2.4 Macroeconomic Performance under Alternative Exchange Rate Regimes

The choice of exchange rate regime for a country has been widely researched and studied for both developed and developing countries. However, the literature on the association between the different exchange rate regimes and indicators of macroeconomic performance, such as inflation, growth, crisis probabilities, volatility and trade flows, is more limited. Most of the literature focuses on theoretical and conceptual discussions on the link between exchange rate regime and macroeconomic performance, rather than on empirical investigations. This is partly due to the complexity of the issue, including problems associated with the exchange rate classification systems. Further, there is no consensus in the existing literature on the association between exchange rate regimes and macroeconomic performance.

The following analysis focuses mainly on literature on developing countries, as it is recognised that the macroeconomic performance under different exchange rate regimes differ depending on the development stage and other structural characteristics of a country. For example, macroeconomic performance under a certain exchange rate regime may be different for an advanced economy compared to a developing economy. Even among developing countries, there is significant difference between countries that are more integrated into world capital markets and those that are not.

2.4.1 Inflation

The theoretical literature establishes a strong relationship between inflation and fixed exchange rate regimes. Fixed exchange rate regimes allow governments to maintain or bring about low inflation by providing a credible nominal anchor. However, while empirical research on the subject is extensive, the results are inconclusive. Husain et al. (2005), using data from 158 advanced, emerging and developing countries for the period 1970–1990 and classifying exchange regimes based on Reinhart and Rogoff's (2004) 'natural classification' (see Section 2.2.2), explored the performance of exchange rate regimes in terms of inflation, growth and crisis vulnerability, evaluating the results separately according to the development stage of the country. The main results of this study in relation to inflation for developing countries are as follows:

- The more rigid the exchange rate regime, the better able it is to deliver lower inflation without forfeiting economic growth.
- Developing countries with flexible exchange rates have higher inflation, but no positive affect on economic growth.
- Fixed regimes in developing countries with limited access to international financial markets have lower inflation and higher regime durability.

The study also found that in emerging market economies that are more integrated with financial markets, a rigid exchange rate regime is associated with lower inflation, though the difference in inflation between those with more rigid and less rigid regimes is smaller than for developing countries. Conversely, for advanced economies, flexible exchange rate regimes are not associated with higher inflation.

A similar result was found by Ghosh et al. (1997), who used a sample of 140 countries with data spanning 1960–1990. According to their results, pegged exchange rate regimes have lower inflation due to smaller monetary growth and lower residual velocity growth, controlling for income and interest rate effects. The results hold even after controlling for the endogeneity of regime choice. Countries that have de jure pegs but de facto floats did not produce the same results. However, Ghosh et al.'s study did not differentiate between different groups of countries as did Husain et al.'s (2005). Taking a different approach to these studies, Bleaney and Francisco (2007b) separated soft pegs from hard pegs in their study on developing countries. Further, instead of separately classifying crawling bands and crawling pegs, they classified them all as soft pegs. They also included other variables such as past inflation and employed fixed country effects to increase the robustness of the inflation and exchange rate regime relationship. They found that while hard pegs achieve lower inflation in developing countries, soft pegs do not have any counter-inflationary benefits, as in the case of more flexible exchange rate regimes.

2.4.2 Growth and Volatility

The choice of an exchange rate regime and its influence on the economic growth of the country is an important issue in exchange rate regime analysis. As the exchange rate can act as a shock absorber for the economy and can influence the determinants of growth such as investment, international trade and the financial sector, the exchange rate regime can have consequences for a country's medium-term growth. As economic theory does not provide a clear answer as to what type of exchange rate regime fosters better economic growth, the relationship between the choice of exchange rate regime and economic growth needs to be empirically tested. Empirical literature on the subject is scant and there is no consensus on the relationship between type of exchange rate regime and economic growth.

According to Ghosh et al. (1997), growth rates of countries with different exchange rate regimes differ only marginally, with a slightly lower rate of growth for pegged exchange rate regimes. However, it was found that the lower inflation rates of pegged exchange rates generally came with higher volatility on the real economy in terms of output and employment. Ghosh et al.'s study covered 140 countries, with data spanning 1960–1990. A later study by Ghosh et al. (2002), using data from 1970–1999, achieved similar results. Hoffmann (2007), using a sample of 42 low and middle-income countries, showed that volatility in GDP growth is less in countries with flexible exchange rates and external shocks are better absorbed. In addition, Levy-Yeyati and Sturzenegger (2003b), using a sample of 183 countries for the period 1974–2000 and a new de facto classification system of exchange rate regimes, found that more rigid exchange rate regimes are associated with lower growth rates and volatility in output compared to less rigid regimes in developing countries. They did not find any significant difference in growth rates and volatility in developed countries across various exchange rate regimes. Levy-Yeyati and Sturzenegger (2001b) and Tavlas et al. (2008) record similar results.

Taking a slightly different approach, Bailliu, Lafrance and Perrault (2003) used a classification scheme based on different monetary policy frameworks, classifying monetary arrangements based on the presence of an explicit monetary policy anchor. They showed that a country with a monetary policy anchor influences economic growth positively, whereas a country without an anchor negatively influences growth. Moreover, they concluded that the monetary policy anchor, rather than the exchange rate regime, is responsible for influencing economic growth. In contrast to most studies on the relationship between exchange rate regime and growth, Dubas, Lee and Mark (2005) and De Grauwe and Schnabl (2004) found that countries with fixed exchange rate regimes have higher growth than more flexible exchange rate regimes.

2.4.3 Crisis Probabilities

The financial crises in the 1990s prompted most experts of exchange rate economics to re-evaluate their views on the choice of exchange rate regime. The dominant view that emerged was that pegged exchange rate regimes, specifically pegged-but-adjustable exchange rate regimes, are crisis prone, especially for emerging market economies with high exposure to international capital flows. Unlike developed countries that are highly exposed to international capital flows, emerging market economies have more fragile financial systems with less developed financial institutions (Rogoff et al., 2004). Consequently, financial crises have been much more frequent in emerging market economies than the rest of the economies. The probability of crises among the different exchange rate regimes across all countries for the period 1990–97 was highest for exchange rate regimes with limited flexibility (7 per cent, compared to 3 per cent for pegged, managed floating and freely floating regimes). Among country groups, emerging countries with pegged exchange rate regimes have the highest probability of crisis, followed by emerging countries with limited flexibility (Rogoff et al., 2004).

In contrast, Ghosh et al. (2002) found that currency crises are more common for countries with floating exchange rate regimes. However, this study is problematic as it used de jure exchange rate regimes, with the result that several of the countries reported in this study to have experienced crises, while officially having floating exchange rates, were actually pursuing less flexible regimes.

Traditionally, capital controls was believed to be the mechanism against currency crises in countries with fixed exchange rate regimes (Saxena & Wong, 1999). However, the effectiveness of capital controls in an increasingly integrated world is highly questionable (Edwards, 2001b). Further, the frequency of currency crises has been higher in emerging market economies with more rigid exchange rate regimes. This is mainly due to their greater exposure to the international financial environment.

2.4.4 International Trade Flows

As discussed previously, one of the arguments for fixed exchange rate regimes is that they reduce foreign currency risks and transactions costs, thus enhancing international trade and investment. Therefore, exchange rate volatility of more flexible exchange rate regimes is believed to hinder international trade. There is much empirical research on the relationship between exchange rate volatility and international trade, but no conclusive results have been found.[5] Some studies, such as that by Clark, Tamirisa, Wei, Sadikov and Zeng (2004) for the IMF, have investigated the effect of exchange rate volatility on trade flows (in this case, using a wide range of countries across different stages of development). Clark et al. did not find a robustly negative relationship between exchange rate volatility and trade. This implies that there is no reason to believe that reducing exchange rate volatility will generate greater international trade. Similarly, Bacchetta and Van Wincoop (2000) showed that the hypothesis that trade flows are lower under floating exchange rate regimes yields ambiguous results. Moreover, trade flows are found to be dependent on several other factors. Using a general equilibrium model, Sercu and Uppal (2003) found that exchange rate volatility could have either a negative or a positive effect on trade flows. However, studies that in-

[5] See studies by Gagnon (1993), Broll and Eckwert (1999), Parsley and Wei (2001), Frankel and Rose (2002), Wang and Barrett (2002) and Bahmani-Oskooee and Hegerty (2009) for empirical research on the link between exchange rate volatility and international trade.

cluded small and developing countries generally found a stronger relationship between exchange rate variability and international trade (Frankel, 1999).

2.5 Determinants of the Choice of Exchange Rate Regime

The literature identifies three main approaches for explaining the choice of exchange rate regime: the optimal currency area, the financial view and the political view. These three approaches are summarised below, listing the major determinants of the exchange rate regimes identified by each approach and the empirical literature on the subject. These determinants are further discussed and analysed in the context of the Maldives in Chapter 7, in which the appropriateness of the current exchange rate regime for the country is discussed.

2.5.1 The Optimal Currency Area Theory

The OCA theory, pioneered by Mundell (1961) and later extended by McKinnon (1963) and Kenen (1969), examines the basic criteria for countries to abandon their own currencies and form a successful currency union. Writing in the early 1960s, Mundell was the first to use the phrase 'OCA' to define a currency area as not needing to correspond to a single country's political borders. An OCA is a geographical area in which the member countries maintain a permanently fixed exchange rate among the member countries or adopt a common currency, while maintaining a flexible exchange rate system with the rest of the world, to maximise their economic efficiency.

The main factors identified by Mundell (1961) for an OCA are labour mobility, wage and price flexibility, and the type of economic shocks. McKinnon (1963) extended the OCA theory by adding additional factors such as the size and the openness of the economy, and the extent of trade integration between member countries. Over the years, as research on the choice of exchange rate regime expanded, several more factors were found to be important in the choice of exchange rate regime. Tavlas (1993) lists these as the similarity of inflation rates, the degree of commodity diversification, the degree of goods–market integration, fiscal integration and real exchange variability.

According to the OCA theory, the smaller and the more open a country is, the greater the benefit of having a fixed exchange rate regime. This is because a fixed exchange rate provides stable bilateral exchange rates and thus enhances gains from trade. When a country's trade is heavily integrated with members of a currency area, or a country trades primarily with the country to which its currency is pegged, a fixed exchange rate regime enhances trade by reducing financial transaction costs and bilateral exchange rate volatility (Levy-Yeyati, Sturzenegger, & Reggio, 2006). Regarding the nature of economic shocks, the optimal exchange rate regime depends on the type of economic shock to which a country is subjected.

Within a Mundell-Fleming framework, this suggests that countries more prone to real shocks, such as TOT shocks or natural disasters, should adopt floating exchange rate regimes. In contrast, countries that face predominantly nominal shocks would benefit more from a fixed exchange rate regime. According to Mundell (1961), fixed exchange rate regimes work better among countries between which there is greater factor or labour mobility. For example, consider a situation in which there is a change in demand in one country, country A, in favour of another country, country B, which causes unemployment in country A. If there is labour mobility along with wage and price flexibilities,[6] workers from country A can move to country B, resolving the unemployment situation in country A, without the need for exchange rate adjustment. Therefore, the presence of labour mobility and price and wage flexibilities among countries reduces the need for those countries to have their own exchange rates.

[6] Along with labour mobility, Mundell (1961) also stressed the importance of price and wage flexibilities.

2.5.2 The Financial View

The financial approach highlights the consequences of international financial integration and links to the hypothesis of the 'impossible trinity' (see Section 2.2.3). Countries that are highly dollarized with currency mismatches are more likely to opt for fixed exchange rate arrangements, as emphasised by Hausmann, Gavin, Pages-Serra and Stein (1999) and Calvo and Reinhart (2000). Conversely, when countries have a significant level of foreign liabilities (public or private), a pegged exchange rate regime is preferred, to prevent solvency risks in the event of currency devaluation.

2.5.3 The Political View

The political view holds that countries that lack institutional credibility may use a fixed exchange rate regime to lower inflationary expectations. According to this view, countries use an exchange rate peg (or an exchange rate anchor) as a 'policy crutch for governments lacking (nominal and institutional) credibility' (Levy-Yeyati et al., 2006, p. 4).

2.5.4 Determinants of the Exchange Rate Regime Choice

Several empirical studies have analysed the determinants of exchange rate regime choice in a cross section of countries, and more than 30 determinants of the choice of exchange rate regime have been identified. Some of the first studies of this kind include Heller (1978), Dreyer (1978), Holden, Holden and Suss (1979), Melvin (1985) and Bosco (1987). Some more recent studies include those by Savvides (1990), Rizzo (1998), and Poirson (2001), Collins (1996), Edwards (1988; 1989) and Frieden, Ghezzi, Stein and de Desarrollo (2000). The main determinants identified in the literature are listed below:

- Size of the economy
- Openness of the economy
- Trade integration
- Nature of shocks—foreign nominal shocks

- Nature of shocks—domestic nominal shocks
- Nature of shocks—real shocks
- Diversification of production and exports
- Labour mobility
- Wage and price flexibility
- Inflation differential
- Capital mobility
- Financial sector development and international financial integration
- Size of foreign exchange liabilities and dollarization
- Degree of ERPT
- Central bank independence and credibility
- Level of foreign currency reserves
- Political instability

Drawing on the above list, the main determinants that influence the exchange rate regime in a small developing country are evaluated in the context of the Maldives in Chapter 7.

2.6 Conclusion

This chapter presented a brief overview of the literature on the choice of exchange rate regime. The literature on the choice between fixed and flexible exchange rate regimes is extensive, but can be grouped under four main topics, as presented in this chapter. These are the classification of and trends in exchange rate regimes, the advantages and disadvantages of various exchange rate regimes, macroeconomic performance under different regimes and the determinants of the choice of exchange rate regimes.

The classification of exchange rate regimes has been one of the most important concepts in exchange rate regime analysis in recent years. This is because earlier analysis of exchange rate regimes was based on the officially announced (de jure) exchange rate regime of a country, which has since been found to be significantly different to the exchange rate regimes of countries in practice (de facto). This has led to several studies on exchange rate regime classification, with one of the most widely used de facto classification systems being the 'natural classification' system of Reinhart and Rogoff (2004). The types of exchange rate regime discerned by this classification form a continuum, with firmly fixed exchange rate regimes at one end and fully flexible regimes at the other. The level of flexibility increases as one moves from the 'fixed' to the 'flexible' end of the continuum. Further, it has been found that the most common form of exchange rate regime is the pegged exchange rate regime. When considering small developing countries separately, the pegged exchange rate regime remains the most common. In contrast, developed countries predominantly have fully independent floats.

There are advantages and disadvantages for both fixed exchange rate regimes and flexible exchange rate regimes. The main advantage of a fixed exchange rate regime is that it provides a credible nominal anchor to control inflation. In contrast, the main advantage of a flexible exchange rate regime is that it allows monetary policy independence. The choice between a flexible and a fixed exchange rate is seen as a trade-off between exchange rate stability and flexibility.

The macroeconomic performance under different exchange rate regimes has also been the subject of a number of empirical studies. Some of these studies have found inflation to be generally lower in countries with fixed exchange rates compared to countries with flexible exchange rate regimes. However, this relationship is only significant for developing countries. Lower inflation rates in countries with pegged exchange rate regimes have also been associated with lower growth rates and higher volatility of output in the real economy. Regarding the probability or frequency of currency crises, fixed exchange rates (except for in the case of the most rigid regimes) pose a high risk of speculative attacks against currency, especially when exposed to volatile capital flows. Therefore, fixed exchange rate regimes are more susceptible to banking sector distress and financial crises.

The determinants of the choice of exchange rate regime are discussed using the OCA theory, the financial view and the political view. There are several determinants of exchange rate regime choice identified in the literature such as the size and the openness of the economy; trade integration; diversification of production/exports; nature of economic shocks; degree of dollarization; exchange rate pass through; central bank independence and credibility; and level of foreign exchange reserves. These determinants are further discussed and analysed in the context of the Maldives in Chapter 7.

Chapter 3 *Real and Nominal Effective Exchange Rates in the Maldives*

3.1 Introduction

One of the most important indicators for exchange rate analysis is the RER. RER plays a key role in the macroeconomic adjustment mechanism in an economy, as it allocates resources in production and dictates spending in the economy. As the RER is a bilateral exchange rate, in exchange rate analysis, it is more common to use a multilateral exchange rate such as the REER. The REER is a weighted average of the domestic currency against a basket of currencies drawn from the country's main trading partners, adjusted for price differentials. Similarly, NEER measures the weighted averages of bilateral NERs.

Real effective exchanges rates are most commonly used as an indicator of price or cost competitiveness. In this regard, a depreciation of the REER indicates an increase in competitiveness of the home country relative to its trading partner. Conversely, an appreciation is regarded as a loss in competitiveness for home country producers of goods and services. However, given that competitiveness encompasses different dimensions of productivity and market performance in interaction with one other, REER may not always be an appropriate measure of competitiveness. REER measures can also be used to evaluate the degree of exchange rate misalignment of the domestic currency by comparing it to its medium to long-run equilibrium (Chinn, 2006). This is the subject of Chapter 4 of this study, in which the long-run ERER for the Maldives is estimated and discussed. The REER is also sometimes used to test the Balassa-Samuelson effect.[7] The NEER is important in exchange rate analysis and can be used to estimate the

[7] The Balassa-Samuelson effect refers to the increase in productivity in the tradable sector relative to non-tradable sector, leading to a rise in the relative price of non-tradables and pushing up the real exchange rate of the country (Appleyard et al., 2010).

effect of NER changes on domestic prices. The latter is known as the ERPT and this is empirically estimated for the Maldives in Chapter 5 of this study.

There are several methodologies used in the literature for constructing the NEER and REER. Therefore, calculating effective exchange rates involves making many choices and assumptions regarding the different elements and variables that go into the computation of the indices. Decisions have to be made about the countries that should be included in the currencies basket, the type of price index to be used and the most appropriate weighting process. These decisions are often dictated by the availability of data, especially in developing countries. Based on the choices and assumptions that are made, effective exchange rates calculated for any given country can produce different results (Ellis, 2001). Therefore, it is important to undertake a comprehensive analysis of the different methodological aspects of calculating effective exchange rates, and their appropriateness in the context of Maldives, to construct the RER and effective exchange rates for the country.

The RER and effective exchange rates have to be constructed for the Maldives, as these indices are not available from either local agencies or international institutions.[8] Therefore, this chapter, with its construction of the exchange rate indices, acts as a foundation for the rest of the chapters in this study. Given that this study is about exchange rate issues in the Maldives, it is also important to look at the developments in the NEER and REER in the Maldives. Apart from the main objective of using these indices in this study, it is hoped that the methodology used in constructing the effective exchange rates in this chapter will be adopted by the Maldivian authorities to estimate future indices in a timely and consistent manner. Overall, this chapter attempts to:

[8] The IMF, in their reports following their regular Article IV consultation visits and more recently the World Bank in their annual Maldives Economic Update, sometimes discusses the movements in REER in the Maldives by means of a chart. However, the data is not available in any time series format, nor is the methodology calculated of the indices known. Moreover, the Article IV consultation reports for the Maldives are not published, except for their reports, in 2008 and 2009.

- Identify, define and review the appropriate measure of the effective exchange rates for Maldives
- Identify the various components that go into the measurement of effective exchange rates
- Construct different measures of effective exchange rates for the Maldives
- Report and discuss the different measures of the effective exchange rates

This chapter is organised as follows. Following this introduction, in Section 3.2, the concepts of RER are discussed. Given the importance of the tradable and non-tradable sectors in RER analysis, Section 3.3 assesses the tradable and non-tradable sectors in the Maldives. In Section 3.4, the methodological issues related to the construction of effective exchange rates are examined. The estimation of the NEER and REER is presented in Section 3.5. This is followed by a discussion of the developments of various measures of NEER and REER in Section 3.6. The last section, Section 3.7, is the conclusion.

3.2 Concepts of Real Exchange Rates

According to Hinkle and Montiel (1999, p. 3):

> The choices made in selecting the appropriate actual real exchange rate for a particular application will obviously affect the equilibrium concept relevant to it and also because the reliability of the estimates of the equilibrium exchange rate will clearly depend on how closely empirical proxies can approximate the "true" variable being measured.

Since the REER index constructed in this chapter will be used to calculate the equilibrium exchange rate and to measure the exchange rate misalignment in Chapter 4, it is very important that the best possible measure or measures of REER be constructed in this chapter. However, this depends on the availability of data.

Before proceeding any further, it is necessary explain some definitions of exchange rates. Some of the definitions are already discussed in Chapter 1 and in the introduction of this chapter. NER is the price of one currency relative to another currency. For example, the exchange rate of the rufiyaa against the US dollar is the bilateral exchange rate between the rufiyaa and the US dollar. The NER is normally quoted in domestic currency terms, as the units of home currency per unit of foreign currency. Defined this way, an increase in the NER reflects a depreciation of the home currency and a decrease is appreciation of the home currency in nominal terms. The simplest definition of RER is that it is the relative price of the goods and services between two countries. In other words, RER is the nominal exchange of the home country adjusted for the price level between the home country and the foreign country. This definition is known as the external RER and is based on the theory of purchasing power parity (PPP). The RER can also be defined as the ratio of the domestic price of tradable to non-tradable goods[9] within a country (Edwards, 1988). This is referred to as the internal RER. The RER between the home currency and an individual foreign currency is referred to as the bilateral RER (BRER). Given that it may not be possible to include all the currencies of a country's trading partners, NEER and REER measure real or NERs, respectively, of the home currency against a basket of currencies of major trading partners, as a weighted average.

RER can be defined as an external RER or an internal RER, with each requiring a different measurement approach. The three most widely used approaches to measure external RER are PPP theory, the Mundell-Fleming one composite good model and competitiveness in traded goods. A less commonly used approach is based on relative labour cost in production.

Theoretical models based on the concept of internal RER are most frequently used in the context of developing countries, whereas the external RER is typically used in developed countries. However, empirical estimates of RER in developing

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[9] Generally, the tradable sector contains goods and services that are imported or those domestically produced goods and services that are in competition with imported goods, either in the domestic or international markets. The non-tradable component contains goods and services that are domestically produced and that cannot be traded. Section 3.3 of this chapter discusses the concept of tradable and non-tradable sectors in more detail.

countries are based on external RER, as estimations based on internal RER are difficult both conceptually and empirically (Hinkle & Nsengiyumva, 1999). The macroeconomic data for most developing countries are at a very basic level and data on tradable and non-tradable goods, which is necessary for the computation of internal RER, are not available for most developing countries. This is also the case for the Maldives.

In Section 3.3, a brief analysis of the tradable and non-tradable sectors in the Maldives is conducted using data on consumer prices for a limited number of years. It shows that the non-tradable sector is relatively insignificant in the Maldives. As internal RER is an indicator of domestic resource allocation incentives in the home country, the internal RER would not be meaningful for the Maldives, given the relative insignificance of the non-tradable sector in the country. In contrast, external RER is a measure of external competitiveness of the home country relative to its main trading partners. Given that the Maldives is a small and highly open developing economy with limited non-tradable sectors, external RER measures are more important for analysing exchange rate movements. Therefore, this study will focus on measures based on external RER. The methodology that is used in this study to construct the effective exchange rates, especially the formulae discussed in Section 3.3.1, is drawn from Hinkle and Nsengiyumva (1999). This methodology has proven appropriate for developing countries, such as the Maldives, with data limitations.

3.3 Tradable and Non-Tradable Sectors in the Maldives

As Knight and Johnson (1997) point out, the identification of tradable and non-tradable sectors is important for policy makers and researchers alike. In relation to this study, such identification assists in the analysis of the effects of currency devaluation, the PPP theory of exchange rates, the determinants of inflation in small and open economies and international trade flows. Generally, the tradable sector contains goods and services that are imported or those domestically produced goods and services that are in competition with imported goods in the domestic or international markets. The non-tradable sector comprises goods and services that are domestically produced and that cannot be traded. In practice, there is a high degree of overlap, making it difficult to classify tradables versus non-tradables definitively (Dwyer, 1992).

For simplicity, several earlier empirical works on the subject categorised all manufacturing as tradables and all services as non-tradables (Gregorio, Giovannini, & Krueger, 1994). However, this method of delineation becomes problematic when dealing with service industries such as tourism and information and communication technology, which are increasingly becoming tradable. Goldstein and Officer (1979) identify two other approaches to separating the tradeable from the non-tradable. The first includes all goods that are actually traded—that is, the exports and imports from the international trade statistics. The second approach goes further to include any good that 'either is internationally traded or could be traded at some plausible range of variation in relative prices' (Goldstein & Officer, 1979, p. 415). Other studies, such as those by Dwyer (1992) and Gregorio et al. (1994) use supply and use tables from national accounts data to identify whether a given commodity or industry is export-oriented or import substitutable. Export orientation is measured by the extent to which a commodity or an industry is exported, in relation to the total production of that commodity or industry. Import substitution is defined as the total goods in a given commodity or industry group that are competing with imports. This is a calculation of the importance or significance of the international trade in each industry. An arbitrarily determined threshold is then used to categorise the commodity or industry group as tradable or non-tradable.

A more indirect method of identifying the tradable and non-tradables sector uses CPI data, classifying the various categories of CPI into tradables and non-tradables (Arce & Robles, 2004; Pitchford, 1986). The tradable component includes all the items in the CPI that are imported from the rest of the world, and the non-tradables are the services that are provided domestically. In the case of the Maldives, only this indirect approach can be used. Detailed CPI data are available from June 2004 to December 2010, while there are very limited national accounts data available.

To identify the tradable and non-tradable sectors for the Maldives, the detailed components of CPI data and the individual items in each component were examined. This enabled the broad categories of the CPI to be divided into tradables and non-tradables. In addition, the import content of the tradable goods was also examined. This shed light on the importance of foreign prices in influencing inflation in the country. Table 3.1 shows the breakdown of the CPI into broad categories of tradable and non-tradables for the Maldives.

Table 3.1: Weights of CPI index by tradables and non-tradables

Tradable	**Weights**	**Non-tradable**	**Weights**
Food and non-alcoholic beverages	33.31	Food and non-alcoholic beverages	-
Tobacco and narcotics	2.76	Tobacco and narcotics	-
Clothing and footwear	5.44	Clothing and footwear	0.52
Housing, water, electricity, gas and other fuels	2.97	Housing, water, electricity, gas and other fuels	16.50
Furnishings, households equipment and routine maintenance	4.99	Furnishings, households equipment and routine maintenance	0.30
Health	0.50	Health	4.92
Transport	2.73	Transport	1.62
Communications	0.62	Communications	5.21
Recreation and culture	4.11	Recreation and culture	0.83
Education	-	Education	3.15
Hotels, cafes and restaurants	-	Hotels, cafes and restaurants	0.77
Miscellaneous goods and services	7.60	Miscellaneous goods and services	0.32
Religion	-	Religion	0.11
Total CPI	65.03	Total CPI	34.25

Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

As the Maldives is very import dependent, a large proportion of the consumer goods in the CPI basket comprise imports. There are a few locally produced items in the food category, such as fish and a few varieties of vegetables and fruits. However, as these items are highly substitutable by imports, they are also classified as tradables. Moreover, industries that produce these do not receive any special protection from the government, such as high import taxes for similar imported goods. A thorough analysis of the individual items in the CPI basket revealed that apart from fish, a few types of vegetables and some locally prepared foods, all other foodstuffs are imported. The analysis revealed that, in the Maldives, about 90 per cent of the tradable goods in the CPI basket are imported. This figure remains high, at 58 per cent, when the total CPI basket is considered.

As seen in Table 3.1, service dominated categories such as housing, utilities and health have their weights classified as non-tradables, following the general assumption that all services are non-tradable. However, these services are also greatly influenced by exchange rate movement and international prices. For example, electricity fees are the indicator item for the electricity component in the CPI basket. The cost of electricity provision to consumers is influenced by the exchange rate and oil prices in the international markets. However, as the electricity company is heavily subsidised by the government, changes in international prices may not be reflected in local prices. In the health category, non-tradables include doctor's consulting fees, dental services and paramedical services. A large proportion of the personnel involved in providing these services are expatriates. While their wages are normally set in US dollars, actual income is received in local currency. Providing the exchange rate peg remains stable, no exchange rate affect would be felt. However, if there was a devaluation, the local currency value of salaries in the health field would change, potentially influencing service fees in this sector.

This brief analysis of the tradable and non-tradable sectors reveals the importance of the tradable sector in the Maldives, as represented by the consumption in the country.

3.4 Methodological Issues

There are several definitions, theories and measurements of RERs as discussed in Section 3.2. There is no consensus on how RERs should be measured, and there are several methodological issues in constructing effective exchange rates. Consequently, choices have to be made on the variables and methods chosen. As mentioned previously, the methodology used in constructing RERs is often dictated by the availability of consistent time-series data, collected over an appropriately long period, for each country.

To calculate the external RER indices, regardless of the approach used, the following is required:

- A mathematical formula (there are different formulae that can be used) and an averaging method (geometric average or arithmetic average)
- An appropriate NER: whether that be the official rate or a parallel market rate for countries in which there is a significant black market. (This is very common in developing countries, especially countries with pegged exchange rate regimes)
- Country weights (based on trade weights of imports, exports and tourism; fixed or changing weights)
- An appropriate price or cost index; for example, the CPI, wholesale price index, GDP deflators or unit labour costs

These issues are discussed in detail below.

3.4.1 Formulae

There are several formulae used in calculating RERs and effective exchange rates. However, in this study, as mentioned earlier, formulae based on the work of Hinkle and Nsengiyumva (1999) are used. Based on the external RER discussed in Section 3.2, the bilateral RER (BRER) can be expressed as:

$$BRER_{dc} = NER_{dc} * \frac{P_{Gf}}{P_{Gd}} \tag{3.1}$$

where $BRER_{dc}$ is the bilateral RER between the domestic currency and a foreign currency; NER_{dc} is the index of units of domestic currency per one unit of foreign currency; P_{Gf} is the general price index of the foreign country; and P_{Gd} is the general price index of the domestic country.

Similar to Equation 3.1, REER can be expressed as:

$$\mathrm{REER_{dc}} = \prod_{\mathrm{i=1}}^{\mathrm{m}} \mathrm{BRER}_{\mathrm{dc_i}}^{\mathrm{\omega_{id}}} \tag{3.2}$$

where $REER_{dc}$ is the REER for domestic currency; *m* is the number of trading partners of the home country; $BRER_{dc_i}^{\omega_{id}}$ is the bilateral RER with i^{th} country; ω is the trade weight assigned to the i^{th} country (where *i* = 1.....m); and

$$\sum_{i=1}^{m} \omega = 1$$

REER can also be calculated as the product of NEER, adjusted for relative prices. This can be expressed as:

$$\mathrm{REER_{dc}} = \frac{\mathrm{NEER_{dc}} * \mathrm{EP_{Gf}}}{\mathrm{P_{Gd}}} \tag{3.3}$$

where NEER is expressed as:

$$\mathrm{NEER_{dc}} = \prod_{\mathrm{i=1}}^{\mathrm{m}} \mathrm{NER}_{\mathrm{dc_i}}^{\mathrm{\omega_{id}}} \tag{3.4}$$

and EP_{Gf} is the effective aggregate price index of foreign trading partners, expressed as:

$$EP_{Gf} = \prod_{i=1}^{m} P_{G_i}^{\omega_{id}} \tag{3.5}$$

Following the identification of the formulae to be used, the next step is to decide on the averaging process that will be used to calculate the weighted average exchange rate indices. The arithmetic average is simpler, but geometric averaging is preferred when constructing effective exchange rates. There are three main reasons for this. First, in an arithmetically averaged index of exchange rate, percentage changes will be different depending on whether the exchange rates are expressed as units of local currency per unit of foreign currency, or vice versa. Secondly, the choice of base period is important for arithmetic averaged indices in the sense that the percentage movements between two periods will change if the base period is changed. In contrast, in a geometrically averaged index, the percentage changes between two periods are not influenced by base period. Further, the base period of indices can be easily changed without affecting the percentage changes. This is a very important feature, as different indices used in the computation of effective exchange rates often have different base periods. Thirdly, geometric averaging treats appreciating and depreciating currencies symmetrically, while arithmetic averaging gives large weights to currencies that have larger appreciations or depreciations relative to home currencies (Ellis, 2001). Due to the advantages of using geometric averaging, this study has adopted this process.

3.4.2 Choice of Nominal Exchange Rate

In many developing countries, the official exchange rate may not be the only exchange rate used in the country. In countries in which there are parallel (black) markets for foreign exchange, the official and unofficial rates might diverge significantly. This would alter the outcomes for RER calculations, depending on the NER used. If a country does not have a significant parallel market, the use of the official exchange rate is suitable. In many developing countries with fixed exchange rate regimes, parallel markets are broad and significant in the economy. In such cases, the exchange rate prevailing in the parallel market may be the representative exchange rate of the country, and using the official exchange rate to calculate RER would not produce reliable estimates (Edwards, 1988). However, the problem with parallel market exchange rates is that they are not always available, especially in a consistent manner.

In the Maldives, parallel markets have occasionally emerged in the past, typically following periods of foreign exchange shortages. The parallel market that emerged in 2001, before the devaluation, was found to be substantial. Since the data on parallel market exchange rates or the volume of transactions using parallel market rates are not available, this study will only use the official NER. This is not expected to influence the RER calculations significantly, as the parallel markets in the Maldives were not known to have persisted for long periods, except more recently - since 2009.

3.4.3 Choice of Country Weights

This section will analyse the trade patterns of the Maldives[10] to identify the country weights for the major trading partners of the Maldives.

Trade patterns

The Maldives is a highly open economy, with both imports and exports playing a significant role in the economy. The degree of openness, which is the ratio of exports and imports to GDP, is over 160 per cent. In addition, the country is heavily dependent on tourism. The sector accounts for over 60 per cent of the foreign exchange earnings of the country and directly accounts for over one-third of GDP. Exports of goods are limited to fish and fish products, with this accounting for only 8 per cent of total exports of goods and services, and less than 10 per cent of trade in goods. The limited resource base of the country is one of the reasons for its heavy reliance on imports for both domestic consumption and for the large and growing tourism industry. The major exporting partners of the Mal-

[10] The statistics used in these analyses are from data obtained from the Maldives Monetary Authority (2009) and various issues of the *Monthly Statistics*, published by the Maldives Monetary Authority (2011) and available on its website (http://www.mma.gov.mv/pub.php).

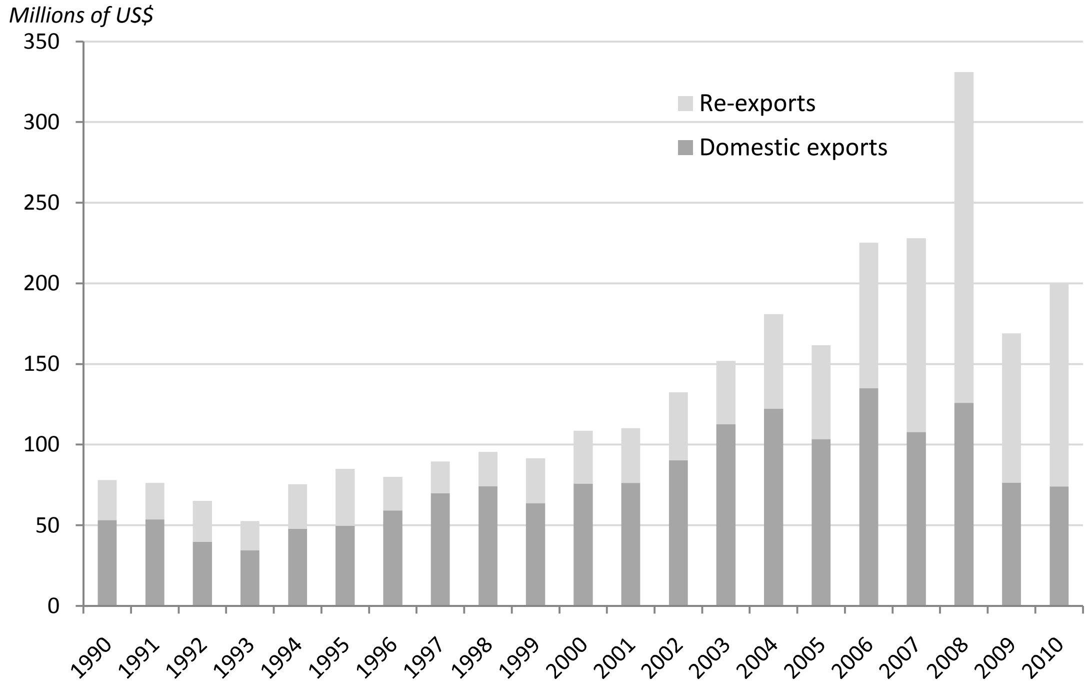
dives are the European countries, accounting for over 70 per cent of exports of goods and services. In contrast, the majority of imported goods come from Asian countries, such as Singapore, India, Malaysia and Sri Lanka. Since the mid-2000s, imports from the United Arab Emirates (UAE) have been increasing rapidly.

Developments in merchandise exports

Merchandise exports comprise domestic exports and re-exports. Domestic exports, which have declined from 70 per cent of merchandise exports in 1998 to 38 per cent in 2008, include fish and fish products. The low growth in domestic exports reveals itself in the minimal increase in domestic export receipts plotted in Figure 3.1. There are several contributing factors to this low export performance, including a low fish catch associated with environmental factors and higher fuel prices in recent years.

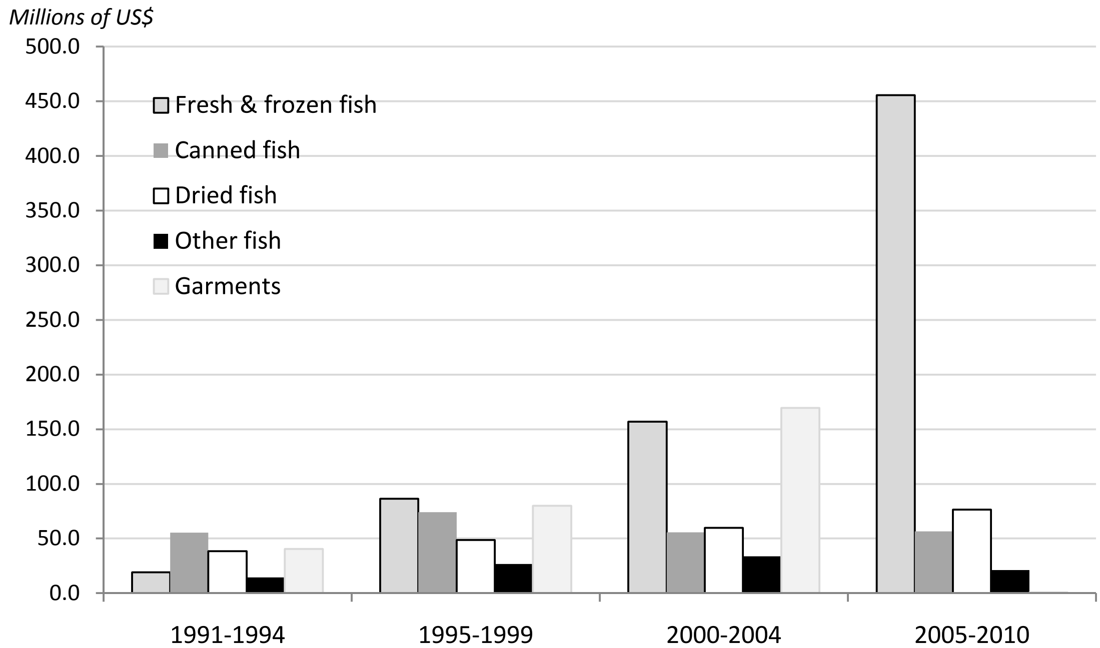
Regarding re-exports, this mainly refers to the sale of imported jet fuel to foreign airline carriers. The recent high price of jet fuel, coupled with the increasing number of foreign airlines landing in the country due to expansion in the tourism sector, has seen re-exports grow significantly since 1990, so that they now account for approximately 62 per cent of merchandise exports. However, it should be noted that re-exports fell significantly in 2009 and 2010 due to the slowdown in the tourism sector. Given the nature of these re-exports, they are not included in the calculation of export trade shares. The changes in the composition of merchandise exports over the last 20 years are evident in Figure 3.2.

Figure 3.1: Merchandise exports, 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Figure 3.2: Composition of merchandise exports, 1991–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Figure 3.2 shows the composition of the merchandise exports of the Maldives. It can be seen that, until the end of 2004, about one-third of all domestic exports were garments. However, the expiration of the *Multi-Fibre Agreement* on 1 January 2004 ended the quotas given to developing countries to export garments to developed countries such as the US (Maldives Monetary Authority, 2004). The garment factories established in the Maldives were mostly Sri Lankan owned and the majority of the workers were expatriates. Moreover, the garment factories were only responsible for finishing Sri Lankan produced garments, having been established principally to take advantage of the Maldives's quota of garment exports to the US. Therefore, at the end of 2004, almost all of the garment factories closed, with minimal losses to the Maldivian economy. The effect on the trade balance was neutral, as imports of textiles mirrored the fall in the export of garments (Maldives Monetary Authority, 2004).

The exports of the country currently comprise only fish and fish products, of which about 80 per cent are exported (predominately to Thailand) as chilled or frozen tuna, as shown in Figure 3.2. About 6 per cent of the fish exports are in the form of canned fish, most of which is exported to European countries. A further 8 per cent of fish exports are dried fish and are exported to Sri Lanka. As shown in Figure 3.2, there has been a rapid increase in the export of chilled or frozen fish, with exports of canned fish declining slightly. The changes in export patterns over the period 1991–2010 reflect the shifts in trading partners over the same period. This is shown in Table 3.2, which gives the average share of trading partners over different periods. For instance, exports to Thailand accounted for around 30 per cent of foreign exports in the late 1980s (not shown here), declining to approximately 10 per cent in the 1990s, before increasing steadily to over 30 per cent in the period 2005–2010. In the 1990s, exports to the United Kingdom (UK) accounted for over 20 per cent of total exports, but the share has declined to 8 per cent in recent years. Similarly, the export share of Sri Lanka has declined over this period. The export trade shares of the Maldives' major trading partners (accounting for approximately 90 per cent of total exports) are shown in Table 3.2.

Table 3.2: Exports shares of Maldives major trading partners, 1990–2010 (%)

	1990–1994	1995–1999	2000–2004	2005–2010
France	0	0	1	8
Germany, Federal	8	8	5	3
Italy	0	0	1	6
Japan	5	10	9	8
Singapore	4	5	3	2
Sri Lanka	23	19	16	15
Thailand	11	10	14	31
UK	24	19	9	10
USA	18	20	36	1
Total	94	91	93	84

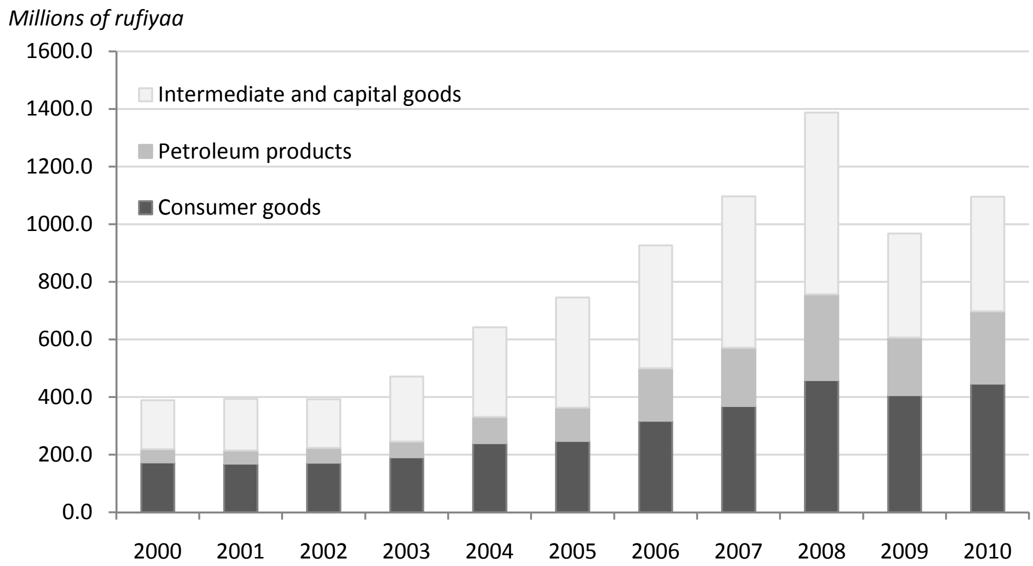
Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Developments in merchandise imports

The Maldives' heavy dependence on imports for both domestic consumption and its industries is evident from the high ratio of imports to GDP, which stands at over 100 per cent as at 2010. This is largely due to the rapid growth in the economy, especially in the import-dependent tourism sector. The growth in merchandise imports and a breakdown of the products being imported is shown in Figure 3.3.

About 34 per cent of imports into the country are consumer goods and 16 per cent are food items. Of the remaining imports, 19 per cent of imports are accounted for by petroleum products and 47 per cent are intermediate and capital goods. The latter category has been growing rapidly in significance in recent years due to the on-going tsunami reconstruction as well as resort construction and renovations.

Figure 3.3: Growth in merchandise imports, 2000–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

For the period 2005–2010, the majority of imports to the Maldives came from Asia (60 per cent). Singapore was the largest individual trading partner (22 percent of total imports) although in the last five years imports from UAE have also been growing strongly, accounting for 18 per cent of total imports, as shown in Table 3.3. Imports from India account for 11 per cent of total imports, while those from Malysia and Sri Lanka constituted 7 percent and 6 per cent, respectively.

Although Singapore is still the most important trading partner, the share of imports from the country has declined considerably over the years, from over 50 per cent of imports in the early 1990s to about 25 per cent in 2005–2010. This is largely due to an increase in exports from other countries, especially the UAE, but also from Thailand and Malaysia. The import shares of the major import trading partners are shown in Table 3.3.

Table 3.3: Imports shares of Maldives major trading partners

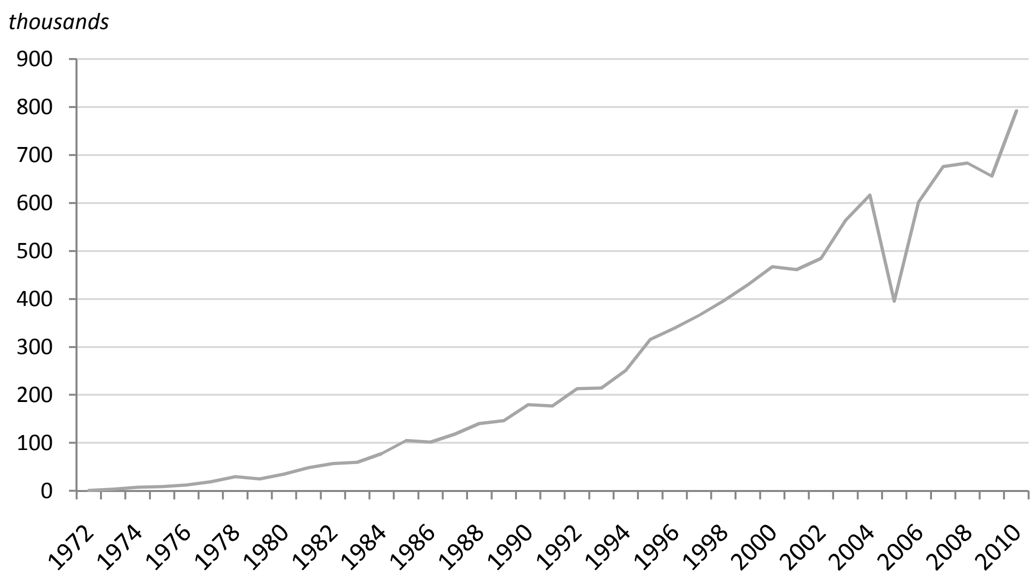
	1990–1994	1995–1999	2000–2004	2005–2010
China	0	0	1	2
France	0	1	3	1
Germany, Federal	3	3	2	2
India	8	11	10	11
Malaysia	2	6	8	7
Singapore	55	31	25	22
Sri Lanka	7	9	13	6
Thailand	3	3	4	5
UAE	3	9	8	18
UK	4	4	2	2
USA	1	1	2	2
Total	86	77	78	79

Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Developments in tourism exports

Tourism is the main economic activity in the Maldives, accounting for almost one-third of GDP and 60 per cent of foreign exchange earnings. Tourism activities began relatively late in the Maldives, but have grown rapidly. The annual arrivals in tourists from 1972–2010 are shown in Figure 3.4.

Figure 3.4: Tourist arrivals, 1972–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

The first tourist resort was opened in 1972 with 60 beds, followed by another resort in the same year with 110 beds. These two resorts received about 1,000 tourists in that year. Over the past decades, tourism has flourished in the Maldives, with the number of tourists resorts increasing to 97 by the end of 2010 with a bed capacity of close to 24,000. The tourist arrivals totalled almost 800,000 in 2010, and annual growth in tourist arrivals has averaged 8 per cent for the last 10 years..

The majority of tourists to the Maldives are from Europe and, until 2008, the tourists from this region constituted about 70 per cent of total tourists. A further 20 per cent of tourists came from Asia. However, in the past two years, there has been a substantial growth in tourist arrivals from China, increasing the Asian market to 30 per cent and reducing the European market to 64 per cent in 2010. As regards the individual countries, over half the tourists to the Maldives come from just four countries: Germany, Italy, the UK and China. This leaves the growth in the tourism sector dependent on the changes in a few markets and the industry highly vulnerable. With the recent weak economic conditions in Europe, the percentage of tourists coming from other countries, such as Russia, Korea and India have seen an increase. The developments in market shares for the main tourist markets are shown in Table 3.4.

Table 3.4: Tourist arrivals by country, 1990–2010 (%)

	1990–1994	1995–1999	2000–2004	2005–2010
China	0	0	2	7
France	6	5	7	7
Germany, Federal	23	21	14	11
India	4	3	2	3
Italy	19	18	24	16
Japan	8	10	9	6
Russia	0	1	2	5
South Korea	0	1	1	3
Switzerland	5	6	6	4
UK	9	14	17	18
Total	74	78	82	79

Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Choosing a weighting scheme

Trade weights should ideally incorporate trade in both goods and services, divided into manufacturing, commodities and services. Such weights are complex to compute and require comprehensive trade data, both domestic and for trading partners. Given the lack of such detailed data in the Maldives, it is more appropriate to compute trade weights based on exports of goods, imports of goods and tourism inflows. For each category (exports, imports and tourism), separate weights can be calculated for each trading partner, allowing them to be used to construct effective exchange rates based on each type of trade.

In addition, an aggregation of these weights can be computed to derive overall trade weights. The trade weights can also be bilateral weights such as these or multilateral weights. This latter option takes into account competing third country market effects (Cox, 1986). Multilateral weights are very complicated and involve the use of disaggregated trade data, which may not be readily available. Third country market effects are not particularly relevant for the Maldives, given the low level of domestic export flows of goods, as seen in Section 3.4.3.2. Other alternative weighting schemes include GDP weights and capital account weights, but these are not commonly used due to the difficulties in obtaining data to construct them.

Constant or fixed weights are the simplest to both derive and use in the construction of effective exchange rates. Fixed weights assume that the relative shares of trading partners remain constant over the period. This assumption rarely holds, especially over long periods, during which time the shares of a country's trading partners may change substantially. If fixed weights are based on a recent period, the weights may not be appropriate for the earlier years. Similarly, if the rates are out-dated, they might not represent current trends. Therefore, weighting schemes that allow trade weights to change from period to period are becoming increasingly popular, as they produce a more representative index of effective exchange rates (Richter & Svavarsson, 2006). However, using moving weights is complex, and the index has to be spliced together whenever the weights change. One commonly used method to overcome this problem is a spliced Laspeyres index (Ellis, 2001).

In the Maldives, the importance of the various main trading partners has shifted significantly (see Table 3.2), which makes moving weights more suitable for computing effective exchange rates. Therefore, this study utilises time-varying weights by assigning five-year averages for each five-year period and chaining the indices as suggested by Ellis (2001) to construct a consistent time-series index of effective exchange rates. The justification for using three-year average weights instead of the more common annual weights is to smooth out the potentially abnormal movements in year-to-year variations in trade. In a small country like the Maldives, annual trade data may be influenced by a large shipment from a specific country for a special project, thereby distorting the trade shares in a given year.

In the previous sections, the trade patterns of the Maldives were discussed, showing that there is a significant difference in the importance of trading partners for imports, exports and tourism. Given this, it is useful to construct effective exchange rates based on different sets of trade weights. In this respect, effective exchange rates are constructed based on imports weights, exports weights, tourism weights and aggregate trade weights, separately. The aggregate trade weights are simply the relative shares of imports, exports and tourism in the total trade in goods and services. The following equations are used to compute the four sets of trade weights.

Import weights:

$$w_i^M = \frac{m_i}{M} \tag{3.5}$$

Export weights:

$$\mathrm{w_i^X} = \frac{\mathrm{x_i}}{\mathrm{X}} \tag{3.6}$$

Tourism weights:

$$w_i^T = \frac{t_i}{T} \tag{3.7}$$

Aggregate trade weights:

$$w_i^{TW} = \frac{M}{M+X+TR} w_i^m + \frac{X}{M+X+TR} w_i^x + \frac{TR}{M+X+TR} w_i^t \tag{3.8}$$

where w_i^M, w_i^X, w_i^T and w_i^{TW} denote the trade weights for the i^{th} country based on imports, exports, tourism receipts and aggregate trade in goods and services, respectively. The variables m_i and x_i represent the value of imports and exports of the i^{th} country and t_i represents the tourist arrivals from the i^{th} country. The variables M and X are the total value of imports and exports of the Maldives, T is the total number of tourists from all the countries and TR is the total tourism receipts.[11]

The trade shares are calculated for the major trading partners in each category using Equations 3.5 to 3.8 for 17 countries. These countries account for about 80 per cent of trade in goods and services for the Maldives. For each country, trade weights in each category are calculated for each five-year period from 1990–2010, resulting in trade weights for four periods[12] (1990–1994, 1995–1999, 2000–2004 and 2005–2010). Similarly, for each of the period, the share of imports, exports and tourism in total trade and services is calculated, as these shares have also varied over time. The use of different weights for different periods requires the indices to be chain-linked to make a consistent time series. Therefore, the calculated indices were chain-linked each time to the old series. The steps undertaken are as follows:

[11] To calculate the tourism shares by country, tourist arrivals data are used because tourism receipts by country are not available. However, when calculating the tourism share in total trade in goods and services, total tourism receipts are used. Since, in Equation 3.8, the trade weight is calculated using trade shares, use of different units is not an issue.

[12] For the last period (2005-2010), six years are included so as to not isolate 2010 as a separate category.

- Identify a common period for both indices (in which the indices are weighted by the previous weights and current weights)
- Multiply the old figure by the new figure to derive a conversion coefficient
- Multiply the old figures by the conversion coefficient
- Put the re-based data with the new figures to create a chained-linked index (Stutely, 2003)

Since the computations of the different trade weights result in a large amount of data, only the countries included in each category are shown in Table 3.5 and the detailed trade weights are presented in Appendix 1, Table A1.1.

Table 3.5: Countries included in trade weights, by category

	Imports (M)	**Exports** (X)	**Tourism** (T)	**Aggregate Trade Weights** (TW)
Austria			x	x
China	x		x	x
France	x	x	x	x
Germany	x	x	x	x
India	x		x	x
Italy		x	x	x
Japan		x	x	x
Malaysia	x			x
Russia			x	x
Singapore	x	x		x
South Korea			x	x
Sri Lanka	x	x		x
Switzerland			x	x
Thailand	x	x		x
UK	x	x	x	x
US	x	x	x	x
Euro Area[1]			x	x
Total	10	9	13	17

Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)
[1/] This excludes Austria, France, Germany and Italy, as their shares are individually allocated

The calculation of weights for different periods allowed the countries included in each period to be based on the significance of that country during that period. Although the inclusion threshold was determined initially at 1 per cent, inclusion of some countries in the basket was delayed until trade share became more significant. This was to limit excessive variation in the basket of currencies over the period. It is also important to note that Australia and UAE are not included in the currency basket due to the unavailability of required data.[13] The exclusion of Australia is not significant, as the country has a trade share of only 2 per cent. However, UAE is the second largest source of imports, accounting for 18 per cent of imports during the period 2005–2010. Further, UAE has held a 10 per cent share in imports since the mid-1990s. Despite this, the necessary exclusion of UAE is not viewed as a problem for the calculation of effective exchange rates. This is because the weight of UAE was allocated to the United States. This decision was based on two factors. Firstly, both the Maldives and UAE have their exchange rates pegged to the US dollar. Secondly, UAE is a major transhipment hub, which means that most of its exports are re-exports. Most of the re-exports are priced in US dollars and the bilateral exchange rates may not have much influence on the price of re-exports.

As mentioned earlier, the trade shares of currencies included in the currency basket account for an average of 80 per cent of trade in goods and services. While this is a good representation of the overall trade, the issue of how to treat the remaining 20 per cent needed to be addressed. One option was to normalise the weights of all the countries based on their trade shares for the total, to sum up to 100 per cent. Another option was to allocate the share to another currency or currencies that might play a more important role than their actual trade share shows. This was the case for the US dollar, which is a major vehicle currency, as the majority of trade transactions globally are carried out in US dollars. While this does not preclude the importance of other currencies in influencing the effective exchange rate indices, this justifies a higher weight allocation to the US dollar than its trade share warrants. Consequently, the share of currencies not included in the imports and exports currency baskets were allocated to the US dollar.

[13] CPI data for Australia is only available on a quarterly basis, while this study uses monthly data. As regards the UAE, monthly CPI data are only available for 2008, 2009 and 2010.

In the case of tourism shares, a slightly different approach is used. Given that a number of countries not included in the tourism currency basket are Euro area countries, these shares were allocated on this basis to the Euro. The remaining was allocated to the US dollar. However, the weights shown for the Euro area in Table 3.5 do not include the four Euro countries already included in the basket, namely Austria, France, Germany and Italy. This is to identify their individual affect. The additional allocation of trade shares to the US means that the highest individual trade weight is on the US dollar, at about 25 per cent in the aggregated trade weights. While this percentage is lower for exports and tourism weights, a share of over 40 per cent on average is assigned to the US in imports-based weights.

As mentioned earlier, a large proportion of external trade transactions in the Maldives, as in many other Asian countries, are invoiced in US dollars. A weighting scheme based on invoicing currency would be very different to those derived here, which are based on trade flows. While the actual trade share of the US in Maldives' trade is very small (less than 3 per cent), 79 per cent of imports into the country in 2009 were invoiced in US dollars.[14] Table 3.6 shows the composition of imports in terms of invoiced currency and trade flows.

[14] Detailed imports data (annual data from 2005–2009) obtained from Customs, Maldives, were analysed to determine the invoice currency, as this information was not available. The results of this analysis produced the currency weights shown in Table 3.5.

Table 3.6: Trade and currency composition of imports, 2009 (%)

	Share of Currency	Share of Imports
China	0.4	2.7
Euro	5.8	6.4
India	0.2	12.1
Malaysia	0.9	6.6
Singapore	5.9	21.4
Sri Lanka	0.2	6.5
Thailand	2.2	5.0
UAE	0.5	15.7
UK	0.7	1.1
US	79.0	2.5
Total	95.7	80.0

Source: Maldives Customs (2009)

The information on invoice currency shown above may suggest that bilateral exchange rates are not important for the Maldives in exchange rate analysis. A weighting scheme based on currency invoicing of trade may therefore seem to be a better alternative. In such a scheme, the bilateral RER of rufiyaa to US dollar would be equivalent to REER, given that almost 80 per cent of the trade is in US dollars. However, this would not be a true approximation of the REER. This is because the bilateral exchange rate between the rufiyaa and the trading partner's currency does affect the trade flows between the countries (Clark, 2004). For example, if the Indian rupee depreciates against the US dollar, this would reflect a parallel depreciation against the rufiyaa, given the fixed exchange rate regime. This would make exports from India relatively cheaper and may influence the import prices in the Maldives. This kind of information would be lost if bilateral exchange rates between trading partners were not included in the effective exchange rate indices. Therefore, the invoicing currency information only provides support for the larger weight attached to the US dollar than the trade share warrants, but does not render the weights based on trade weights irrelevant. Therefore, this study will use the trade weights derived in the above section, which are based on trade flows with appropriate adjustments in the context of Maldives.

3.4.4 Choice of Price or Cost Index

A price or index that accurately captures domestic and foreign prices and that is representative and comparable across all of the countries should be used in constructing REER. However, it is difficult to find such a price or cost index. The price or cost indices typically used are CPIs, unit labour costs, producer price indices (PPIs, also known as wholesale price indices, WPIs), GDP deflators or export and import unit values. Each of these indices has its own advantages and disadvantages. Of all the indices, CPI is the most frequently used price index, as it is more readily available than the other indices, especially for developing countries. The main criticism of CPI is that it includes the price of non-tradable items, which may bias the degree of competitiveness measured by the RER (Lafrance, Osakwe, & St-Amant, 1998).

In the Maldives, only the CPI and GDP deflators are available. The GDP deflators are only available annually, whereas CPI data are available on a monthly basis. Recently, the Maldives have also begun to publish PPI, but this is available only from 2001 on a quarterly basis. As only CPI data can be used on a monthly basis, this study uses CPI as the price index to construct the monthly RER index.

3.5 Estimation of Real and Nominal Effective Exchange Rates

To calculate the bilateral RERs and the effective exchange rates, the nominal official exchange rate of the rufiyaa per US dollar and the cross rates of US dollar against the currencies of the Maldives' major trading partners are used. The NERs of the rufiyaa against the other currencies are cross rates calculated from the exchange rate of a particular country against the US dollar. The data used in the construction of the indices are from different sources. The trade data was mainly collected from the Maldives Monetary Authority (2009, 2011), who provided detailed time-series data on both trade in goods and tourism. However, there were some missing data, which were updated using various issues of Monthly Statistics, published by the Maldives Monetary Authority (2009, 2011) on their website, and the Maldives Statistical Year Books, published by the Department of National Planning (2005). These data are also available on the department's website. The NER and CPI data were extracted from the IMF's International Finance Statistics (IFS) database. The CPI data for China was obtained from the OECD's Statistics website (OECD), as only the percentage change in CPI was available on the IFS database. For the European countries, Euro conversion rates were used to convert the national currency exchange rates to Euro equivalents prior to the adoption of Euro. As the trade share of other European countries not included in the currency basket was allocated to the Euro, the exchange rate and CPI for the Euro area was required. Since this was not available for the period prior to 1998, German data was used as a reference for the period. For all the data series, both the monthly and annual data were collected for the period 1990–2010.

Using Equations 3.1 for BRER, Equation 3.2 for REER and Equation 3.4 for NEER (see Section 3.4.1) and the trade weights derived in Section 3.4.3, exchange rate indices were constructed. The reference year for the indices is 2000=100. Since the trade weights used in the construction of indices were time varying, the index numbers for different periods were chained-linked using the method outlined in Section 3.4.3. The exchange rate indices calculated are as follows:

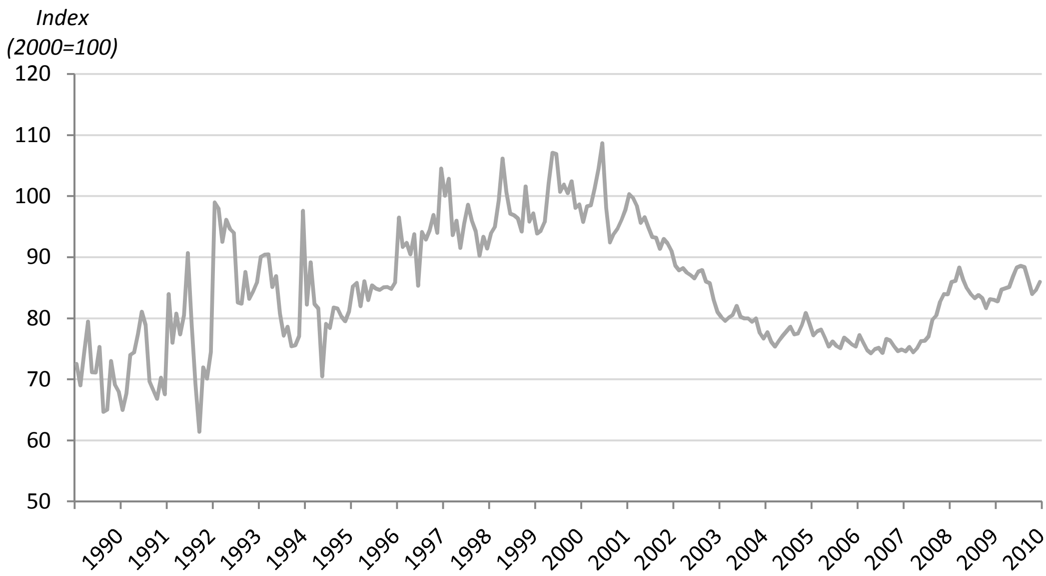
- BRER—bilateral RER of the Maldives against 17 trading partners
- REER(M)—real effective exchange rate based on import weights
- REER(X)—real effective exchange rate based on exports weights
- REER(T)—real effective exchange rate based on tourism weights
- REER(TW)—real effective exchange rate based on aggregate trade weights
- NEER(M)—nominal effective exchange rate based on import weights
- NEER(X)—nominal effective exchange rate based on export weights
- NEER(T)—nominal effective exchange rate based on tourism weights
- NEER(TW)—nominal effective exchange rate based on aggregate trade weights

In total, nine different indices were calculated, both on a monthly basis and on an annual basis, for the period 1990–2010. The data on all these indices are reported in Appendix 1, Tables A1.2 and A1.3. The developments in these indices are discussed below in Section 3.6.

3.6 Developments in Real and Nominal Effective Exchange Rates

The aggregate trade-weighted REER index is shown in Figure 3.5.

Figure 3.5: Real effective exchange rates, aggregate trade-weighted, 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)
Note: An increase in the index reflects an appreciation and a decrease in the index reflects a depreciation of the rufiyaa.[15]

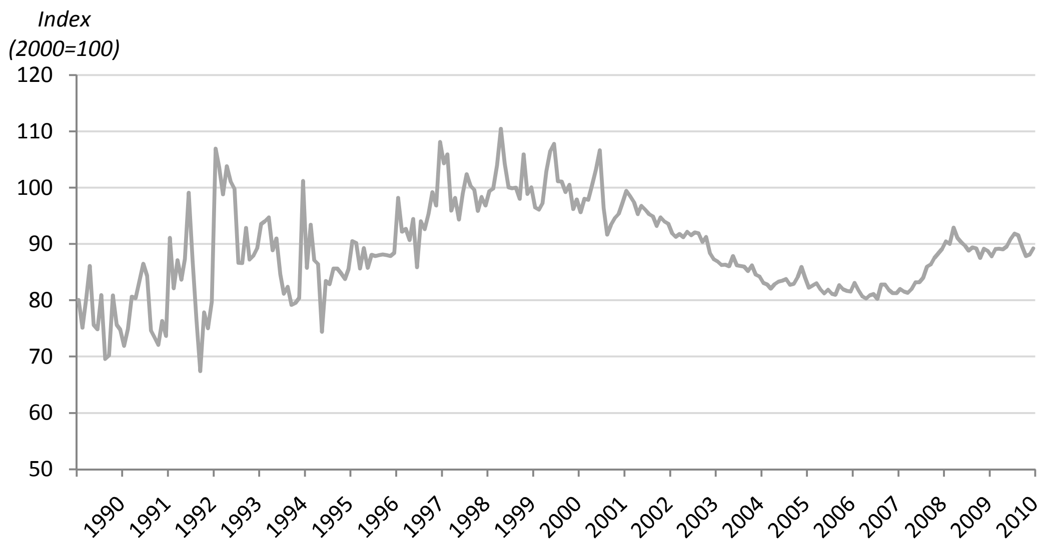
The developments in the REER can be divided to four phases. The first phase is the early 1990s, during which the REER (TW) was relatively volatile due to the macroeconomic imbalances facing the country. As part of the economic stabilisa-

[15] The exchange rate indices calculated using formulae presented in Section 3.4.1 are measured in domestic currency terms (units of domestic currency per foreign currency). When measured this way, an increase in the index indicates depreciation and a decrease indicates an appreciation. However, the charts and tables on exchange rate indices included in this study show exchange rate measured in foreign currency terms (units of foreign currency per domestic currency), unless otherwise indicated. This is for ease of interpretation, especially visually, as an increase in the index represents an appreciation and a decrease represents depreciation.

tion program that was implemented, the rufiyaa was pegged to the US dollar in 1994. The second phase is from 1994 to the 2001 devaluation of the rufiyaa against the US dollar. This was a period of a steady appreciation of the REER(TW). The third phase is the period following the July 2001 devaluation of the rufiyaa until mid-2007. During this period, the REER(TW) depreciated significantly, tracking the weakening of the US dollar in the international market. The last phase is the period since 2007 during which time the REER(TW) appreciated. This has been owing to the higher rates of inflation in the Maldives and the relative strength of the US dollar against major currencies.

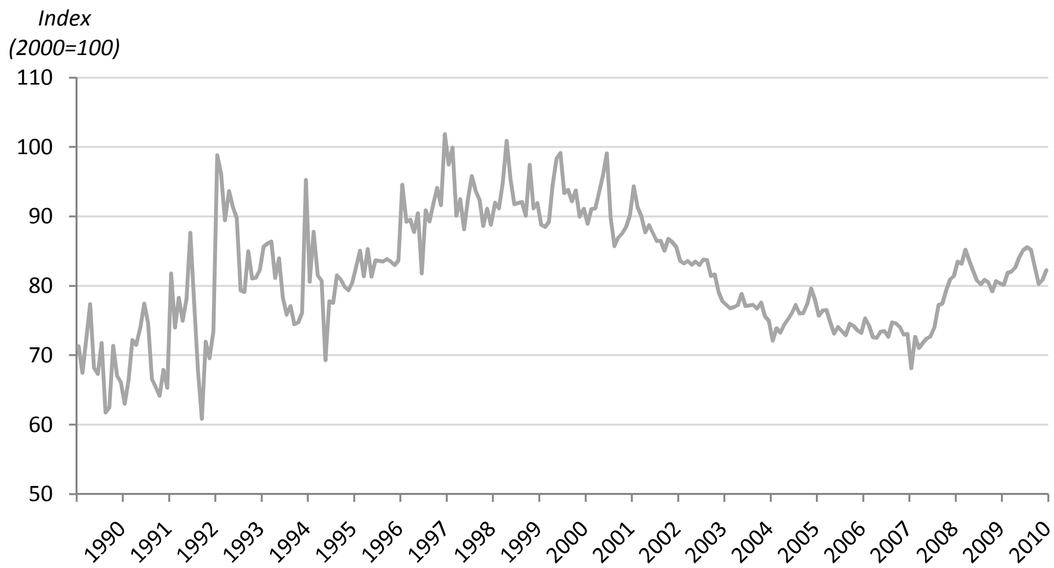
As seen in Figures 3.6 to 3.9, the four REERs computed—REER(M), REER(X), REER(T) and REER(TW)—follow the same patterns, but the magnitude of change in the indices differs. Since the import-weighted REER has a higher share of US dollar than the other three indices, the scale of depreciation and appreciation over the period is relatively low, compared to other indices.

Figure 3.6: Real effective exchange rates, import weighted, 1990–2010



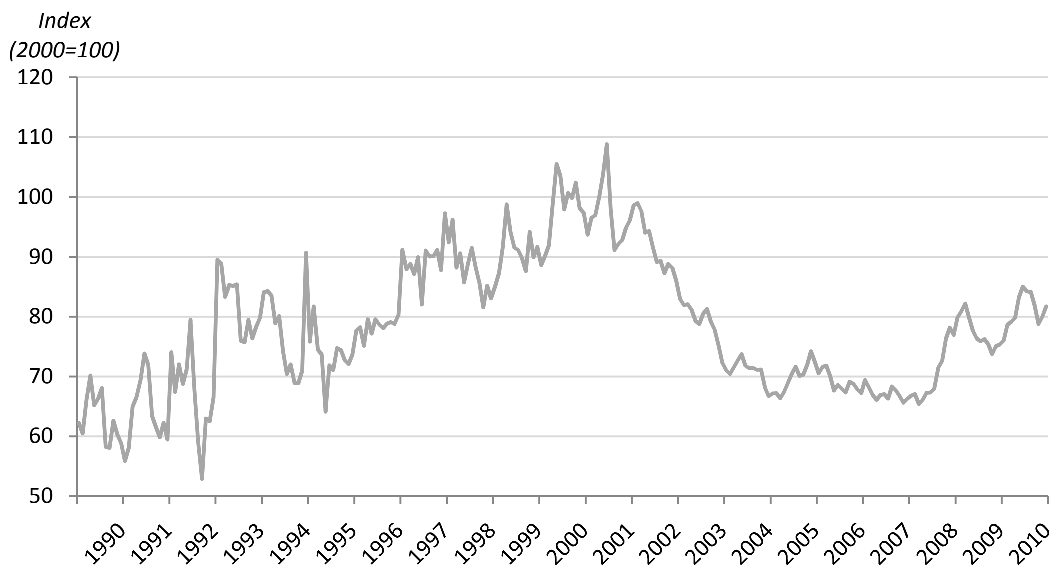
Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Figure 3.7: Real effective exchange rates, export weighted, 1990–2010



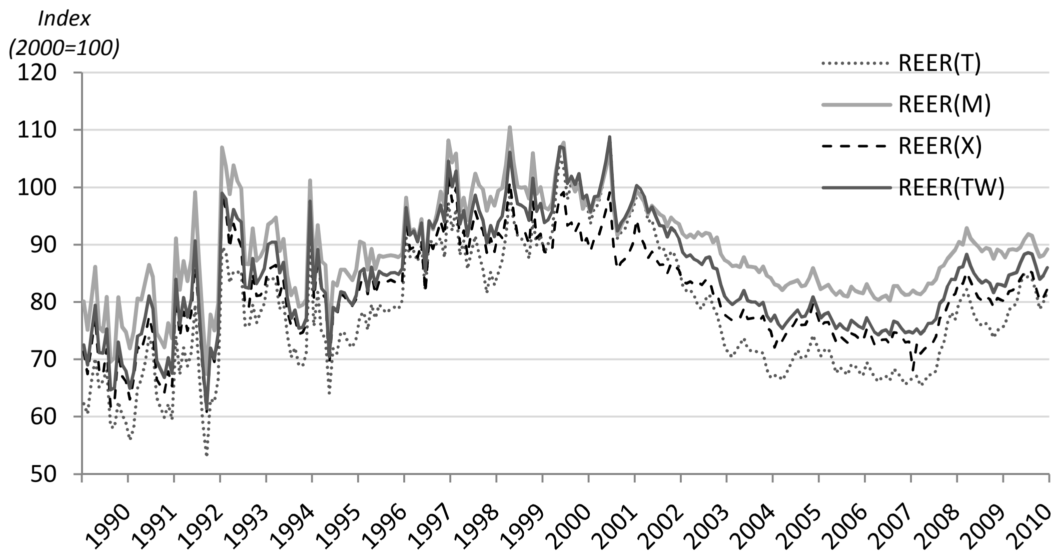
Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Figure 3.8: Real effective exchange rates, tourism weighted, 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Figure 3.9: Comparison of the different measures of REER, 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

The average rates of depreciations and appreciations for different periods during 1990–2010 for the four different REER indices are shown in Table 3.7. As also evident from Figure 3.9, the level of appreciation and depreciation for the four indices are significantly different from one another. The tourism-weighted index experienced the largest appreciations and depreciations compared to other indices. During the period 2001–2007, the REER(T) depreciated by 39 per cent, increasing the relative competitiveness of the Maldives exports. This means that both exports of goods and tourism services in the Maldives were relatively cheaper for foreign importers or tourists during this period. While this gain in competitiveness in the export of goods appears obvious, it is less clear how much competitiveness would be gained by the tourism sector from the REER depreciation. This is because the REER depreciation makes the imports into the country relatively more expensive, which would increase the costs in the tourism sector given the heavy reliance of the sector on imports. Moreover, the usefulness of REER as a competitiveness indicator for the tourism sector is unclear. Apart from the previously mentioned impact of imports, a large proportion of employees in the tourism sector are foreign workers and their wages are set and settled in US dollars. Therefore, the relative costs of the tourism sector due to an exchange rate change may not have the same impact as goods exports.

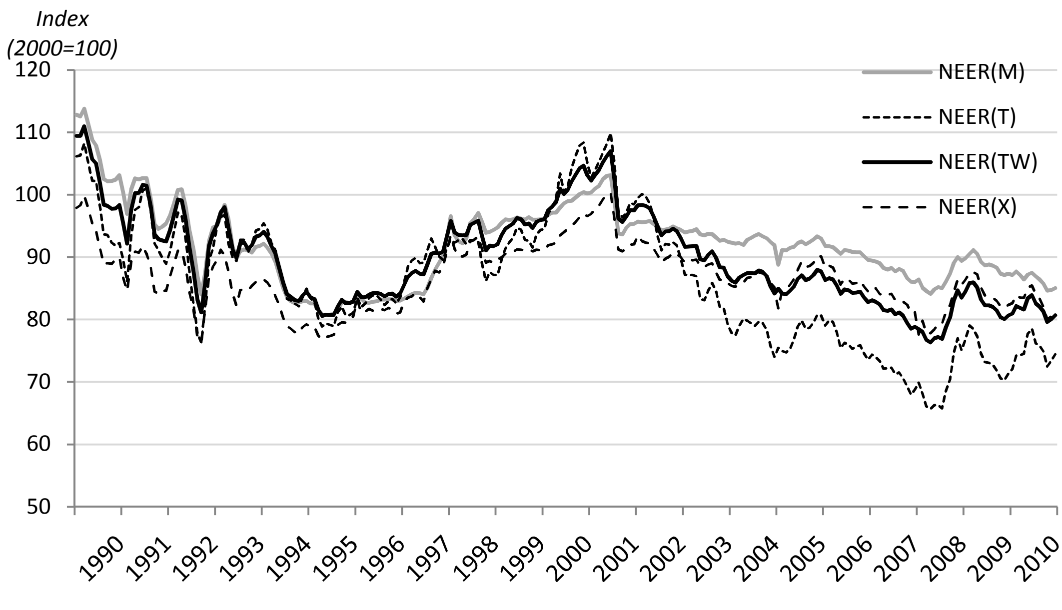
Table 3.7: REER appreciations and depreciations

	1990–1995	1995–2001	2001–2007	2007–2010
REER(M)	4.2	24.7	(23.8)	9.8
REER(X)	9.0	23.1	(26.3)	12.6
REER(T)	15.5	47.8	(39.1)	23.4
REER(TW)	9.0	34.0	(31.1)	14.8

Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)
Note: A positive figure indicates an appreciation, while a negative indicates depreciation.

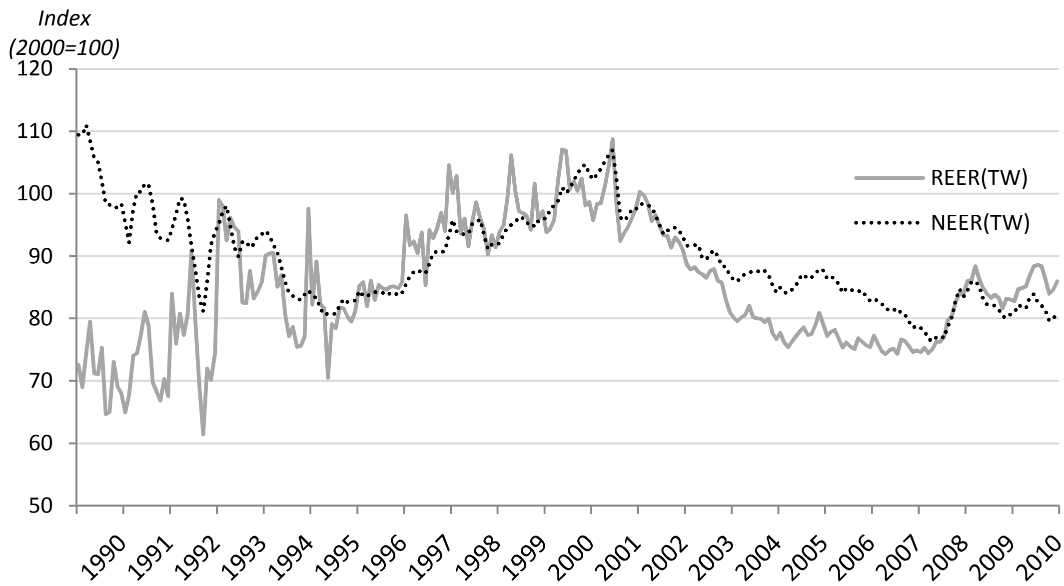
Regarding the NEERs, shown in Figure 3.10, all four NEER measures have approximately the same trends. Similar to the REER indices, the magnitude of change differs across the indices, especially between the tourism-weighted NEER and the import-weighted NEER (NEER(T) and NEER(M)). Figure 3.11 compares the aggregate trade-weighted NEER and REER. This shows that in the pre-exchange rate peg period, NEER depreciated significantly, while the REER appreciated. The appreciation of the REER was the result of the high rates of inflation experienced during that period.

Figure 3.10: Measures of NEER, 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Figure 3.11: Real and NEER, trade-weighted, 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

3.7 Conclusion

This chapter constructed the REER and NEER for the Maldives, as these were not available for the country. Although the NER of the Maldives is fixed against the US dollar, the NERs against other major trading partners and the RERs always fluctuate. Therefore, it was important to construct these indices for the Maldives, both for use in monitoring their development and for future exchange rate analysis. Indeed, the creation of these indices was necessary for the empirical analyses in the following two chapters of this thesis, Chapters 4 and 5.

The construction of effective exchange rate involves several issues, as were discussed in this chapter. The RER calculated in this chapter is based on the external definition of the RER, and not on the internal definition, as suggested by theoretical literature on developing countries. The main reason for not using internal RER was that it is not very relevant for the Maldives given the openness and the limited non-tradable sector of the economy, as discussed earlier.

Another problem faced in the construction of effective exchange rates is that it is not possible to include the exchange rate of every trading partner in that construction. Therefore, choices had to be made as to which countries to include and what criteria to use for inclusion. The countries that were included in the trade weights accounted for almost 80 per cent of the trade, and individually accounted for 1 per cent or more of the Maldives trade. Given the significant difference in trading partners in relation to imports, exports and tourism, weights were calculated for each sector separately and then as an aggregate to represent total trade in goods and services. Regarding the choice of price index, CPI data were used, as this was the only data series available at the required frequency, for the required length of time.

Nine indices were calculated for the Maldives for the period 1990–2010, on both a monthly and annual basis. The effective exchange rate indices were relatively stable in the Maldives, although there had been periods of large exchange rate appreciations and periods of depreciations that were more moderate. All the indices constructed using the different trade weights showed similar trends, although the magnitudes of those changes differed. The analysis of the REER is further extended in the next chapter, in which REER movements relative to its equilibrium level are discussed.

Chapter 4 Equilibrium Real Exchange Rates and Exchange Rate Misalignment

4.1 Introduction

In a highly integrated and globalised world, exchange rate plays a crucial role in linking the domestic economy to the rest of the world. The pegged exchange rate of the Maldives serves well to provide a stable NER against the US dollar. While a pegged exchange rate fixes a NER against the currency or currencies it is pegged to, it fluctuates against all other currencies. Moreover, as Gylfason (2002, p. 1) points out, 'irrespective of NER arrangements, the RER always floats—if not through NER adjustment, then through price change'. Therefore, it is important to observe the behaviour of the RER and assess whether the real exchange is consistent with its long-run ERER. Persistent deviations of RER from its ERER[16] may result in RER misalignments. Exchange rate misalignment is defined as the difference between the actual RER and the ERER. According to Edwards (1989), exchange rate misalignment may incur several costs to the economy such as reduction in economic efficiency, misallocation of resources, increased capital flight and trade-related inefficiencies and costs.[17] Moreover, sustained overvaluations of the exchange rate can lead to currency crises, while sustained undervaluations can overheat the economy (Siregar & Rajan, 2006). A few studies have also found that exchange rate misalignments are more frequent in countries with fixed exchange rate regimes compared to more flexible regimes (Coudert & Couharde, 2009; Hoffmann, 2007), and that the misalignments can be largely attributed to

[16] In the literature, the ERER is generally used to refer to the long-run ERER. In this study as well, ERER refers to the long-run ERER. Similarly, exchange rate misalignment refers to the real exchange rate misalignment. Moreover, the exchange rate measure used in the ERER is the REER, unless stated otherwise, as is common practice in most literature.

[17] When countries face exchange rate misalignments, especially when the RER is overvalued in a fixed exchange rate regime, there is greater loss of international reserves. As a result, governments may impose trade taxes and other barriers to trade, which will create inefficiencies.

weak macroeconomic fundamentals. However, misalignments can occur in any type of exchange rate regime.

As mentioned in Chapter 1, in the year 2007, the IMF, following the regular Article IV consultation assessment of the Maldives, stated in their report that the country's exchange rate was 'fundamentally misaligned' (IMF, 2007). The Maldives was the first country to be labelled as misaligned by the IMF under their new framework on exchange rate surveillance of member countries. The government of the Maldives disagreed that the country's exchange rate was misaligned and several directors of the Executive Board of the IMF also raised their concern over such an assessment, given the data limitations of small developing countries such as the Maldives. As there were severe macroeconomic imbalances in the economy and, more importantly, in the absence of any estimates of not just equilibrium exchange rates but also of REER, it was difficult to refute the assessment of the IMF. However, in the following year, in their report on the Maldives (IMF, 2009b), the IMF admitted that their previous year's assessment of the exchange rate was wrong and that the exchange rate was not misaligned. This issue highlights the importance for policy-makers in the country to remain vigilant about the behaviour of the RERs and equilibrium exchange rates.

Given the importance of estimating equilibrium exchange rates for measuring exchange rate misalignment, this chapter empirically estimates the equilibrium exchange rates using a common approach used for developing countries. There are several approaches to measure ERER and, as Driver and Westaway (2004) note, the ERER is sensitive to the model and methodology used. Therefore, it is important to measure ERER using as many approaches as possible. However, in the case of the Maldives, data limitations constrain the use of different approaches. Therefore, this chapter will use a single-equation reduced-form model that will link the RER to a set of macroeconomic fundamentals, based on the equilibrium exchange rate models used by Edwards (1988), Elbadawi (1994) and Baffes et al. (1999). The econometric techniques of cointegration and ECM are used to model the long-run determinants of REER and the short-run dynamics. Using the long-run estimates of the REER and using time-series decomposition techniques, the ERER is estimated. The percentage deviation from the actual REER and the estimated ERER is then calculated as the real exchange misalignments.

This approach to estimating ERER and other prominent approaches, as well as definitions and concepts of ERER and exchange rate misalignment are discussed in Section 4.2. Section 4.2 also presents some of the empirical literature on ERER and exchange rate misalignment, especially for countries similar to the Maldives. The theoretical framework used as a basis for the empirical analysis in this chapter is presented in Section 4.3. Section 4.4 estimates the empirical model and assesses the ERER and exchange rate misalignment in the Maldives. Section 4.5 is the conclusion.

4.2 Literature Review

4.2.1 Concepts and Measurement of Equilibrium Real Exchange Rates and Real Exchange Rate Misalignment

As the definitions, concepts and measurement of RERs and REER have already been discussed in Chapter 3, this section will start with the concept of equilibrium exchange rates. As in the case of RERs, there is no single measure of ERER, as it is an unobserved variable. While there are various definitions of equilibrium exchange rates, most definitions contain three parts. The first and second parts involve a distinction between the NER and RER, and the bilateral and effective exchange rates, respectively. Most economists prefer to use the RER and the effective exchange rates in defining equilibrium exchange rates. This is because relative prices are more appropriate in assessing exchange rate misalignment, especially in fixed exchange rate regimes. Moreover, they also serve as an indicator of the competitiveness of the country. Effective exchange rates are used on the basis that, given the multiple trading partners of a country, these rates would be more representative of a country's overall trade or current account balance than would bilateral exchange rate balances (Isard, 2007). The third element in defining equilibrium exchange rate lies on the time horizon of the equilibrium concept. The ERER can be defined as a short-, medium- or long-term concept. As described in Driver and Westaway (2004), the time horizon of the equilibrium exchange rate can be explained using a reduced-form function of the exchange rate, e_t, expressed as:

$$e_t = \beta' Z_t + \theta' T_t + \varepsilon_t \tag{4. 1}$$

where Z_t represents a vector of fundamental variables that influence the exchange rate in the medium- to long-term; T_t is a vector of transitory variables that influence the exchange rate in the short-term, which includes current and lagged variables included in $Z_t$as well as their dynamic effects. ε_t represents the random disturbances and β and θ represent the vector coefficients.

The short-term equilibrium exchange rate, which is often referred to as the 'current equilibrium exchange rate', is found when the market has full information and behaves in a rational manner (Williamson, 1983). From Equation 4.1, the short-term equilibrium can be expressed as:

$$e_t^{ST} = \beta' Z_t + \theta' T_t \tag{4. 2}$$

The short-term equilibrium is determined by the fundamental variables given in vector Z, which is at their actual or current levels, and the vector of transitory variables, T.

The medium-term equilibrium exchange rate is the exchange rate at which the economy simultaneously achieves both internal and external balance. Internal balance is achieved when the economy is at full employment and there is low inflation; that is, when the economy is at the non-accelerating inflation rate of unemployment. External balance is achieved when current and future current account balances satisfy the inter-temporal budget constraint. This means that the current account needs to be at a sustainable level and converging towards stock-flow equilibrium (Isard, 2007). From Equation 4.1, the medium-term equilibrium exchange rate can be expressed as:

$$e_t^{MT} = \beta' \hat{Z}_t \tag{4.3}$$

where the medium-term equilibrium exchange rate is determined by the predetermined fundamental variables at their trend levels (given by the term $\hat{Z}$).

The long-term equilibrium exchange rate is when the whole economy is in full stock-flow equilibrium. At this level, the exchange rate is determined by the steady-state values of fundamentals, which are given as $\bar{Z}$ in Equation 4.4.

$$e_t^{LT} = \beta' \bar{Z}_t \tag{4.4}$$

The exchange rate misalignment is the difference between the actual exchange rate and the equilibrium exchange rate. The equilibrium exchange rate is the short-, medium- or long-term equilibrium exchange rate, as described above. In the literature, current misalignment is used to refer to the deviation of exchange rate from the short-term or current equilibrium exchange rate. The total misalignment refers to the deviation of exchange rate from the long-term equilibrium exchange rate (Clark & MacDonald, 1998).

There are several measures of equilibrium exchange rates and these have been used for both developing and developed countries.[18] As Driver and Westaway (2004, p. 24) point out 'there is, sadly, no completely comprehensive and logical mapping of one equilibrium exchange rate methodology to another … the mapping between different time frames is often far from perfect'. Therefore, it is necessary to discuss the most commonly used measures of equilibrium exchange rate as found in the literature. However, more emphasis is given to the one used in the empirical analysis in this study.

4.2.2 Purchasing Power Parity

PPP is a common starting point in the discussion of equilibrium exchange rates. This is because most economists believe in some variant of PPP as a long-run de-

[18] Driver and Westaway (2004) and Siregar and Rajan (2006) provide a good review of various measures of equilibrium exchange rates.

terminant of exchange rates (Taylor & Taylor, 2004). According to the theory of PPP, the price of common goods in two countries will be equal when denominated in a common currency, and RER will be constant and equal to unity. The theory of PPP is based on the law of one price (LOP), which asserts that the international arbitrage equalises the price of goods in two countries (Salvatore, 2001). For example, if prices are high in one country and low in another country, traders in the high-price country will buy the goods from the low-price country. This will affect the demand and supply of goods in each country, thus equalising prices in both the countries. If the goods included in each country's aggregate price basket are the same, with same weights attached to goods in each country, then according to LOP, the exchange rate between the two countries will be in equilibrium and the PPP will hold.

However, there are several reasons why LOP might not hold. Trade between countries involves several costs, such as transport costs, taxes, tariffs and duties and non-tariff barriers. These costs can be significant and can prevent prices from equalising across the two countries. Further, the presence of non-traded goods in the consumption baskets of each country can interfere with the achievement of equilibrium. Since there are differences in consumer preferences in each country, the weights assigned to such goods may differ significantly from country to country. Another important point of difference relates to goods produced in different countries, which are not identical, but rather differentiated goods, with the exception of primary commodities (Salvatore, 2001). These factors contribute to the failure of PPP. Notwithstanding, advocates of PPP theory argue that these are short-run factors and, even if PPP does not hold in the short run, in the long run, PPP holds as an equilibrium concept (Taylor & Taylor, 2004).

The empirical studies on the validity of PPP as a long-term equilibrium concept have produced mixed results. Earlier studies of PPP essentially tested the following Equation (see Equation 4.5).

$$s_t = \alpha + \beta(p_t + p_t^*) + \mu \tag{4.5}$$

where s is the RER at time t, in logs; p and p^* are domestic and foreign prices, respectively, at time t, in logs; α and β are regression coefficients and μ is an error term (Breuer, 1994).[19] The test for PPP generally involves a test of the restrictions of the coefficients in given in Equation 4.5, in which absolute PPP holds if $\alpha = 0$ and $\beta = 1$. The same restrictions are used for the relative PPP, but the variables are regressed in their first differences. While evidence to support PPP was found in some studies, one of the main problems of the earlier studies on PPP was that they did not address the issue of non-stationarity of the variables. Non-stationarity poses a problem, as running an OLS regression on non-stationary data can lead to spurious results, and statistical inferences made from such regressions will not be valid.

With the development of econometric techniques of unit root tests and cointegration, recent studies of PPP used these techniques to validate the PPP in the long run. If the time-series data on RERs exhibits stationarity, then this implies that the RER is mean reverting over the long run (Taylor & Taylor, 2004). Again, different studies produced different results. The initial studies using unit roots tests rejected the validity of the PPP in the long run. However, Frankel (1986, 1990) observed that the failure to accept PPP might be attributable to the low statistical power of the unit root tests, due to the short time span of the data used. To overcome this problem, several studies used pooled cross-section data sets, longer periods and several currencies to test the stationarity of exchange rates simultaneously. These tests had better statistical power and, in these studies, exchange rates were found to be mean reverting in the long run. However, some of the studies that used panel data jointly tested the null hypothesis of unit roots, and rejected the null. This meant that at least one of the exchange rates is mean reverting. However, it might not necessarily be mean reverting for all currencies used in the panel data. Therefore, this cannot be taken as a mean reversion of all

[19] Breuer (1994) provides a good evaluation of several empirical studies on PPP. Further reviews on PPP are also given by Froot and Rogoff (1995), Rogoff (1996) and Sarno and Taylor (2002b).

the exchange rates in the sample, as noted by Taylor and Sarno (1998). When there is mean reverting behaviour, this is seen to take place over a long time span, sometimes dating back to the late nineteenth century (Taylor & Taylor, 2004).

4.2.3 Fundamental Equilibrium Exchange Rate

Several models of equilibrium exchange rates are based on the macroeconomic balance approach, in which the equilibrium exchange rate is defined as the exchange rate at which the economy achieves internal and external balance simultaneously (see Section 4.2.1). In contrast to the PPP approach, the equilibrium exchange rate in macroeconomic balance approach is a time-varying concept, rather than a value at a fixed point in time. One of the most commonly used models of the macroeconomic balance approach, especially for developed countries, is the fundamental equilibrium exchange rate (FEER), as introduced and developed by Williamson (1983, 1994).[20]

One of the most controversial aspects of the FEER approach is choosing a current account target to represent the external balance of the economy. Current account balance is taken as the sustainable level. However, quantifying what is sustainable is difficult and judgment-based. The easiest way to choose a sustainable current account balance may be to choose a balanced current account. This is often not feasible or desirable for most countries, as countries can benefit from having a current account surplus or deficit. Therefore, according to Williamson (1994, p. 183), the current account target should be 'a current account balance that transfers capital at a rate that is sustainable and desirable, and therefore consistent with macroeconomic equilibrium, rather than to eliminate all imbalances'. However, it is also equally difficult to identify the level of capital flows that are consistent with the equilibrium in the macro economy. Given that the sustainable current account is based on judgment and the equilibrium exchange rate is regarded as the rate that is consistent with 'ideal economic conditions', the FEER approach is considered a normative approach.

[20] Since Williamson, several others have produced further work on the FEER. Among the most notable is Wren-Lewis (1992).

The estimation of FEER involves three steps. The first step is to calculate the trend (or underlying) current account of the country. As stated in Wren-Lewis and Driver (1998), the trend current account is different from the actual current account recorded for the country. The trend current account is the current account that would have been achieved in the absence of cyclical factors and economic shocks; while output is at their potential levels (internal balance), both at home and abroad and the RER is at its actual level. This is usually derived from trade elasticities, which are estimated using trade equations for imports and exports. The second step involves estimating the sustainable current account that could be maintained in the medium-term, which is normally taken as the net savings balance (domestic savings minus domestic investment) position. In most cases, net savings are determined based on medium-term macroeconomic fundamentals, such as variables that reflect demographic trends, stage of development and public sector budget deficits (Isard, 2007). The final step is to estimate the RER, or FEER, that would be required to bring the trend current account balance to the sustainable current account level.

There are several criticisms of the FEER approach, one of which is that it is often sensitive to the value that is chosen as the sustainable current account balance. Consequently, different results for equilibrium exchange rates can be obtained when using different current account sustainable levels. Another issue is that the trade elasticities, which are central to the calculation of trend current account balance, are also sensitive, due to the difficulties in estimating well-defined trade equations. An additional issue relating to the use of the FEER approach for small developing countries is the lack of data, especially good quality data, on current and capital accounts for a reasonable period. Therefore, the FEER approach, as discussed here, is usually applied in the estimation of equilibrium exchange rates for industrial countries.

According to Bayoumi, Clark, Symansky and Taylor (1994), the equilibrium exchange rate calculated from the FEER approach is actually a desired equilibrium exchange rate, given the normative aspects of 'internal and external balance' used in the FEER.

4.2.4 Behavioural Equilibrium Exchange Rate

The behavioural equilibrium exchange rate (BEER) is a statistical approach developed by Clark and MacDonald (1998) to explain the behaviour of the exchange rate. It involves the estimation of a reduced-form equation that determines the RER as a function of a set of fundamental variables. The theoretical foundations of the BEER approach are based on the uncovered interest parity condition, which is adjusted to include a time-varying risk premium. Clark and MacDonald (1998) use the ratio of domestic and foreign government debt as a proxy for the time-varying risk premium, as does most of the empirical work that uses the BEER approach. The equilibrium exchange rate using the BEER is estimated using short-run interest rate differentials, long-run economic fundamentals and a time-varying risk premium. The long-run economic fundamentals identified by Clark and MacDonald (1998) are the terms of trade (tot), the relative price of non-traded to traded goods to represent the Balassa-Samuelson effect (tnt) and the net foreign assets (nfa). Using these, the following Equation 4.6 expresses the BEER real exchange rate.

$$\mathrm{BEER} = \left(\mathrm{r} - \mathrm{r}^{*}, \frac{\mathrm{gdebt}}{\mathrm{gdebt}^{*}}, \mathrm{tot}, \mathrm{tnt}, \mathrm{nfa}\right) \tag{4.6}$$

where r and r* are the domestic and foreign real interest rates, respectively and gdebt and gdebt* are the domestic government debt and foreign government debt, respectively. The estimated equilibrium exchange rate from Equation 4.6 is referred to as 'current equilibrium'. This would normally have a substantial amount of short-term 'white noise' or business-cycle fluctuations. Since the long-run equilibrium should not have such fluctuations, the long-run equilibrium exchange rate is smoothed out using a smoothing factor, such as the Hodrick-Prescott (HP) filter. The difference between the actual exchange rate and the long-run equilibrium gives the total misalignment of the exchange rate (Clark & MacDonald, 1998).

4.2.5 *The Equilibrium Real Exchange Rate Models for Developing Countries*

The equilibrium model developed by Edwards (1988) shows that both nominal and real factors influence the exchange rate in the short run. However, in the long run, only real (fundamental) variables influence the ERER. This model was the first of its kind to be developed for developing countries, as most other models are more suited for use with developed countries. Edwards (1988) defines RER as the relative price of tradables to non-tradables, or the internal RER. Defined this way, RER can be used as a measure of competitiveness of a country. Therefore, a decline in RER is a real appreciation, and this would increase the cost of producing domestic tradable goods. According to Edwards (1988, p. 8), ERER is the:

> relative price of tradables to nontradables that, for given sustainable (equilibrium) values of other relevant variables—such as taxes, international prices, and technology—results in the simultaneous attainment of internal and external equilibrium.

Moreover, the ERER is not a single equilibrium, but rather 'a path of ERERs through time' (Edwards, 1988, p. 5). The path of ERER is influenced by the current as well as the expected future values of fundamentals. These fundamental variables will be affected by both temporary and permanent changes and only the permanent changes will have an effect on ERER. There are internal as well as external fundamental variables that can influence the ERER. External fundamentals include international prices or TOT; international transfers, including external aid; and world interest rates. Internal fundamentals include import tariffs, import quotas and export taxes; exchange rate and capital controls; domestic taxes and subsidies; the composition of government expenditure; and technological progress.

Edwards' (1988) model has similarities with the FEER approach in that the equilibrium exchange rate is defined as the rate that is consistent with the simultaneous achievement of both internal and external equilibrium. However, unlike the FEER approach, normative judgments are not required in this model, as the variables are endogenously determined in the system. The equilibrium exchange rate model used by Edwards (1988) is a two-period inter-temporal optimisation model of a small open economy, in which there are three types of goods—exportable goods, importable goods and non-tradable goods—with the economy producing the exportable and non-tradable goods and consuming the importable goods and non-tradable goods. Fundamental determinants of the equilibrium exchange rate are determined using the theoretical framework and the model is estimated using a reduced-form single-equation approach.

Works by Elbadawi (1994), Montiel (1999) and Baffes et al. (1999), among others, have used a similar approach to estimate equilibrium exchange rates for developing countries empirically. The reduced-form approach allows the country-specific variables to be included in the estimation. Moreover, this approach is better suited for use in small developing countries that normally have serious data limitations, as data requirements are relatively less in this approach as compared to other approaches of estimating equilibrium exchange rates.

Elbadawi (1994) specifies a simple model based on the Dornbush (1974) model of traded and non-traded goods to estimate the ERER. According to Elbadawi (1994, p. 95):

> A successful modelling strategy should have at least three elements: it should specify the ERER as a forward-looking function of the fundamentals; it should allow for flexible dynamic adjustment of the RER toward the ERER; and it should allow for the influence of short-to-medium-run macroeconomic and exchange rate policy on the RER.

Elbadawi (1994) specifies the long-run equilibrium exchange rate as a function of several sustainable values of the fundamental variables. These variables are the TOT; the openness of the economy; the ratio of net capital inflow to GDP; the ratio of total government expenditure to GDP; and the ratio of current government expenditure to total government expenditure. Cointegration techniques are used to estimate the model and the sustainable values of the fundamentals are derived using a decomposition method such as Beveridge-Nelson.

Similarly, Montiel (1999) and Baffes et al. (1999) identified long-run equilibrium exchange rate as 'the rate that prevails when the economy is in internal and external balance for sustainable values of policy and exogenous variables' (Baffes et al., 1999, p. 407). The internal balance is defined as the level at which both labour markets and non-traded goods markets clear. The external balance is defined as the level at which the 'the country's net creditor position in world market has reached a steady-state equilibrium' (Baffes et al., 1999, p. 409). The equilibrium exchange rate model specified by Montiel (1999) and adapted by Baffes et al.(1999) is given in Equation 4.7:

$$e^* = e^*(g_N, g_T, z, r_W, \pi_T), \quad e_1 < 0, e_2 > 0, e_3 < 0, e_5 > 0 \tag{4.7}$$

where e^* is the equilibrium exchange rate; g_N is the government spending on non-traded goods; g_T is the government spending on traded goods; z is the net foreign aid received by the government; r_W is the world interest rate; and π_T is the rate of inflation in the domestic price of traded goods. The basic model given in Equation 4.7 can be modified and extended to include fundamental variables that are important for a given country.

The single-equation approach is often used for macroeconomic modelling in developing countries. This approach theorises the determinants of the independent variable and uses econometric techniques to estimate the relationship between the independent variable and each of the determinants. The main advantages of the single-equation approach are that it is relatively simple to use and requires less data than more complex models (Stabler, Papatheodou, & Sinclair, 1997). Most of the empirical studies on developing countries are based on the above models of ERER. The studies that use a BEER approach also take the theoretical underpinnings for the fundamental variables from the models reviewed here.

4.2.6 Empirical Studies on the Equilibrium Real Exchange Rate and Exchange Rate Misalignment

There are several empirical studies on estimating ERER, using a large array of approaches. This section will discuss some of the notable studies applicable to developing countries that are based on the approaches discussed above. Since there are no studies dealing specifically with the Maldives, or addressing the Maldives as part of a panel study, this study will consider empirical studies on small island developing countries similar to the Maldives to gauge the extent of exchange rate misalignment in such countries. This is expected to provide a good yardstick for the empirical analysis undertaken for the Maldives later in the chapter.

As discussed earlier, in the model developed by Edwards (1988), both nominal and real variables influence short-run dynamics, while long-run equilibrium is determined by real and fundamental variables. Edwards applies his model to a sample of 12 developing countries, using quarterly data from 1965–1983. The fundamental variables included, as dictated by theory, are TOT, lagged capital inflows, lagged real growth (as a proxy for technological progress), the ratio of government consumption to GDP, a proxy for exchange and capital controls, and country-specific dummies. The empirical results revealed that the countries that experienced larger RER misalignments had lower economic performance. In most cases, the disequilibrium was caused by fiscal indiscipline.

Using annual data from 1967–1990 for Chile, Ghana and India, Elbadawi (1994) (see Section 4.2.5) estimated equilibrium exchange rates and their misalignments. The fundamental variables used to calculate the long-run ERER were TOT, a measure of openness, the level of net capital flows relative to GDP, the share of government spending in GDP, and the rate of growth of exports. Cointegration techniques were used to establish long-run cointegrating specifications for ERER and the associated short-run error-correction model. The estimated long-run ERER were then used to determine the RER misalignment for these countries. The model proved to be robust in producing significant and consistent results for the three countries. The RER misalignment indices derived from the estimated ERER closely matched the well-known periods of exchange rate overvaluation for Chile and Ghana. As for India, no substantial misalignments were predicted, which conformed to their macroeconomic history. The findings of the study also supported the view, as mentioned earlier, that equilibrium exchange rate is variable over time and is not constant, as the PPP model suggests.

The study by Baffes et al. (1999) provides a good example of empirically estimating equilibrium exchange rates in small samples with data restrictions. Using annual data for Côte d'Ivore and Burkina Faso, a single-equation econometric model was developed for each country. The estimation was conducted using cointegration techniques and ECM. The results identified the known exchange rate overvaluation and undervaluation periods for the two countries.

The literature on small island developing countries is limited. However, some of the available studies are summarised in Table 4.1. Most of these studies estimate ERER using a reduced-form equation that explains the RER in terms of a set of macroeconomic fundamental variables. As can be seen from the 'variables used' column in Table 4.1, the choice of fundamentals varies among the studies. The most common variables used are net foreign assets, TOT, government consumption, fiscal position, productivity and openness.

Table 4.1: Summary of literature on small island developing economies

Country/Region	Approach	Time-Series Technique/Period	Variables Used	Results
ECCU countries: Antigua and Barbuda; Grenada; St. Lucia; Dominica; St. Kitts and Nevis; St. Vincent and the Grenadines (IMF, 2008)	FEER approach Macroeconomic balance (MB) approach	Panel regression Annual data from 1979–2006 was used	FEER approach: productivity differentials, TOT, government consumption and net foreign assets MB approach: fiscal balance, oil balance, relative income, relative economic growth, demographics and net foreign assets	FEER approach: A significant relationship was found between RER and most of the variables, especially in the tourism driven productivity differential and tourism TOT. There was very little overvaluation of the equilibrium exchange rate, apart from overvaluation periods in the early 1990s and 2000s. MB approach: Current account imbalances were above equilibrium level but were expected to decline to sustainable levels in the medium-term.
Jamaica (Robinson, 2010)	CHEER approach BEER approach PEER approach	Cointegration and vector error correction Monthly data from 1995–2009 were used	Domestic price, foreign prices, domestic and foreign interest rates, interest rate differential, net foreign assets, net government debt differential, productivity, TOT, REER, unit labour costs, ratio of tradables to non-tradables and trade balance to total trade	1995–mid-1996: Currency was undervalued. This was corrected in 1997. 2003: Currency undervaluation was found, which was corrected over the next two years. 2007: There was currency undervaluation and correction in 2008, with significant depreciation.
Mauritius (Imam & Minoiu,	Macroeconomic balance approach	Mix of panel and time-series	FEER- MB: overall fiscal balance, the NFA position, relative per capita GDP,	FEER-MB: No serious misalignment, as the REER was close to equilibrium

2005)	(FEER-MB) The single-equation fundamentals approach (FEER-SE) The capital-enhanced approach (CHEER) The external sustainability approach (ES)	techniques	per capita GDP growth and population growth FEER-SE: TOT, government consumption, openness, relative productivity, NFA position and capital controls dummy CHEER: domestic price, foreign price, domestic interest rates and foreign interest rates ES: NFA and GDP	value. FEER-SE: Since 2003, the REER has been close to its equilibrium value. CHEER: At the end of 2007, the REER seems to have reached equilibrium levels, following some volatility in earlier periods. ES: The REER appeared to be slightly overvalued.
Caribbean countries: Barbados, Jamaica and Trinidad (Moore, Greenidge, & Skeete, 2004)	BEER approach	Cointegration Quarterly data, 1970–2001	Productivity differentials, openness, fiscal balance and net foreign assets	Barbados: In the 1990s, the currency was undervalued but then converged to equilibrium values after that. Jamaica: The currency was mostly undervalued, except for the periods 1983–1984 and 1986–1992, at which time the currency was overvalued. This was corrected by nominal depreciations. Trinidad: The currency was mostly overvalued.
ECCU countries: Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia and St. Vincent	BEER approach	Panel cointegration Annual data, 1990–2007	Ratio of government consumption to GDP, relative tourism productivity, TOT and the ratio of net capital inflows to GDP	For the period 1995–2000, the level of misalignment was less than 1 per cent for all the countries except Montserrat. However, in the period 2001–2007, misalignment became significant for most countries. The currency

and the Grenades. (Grenade & Riley, 2009)				undervaluation during this period ranged from 0.7 per cent in Anguilla to 4.1 per cent in Antigua and Barbuda.
Fiji (Jayaraman & Choong, 2011a)	Single-equation approach	Cointegration Annual data, 1980–2007	Openness, net foreign assets and government expenditure	The results show that the REER has been close to its equilibrium value.
ECCU countries (Pineda, Cashin, & Sun, 2004)	PPP approach Fundamentals-based equilibrium exchange rate Macroeconomic balance approach	Unit roots tests SUR equations Panel data estimation	PPP: REER Fundamentals-based ERER: productivity differential, TOT, government consumption and net foreign assets MB: Fiscal balance, oil balance, relative income, relative economic growth, foreign direct investment and grants	PPP: REER is mean reverting in the long run, which gives support to the PPP hypothesis. There was very little evidence of misalignment and the speed of adjustment of any variations from the equilibrium exchange rate were relatively quick. Fundamentals-based ERER: There was very little evidence of misalignment of the currency. MB: No significant misalignment of the currency was observed.

4.3 Theoretical Framework and Fundamental Determinants of the Equilibrium Real Exchange Rate

The empirical analysis used in this study is based on the theoretical models of ERER used by Edwards (1988), Elbadawi (1994) and Baffes et al.(1999), which were discussed previously in Section 2.1.4 of this chapter. Following from this, this study estimates a single-equation reduced-form model, which links the RER to a set of macroeconomic fundamentals. As mentioned previously, the reduced-form approach allows country-specific variables to be included in the estimation. Moreover, this approach is better suited for small developing countries like the Maldives that normally have serious data limitations, as data requirements are relatively low, compared to other approaches of estimating equilibrium exchange rates.

The macroeconomic fundamentals that are used to identify the ERER differ across studies, as evident from the review of the literature in Section 4.2 of this chapter. The choice of fundamentals used in the literature is often dictated by data availability and the suitability to the particular characteristics of the country being analysed. The key macroeconomic fundamentals that are expected to determine the ERER for a small island tourism economy such as the Maldives, based on the literature on small island economies, are the TOT, trade restrictions, net foreign assets, government expenditure and the productivity differential. These are discussed below.

4.3.1 Terms of Trade

A country's TOT is defined as the ratio of the price of the country's exports to its imports. In other words, it is the export purchasing power of a country in terms of imports. The impact of TOT on RER is theoretically ambiguous, as the income and substitution effects resulting from a change in TOT move in opposite directions.

For example, a positive TOT shock will generate an increase in national income, which may increase the demand for non-traded goods (income effect). This will lead to an increase in domestic inflation, resulting in an appreciation of the RER. Conversely, it could increase demand for imports to the detriment of domestic goods (substitution effect), causing a reduction in demand for non-traded goods, which would result in a depreciation of the RER. In commodity-producing countries, the income effect is generally more significant than the substitution effect. In general, if the income effect is larger (smaller) than the substitution effect, the RER will appreciate (depreciate). Therefore, the effect of TOT on RER is ambiguous.

4.3.2 Trade Restrictions

Trade openness is often used as a proxy for the severity of trade restrictions in a country. This is usually measured as the ratio of the sum of imports and exports to nominal GDP. Sometimes it is also measured as the ratio of imports to nominal GDP or the constant value of imports to real GDP. While a trade-restriction index would be a better proxy, such an indicator is not available for the Maldives. If a country's trade is more liberalised, the trade is assumed greater, and the trade openness ratio would be large. An increase in trade liberalisation of a country following the easing of import tariffs and other trade barriers would boost imports, which would lead to RER depreciation.

4.3.3 Net Foreign Assets

The net foreign assets of a country show the net external position of a country, with higher net foreign assets enabling the country to increase its expenditure beyond domestic income levels. This leads to excess demand for both tradable and non-tradables goods and causes the relative price of non-tradables to rise. This leads to an appreciation of the RER.

4.3.4 Government Expenditure

The effect of an increase in government expenditure on RER can be either positive or negative. If an increase in government expenditure is due to higher expenditure on non-tradables, the RER will appreciate. Conversely, if tradables that increase the consumption of imports make up a greater part of government spending, this would increase the trade deficit. A higher trade deficit has to be accompanied by a depreciation of the RER, if external equilibrium is to be maintained.

4.3.5 Productivity Differential

This is a variable used to capture the Balassa-Samuelson effect, which is based on the hypothesis that an increase in productivity of the tradables relative to non-tradables in a given country, if larger than in other countries, will cause an appreciation of the real exchange rate. GDP per capita is the most commonly used variable to proxy the productivity differential, although additional sectoral productivity variables, such as tourism productivity, are used in tourism-based economies. Balassa-Samuelson effect in this tradable-nontradable context, however, is not very relevant for a small tourism dependent open economy like the Maldives. In such countries tourism productivity is a more relevant indicator for a country's productivity. Grenade and Riley (2009) and Pineda et al. (2004), in their studies on the ERER of Caribbean countries, used the ratio of per capita tourist arrivals of each country to the per capita tourist arrivals of the largest or most dominant tourism country in the region (in their cases the Bahamas). In the case of Maldives, this ratio can be calculated as the per capita tourist arrivals of the country to the per capita tourist arrivals of Mauritius.[21] However, monthly time-series data for the period 1990–2010 is not available for Mauritius. Therefore, this precludes the use of such a proxy for the productivity differential.

21 Mauritius is the second highest per capita tourist arrival destination in the Indian Ocean region after Maldives. The small island tourism economies in the Indian Ocean that are the main competitors of the Maldives are Mauritius, Seychelles and Comoros. Of these four countries, Mauritius is the country that receives the largest number of tourist arrivals, while the Maldives has the highest per capita rate of tourist arrivals.

Moreover, while the tourism-based productivity differential has been used in several studies on Caribbean countries, the appropriateness of such an indicator to reflect the productivity differential may not be sound. Tourism productivity is much more complex to measure than the productivity of other sectors, such as the manufacturing. One reason for this is that the inputs and outputs are difficult to standardise, as they are heterogeneous. Another reason is that tourism is a service-oriented industry and the quality of the service is very important for sectoral productivity. Quality, rather than quantity, is more important in tourism services, especially in upmarket tourism, such as that in the Maldives. Therefore, it is difficult to measure productivity by a quantity variable such as the number of tourist arrivals (Li & Prescott, 2009). Consequently, due to the absence of any suitable proxy for the productivity differential, this variable was not included as a fundamental determinant of REER.

4.4 Modelling the Equilibrium Real Exchange Rate and Measuring the Exchange Rate Misalignment

4.4.1 Empirical Model

To estimate the ERER and its misalignment, a long-run relationship between the REER and the fundamental variables (as discussed above) has to be estimated. Based on the theoretical models of Elbadawi (1994) and Baffes et al. (1999), the following empirical model, as shown in Equation 4.8, is specified for the Maldives:

$$lreer_t = \beta_0 + \beta_1 ltot_t + \beta_2 lopen_t + \beta_3 nfa_t + \beta_4 lge_t \qquad (4.8)$$

The variables included in Equation 4.8, along with the expected signs of the variables, are listed in Table 4.2, below.

Table 4.2: List of variables

Variable	Description	Expected sign
$lreer$	natural log of REER	
$ltot$	natural log of TOT	+/- ive
$lopen$	natural log of the openness of the economy	- ive
nfa	net foreign assets as a percentage of GDP	+ ive
lge	natural log of government expenditure as a percentage of GDP	+/- ive

To estimate the ERER and its misalignment, the following steps are required (Baffes et al., 1999):

- Determine the order of integration of the time-series data for each variable included in the model
- Estimate the long-run parameters of the fundamental variables
- Compute the sustainable values of the fundamentals
- Estimate the ERER using the sustainable values and the long-run coefficients from the estimated model
- Compute the exchange rate misalignment

4.4.2 Methodology

Given the non-stationary nature of the time-series macroeconomic data, cointegration techniques are used to estimate the model specified in this study. The empirical literature on equilibrium exchange rates shows that a large majority of the studies use a cointegration approach to analyse the equilibrium exchange rates, as evident from Table 4.1. According to Elbadawi (1994, p. 121), using cointegration techniques to model ERER provides 'a tractable empirical estimation of the ERER in a manner that is also consistent with theory'.

Since the seminal work of the Nobel laureate CWJ Granger (1981), it is now well established in the econometrics literature that OLS applied to non-stationary data can lead to spurious results. The concept of cointegration was first introduced by Granger in 1981 and later developed by Engle and Granger, Engle and Yoo, Phillips and Ouliaris, Stock and Watson, Phillips, Johansen and Johansen, and

Juselius (see Banerjee, Dolado, Galbraith, & Hendry, 1993), among others. Cointegration enables testing for a long-run equilibrium relationship among macroeconomic variables.

Before testing for cointegration, it is necessary to check whether the time series are indeed non-stationary. Several tests can be used for testing the presence of unit roots. However, the most common (due to its simplicity) is the augmented Dickey Fuller (ADF) test (Harris & Sollis, 2003). Three variations of the ADF test exist, taking into account the role of constant and trend terms. If the time series of the variable to be tested appears to be fluctuating around a sample average of zero, the test equation does not include a constant or a trend. If the series fluctuates around a sample average of non-zero, the test equation includes only a constant and no trend. In the last test equation, both a trend and a constant are included and this is used if the series appears to be fluctuating around a linear trend (Hill, Griffiths, & Lim, 2008). All the variables in this study are tested for unit roots using the ADF test.

While there are many tests for cointegration, Johansen's (1995) cointegration procedure is the most frequently used, especially when there are more than two variables. Johansen's cointegration test provides the number of cointegrating vectors in non-stationary time series and reports two types of test statistics. The first is the trace statistics, which test the null hypothesis of r cointegrating vectors from r=0 to r=k-1. The second is the maximum eigenvalue statistic, which tests the null hypothesis of r cointegrating vectors against an alternative of r-1.

The cointegration procedure also requires setting the appropriate lag length of the model. This is very important, as cointegration tests are sensitive to the lag lengths chosen. Lag lengths are chosen based on information criteria such as the Akaike information criterion (AIC), the Schwarz information criterion (SIC) and the Hannan-Quinn information criterion (HQ). The most common approach in selecting lag length is to estimate an unrestricted vector auto regression (VAR) model, including all variables, including any dummy variables, for a large number of lags. The number of lags can then be reduced one by one, re-estimating the model each time, until zero lags. The models can then be checked for the values of AIC or SIC and the diagnostic tests (gaussian white noise residuals). The model that minimises the AIC or SIC, as well as passing all the diagnostic tests, can be selected as the model that has the optimal lag (Enders, 2004).

The cointegrating analysis is based on an unrestricted VAR model, which can be specified as in Equation 4.9:

$$Z_t = A_1 Z_{t-1} + \dots\dots\dots + A_k Z_{t-k} + Bx_t + \mu_t \tag{4.9}$$

where Z_t is a n x 1 vector of endogenous variables used in the model, which is $Z_t = [lreer_t, ltot_t, lopen, nfa_t, lge_t]'$, a (5 x 1) matrix, and A_i and B represent an (n x n) or a (5 x 5) matrix of parameters, respectively. x_t is a (5 x 1) matrix of deterministic variables, such as a constant and time trend, and μ_t is a (5 x 1) matix of independently and normally distributed errors.

If there is a cointegration relationship among the variables given in Z_t, the VAR model has to be modified to allow for the cointegrating relationship between the I(1) variables. This leads to a model known as a vector error-correction model (VECM), which is a special form of VAR for I(1) variables that are cointegrated. The error-correction model describes the short-run dynamics or adjustments of the cointegrated variables towards their long-run equilibrium values. A VECM also allows the incorporation of more than one error-correction term if there is more than one cointegrating vector. The VECM gives the one-period lagged cointegrating equation or equations and the error-correction terms for each cointegrating equation, followed by the lagged first differences of the endogenous variables (Enders, 2004).

By differencing Equation 4.9, it can be reformulated into a VECM, as specified below in Equation 4.10 (Harris & Sollis, 2003).

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \dots\dots.. + \Gamma_{k-1} \Delta Z_{t-k-1} + \Pi Z_{t-1} + Bx_t + \mu_t \qquad (4.10)$$

where Γ_i = -(I - A_1- .... -A_i), (i = 1, ... , k-1) and Π = -(I - A_1- .... -A_k). The (5x5) Π matrix contains information on the long-run relationships and can be defined as $\Pi = \alpha\beta'$, where α is the adjustment coefficient or the speed of adjustment to disequilibrium and β is a matrix of long-run coefficients. A value close to zero in the coefficient of α implies a slow convergence to equilibrium and a value close to one represents a fast convergence.

As mentioned previously, to estimate the ERER, the sustainable values (also called permanent values) of the fundamental variables are required. The most widely used method is the time-series decomposition technique, which differentiates temporary and permanent movements in a given time-series data set. The stochastic non-stationarity of time-series data enables the decomposition of time series to temporary and permanent movements (Elbadawi, 1994). There are several decompositions techniques able to be used for this purpose, such as Beveridge-Nelson decomposition, moving averages (MA) and the HP filter. Of these, the HP filter is often preferred over the others, as they have been found to be problematic in small samples (Baffes et al., 1999). However, in the empirical analysis in this chapter, both the HP filter and the MA method will be used to allow for comparison.

The HP filter is a two-sided linear filter that extracts a smoothed series s from a time series y, by solving the minimisation problem, as shown in Equation 4.11 with respect to s.

$$\min \sum_{t=1}^{T} (y_t - s_t)^2 + \lambda \sum_{t=2}^{T-1} [(s_{t+1} - s_t) - (s_t - s_{t-1})]^2 \qquad (4.11)$$

The parameter λ is the penalty parameter and the smoothness of s depends on the value of λ. Therefore, the larger the value of λ, the smoother s will be, such that $\lambda = \infty$, s approaches a linear trend (Startz, 2006). In the MA method, the number of years used for averaging is based on the coefficient of the error-correction term in the error-correction model. This represents the speed of adjustment to an exogenous shock, and shows the period (in months, quarters or years) required for the effect of a shock to be eliminated. As regards the calculation of the RER misalignment, it is simply the calculation of the percentage deviation of the actual REER from the ERER. A positive deviation represents an overvaluation and a negative deviation represents an undervaluation of the RER.

4.4.3 Data and Description of the Variables

The empirical analysis is conducted using monthly data from January 1990–December 2010 (252 observations). The main reason for choosing this period is that data prior to 1990 are comparatively unreliable and monthly data are lacking. One of the main limitations of time-series analysis of small developing countries is the lack of adequate data for modelling. Data for some of the fundamental variables are either not available or only available annually. In the case of the former, proxy variables have to be found to represent those fundamental variables. In the latter case, temporal disaggregation techniques can be used to generate monthly data from annual data. The data was mainly obtained from the Maldives Monetary Authority (2009, 2011) and the Department of Planning (2005), unless otherwise stated. The description and construction of data for all variables included in the model specified in Equation 4.8 are discussed below.

Real effective exchange rates

In theoretical terms, RER is defined as the relative price of tradables to non-tradables. As discussed in Chapter 4, this definition of RER, referred to as internal RER, is difficult to estimate, both conceptually and empirically (Hinkle & Nsengiyumva, 1999). This is because data on prices of tradables and non-tradables are rarely available, especially in developing countries in which macroeconomic data are extremely limited. Therefore, an external RER definition is usually adopted in the empirical analysis of RERs. The external RER is defined as the NER adjusted for the relative price levels between countries. Based on this, a

REER, which is a trade-weighted average of the CPI of the country's main trading partners relative to that of the domestic currency, is used.

The REERs used here are the CPI-based REERs that were constructed on a monthly basis for the period January 1990 to December 2010 in Chapter 3 of this study. Recall that the REER measures the NER or RER of the home currency against a basket of currencies of that country's major trading partners, calculated as a weighted average. The REERs used are measured in terms of foreign currency units per unit of domestic currency and an increase in the index represents an appreciation and a decrease represents depreciation. The variables are expressed in logarithms.

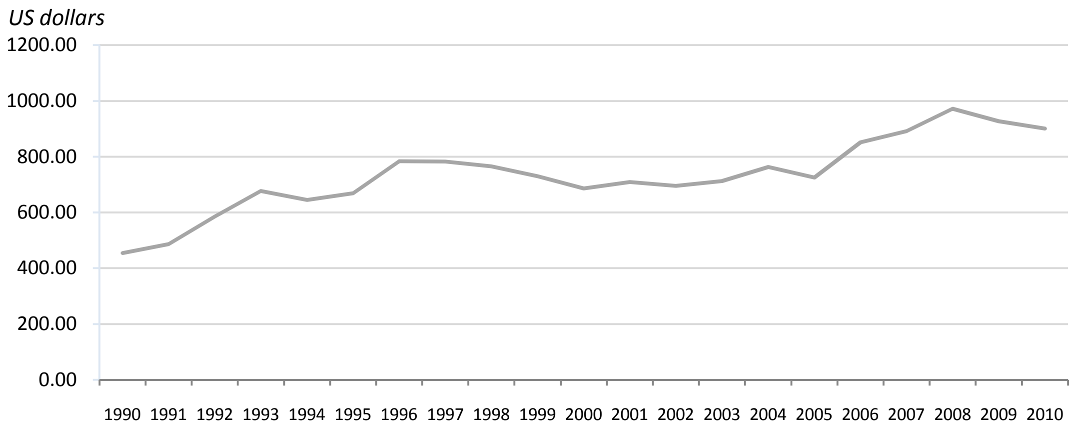
Terms of trade

TOT is calculated as the ratio of export prices to import prices. The data is only available annually for the period 2001–2010 for the Maldives. This is clearly not adequate for the empirical analysis performed here. As data on import and export price indices are not available either, it is not possible to compute this index simply. Therefore, other proxies have to be found to construct TOT data for the Maldives. These are discussed below.

Export prices: In empirical studies of the ERER of some Caribbean countries, TOT based on tourism prices have been used to reflect the dominance of the tourism sector in trade more effectively (Pineda et al., 2004). This may be a better option for the Maldives, as the tourism sector dominates in the overall exports of goods and services. The tourism TOT are constructed using a price deflator for exports of services, which is the ratio of nominal exports of services (largely tourism receipts) to the volume of exports of services (number of tourists). Therefore, to construct such an index of TOT, time-series data on number of tourist arrivals and tourism receipts are required.

For the Maldives, monthly data on tourist arrivals are easily obtained for the period required. However, data on tourist receipts are available only on an annual basis. Apart from the lack of monthly data, the annual data itself is problematic. The tourism receipts are calculated by the MMA for balance of payments compilation purposes. Given the lack of information on the revenue earned by the tourism sector, the tourism receipts are very crude estimates. The main issue with these estimates is that the tourism prices (such as room rates and other service prices) used are based on a very small sample survey that was conducted in 1994. These tourism prices have been used for the calculation of the tourist expenditure over the period 1994–2010, with only small adjustments over the years, due to the lack of appropriate data. Therefore, the changes in tourism receipts from year to year reflect changes in the number of tourists and tourist bed nights, rather than real changes in price. The average expenditure per tourist arrival, calculated as total annual expenditure in US dollars divided by annual tourist arrivals to the Maldives, is shown in Figure 4.1. To use this as a proxy measure for export prices, a temporal disaggregation procedure can be used to generate a monthly series from the annual data. The temporal disaggregation procedure used is discussed later in Section 4.4.5.

Figure 4.1: Average expenditure per tourist in the Maldives, 1990–2010



Source: Constructed from data obtained from the Maldives Monetary Authority (2009, 2011)

Another alternative explored for calculating tourism TOT involved obtaining the tourism expenditure in the Maldives of the tourists from the UK, as compiled by the National Statistics Office of the UK. These data were made available on request, but had two problems. First, the data were only available from 2006 on a quarterly basis. Secondly, the average expenditure per person varied significantly from quarter to quarter and did not seem to reflect the actual tourism prices in the country.

A further option is to use the base rates used by the MMA and apply the inflation rate to it. This can be justified by the fact that the CPI in the Maldives is heavily influenced by import prices, as a large proportion of the consumption basket is comprised of imports and almost all goods sold in the tourist resorts are imported. However, the main problem with this is that the CPI is based on a consumption basket of the representative local household, which is likely to differ significantly from the consumption of tourists. This is further discussed in the following paragraph.

A widely used measure in empirical studies on tourism demand as a measure of tourism prices is the relative CPI of a country's tourism trading partners to the domestic CPI. This is based on the demand theory that hypothesises that demand for tourism is inversely related to relative prices. This means that tourists will choose a country that has a lowest cost of living relative to their own when deciding to travel to a country for a holiday. Several studies have found evidence to support this hypothesis (Lee, Var, & Blaine, 1996; Loeb, 1982; Uysal & Crompton, 1984). However, the problem with using relative CPI as a proxy for tourism prices is that it assumes that the consumption patterns of tourists are similar to those of the locals.

As mentioned previously, the CPI represents the general consumption basket of the locals and, in most countries, especially small developing countries such as the Maldives, the consumption patterns of tourists and locals differ significantly.[22] As noted by Forsyth and Dwyer (2009), there are significant differences between lo-

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[22] In the Maldives, tourist resorts are built on uninhabited islands using a one island one resort concept. Only tourists and staff live on the island and the facilities in the resort are exclusively designed for tourists. Tourists spend the majority of their holidays on their island except for a day tour to a nearby island or the capital Male'. Therefore, the consumption of tourists is confined to that which is offered by the resort.

cal consumption and tourist consumption in every country. This is more apparent in the Maldives, where the tourists are isolated from local venues and ties. According to Berkhout (2007), the studies that found support for the relative price as a determinant of demand were mostly for countries with larger mies, such as South Korea, the US and Turkey. Further, these larger countries are very different to small island tourism countries, in which the domestic demand arises principally from the tourism sector, with tourism and local consumption of goods and services differing markedly. For example, in a study by Croes and Vanegas (2005) on Aruba, a very small island country in the Caribbean, the relative price was found to be insignificant in the demand for tourism.

An alternative measure to CPI that has been suggested in several studies (Berkhout, 2007; Forsyth & Dwyer, 2009; Martin & Witt, 1987) is a tourism price index (TPI). The TPI is constructed in a similar manner to the CPI: by recording the price movements of a representative basket of goods and services as typically consumed by a tourist in the destination country. The main problem with the TPI is that it requires extensive data gathering, meaning that these data are not available for most countries. As expected, for the Maldives, this indicator does not exist.

Exchange rate has also been used as a proxy for tourism prices. This relies on the assumption that tourists base their decisions to visit a country on the cost of living in that country. The strength or weakness of the currency of the tourism source country is taken as an indicator of the cost of living for a tourist in that country. The exchange rate is an easily available and understood indicator for the tourist (Ioannides & Debbage, 1998; Martin & Witt, 1987; Song, Witt, & Li, 2009). However, most authors note that when using exchange rates as export prices, CPI-adjusted exchange rates should be used (which is simply a tourism trade-weighted RER). However, given that the dependent variable in the model specified in Equation 4.8 is the REER, including REER as a proxy for TOT would lead to multicollinearity in the regression analysis.

Based on the above discussion, Table 4.3 lists the indicators that have been used in the empirical literature as proxies for tourism prices. None of the proxies for tourism prices discussed above is adequate to represent tourism prices. However, given that a choice has to be made among them, this study will use tourism expenditure per tourist arrival as a proxy for tourism prices, as this is the best among the available indicators as seen in Table 4.3.

Table 4.3: Tourism price indicators

Indicator	**Availability for the Maldives**	**Problems/Issues**
Total tourism receipts divided by the number of tourist arrival	Yes	Tourism prices used over the years were relatively unchanged
Tourism rates with inflation applied divided by the number of tourist arrivals	Yes	CPI is not a good indicator for tourism prices
Relative CPI	Yes	CPI is not a good indicator for tourism prices
TPI	No	
Exchange rate (REER(TW))	Yes	Using this creates a problem of multicollinearity in the regression analysis as the dependent variable is the REER

Import Prices: The best indicator of import prices is the import price index. However, such data is not available for the Maldives. The next alternative is to use the PPIs of the major trading partners, weighted by their import shares in the total imports of the Maldives. The primary reason for the choice of PPI over CPI is that the PPI will be more reflective of the export prices of these countries. Given that the import weights of the trading partners have changed significantly over the period 1990–2010, time-varying weights are used. The resulting indices are then chain-linked using the index-splicing method.[23] The main problem with the foreign price index calculated here is the absence of time-series CPI or PPI

[23] Time-varying weights, chain-linking and splicing were discussed in Chapter 3 of this study in the context of the calculation of NEERs and REERs for the Maldives.

data for the main importing partner of the Maldives—UAE. However, the majority of UAE exports to other countries are re-exports, so the PPI of UAE will largely reflect the producer prices of the UAE's importing countries. According to the country's trade statistics, the UAE's major trading partners are India, China, the US and the Euro area (Department of Foreign Affairs and Trade, 2010). An analysis of the data on the major imports of UAE and the Maldives shows that most of the items imported from UAE to the Maldives originated from India, China and the Euro area. Therefore, the import weight of UAE is allocated to India and the Euro area. China is excluded, as PPI data was not available for the country. Although this is a very rough estimate, this is the best available estimate, given the data limitations.

Another proxy used in some studies is the CPI of tradable goods. This can be used to represent the import prices, as the majority of tradable goods (90 per cent) in the Maldives are imported. However, such data for the Maldives is not available and, given the lack of detailed CPI time-series data, it was not possible to construct this data. The compiled import-weighted index of PPI of the major trading partners as described above is used as a proxy of import prices.

Tourism terms of trade: The tourism TOT is calculated for the Maldives as follows:

$$\mathrm{TTOT}_t = \frac{\mathrm{ExpTA}_t}{\mathrm{PPI}_t} \times 100 \tag{4.12}$$

where TTOT is the tourism TOT; ExpTA is the average expenditure per tourist arrival to the Maldives; and PPI is the import-weighted PPI of trading partners, all at time period t.

Trade openness

Since there are no direct measures of trade restrictions of economy, trade openness is often used as a proxy. It is defined as follows:

$$\mathrm{OPEN_t} = \frac{\mathrm{IMP_t} + \mathrm{EXP_t}}{\mathrm{GDP_t}} \times 100 \tag{4.13}$$

where OPEN is the openness of the economy; IMP is the value of imports and EXP is the value of exports, all at time period t. Apart from the above measure of trade openness, two other measures of trade openness mentioned in Section 4.3.2 were tested in the empirical model. While the three measures yielded roughly the same results, the above measure of openness proved to be most robust to the model. While the monthly data for imports and exports are readily available, GDP data is only available on an annual basis. Therefore, monthly data had to be created from the annual data, and this process is discussed in Section 4.4.5.

Net foreign assets

This is the net foreign assets of the banking system, expressed as a percentage of GDP.

Government expenditure

This is the ratio of current government expenditure to GDP. As data on expenditure on tradable goods is not available, current expenditure is regarded as the closest proxy.

4.4.4 Creation of Monthly Data from Annual Data

As mentioned previously, monthly data for tourist expenditure and nominal GDP were generated using temporal disaggregation techniques. Temporal disaggregation is the process of generating high-frequency data (for example, monthly) from low-frequency data (for example, annual). The monthly data can be generated from just the annual data or by using annual data together with a related high-frequency data series. There are a number of methods that can be used for temporally disaggregating a time series. Chen (2007) provides a comprehensive survey and an empirical comparison of these methods. This study used the ECOTRIM software developed and made available by Eurostat for generating the required monthly series. To generate monthly data using only annual data, ECOTRIM gives a choice of three techniques. These include the Boot, Feibes and Lisman method (at first and second difference) and the Denton method. When there are related series available, three variants of the popular Chow-Lin regression method can be used, including the AR(1), Fernandez and Litterman methods (Barcellan & Buono, 2002).

The GDP series was generated using the Fernandez method, using monthly tourist bed nights as a related series. The latter was used due to the tourism sector directly accounting for close to one-third of GDP and directly or indirectly accounting for almost three-quarters of GDP. Therefore, the GDP in the Maldives is closely linked to tourism developments. The Fernandez method was also used for the average expenditure series. As a related series, monthly tourist-arrival data were used based on the significant seasonality in arrivals in the peak and off-peak seasons. The movements in monthly tourist arrivals captured the price variation in the peak and off-peak seasons. The population series was generated using the Boot, Feibes and Lisman method. Given that there is no related series and that the population does not vary significantly from month to month, this method was seen as the most appropriate.

4.4.5 Model Estimation and Results

Unit roots and order of integration

All the variables were tested for unit roots using the ADF test. As a plot of the time series would provide an indication of whether to use a constant, a constant and a trend, or none, a graphical representation of the time-series data for each variable was conducted (see Appendix 2, Figure A2.1). The plots of the data showed that all the variables fluctuated around a non-zero mean. Therefore, the test equation with a constant was used for testing the unit roots for all the variables. To apply the ADF test, the number of lagged terms to be included in the test equation had to be specified. This was determined based on the SIC, but additional lags were included when autocorrelation was found in the residuals, until it was eliminated. The results of the unit root tests show that the null hypothesis of a unit root cannot be rejected at 5 per cent significance levels for the variables in levels. The unit root tests were then carried out on the first difference of the variables. These showed that all the variables are stationary at first difference, indicating that each series is integrated at the same order—I(1). These results are shown in Table 4.4.

Table 4.4: Unit root tests

Variable	No. of Lags	ADF Test Statistic		ADF Critical Value	Result
		Levels	First Difference		
lreer	9	-1.76	-8.64	-2.87	I(1)
ltot	12	-2.29	-4.30	-2.87	I(1)
lopen	5	-1.90	-14.02	-2.87	I(1)
nfa	4	-1.33	-7.57	-2.87	I(1)
lge	6	-1.65	-8.56	-2.87	I(1)

Note: The null hypothesis of unit root is rejected if ADF test statistic < ADF critical value .
ADF critical values are MacKinnon (1996) one-sided p-values at 5 per cent significance level, provided by EViews software.

Given that all the variables included in the model are non-stationary and integrated at I(1), cointegration tests are used to check for the existence of a long-run equilibrium relationship among the variables. As mentioned previously, Johansen's (1995) cointegration procedure is used to test for cointegration. As for the lag selection, the SIC information criteria is used, and the model that minimises the SIC and eliminated autocorrelation is a model with four lags. The cointegration test is applied to an unrestricted VAR model of the five variables specified in Equation 4.9. Several dummy variables were also included in the VAR model as exogenous variables, to account for the seasonality in the data and the outliers. The seasonal dummies are centred (orthogonalised) dummy variables as suggested by Johansen (1995). Three impulse dummies for the first three months of 2005 are included to take into account the December 2004 tsunami impact. The reason for including separate dummy variables for each month instead of one annual dummy is to capture the impact on each month, as the effects of the tsunami were greater in the first month after the tsunami than in subsequent months. Two other dummy variables, one for the 1993 macroeconomic crisis[24] and one for December 1999[25] are also included in the estimation to eliminate the effects of outliers in the data. These dummy variables were necessary to achieve a well-specified model for estimation.

The results of the cointegration test show that there is one cointegrating equation according to both the trace statistic and the maximum eigenvalue statistic, as shown in Table 4.5.

Table 4.5: Results of Johansen cointegration test

Null Hypothesis	**Eigenvalue**	**Trace Statistic**	**5% C.V**
H_o: r = 0*	0.21	122.97	69.82
H_o: r ≤ 1	0.18	66.33	47.86
Null Hypothesis	Eigenvalue	Max-Eigen Statistic	5% C.V
H_o: r = 0*	0.21	56.64	33.88
H_o: r ≤ 1	0.00	0.21	3.84

** Denotes rejection of the hypothesis at the 0.05 level*
The Trace test indicates one cointegrating equation at the 0.05 level, and the maximum eigenvalue test indicates one cointegrating equation at the 0.05 level

The existence of a cointegration relationship enables the VECM specified in Equation 4.10 to be estimated. The VECM estimated using the variables specified in the REER model is presented in Appendix 2, Table A2.1, and the results are discussed below. In terms of diagnostic tests, the VECM is checked for serial autocorrelation, normality and heteroscedasticity. The results in Table 4.6 show that the residuals are free of serial correlation and are homoscedastic. However, the model did not satisfy the normality assumption, due to kurtosis. However, as

24 The Maldives faced severe macroeconomic imbalances in the early 1990s which culminated in 1993 with inflation reaching 20 percent, budget deficit amounting to 16 percent of GDP and an unsustainable current account deficit draining the international reserves to less than 2 months of imports. The government of the Maldives took several policy reforms to redress these imbalances in 1994 which coupled with a favourable external environment improved the macroeconomic conditions of the country.

25 The dummy variable for 1999 is to take account for an outlier in data series.

shown by Gonzalo (1994) and Hubrich (1999), the Johansen procedure for VECM is robust under non-normal residuals and therefore the estimates remain valid.

Table 4.6: Diagnostic tests of the VECM

Serial Correlation	LM test(1–4)	24.42 [0.50]
Normality	Jarque-Bera	211.8 [0.00]
Skewness		14.53 [0.01]
Kurtosis		197.3 [0.00]
Heteroscedasticity	White test	937.0 [0.30]

The p-values are given in brackets

Long-run cointegration relations

The long-run relationships for the cointegrating relation identified by the VECM gives the estimated long-run equation. The estimated cointegrated vector normalised for REER (*lreer*) is specified in Equation 4.14, with the t-statistics in brackets. All the variables are statistically significant.

$$\begin{aligned} lr\hat{e}er = 1.43 + &0.69ltot - 0.60lopen + 0.04nfa + 0.42lge \\ &(4.50) \quad (-4.92\ ) \quad (2.48) \quad (3.53) \end{aligned} \tag{4.14}$$

The estimated coefficients of the variables included in the model, which represent the fundamental variables of the equilibrium exchange rate, have the expected signs. They are also in line with the theoretical underpinnings discussed in Section 4.3. As expected, an increase in TOT leads to an appreciation of the REER, while an increase in the openness of the economy, representing a reduction in trade restrictions, has the opposite effect. In the case of an increase in net foreign assets and government expenditure as a percentage of GDP, these have an appreciating effect on the REER.

The short-run model

The short-run dynamics of the model can be specified either as a single-equation error-correction model or as a VECM. If the cointegration test indicated only one cointegrating equation and if all the right-hand-side variables are weakly exogenous (as discussed below), then a single-equation approach to ECM is appropriate. However, if there are multiple cointegrating vectors and the right-hand-side variables are not weakly exogenous, then a VECM should be used (Harris & Sollis, 2003).

A weak exogeneity test is carried out to ensure that all the right-hand-side variables are exogenous and the left-hand-side variable is endogenous. As specified in Equation 4.10 in the $\Pi = \alpha\beta'$ matrix, α is the adjustment coefficient or the speed of adjustment to disequilibrium. If all $\propto_{ij}$ in row i of α are equal to zero, the corresponding cointegrating equation determine the i^{th} element of Δx_t. This would mean then the variable is weakly exogenous to the system. The tests for weak exogeneity of the variables are shown in Table 4.7, revealing an asymptotically distributed $\chi^2(1)$ test under the null hypothesis of the existence of weak exogeneity (Harris & Sollis, 2003). The results of the tests show that the variables: TOT (*ltot)*, openness of the economy *(lopen)*, net foreign assets *(nfa)* and government expenditure *(lge)*, are all weakly exogenous, while REER (*lreer)* is endogenous to the system.

Table 4.7: Weak exogeneity tests

	lreer	ltot	lopen	nfa	lge
Chi-square(1)	9.278	0.335	1.196	0.043	1.168
Probability	0.00	0.56*	0.27*	0.84*	0.28*

** Denotes rejection of the hypothesis at the 1 per cent level.*

Note: The test for weak exogeneity is run under the assumption of one cointegrating equation. The failure to reject the null hypothesis is evidence of the weak exogeneity of the variable of interest.

The weak exogeneity of the right-hand-side variables, coupled with one cointegrating equation, enables the short-run dynamics of determinants of the REER to be modelled through a single-equation approach. According to Edwards (1998) and Elbadawi (1994), apart from the long-run fundamental determinants of RER, macroeconomic policies such as monetary policy and exchange rate policy also affect the RER in the short run. As such, if macroeconomic policies are inconsistent with the long-run fundamentals, RER will become overvalued. Therefore, in the short-run error-correction model, two additional variables are included. The variable *excre*, measures the excess supply of domestic credit to represent the expansionary monetary policy. It is measured as the rate of growth in domestic credit minus the lagged rate of growth of real GDP. An increase in excess credit is expected to lead to an overvaluation of the RER. The second variable, *dev*, measures changes in the NER. According to Edwards (1988), in a fixed exchange rate system, a nominal devaluation will help to alleviate RER overvaluations in the short run. Therefore, the variable is expected to have a negative sign.

The short-run error-correction model derived from the long-run relationship estimated in Equation 4.14 is specified in Equation 4.15:

$$\begin{aligned}\Delta lreer_t = {} & \alpha_0 + \sum_{i=1}^{4} \alpha_1 \Delta lreer_{t-i} + \sum_{i=0}^{4} \alpha_2 \Delta ltot_{t-i} \\ & + \sum_{i=0}^{4} \alpha_3 \Delta nfa_{t-i} + \sum_{i=0}^{4} \alpha_4 \Delta lge_{t-i} \\ & + \sum_{i=0}^{4} \alpha_5 \Delta excre_{t-i} + \sum_{i=0}^{4} \alpha_6 \Delta dev_{t-i} \\ & + \sum_{i=1}^{3} \delta_7 D05_i + \delta_8 D93 + \delta_9 D99 + \sum_{i=1}^{11} \delta_{10} S_i \\ & + \theta_{11} ect_{t-1} + \mu\end{aligned} \tag{4.15}$$

The variables in the Equation 4.15 are as described earlier in Table 4.2 and in the preceding paragraph. For ease of reference, the variables in Equation 4.15 represent: the REER (lreer), TOT (ltot), net foreign assets (nfa), government expenditure (lge), excess domestic credit (excre) and NER devaluations (dev). Δ denotes the difference of the corresponding variable. The variables D05, D93 and D99 are the impulse dummies and S refers to the seasonal dummies, all of which were discussed earlier in this section. The term ect_{t-1} represents the error-correction term in the model and is derived from the long-run model and estimated as (*lreer* - 0.69*ltot* + 0.60*lopen* - 0.04*nfa* - 0.42*lge* - 1.43).

Equation 4.15 is estimated with four lags using OLS. As this model is over-parameterised, the general-to-specific methodology was applied to achieve a parsimonious model, dropping insignificant lags and variables at each level, while checking for model adequacy. The results of the final error-correction model estimated are presented in Table 4.8 and the diagnostic tests are shown in Table 4.9. As before, the normality assumption of the model is not satisfied. However, the model satisfies the assumption of no serial correlation and homoscedasticity of the residuals as well as the stability of parameters. The stability tests for the model were used to check whether the parameters of the model are stable across various subsamples of the data used in the model. The plot of recursive residual plot shows that residuals lie within a band of +/- two standard errors, indicating that parameters in the equation are stable. This is further confirmed by the plots of the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMsq) with 5 per cent critical bands. In both plots, cumulative sums are within the critical bands. These plots are shown in Appendix 2 (see Appendix 2, Figure A2.2). All three tests support the stability of the estimated model.

Table 4.8: Short-run dynamics of the real effective exchange rate

Dependent variable is dlreer

Variable	Coefficient	Standard Error	t-statistic	Prob.
Constant	0.002	0.003	0.87	0.39
$dlreer_{t-1}$	-0.38	0.06	-6.46	0.00
$dlopen_{t-1}$	0.09	0.02	5.79	0.00
$dlopen_{t-2}$	0.05	0.01	3.70	0.00
Ddev	-0.88	0.24	-3.63	0.00
$ddev_{t-1}$	-0.98	0.26	-3.79	0.00
$ddev_{t-2}$	-0.54	0.25	-2.19	0.03
D93	0.17	0.03	5.46	0.00
ect_{t-1}	-0.07	0.02	-3.20	0.00

The d in front of the variables denotes the difference variables.

Table 4.9: Diagnostic tests of the error-correction model

Serial correlation	Breush-Godefrey LM test	0.381 [0.37]
Functional form	Ramsey reset test	1.787 [0.18]
Normality	Jarque-Bera	477.6 [0.00]
Heteroscedasticity	White test	1.319 [0.23]

The p-values are given in brackets

The results from the short-run models show that the long-run determinants of the REER are not important for the short-run dynamics. Only the lagged effects of *lreer* and *lopen* are significant in the short run, but they have the wrong signs. The variable *excre* is also not significant. Moreover, the results suggest that in the short run, only nominal devaluation affects the behaviour of the REER. The negative sign on the variable *dev* shows that devaluation has the effect of depreciating the REER in the short run, both contemporaneously and when lagged.

The error-correction term in the model is highly significant and negative. The negative coefficient on the error-correction term suggests that if the REER is overvalued, it will adjust downwards to its equilibrium position. According to the error-correction term, about 7 per cent of the disequilibrium is corrected each month. The coefficient on the error-correction term can be used to derive the speed of adjustment in terms of the number of months (years) it takes to eliminate a given percentage of an exogenous shock, using the Equation 4.16:

$$(1-\propto) = (1-\hat{\beta})^T \tag{4.16}$$

where $\propto$ is the percentage of an exogenous shock to be eliminated, $\hat{\beta}$ is the absolute value of the error-correction term and T is the number of months.

Using Equation 4.16 with an error-correction term of -0.07, it takes 74 months, or just over six years, to dissipate a shock to the REER. The slow speed of adjustment reflects the fixed exchange rate regime and the inability of the NER regime to adjust to external shocks. The speed of adjustment for the Maldives is consistent with the results for other small developing countries, such as the countries in the Caribbean. For the Bahamas, the speed of adjustment was nine years (Grenade & Riley, 2009) and for Barbados, it was eight years (Moore et al., 2004). Similar results were also found for countries with fixed exchange rate regimes, such as the small countries in the Middle East (Achy, 2001) and the counties of the Eastern Caribbean Currency Union (ECCU) (Pineda et al., 2004).

Equilibrium real exchange rate and exchange rate misalignment

As mentioned previously, the sustainable values of the fundamental variables included in the long-run model (see Equation 4.14) need to be derived to estimate the long-run ERERs. However, sustainable values are not directly observable, as the fundamental variables generally exhibit both transitory and permanent components. Therefore, time-series decomposition techniques—here, the HP filter and the MA method—are used to filter out the permanent values of the fundamental variables. In the MA method, the number of years used for averaging is chosen based on the number of months it takes to eliminate 90 per cent[26] of an

[26] In most of the literature, the number of months (years) to eliminate 80–90 per cent of an exogenous is used rather than the full 100 per cent, as the latter would lead to a loss of too many

exogenous shock. Using Equation 4.16 and an adjustment coefficient of -0.07, this was found to come to 32 months for the Maldives. Therefore, a 32-month MA data series is calculated for each of the fundamental variables. These values are then applied to the long-run coefficients estimated from the REER in Equation 4.14 to derive the ERER. The estimated ERER, using the HP method—denoted ERERhp—and the MA method—denoted ERERma— together with the actual REER, are shown in Figure 4.2.

Figure 4.2: REER and equilibrium real exchange rate indices, 1990–2010

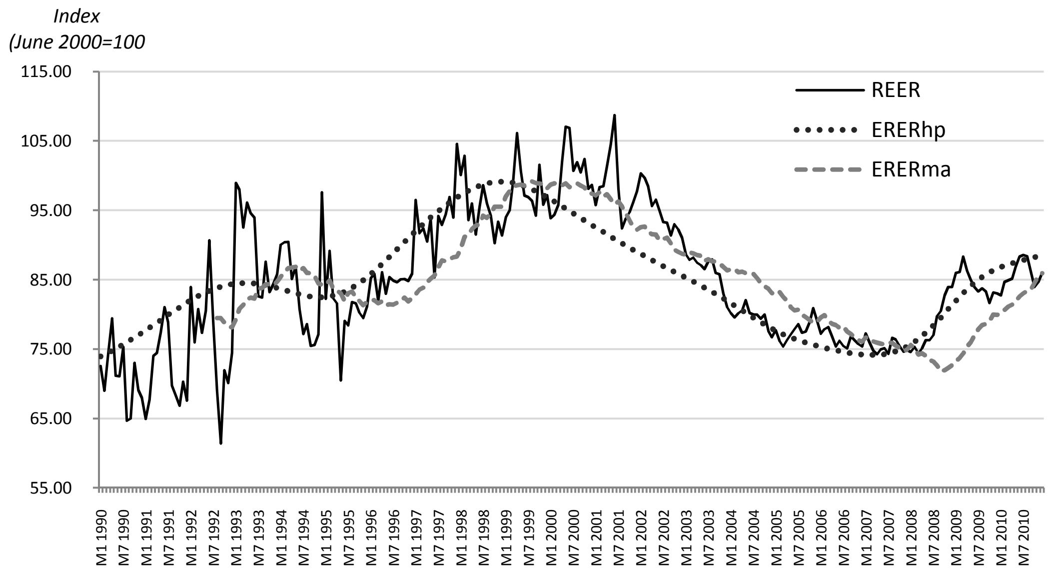
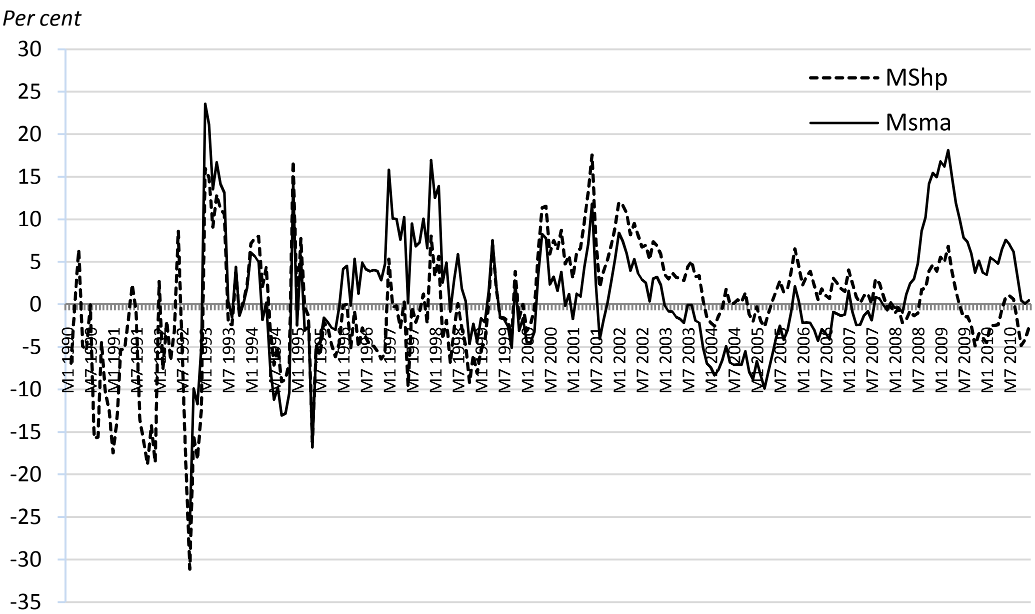


Figure 4.2 shows that both the MA and the HP methods yield very similar estimates and follow the same trends. When the actual REER is above the ERER, the RER is overvalued. Likewise, when it is below the ERER, it is undervalued. As seen in Figure 4.2, the REER was very volatile in the 1990s, especially prior to the adoption of the fixed exchange rate in September 1994. Since the 1990s, the REER has appeared overvalued, except for during the period 2004–2007. The difference between the REER and the ERER is the exchange rate misalignment, and this gives a better indication of the RER overvaluations and undervaluations.

observations (Elbadawi, 1994). In the case of the Maldives, 100 per cent of a shock is eliminated in 74 months, which means that about one-third of the estimation period will be lost given that there are 252 months.

The exchange rate misalignment is calculated as the percentage deviation of the REER from the ERER. This is shown in Figure 4.3, with MShp denoting the misalignment computed using the ERERhp and MSma denoting the misalignment computed using ERERma.

Figure 4.3: Real exchange rate misalignments, 1999–2010



It can be seen from Figure 4.3 that the misalignment measured by the two methods follows the same trends, but the degree of misalignment varies between the two series. In the 1990s, highly volatile levels of misalignments are seen, with large overvaluations and undervaluations of the REER, especially in the first half of the 1990s. This is attributable to the severe macroeconomic imbalances in the economy, characterised by high and volatile inflation and large current account and budget deficits. To address this problem, in late 1994, the authorities adopted a fixed exchange rate regime and implemented several macroeconomic stabilisation measures that improved the macroeconomic conditions in the Maldives.

In the second half of the 1990s, the ERER according to the MA method showed exchange rate overvaluations, while the HP method showed that REER was more in line with the equilibrium levels, with periods of undervaluation. In general, misalignments of +/- 5 per cent are not taken as significant, given the limitations of data (IMF, 2009). Regarding the periods of misalignments, the RER was overvalued for approximately 20 per cent of the period and undervalued for 16 per cent. In total, the RER of the Maldives was significantly misaligned during 36 per cent of the months, during the 20-year period from 1990–2010—not a particularly high proportion of the time.

Figure 4.4 shows the misalignment of REER during the period 2000–2003, to get a closer look at the period. It is seen that there was a sharp overvaluation from the beginning of 2000, with the degree of misalignment rising to almost 20 per cent by June 2001. This was followed by a 9 per cent devaluation of the official exchange rate of the rufiyaa to the US dollar in July 2001. The devaluation immediately reduced overvaluation, but did not eliminate the misalignments completely (according to the HP series). Moreover, the degree of misalignment increased again in the following months, with the REER remaining overvalued until the end of 2003.

Figure 4.4: Real exchange rate misalignments, 2000–2003

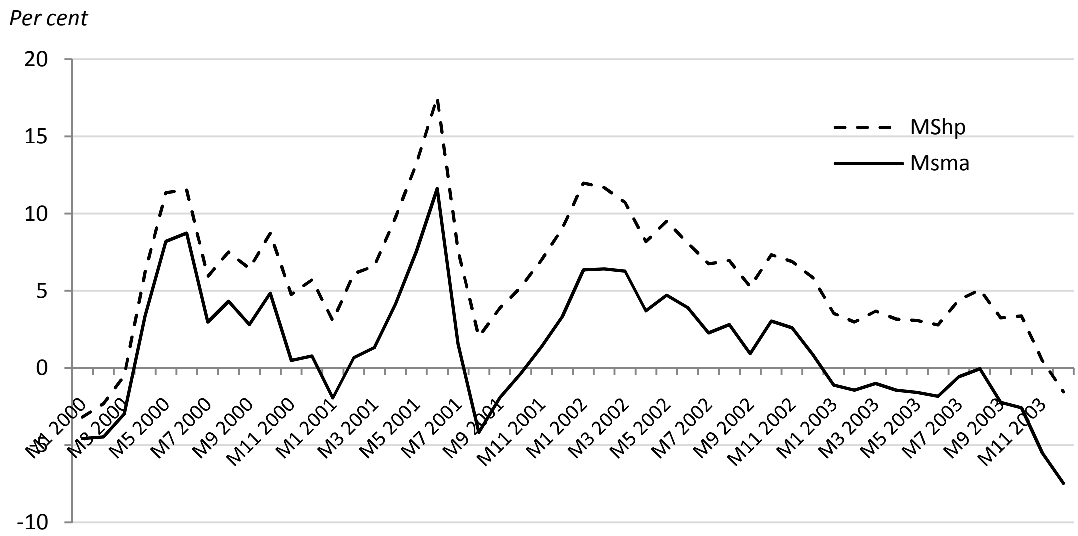
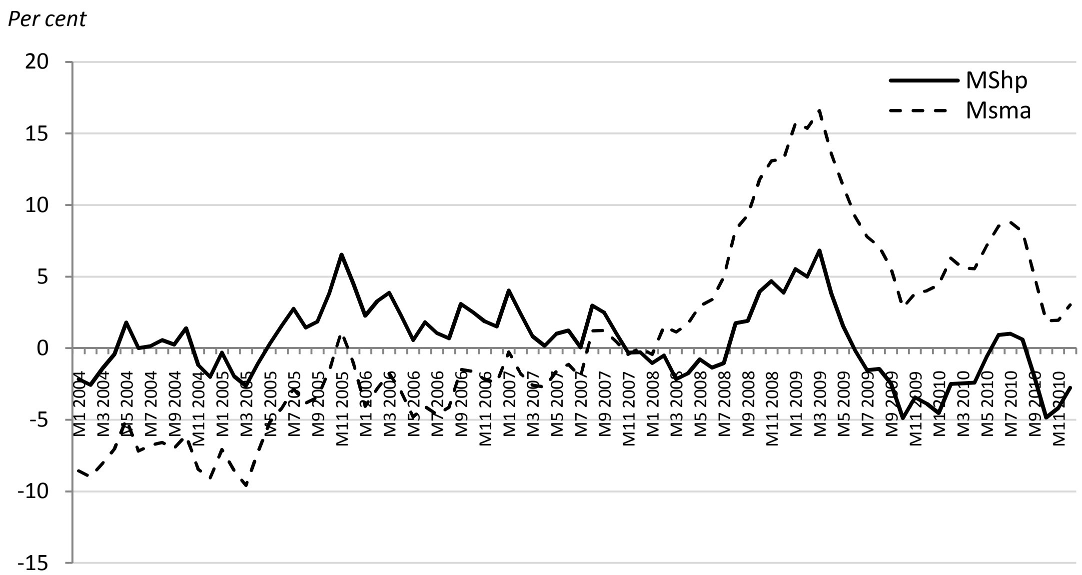


Figure 4.5 shows the misalignments during the period 2004–2010. Again, the purpose is to look closely at the developments during the period. It can be seen that, from the beginning of 2004 until the end of 2007, the REER was almost at

equilibrium levels (although the MA method shows undervaluations). As mentioned in the introduction of this chapter, it is interesting to note that the IMF in 2007 declared that the REER of the Maldives during this period was misaligned and overvalued, as part of their new exchange rate surveillance program. However, in 2008, the IMF (2009) admitted that their assessment was not correct and the REER was not overvalued, which is more in line with the results shown here. Beginning from 2008, the REER shows overvaluation with misalignments of over 15 per cent in the first few months of 2009. The levels of misalignment were reduced considerably in the later months of the year. However, the REER remained overvalued in 2010; showing a rising trend at the end of 2010. Again, this was a period of significant macroeconomic imbalance in the Maldivian economy, with the government budget deficits and current account deficits growing steeply.[27] Moreover, the TOT also declined due to a general slump in the tourism sector, stemming from the economic downturn in the major European markets.

Figure 4.5: Real exchange rate misalignments, 2004–2010



[27] The budget deficits as a percentage of GDP in 2008 and 2009 were 17 and 31 per cent, respectively. The current account deficits as a percentage of GDP were 51 per cent in 2008 and 32 per cent in 2009.

While the estimated ERER for the Maldives is statistically robust and adequate to make inferences from the results, it is important to note that the estimates of ERER are not absolute, given the limitations in the data quality and availability. As discussed previously, the variables used for the estimation of the REER model are proxies for the fundamental variables used in the theoretical model, as the fundamental variables are not directly available. Therefore, caution should be used in interpreting the results, especially the exact levels of misalignments for individual periods. The levels of misalignment for any individual period should be taken as a rough guide, rather than as an absolute value. However, the overall trends of ERER are in line with the macroeconomic developments during the period and give a good indication of the periods of REER overvaluations and undervaluations.

4.5 Conclusion

The REER of the Maldives has experienced varying levels of misalignments during the last two decades. There have been periods of both undervaluation and overvaluation of the currency, with more volatile levels of exchange rate misalignments during the early 1990s, prior to the adoption of the fixed exchange rate. During this period, the Maldives maintained a managed float. It was also seen that, in the year 2000 and the first half of 2001, the REER became sharply overvalued, leading to a nominal devaluation of the official exchange rate, which was fixed to the US dollar. While this reduced the level of misalignment of the REER, it was not enough to bring the REER to its equilibrium level and the exchange rate remained overvalued for a long time. In recent years, the REER has once again seen sharp overvaluations following macroeconomic instability stemming from the downturn in tourism and large current account and budget deficits.

This chapter estimated the ERER for the Maldives and identified the episodes of exchange rate misalignments, using a reduced-form equation based on the ERER models put forward by Edwards (1988) and Elbadawi (1994). Using a cointegration approach, a long-run relationship was established between the REER and a set of fundamental variables, as dictated by the theoretical foundations of ERER models. The fundamental variables chosen for modelling the determinants of REER for the Maldives were the TOT, the openness of the economy, net foreign assets as a percentage of GDP and government expenditure as a percentage of GDP. A short-run error-correction model was also estimated to identify the short-run dynamics of REER. It was shown that the speed of adjustment of the REER of the Maldives to an exogenous shock is around six years, the slow adjustment reflecting the fixed exchange rate regime. This is consistent with other small island developing economies like the Maldives. Moreover, the short-run model showed that only nominal devaluation has an affect the behaviour of the REER in the short run.

The estimated long-run REER contains both permanent and transitory components, whereas the long-run ERER should contain only permanent values. Therefore, the HP filter and a MA method were applied to the fundamental variables to filter out the transitory components and derive ‘sustainable’ values of the fundamental variables. The ERER for the Maldives was estimated using the ‘sustainable’ values and the estimated long-run coefficients from the REER model. In addition, the misalignments of the REER were calculated as the percentage deviations of the actual REER from the estimated ERER. The ERER calculated, using both the HP and MA method, yielded similar trends, although the levels of misalignments differed between the two methodologies. This shows the sensitivities of the results to the methodology used, and that caution should be exercised when interpreting the individual levels of misalignments.

The analysis of the equilibrium exchange rates suggests that the RER in the Maldives has been close to its equilibrium level during the greater part of the period under analysis. Although RER misalignment is generally believed to be higher under fixed exchange rate regimes, the pegged exchange rate regime of the country does not seem to have led to significant RER misalignments in the past 16 years. In fact, the volatility in RER misalignments was shown to be lower after the adoption of the fixed exchange rate in 1994, as compared to the pre-1994 period of the managed float. However, it is difficult to compare the misalignments under the two regimes as the period under the managed float included in this study is very short (3 years) and was a period of severe macroeconomic imbalance.

One important policy implication of the analysis in this chapter is that, while a nominal devaluation is important in realigning the RER, when it is overvalued, the realignment is short-lived if the macroeconomic fundamentals of the economy, as discussed in this chapter, are not at their equilibrium levels. Therefore, for the Maldives to keep the RER at its equilibrium level under a pegged exchange rate regime, it is important to maintain macroeconomic stability in the country.

Chapter 5 | Inflation Dynamics in the Maldives

5.1 Introduction

In small and open developing countries, fixed exchange rate policies are often used to stabilise domestic prices and control inflation. In the Maldives too, due to its high degree of openness and the small size of the economy, a pegged exchange rate system has been in place since 1994. To determine the efficacy of the pegged exchange rate regime in controlling inflation, it is important to analyse the dynamics of inflation in the Maldives empirically. Macroeconomic research in the Maldives is extremely limited, with this being the first study to model and analyse the dynamics of inflation in the country.

The objective of this chapter is two-fold. First, the exchange rate and inflation relationship in the Maldives will be examined. Second, this chapter will identify the factors, other than the exchange rate, that drive inflation in the Maldives. In small open economies, foreign prices also play a significant role in influencing domestic inflation, as these countries are heavily dependent on imports and are price takers in the international market. Therefore, it is important to identify the relative role that the exchange rate plays in influencing inflation, as compared to other factors, such as foreign prices.

Since the focus of this study is on exchange rate issues, a special emphasis in given to understanding the relationship between inflation and exchange rates. Therefore, it is important to identify the degree and speed of ERPT to domestic prices. ERPT refers to the extent to which changes in exchange rate are reflected in domestic prices, such as import prices, export prices and consumer prices. If the change in NER is fully transmitted to the domestic prices, the ERPT is complete. If there is no change in domestic prices from a change in exchange rate, then the pass-through is zero. In most cases, domestic prices respond to a change in nominal exchange, but not by the full extent of the change in exchange rate. This is called incomplete or partial ERPT. The extent of ERPT has important implications for the choice of exchange rate regime. If the ERPT is high or nearly complete, a flexible exchange rate will mean greater exchange rate volatility and higher volatility in inflation.

The remainder of this chapter is structured as follows. Following this introduction, Section 5.2 reviews the theoretical and empirical literature on the causes of inflation. In Section 5.3, the ERPT literature is reviewed. The CPI is chosen as the measure of inflation in modelling inflation in the Maldives, as this is the most commonly used measure of inflation in the country. Moreover, it is the only price index available on a monthly basis for the period used in this study (1990–2010). Therefore, to understand the process of inflation in the Maldives, the composition of the CPI is analysed in Section 5.4. As a background to this, it was important to investigate the tradable and non-tradable components of the CPI, as was done in Chapter 4. Next, Section 5.5 describes the developments and sources of inflation in the Maldives. In Section 5.6 the theoretical and empirical framework, description of the data and the methodology used in modelling inflation in the Maldives are presented. This is followed by a discussion of the results from the estimated model. This chapter also uses the econometric techniques of cointegration and the VECM used in Chapter 4. In addition, the relationship between inflation and the exchange rate is further analysed using variance decomposition and impulse response functions. This identifies the extent of ERPT to domestic prices. The last section of this chapter, Section 5.7, is the conclusion.

5.2 Review of Literature on Inflation

5.2.1 Theoretical Literature on Inflation

There are a number of theories on inflation. The two most prominent theories are the demand-pull and cost-push theories, with most theories and models of inflation based around these two theories. However, considering that these two causes of inflation are not always straightforward and it is difficult to identify the actual source of inflation, different approaches of looking at the causes of inflation exist in the literature. The debate on inflation is generally centred on two main schools: Keynesian and Monetarist. An alternative view that is gaining prominence in explaining inflation in developing countries is the structuralist view.

In the simplest terms, demand-pull inflation is caused by 'too much money chasing too few goods'. This creates an increase in demand for goods and services in the economy, leading to an increase in the price level. In contrast, cost-push inflation refers to a general increase in price level associated with a reduction in aggregate supply. A contraction in aggregate supply might result from an increase in the cost of the inputs of production or from a supply shock to the economy, such as a flood or drought. For example, a rise in the cost of inputs for a firm will induce the firm to raise their prices to compensate for the higher costs and maintain their real value of profits. In this situation, workers seeing their real wages fall demand higher nominal wages. This in turn pushes up the cost of production and the general price level in the economy (Ball, 2007). Several factors may cause cost-push inflation, including:

- A rise in prices of non-labour inputs, such as oil prices
- An increase in interest rates (increasing the cost of borrowing, which is also an input price)
- Increases in wages
- An increase in indirect taxes, such as value-added tax or import duties or the removal of subsidies
- An increase in the price of imported raw materials due to changes in exchange rates, international commodity prices or external shocks

Various theories are used to explain the causes of inflation as put forward by different schools of thought. The theory of PPP is the simplest approach to explain inflation for a small open economy. The PPP theory postulates that inflation in one country must equal the inflation of another country when expressed in a common currency.[28] This is expressed in Equation 5.1:

$$P = E_t + p_t^f \tag{5.1}$$

where P is the domestic price level, E_t is the NER and p_t^f is the foreign price level. According to Equation 5.1, on the assumption that PPP holds, under a fixed exchange rate regime, domestic prices will adjust to equalise with foreign prices. If the exchange rate regime is flexible, the changes in NER will equalise to maintain PPP. However, as discussed in Chapter 4, PPP may not hold in the short run, or sometimes even in the long run (Isard, 1995). Regardless of the validity of the PPP, the above equation can be seen as an equation for imported inflation. Imported inflation is referred to as an increase in domestic prices, due to an increase in the prices of imports. The prices of imports are influenced by changes in exchange rates and foreign prices. Therefore, if the economy is heavily import-dependent, inflation in the country may be determined by the exchange rate and foreign prices.

Following from classical economists such as David Hume, Adam Smith, David Ricardo and James Stuart Mill, and neo-classical economists such as Leon Walras, Alfred Marshal and Arthur C Pigou, inflation was always considered to arise from changes in money supply, based on the quantity theory of money (Trevithick & Mulvey, 1975). Such thinking was later revived by the monetarists and, as famously put forward by the most prominent monetarist of recent times, Milton Friedman, 'inflation is always and everywhere a monetary phenomenon' Friedman argued that there is a stable and positive relationship between inflation and money supply (Friedman, 1963). According to monetarists, inflation is caused by excess aggregate demand in the economy caused by an excess supply of money. This phenomenon in explained by the quantity theory of money, which was originally explained by Fisher's equation of exchange as:

[28] As the theory of PPP has been already discussed in Chapter 4, it will not be discussed in detail here.

$$MV = PT \tag{5.2}$$

where M is money supply, V is velocity of money, P is the price level and T is transactions in the economy. As it is difficult to measure T, it is normally proxied by aggregate income, Y. Therefore, the equation is normally stated as:

$$MV = PY \tag{5.3}$$

Equation 5.3 is an accounting identity and shows that the nominal expenditure on all goods and services in the economy should equal the value of output in the economy. The above equation assumes that velocity is fixed in the short run. The equation also assumes that the economy is in equilibrium and at full employment, thus giving a constant output. Therefore, the price level P can only rise from an increase in money supply, M. To control inflation, money supply has to be limited, which makes monetary policy the most effective tool to tackle inflation. One of the criticisms of this view is that velocity can vary even in the short run. Consequently, controlling the money supply may not suppress inflation. This has led some monetarists to concede that, while inflation is caused by money growth, this might not always hold true in the very short term (Ball, 2007).

According to the Keynesian approach to inflation, inflation is a result of excess demand in the economy.[29] That is, excess demand in the economy will create an inflation gap, which is the difference between aggregate demand and the potential level of output at full employment. Any of the factors influencing the aggregate demand in the economy can create excess demand. These components are shown in Equation 5.4:

$$AD = C + I + G + (X - M) \tag{5.4}$$

where AD is aggregate demand (the sum of all spending in the economy), C is consumer expenditure, I is investment, G is government expenditure, X is exports

[29] The distinction between Keynesians and Monetarists is not as important as it used to be, and Keynesian also considers the growth of money supply as a cause of inflation. Similarly, structuralist theory of inflation has elements from other theories of inflation.

and M is imports. A rise in consumption due to lower inflation, a tax cut or increased consumer confidence could lead to a rise in aggregate demand. Likewise, higher government spending or increased investments by the private sector or an improvement in exports of the country could cause an increase in aggregate demand. This would lead to a higher equilibrium price level and equilibrium output level.

The relationship between inflation and unemployment was another concept that was used to explain wage and price inflation. Based on an empirical study in the late 1950s, Phillips (1958) found an inverse relationship between inflation and unemployment, which came to be known as the Phillips curve. As this was an empirical model, Richard Lipsey tried to provide some theoretical underpinnings to the model by examining the behaviour of wages in a micro-labour market setting. In the early 1960s, the model was taken further by Paul Samuelson and Robert Solow (Mankiw, 2009). As the Phillips curve model depicts a trade-off between wage inflation and unemployment, this has significance for both the theory of inflation and economic policymaking. The relationship between inflation and unemployment can be expressed in the following equation (see Equation 5.5):

$$\pi_t = (\mu + z) - \alpha u_t \tag{5.5}$$

where π_t is the inflation rate; $u_t$is the unemployment rate; z is a variable that represent all the other factors that would influence wage setting; μ is the mark-up; and α is a parameter to capture the trade-off between inflation and unemployment (Blanchard, 2003).

The empirical analysis of the Phillip curve gave evidence on a short-run trade-off between wages and unemployment, but no conclusive evidence was found on the long-run trade-off between the two (Trevithick & Mulvey, 1975). Both Friedman and Edmund Phelps challenged the validity of the Phillip's curve and proposed a so-called 'expected-augmented Phillip's curve' which incorporates future expectations of inflation. This is expressed in Equation 5.6:

$$\pi_t = \theta\pi^e + (\mu + z) - \alpha u_t \tag{5.6}$$

where π^e is the expected inflation and θ is the expectations adjustment parameter. It is argued that workers form their expectation of future inflation based on past inflation. When inflation is persistent and high in the economy, workers would expect inflation to rise further in the future. These inflation expectations would be included when setting their wages. Expectations such as this, based on past behaviour, are called adaptive expectations (Salvatore, 2001).

Another dominant school of thought in explaining inflation, especially in developing countries, is the structuralist view. In contrast to the monetarists' view of inflation, structuralists believe that inflation is caused by non-monetary factors in developing countries, unlike in more developed countries. As such, price pressures mainly emanate from the real sector bottlenecks in the economy (Bernanke, 2005). It is argued that inflation is inevitable in developing countries pursing rapid growth policies, given that these countries have structural bottlenecks in the real sector of the economy. The structuralist's view of inflation is based on three main assumptions. These are '(1) relative prices … change when economic structure changes; (2) [there exists] downward inflexibility of [some] money prices; and (3) [there is] a passive money supply closing the deflationary gap caused by price increases' (Canavese, 1982).

The inflation models of structuralists identify three main factors that may cause inflation in developing countries. The first is the rigidity of food supply in the developing countries due to the bottlenecks in the agriculture sector. This is because, when countries become more industrialised, workers move from the agricultural to the industrial sector. This creates a reduction in supply in the agriculture sector, while at the same time increasing the demand for food as the population urbanises and become more affluent. The rigidity of the food supply and the inability to import food to cater for the market drives up the food prices. As prices in the industrial sector are downwardly rigid, the rise in food prices drives up the general price level in the country (Fischer & Mayer, 1981).

The second factor is the foreign exchange bottleneck, which arises when foreign exchange receipts in the country fall short of financing the high demand for imports. Increased demand for imports may come from both the private sector and the government. Demand can stem from the rapid development of the country, greater industrialisation and the increasing population of the country.

The third factor that causes inflation arises from a financial constraint that developing countries face. That is, developing countries in the process of urbanisation and industrialisation create an increased demand for both physical and social infrastructure facilities, which the government is unable to finance from its revenue. The structure of the revenue and tax systems in most of these countries is inefficient and rudimentary. Governments are therefore unable to access enhanced revenue from the increased wealth resources in the country resulting from the growth and development. Governments faced with such budget constraints often recourse to deficit financing, increasing money supply and creating inflationary pressures in the economy (Kirkpatrick & Nixon, 1976).

Apart from the factors discussed above, there are several other sources of inflation, especially in developing countries. In developing countries, fiscal imbalances are often a major source of domestic inflation, as fiscal deficits can contribute to high money growth and exchange rate depreciation (Montiel, 1989). According to adaptive expectations, people base their inflation expectations on the past behaviour of inflation, which creates inflation inertia. Inflation inertia is considered another important determinant of inflation in developing countries, especially when there is wage indexation and a history of high inflation in the country (Loungani & Swagel, 2001).

5.2.2 Empirical Literature on Inflation

No empirical studies on inflation have been done so far for the Maldives. This is the first attempt to examine the determinants of inflation in the Maldives empirically. While there is a considerable number of empirical studies on inflation determinants for developed and developing countries, studies on small island developing countries are still very limited. Some general studies on developing countries and the available studies on small island developing countries are discussed below. A review of these studies will help to identify the factors influencing inflation in countries similar to the Maldives and the methodologies used for empirical analysis. This will help to build and estimate a suitable econometric model of inflation for the Maldives, and allow for the comparison of results obtained for the Maldives with similar countries.

Loungani and Swagel (2001), using a sample of 53 developing countries, examined the inflationary process in these countries, focusing on the relationship between sources of inflation and exchange rate regimes. They used VAR models to look at the relationship between the variables and variance decomposition techniques to identify the effect on inflation from a shock to each of the explanatory variables in the model. The study found that the main causes of inflation are money growth and exchange rate changes due to fiscal effects. Regarding inflation inertia, past inflation accounted for about 10–20 per cent of inflation movements. However, the output gap and supply-side cost shocks were not as important in explaining inflation movements. This may be due to the use of annual data, as the influence from these two variables may be short term. The study also found that in Asian and African countries, inflation inertia was more important than fiscal variables, output gap and supply-side shocks. In contrast, in South American countries, fiscal variables were more important. Finally, fiscal variables contribute more to inflation in floating exchange rate regimes, compared to in fixed exchange rate regimes.

In modelling inflation process in Sri Lanka, Cooray (2008) found that inflation is mainly determined by real GNP, exchange rates and import prices. The money supply was also significant, but only in the long run. The determinants of inflation for Mauritius were analysed in a paper by Imam and Minoiu (2005), using quarterly data from 1977 to 2004 in a vector autoregressive framework. Two equations were estimated: a PPP equation and a monetary equation. The results showed that PPP does not hold for Mauritius and that foreign prices influence domestic inflation significantly. Further, ERPT was not very high, due to administered prices. As regards the monetary equation, the price elasticity of money was very high, at around 0.74.

As the Maldives have a pegged exchange rate to the US dollar, it would be interesting to look at inflation determinants in countries with similar exchange rate policies. A study by Kandil and Morsy (2009) on six Gulf countries that have or had pegged exchange rate regimes for a long period, studied the determinants of inflation using cointegration and ECM. The model estimated inflation as a function of NEER, foreign prices, money supply and government spending. Both foreign prices and NEER influence the domestic prices in the long run, with the former more important than the latter in determining inflation in most of the countries. However, in the short run, the external factors were important only in some countries. Monetary growth was inflationary in two countries in the long run and for only one country in the short run. Higher government spending was disinflationary in all the countries in the long run, as it eased the capacity constraints in the economy. In the short run, a variable reflecting excess demand was included and this was significant for three countries, indicating that real output higher than the potential output is inflationary.

There have been a few studies on inflation for the Caribbean country of Barbados. Downes (1985) examined the factors influencing inflation in the country and found that import prices and interest rates are the main determinants of inflation (contributing 73 per cent and 7 per cent, respectively), whereas wage rate changes were found to be insignificant. Cumberbach (1995) also found similar results for Barbados, with the main determinant of inflation being import prices, although he found that the consumer credit rate, unit labour costs and real national income also contributes significantly to inflation in the country. Using cointegration and ECM, Downes, Holder and Leon (1985) also investigated the long-run relationship and short-run dynamics of inflation in Barbados. Wages, productivity, unemployment, price of tradables and import prices were found to influence the inflationary process in Barbados. Inflation in Barbados has been shown to have a close relationship to the movements in the tourism sector, indicating the importance of demand-side factors in explaining inflation in the country. In most of the studies on small open economies, according to Coppin (1993), the demand-side factors are ignored, with the assumption that inflation is mostly due to external factors. To fill this gap, he examined the determinants of inflation in Barbados, to check whether demand-side effects, such as the level of real tourism activity, or supply-side effects, such as imported inflation and interest rates, are more important in explaining inflation in the country. He also examined the seasonal patterns in inflation in the country. Both demand-side and supply-side factors were shown to influence inflation in Barbados.

Holder and Worrel (1985) analysed whether domestic factors are more important than foreign factors in the inflation process in three Caribbean countries: Barbados, Jamaica and Trinidad and Tobago. Using least square regressions on a log-linear model, they found that foreign prices, exchange rate changes and trade barriers were important sources of inflation in all three countries. Domestic interest rates were important in determining inflation only in Barbados, while wages were important only in Jamaica.

A study by DaCosta and Greenidge (2008) on four Caribbean countries analysed the determinants of inflation in these countries using annual data from 1970 to 2006. Dynamic OLS were used to estimate their model, which included a large number of variables. They included inflation rate, oil prices, world prices, real national income, interest rates, unemployment rate, money supply and exchange rates. While not all the variables were significant for all the countries, for most of the countries, world prices, real national income, money supply, exchange rates and interest rates were important determinants of inflation.

The causes of inflation in Fiji were studied by Dewan, Hussein and Morling (1999), using a basic mark-up model similar to the model described in Equation 5.5. The main variables in the model were consumer price inflation, unit labour costs, import prices and output gap. The model was estimated as an unrestricted error-correction model. The results showed that about 75 per cent of the long-run movement in inflation comes from import prices and about 25 per cent from labour costs.

The above discussion on theoretical and empirical literature on inflation shows that there are a number of factors influencing developing countries, and no single theory can explain inflation in a given country. Moreover, the empirical evidence suggests that variables from different theories are important in explaining inflation in different countries. The factors identified by the literature as important determinants of inflation include money growth; exchange rate; fiscal deficit; real output gap; foreign prices; expected inflation; interest rates; nominal wages; unit labour costs; unemployment rates; and tax rates. Several studies model the determinants of inflation, drawing from different theories of inflation and using factors that seem to suit the particularities of the country or countries in focus. In a similar manner, this study will also take both external sector and monetary sector variables to model the inflation process in the Maldives.

5.3 Review of Literature on Exchange Rate Pass-Through

The effect of exchange rate changes on domestic prices has become an area of increasing interest for both academics and policy makers in developed and developing countries. As stated in the introduction of this chapter, the ERPT refers to the percentage change in the domestic prices, generally import prices, from a 1 per cent change in exchange rate. Percentage change in exchange rate to consumer prices or any other domestic prices, such as producer prices or wholesale prices are also referred to as ERPT. When a change in exchange rate is fully transmitted to import prices, then ERPT is said to be complete. In contrast, it can be zero if a change in exchange rate has no effect on import prices. In general, most countries experience incomplete or partial ERPT, which is when some exchange rate changes are reflected in import prices to some extent (Menon, 1995).

The degree and speed of ERPT has important implications for the choice of exchange rate regime. A fundamental argument in favour of flexible exchange rate regimes is their ability to adjust relative prices of a country when there is a country-specific real shock to the economy. This assumes that changes to NERs are quickly transmitted to import prices, leading to an expenditure-switching effect between imported goods and home-produced goods. Therefore, a high ERPT is required for this price adjustment process of flexible exchange rate regimes to work (Bache, 2006). However, as mentioned earlier, a flexible exchange rate regime in a high ERPT environment will mean greater exchange rate volatility and higher volatility in inflation. Therefore, in countries in which price stability is the prime objective, a fixed exchange rate regime is preferred if the ERPT is high.

There are two stages of ERPT: in the first stage, exchange rate changes are transmitted to import prices; and in the second stage, import price changes are transmitted to consumer prices. The extent to which the consumer prices reflect the changes in import prices will depend on the share of imported goods in the domestic consumer basket. In addition, consumer prices in the domestic economy may also rise if higher import prices induce consumers to switch to domestically produced goods, which will increase the aggregate domestic demand in the economy. This will create an upward pressure on the domestic prices as well as on the nominal wages (Bailliu & Bouakez, 2004).

As mentioned previously, ERPT is mostly incomplete and this reflects a departure from the LOP in traded prices. According to LOP, goods that are homogenous must sell for the same price when converted to the same currency, regardless of where it is sold and assuming that there are no transportation costs or barriers to trade. Due to the types of trade costs and pricing to market (PTM) strategies adopted by firms, LOP does not hold in the real world. PTM refers to industry's practice of discriminating price according to different destination markets. This is one of the most important determinants of ERPT. Exporters will be more willing to absorb the costs of exchange rate changes, leaving their prices unchanged, if they believe that other players in the market will not raise their prices and that consumers are relatively price sensitive. This is because they do not want to lose their market share, especially in large and important export markets such as the US. As a result, PTM in such a situation will be high and ERPT will be low. In contrast, when exporters face a highly differentiated market, they will be less likely to adjust their prices to exchange rate changes and importers will bear the costs. In this case, PTM will be low and ERPT will be high (Bailliu & Bouakez, 2004).

The invoice currency of exports is also important for ERPT and the optimal exchange rate regime. According to Devereux and Engel (2002), if exports are invoiced in producer currency, exchange rate changes are fully, or to a large extent, reflected in import prices. In such a situation, ERPT will be high and a flexible exchange rate regime would be beneficial in adjusting to country-specific external shocks. However, if exports are invoiced in local currency, the exchange rate has little effect on the import prices. In this case, the ERPT will be low and no benefits can be attained from having a flexible exchange rate regime.

The inflationary environment in a country, as discussed earlier, is also known to be a key factor in determining the ERPT. According to Taylor (2000), the decline in ERPT in developed countries is mainly the result of the low inflation that these countries have experienced since the 1980s or early 1990s. When inflation is low and stable, there is less persistent inflation, which leads to a reduction in the expected persistence of costs and price changes. Therefore, in a low-inflation environment, producers are more reluctant to pass on the costs to consumers. They fear that the other competitors might not follow the price increase and they might lose their market share. As a result, firms lose their pricing power, leading to a low ERPT.

Taylor's hypothesis of low inflation leading to low ERPT was tested by Choudhri and Hakura (2006) in a cross-sectional study of 71 countries using new open economy macroeconomic models. They found evidence of a strong and positive link between the average inflation rate and ERPT. However, this evidence is far from conclusive, as shown by Campa and Goldberg (2002) in their study of 25 OECD countries. They found that there is only a weak association between high inflation and exchange rate volatility and high ERPT. Moreover, microeconomic factors, such as the composition of imports, are more important in determining the ERPT. In a review of ERPT literature on Asian countries, Ghosh and Rajan (2007) found that pass-through tends to be high in countries that are relatively smaller and more open, and which have higher import content, limited domestic substitutes for imported goods and more exchange rate volatility.[30] Exchange rate misalignment has also been considered as a determinant of ERPT in some studies (Goldfajn & Werlang, 2000).

Most of the earlier empirical studies on ERPT are based on developed countries, especially larger economies like the US. However, in recent years, more cross-sectional studies and country-specific studies on developing countries have emerged, as there is now greater interest in the exchange rate issues of these countries. However, there are still not many studies on small island developing countries like the Maldives, and no such studies exist for the Maldives.

In a comprehensive survey of the literature on ERPT, Menon (1995) found that of the 43 studies that were included in his survey, more than half were on the US and Japan and many of the rest were on developed countries as well. The general conclusion from these studies is that pass-through is incomplete and time or lags

[30]Low ERPT when there is greater exchange rate volatility may also be due to the menu costs faced by firms. Menu costs are essentially costs associated with changing a firm's prices. However, menu costs may also include costs such as updating computer systems, re-tagging items and hiring consultants to develop new pricing strategies when prices changes.

taken for the transmission of exchange rate changes to prices are generally extensive. The empirical evidence on ERPT in developed countries shows that the ERPT in these countries has declined substantially since the 1980s and 1990s (Bailliu & Bouakez, 2004). Empirical literature on developing countries indicates that ERPT is very country specific and results cannot be generalised across the developing countries.

In a study of eight East Asian countries, Ito, Sasaki and Sato (2002) found that ERPT to import prices in Thailand was more than complete (over 166 per cent) while pass-through to consumer prices was at 26 per cent. Meanwhile, ERPT to import prices for Korea was not statistically significant, although it showed a 13 per cent pass-through to consumer prices. Ghosh and Rajan (2007) also examined the ERPT for Thailand and Korea and found that ERPT was higher for Thailand than for Korea. They did not find evidence of a reduction in ERPT for either of these countries, and in fact found ERPT to be higher since the Asian crisis. This was largely owing to the greater openness of the economy and greater volatility in exchange rates.

In a study of 25 developing countries, Barhoumi (2006) found evidence of high ERPT in the long run,[31] but the degree of pass-through was heterogeneous among the countries. He further examined the cross-country differences by taking into consideration the different exchange rate regimes and trade distortions in these countries. He found that fixed exchange rate regimes and lower trade barriers potentially lead to a higher ERPT to import prices in the long run compared to countries with floating exchange rate regimes and higher trade barriers.

As mentioned earlier, there are a few studies of ERPT in small countries like the Maldives. Looking at Jamaica, McFarlene (2002) analysed the ERPT to consumer prices in Jamaica, using monthly data from January 1990 to December 2001. He found that the degree of ERPT remains high for the country, but the

[31] Long-run is taken as 12 months.

speed of ERPT has declined substantially when the period 1990–1995 is compared to the latter period, 1996–2001. While the high pass-through is associated with the openness of the economy, the relative size of the economy and the relative elasticities of supply and demand in the country, the reduction in the speed of ERPT may be attributable to the more favourable macroeconomic environment. In particular, the low and stable inflation during the period 1996–2001 compared to the earlier period (1990–1995) may explain the reduction. Wimalasuriya (2007) empirically analysed the ERPT in Sri Lanka into different domestic prices, using monthly data from 2000–2005. She found the ERPT to be high for both import prices and consumer prices, though the pass-through effect is lower for consumer prices compared to import prices. He also found that pass-through to producer prices was complete within six months.

From the above review of the literature on ERPT, the following general conclusions can be made:

- ERPT is incomplete and pass-through decreases along the production chain (such as from import prices to manufacturing or wholesale prices to consumer prices).
- Both microeconomic as well as macroeconomic factors influence the degree of ERPT.
- ERPT has generally declined for developed countries.
- The degree of pass-through shows substantial cross-country heterogeneity. It also varies among different studies and across time horizons.
- Studies on small island economies are scarce.

As regards the extent of ERPT, it is expected to be high if the country has the following characteristics:

- High degree of openness of the economy
- Large share of imported goods in the consumer basket
- Imports invoiced in producer currency prices

- Low PTM
- Low trade barriers
- A fixed exchange rate regime

As the Maldives has most of these characteristics, it is expected that the ERPT to domestic prices will be high.

5.4 Developments and Sources of Inflation in the Maldives

5.4.1 Structure and Composition of Consumer Price Index

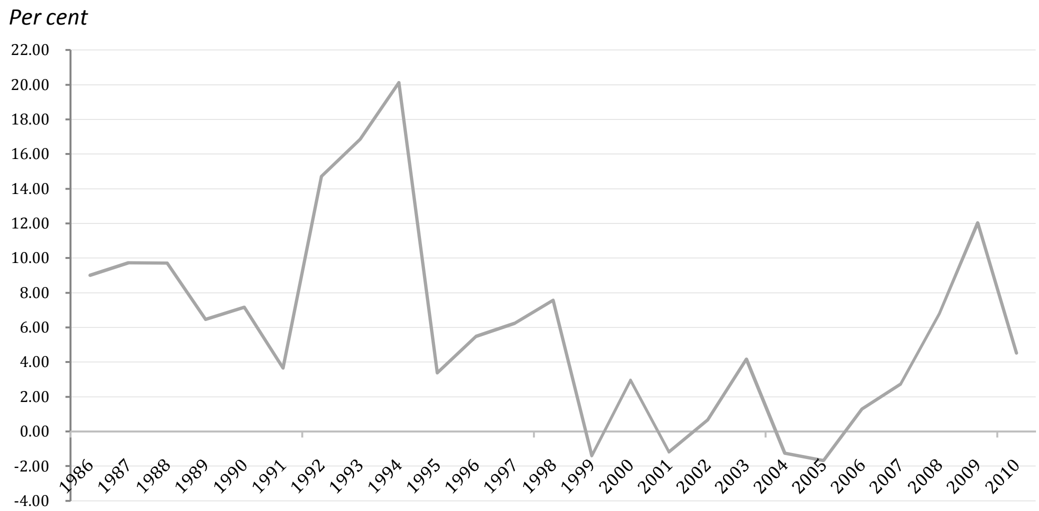
The extent of ERPT and the importance of different factors that influence domestic inflation depend very much on the composition of the CPI. The CPI is compiled on a monthly basis for the whole country (CPI National), for the capital Male' (CPI Male') and for the region, which excludes the capital Male' (CPI Atolls). However, only CPI Male' is available for any considerable length of time, as National and Atoll indices are only available from 2006. The CPI index has 13 categories, with the largest weights allocated for food (31 per cent) and housing, electricity, gas and other fuel (25 per cent).

The exchange rate effect on prices is expected to be very high in the Maldives, as the tradable sector is very large, while the non-tradable sector is very small. In Chapter 3, the consumer basket used for the CPI was decomposed into tradables and non-tradables. This analysis showed that about 90 per cent of the tradable goods in the CPI are imports and about 58 per cent of the total CPI basket comprises imported goods. While the services in the consumption basket were classified as non-tradables, as discussed in Chapter 3, these services are also greatly influenced by exchange rates in the country (see Section 3.3). Consequently, very few items in the consumer basket in the Maldives are devoid of any influence from foreign factors such as international prices and exchange rates.

5.4.2 Inflation Developments

Inflation in the Maldives has been volatile in the period under review (1990–2010), with two episodes of very high inflation, as can be seen in Figure 5.1. Food prices are the main source of inflation in the country, as these constitute about one-third of the CPI basket. Most of the goods in the consumer basket are imported and this makes domestic inflation vulnerable to international prices.

Figure 5.1: Annual inflation rates, 1986–2010



Source: Maldives Monetary Authority (2009, 2011)

Inflation, which came down from almost 10 per cent in 1986 to about 4 per cent in 1990, increased to a record high of 20 per cent over the following three years. This was a time of serious macroeconomic imbalance in the country, stemming from both external and domestic factors. On the external front, the tourism and fisheries sectors, which were the dominant sectors in the economy, were adversely affected by weak tourism markets and low international fish prices. The current account deficit as a percentage of GDP rose to almost 17 per cent in 1993, from just about 6 per cent in the previous two years. On the domestic front, following surplus budgets in 1987 and 1988, the deficit ballooned in the subsequent years, reaching a high of 14 per cent of GDP in 1991. The growing budget deficits largely resulted from the government's recurrent expenditure, owing to increases in wages and salaries for government employees and extravagant spending on two events: the 25th Anniversary of Independence of the Maldives and the hosting of the annual conference of the South Asian Association for Regional Cooperation (SAARC) in 1991. The deficit was financed mainly by monetisation and, as a result, monetary growth became excessive (an annual growth of 36 per cent in broad money).

Following this episode of macroeconomic destabilisation, the government implemented several macroeconomic and structural reforms in 1994. This included the formal adoption of an exchange rate peg to the US dollar, moving away from the previous policy of a highly managed exchange rate regime. Due to the stabilisation measures, the government budget deficit and the current account deficit as a percentage of GDP was reduced dramatically to 5 and 3 per cent, respectively, in 1994. Consequently, inflation also came down to 3 per cent at the end of the year. Inflation remained subdued in the second half of the 1990s, mainly because of the steady appreciation of the nominal effective exchange rate, which had been taking place since 1995. The low prices of fish in the domestic market also contributed to the low inflation. Moreover, imported prices of clothing and footwear declined in 2000, contributing to the overall decline in prices in 2000 and a negative rate of inflation for the year. The public sector[32] wage increase of 35 per cent in September 1999 did not seem to affect overall inflation in 2000.

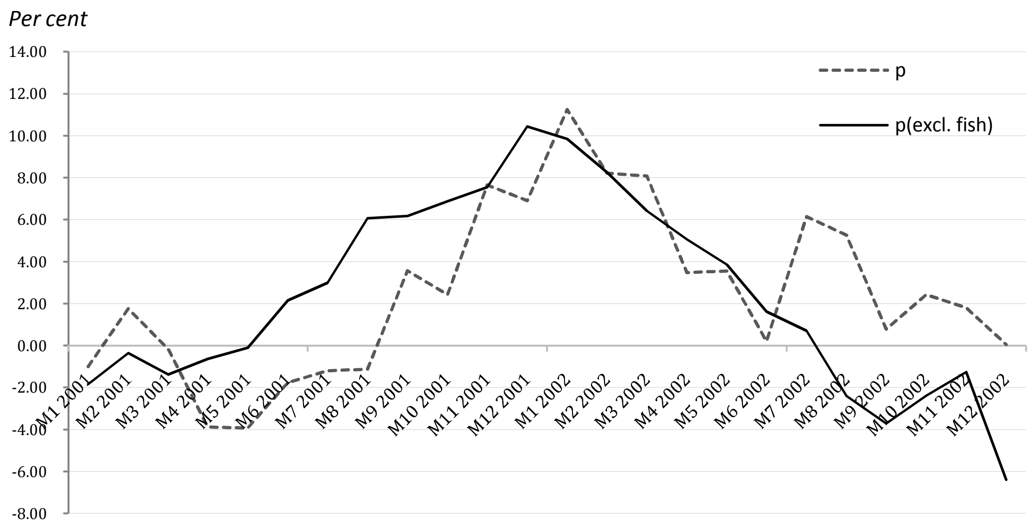
In a small open economy like the Maldives, a devaluation of the exchange rate is expected to feed through to inflation through higher import prices. In 2001, the rufiyaa was devalued by 9 per cent against the US dollar. While the average rate of inflation[33] for the year did not increase substantially in 2001 (see Figure 5.1), the year-on-year inflation registered a significant increase. The monthly inflation rates during 2001 and 2002 are shown in Figure 5.2. The year-on-year inflation rate at the end of 2001 was about 7 per cent, in contrast to the negative rates of

[32] The public sector in the Maldives is large, with the government administration accounting for about 13 per cent of GDP.

[33] The annual inflation rate here is calculated using the average monthly indices of CPI for the year, as this is more representative of the actual inflation during the year than the year-on-year inflation rates. However, the latter are also useful when analysing the monthly developments.

inflation in the first half of the year. The inflation rate, excluding the more volatile domestic prices,[34] is also shown in Figure 5.2. This figure reveals that inflation was already rising prior to the July 2001 devaluation. This is because, in the period leading up to the devaluation, the foreign exchange market was very tight and there was a large black market. As a result, the cost of imports was on the rise in local currency terms, as the black market exchange rate was significantly higher than the officially fixed rate. The resulting increase in domestic consumer prices is an indication of the high ERPT in the economy. The high import costs associated with the exchange rate devaluation was passed on to the consumers, especially for food imports.[35] This was despite the decline in the fish index and the depressed demand in the economy, due to the private sector wage reductions in response to the economic downturn following the 11 September terrorist attack in the US. Following the stabilisation of the high import prices in the second half of 2001 and in the following year, the inflation rate fell steadily over the period 2002–2004.

Figure 5.2: Inflation rates and inflation (excluding fish prices), 2001–2002



Source: Maldives Monetary Authority (2009, 2011)

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[34] Fish and fish products have a 5 per cent weight in the CPI basket. The fish index is usually very volatile, reflecting the daily demand and supply of fresh fish in the local fish market in Male'. The year-on-year increase in the fish index in 2001 was 30 per cent.

[35] As discussed in Section 5.4, most of the items in the food category, apart from fish, are imported.

In the years following the 2004 tsunami, inflation began to rise again in the Maldives. As the reconstruction of the islands and tourist resorts damaged by the tsunami began, supply-side bottlenecks arose, as all construction materials are imported. While there is an unlimited supply of goods available for import from international markets, the handling capacity for imports into the Maldives is limited, as the existing customs and port infrastructure is constrained. As a result, upward pressure was placed on the price of consumer goods. This was also a period of rising global food prices and oil prices, which further contributed to rising inflation. Another factor contributing to the upward surge in inflation in the years following the 2004 tsunami is related to the increased migration of people from the outer islands to the capital, Male'. This increased the demand for rental properties in Male' and, given the shortage of such properties on the island, drove up rental prices. The only dampening effect on inflation during the post-tsunami period came from the decline in the communication index because of the reduced telecommunication rates stemming from the opening up of the mobile phone services sector. At the end of 2008, inflation reached a peak of 12 per cent as the prices of most of goods and services in the consumer basket increased significantly. However, inflation rates were moderated somewhat in 2009 and 2010, to 5 per cent and 6 per cent, respectively. This reflected the deceleration of world commodity prices and domestic fish prices.

Based on the above analysis of the developments in inflation, together with the main variables identified in the theoretical and empirical literature, expected sources of inflation for the Maldives are described in the next section.

5.4.3 Sources of Inflation

Being a small and open economy, it is generally believed that inflation in the Maldives is imported. Apart from exchange rate movements, which would be reflected on the imported value of a good, the final price of an imported good that is sold in the domestic market is also influenced by changes in costs associated with structural factors such as transportation, storage, finance, insurance, wholesaling and retailing. However, due to the unavailability of data on these structural factors, it is not possible to examine their contribution to inflation.

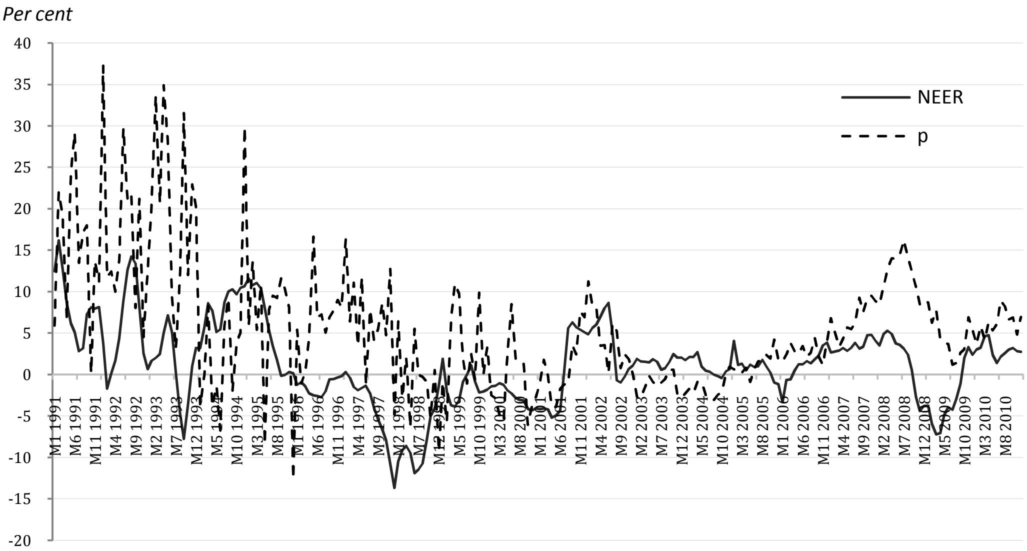
Drawing from the theoretical and empirical literature and the analysis on the developments of inflation in the Maldives in the past two decades (1990–2010), several sources are identified as possible determinants of inflation. They include the NEER, foreign prices, monetary factors (money supply, credit to the private sector and credit to the government), budget expenditure, real GDP and wage levels. The relationships between these variables and inflation are discussed below.

Nominal exchange rates and inflation

The NEER used in this study is the import-weighted exchange rate constructed in Chapter 3 of this study. As the Maldives have a fixed exchange rate to the US dollar, the changes in the US dollar against the major trading partners of the Maldives changes the exchange rate between the Maldivian rufiyaa and the currencies of its major trading partners accordingly. Given that the Maldives trades very little with the US, the exchange rate changes of major trading partners is captured in the NEER.

The developments in the NEER are shown in Figure 5.3. In this chapter NEER measured in terms of domestic currency units per unit of foreign currency is used. Therefore, a decline in the value of the NEER represents an appreciation of the Maldives rufiyaa against an import-weighted basket of currencies, while an increase represents a depreciation. Depreciation of the NEER makes the imports into the country more expensive, resulting in higher import prices. This directly translates to higher consumer prices in the Maldives. As most of the inputs in the domestic production of goods and services are also imported, higher import prices of inputs also influence consumer prices. As such, a depreciation of the currency should be associated with an increase in inflation and an appreciation should lead to a decline in inflation. The developments seen in Figure 5.3 seem to suggest the existence of such a relationship, especially in more recent years.

Figure 5.3: Annual growth in NEER and inflation rates (p), 1991-2010



Source: Maldives Monetary Authority (2009, 2011)

Foreign prices

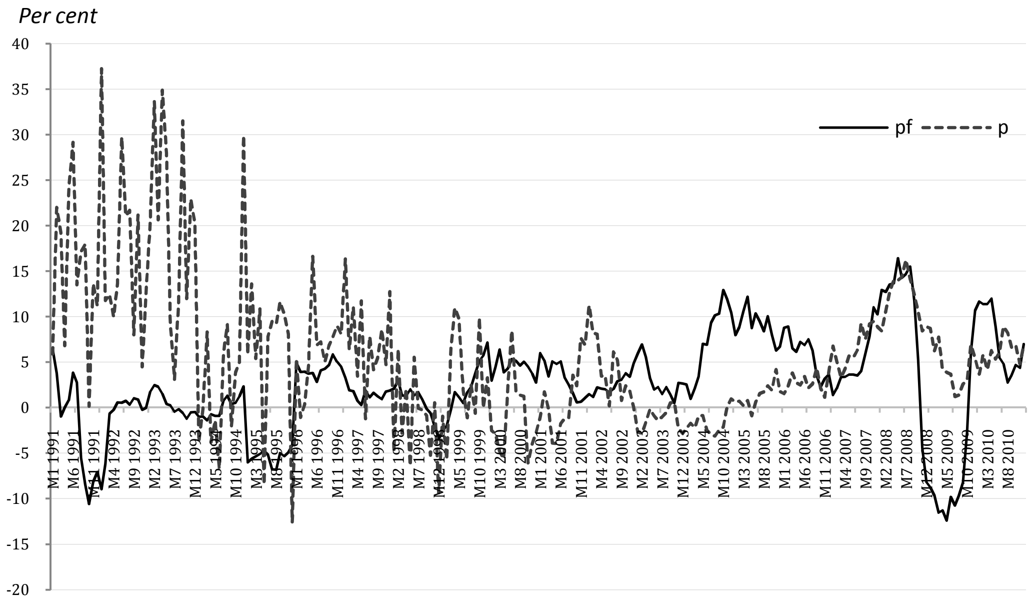
Foreign inflation can transmit to inflation in the domestic economy directly and indirectly. Higher import prices will be reflected almost instantaneously in the goods imported for final consumption and this will normally show as a proportional increase. Higher import prices of inputs into production are indirectly transmitted to consumption goods, with a time lag before the higher prices are reflected in the domestic prices of these goods.

The best indicator of foreign prices is the import price index. However, as discussed in Chapter 4, such data is not available for the Maldives. Instead, the PPI of the Maldives' major trading partners, weighted by their import share in the total imports of the Maldives, as constructed in Chapter 4, is used in this chapter.

The growth in foreign prices, as measured by the PPI of the major trading partners, is shown in Figure 5.4, along with the rate of inflation. As in the case of the NEER, the inflation rate moves in tandem with the changes in foreign prices. However, the changes in inflation and the foreign prices are not proportional.

This is expected, as domestic inflation is influenced by other factors, such as the prices of non-tradable items in the consumption basket.

Figure 5.4: Annual growth in foreign prices (p^f) and inflation rates (p), 1991-2010

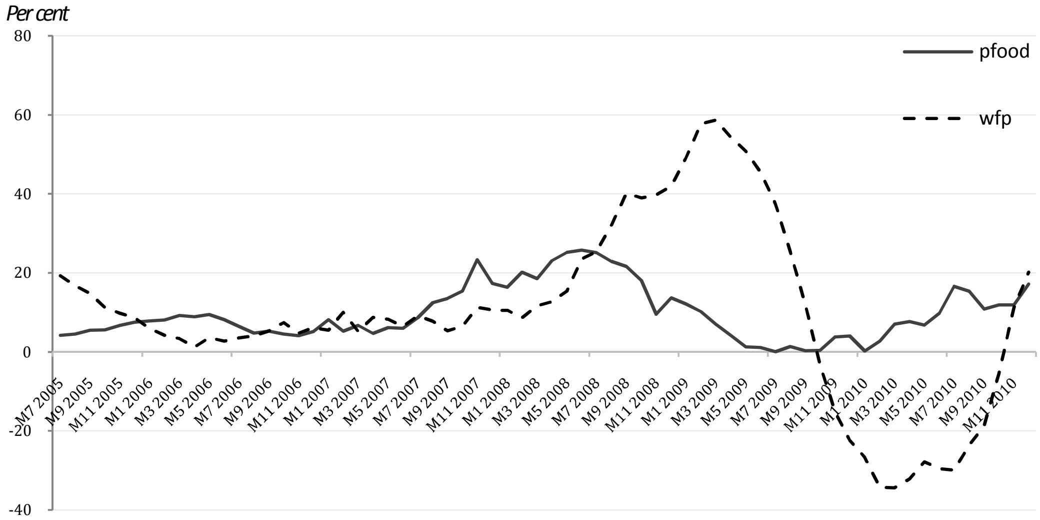


Source: Data constructed from IFS Database (2009)and Maldives Monetary Authority (2009, 2011)

As mentioned before, about one-third of the CPI consists of food items, the majority of which is imported. Therefore, the relationship between world food prices and food inflation in the country becomes important.[36] Developments in world food prices, together with domestic food inflation (as a percentage change in the food price index), are shown in Figure 5.5. Domestic food prices are shown to respond to changes in world food prices, but the rate of increase in domestic food prices is slight compared to the increase in world food prices. Moreover, the fall in world food prices has had a subdued effect on domestic food inflation. The reason for the limited relationship between the two factors may relate to the administered prices of staple foods in the country, these being rice and flour.

36 The food price index is only available from June 2004 on a comparable basis.

Figure 5.5: Annual growth in world food prices and food inflation rates, 1990-2010

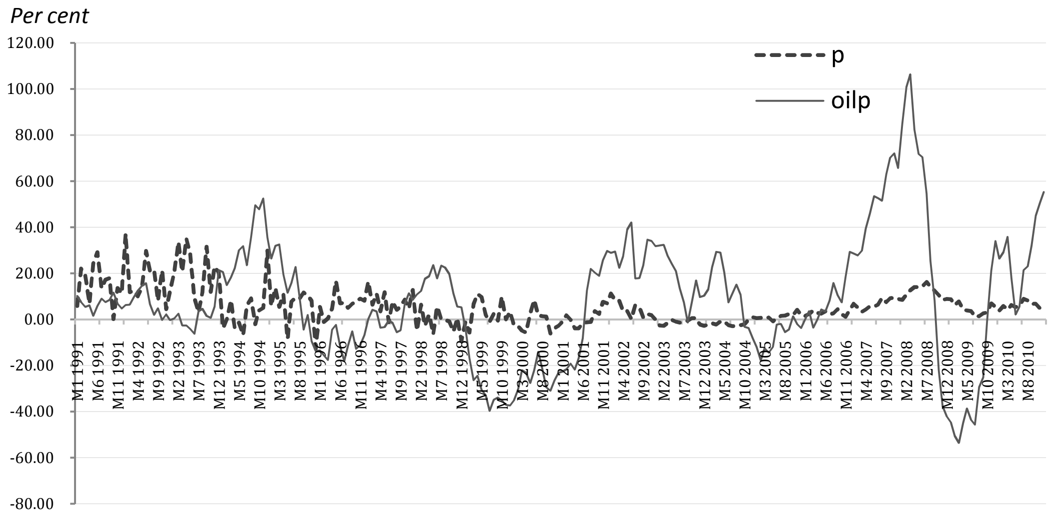


Source: FAO (2011) and Maldives Monetary Authority (2009, 2011)

The price of oil affects the domestic economy in most countries. The Maldives is particularly dependent on oil imports, as the main industries of the country have high dependence on and a highly inelastic demand for oil. Oil imports account for about 20 per cent of total imports in value terms. In the case of tourism, oil affects the transportation of both goods and tourists to the tourist resorts. In addition, each resort generates its own power, requiring oil supplies. As regards the fisheries sector, the consumption of oil is high, especially given that large fishing vessels are now engaged in fishing activities. Given that the Maldives are a small chain of islands, with 200 inhabited islands spread across 900,000 square kilometres, sea transport is paramount to the economy.

As Male' is the hub of the wholesale and retail sectors, most of the goods consumed in the rest of the country are distributed from Male'. However, the direct impact of oil observed on the domestic consumer prices in Male' (which is the CPI index used in this analysis, as discussed earlier) is very little. Consumer goods and services that are influenced by international oil prices, such as electricity charges in Male', are heavily regulated and subsidised by the government. Therefore, the direct impact of oil price changes is not observed in the domestic consumer prices. The lack of responsiveness of inflation to oil prices is evident from Figure 5.6.

Figure 5.6: Annual growth in international oil prices (oilp) and inflation rates (p), 1991-2010

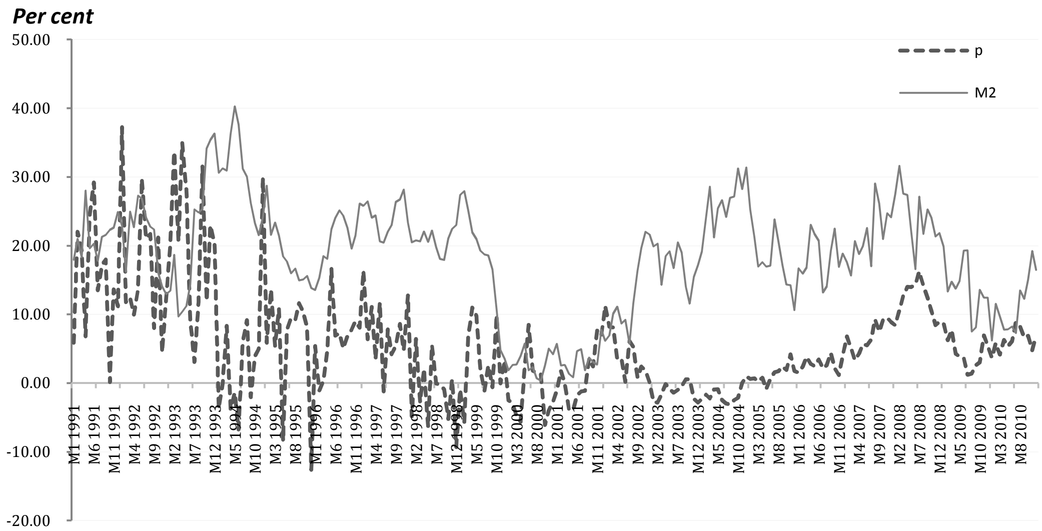


Source: FAO (2011) and Maldives Monetary Authority (2009, 2011)

Monetary growth and inflation

According to the monetarist view of inflation, excessive growth in money creates inflation. Figure 5.7 shows the developments in inflation together with broad money (M2) in the Maldives. This is the widest monetary aggregate of money supply and measures the total liquidity in the system. Given the high credit demand in the economy, especially from the tourism sector, and the frequent deficit monetisation by the government, the growth in M2 has remained high in most years. This is seen in Figure 5.8 in the rapid expansion in credit to the government as well as to the private sector. The decline in private sector credit in 2009 and 2010 reflects the downturn in the economy and the increased caution on the part of commercial banks in their lending activities after the global financial crisis.

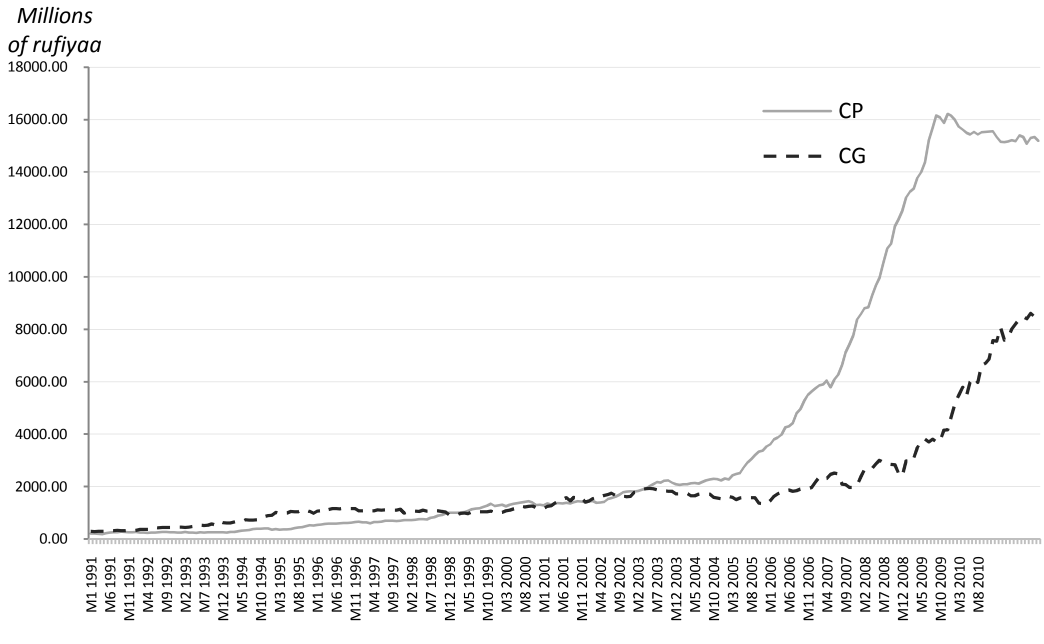
Figure 5.7: Annual growth in money supply (M2) and inflation rates (p), 1991-2010



Source: Maldives Monetary Authority (2009, 2011)

While the impact of monetary expansion will be seen in inflation, probably with a lag, it can be seen from Figure 5.7 that there is some correlation between broad money and inflation. The rapid expansion in credit in the economy also creates inflationary pressure due to the existence of supply-side bottlenecks. As almost everything is imported in the Maldives, the rapid growth in private sector credit and credit to the government increases the demand for imports. Importers frequently face foreign currency shortages when there is a rapid increase in demand for imports. This shortage is also severe during times of tourism downturns, as it curtails foreign exchange inflows to the country. In addition, the limited infrastructure and capacity constraints in areas such as port facilities and inter-island transport contributes to inflation in the domestic economy.

Figure 5.8: Credit to the private sector (cp) and credit to the government (cg), 1991-2010



Source: Maldives Monetary Authority (2009, 2011)

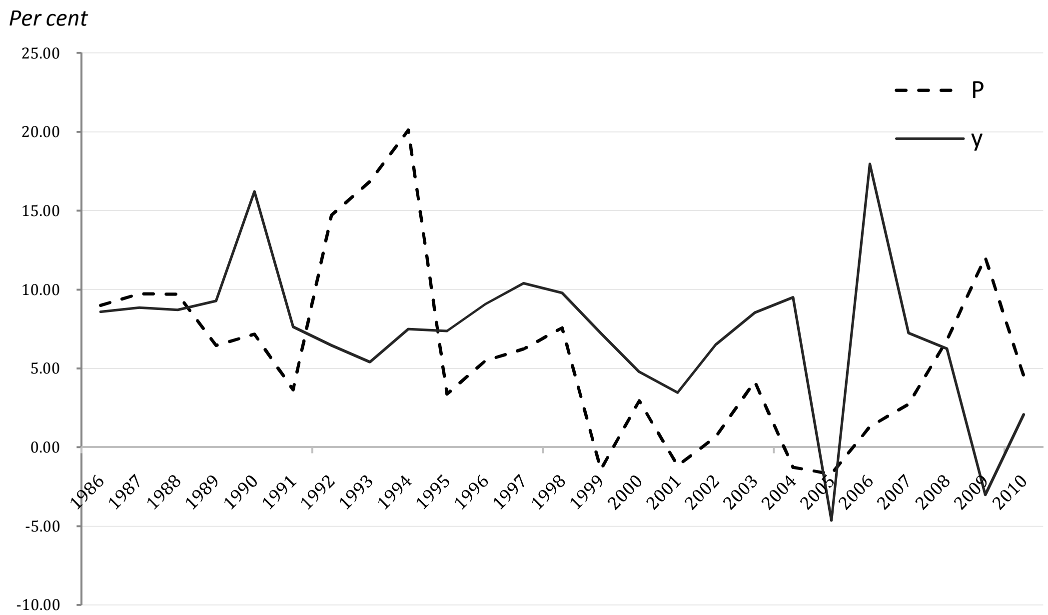
Wage increases and inflation

In the Maldives, the labour market is not very developed. There are no labour unions, and labour rights are very limited. In addition, the large pool of cheap expatriate workers available from neighbouring countries has led to limited (often no) bargaining power for employees. There is no data available on the wage levels in the country, especially in the private sector. The only available information on wages is the total wage bill of the government, in annual terms. However, the total wage bill of the government is not a good indicator of the general wage levels in the country. This is because the wage bill changes with shifts in the composition of employees, such as more employees in higher positions than in the previous year. In recent years, government sector employment has been politically motivated, with extensive and erratic job promotions given to employees with certain political affiliations. Further, the wage levels of the government are generally increased after every election (every five years), often leading to a wage spiral in the private sector. This promotes inflation, as the cost of inputs in the private sector increases when the wage level rises. However, in the absence of data on wage levels, it is difficult to gauge the relationship between the two.

Real gross domestic product and inflation

According to the empirical and theoretical literature, real GDP growth eases the demand pressures in the economy, leading to a decline in the rate. Since real GDP data are only available on an annual basis, Figure 5.9 shows the annual developments in real GDP and inflation rates. As shown, the relationship between the two variables seems to be positive rather than negative. This might be a sign of overheating in the economy.

Figure 5.9: Annual growth in real GDP (y) and inflation rates (p)

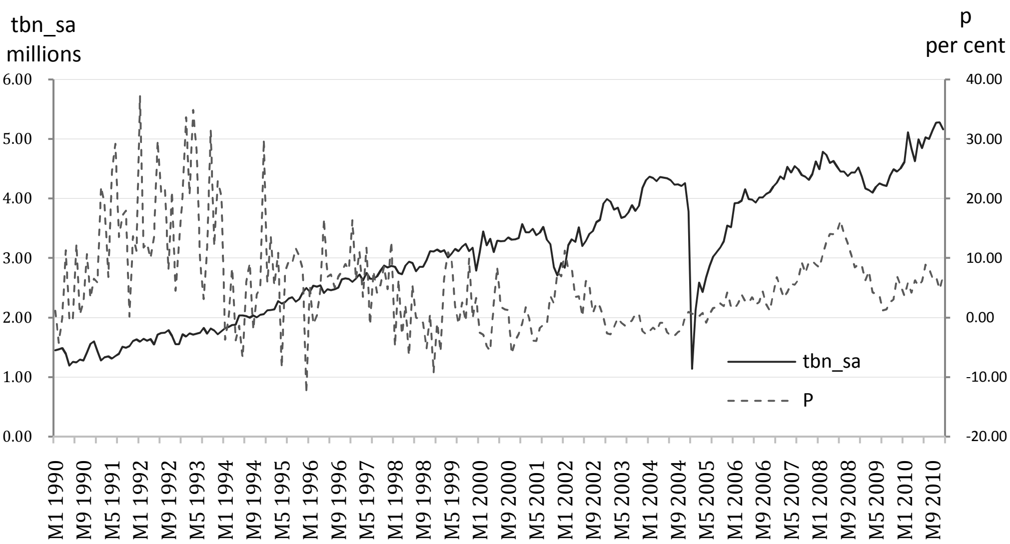


Source: Maldives Monetary Authority (2009, 2011)

In a study by Coppin (1993) on Caribbean countries, he asserts that in tourism-dependent countries, the real GDP is driven by the tourism sector, and an expansion in tourism will lead to higher inflation. He argues that tourists will compete with locals for the available consumption and infrastructural goods, driving up domestic prices, assuming tourism activity does not take place in an enclave. In the case of the Maldives, tourists do not directly compete with locals for such goods, as tourism does in fact take place in an enclave (in the sense that tourists are located on separate tourist islands). These islands are solely for the purpose of tourism and almost all tourism activities take place in these islands. Given the high import dependence of the economy, which is even higher in the tourism sector, the demand for goods is met by imports. However, if the demand for imports is not met due to the structural bottlenecks in the economy, as discussed earlier, an increase in tourism could lead to a rise in inflation.

Therefore, an increase in tourist bed nights can increase or decrease inflation. In Figure 5.10, the relationship between tourist bed nights and inflation rates shows different trends during different periods. In the 1990s, inflation was too volatile and tourism was expanding too rapidly to discern any visual relationship between the two. During the period 2000–2004 (prior to the tsunami), a negative relationship is seen, after which inflation seems to positively track tourist bed nights. However, since this latter period was the post-tsunami reconstruction period, the developments in inflation cannot be associated simply to tourism developments.

Figure 5.10: Tourist bed nights, seasonally adjusted, (tbn_sa) and inflation rates (p), 1990-2010



Source: Maldives Monetary Authority (2009, 2011)

5.5 Modelling the Inflation Process in the Maldives

5.5.1 Theoretical Framework

Following the analysis of the sources of inflation in the Maldives in Section 5.4.3, this section first specifies an inflation model for the Maldives. There are several theories that have been developed to explain inflation under various circumstances, as discussed in Section 5.2 of this chapter. The theoretical specification for the empirical model used in this section is based on a simple model of price determination in a small open economy. Small open economies are heavily dependent on imports and are generally price takers. Therefore, domestic prices in the country are influenced by foreign prices and changes in NERs. Based on these assumptions, the model specified below uses a tradable and non-tradable sectors framework to determine overall prices in the economy:[37]

$$P_t = f({P_t}^T, {P_t}^{NT}) \tag{5.7}$$

where price P_t is a function of the prices in the tradable sector, ${P_t}^T$, and the prices in the non-tradable sector, ${P_t}^{NT}$. The prices in the tradable sector are determined by the world market and the prices of these in the domestic economy is a function of foreign prices (p_t^f) and NER (E_t), assuming that PPP holds. This is given in Equation 5.8:

$${P_t}^T = f(E_t, p_t^f) \tag{5.8}$$

Domestic prices will increase if the exchange rate depreciates or foreign prices increase. Equation 5.8 can be regarded as an equation of external inflation, as discussed in Section 5.2.1.

Prices in the non-tradable sector are determined in the domestic money market and this can be specified using the quantity theorem of money. This was dis-

[37] The model specified here draws from inflation models used in studies of small developing economies, such as those of Cumberbach (1995), Downes, Holder, & Leon (1991), Moriyama (2009) and Williams and Adedeji (2004).

cussed in Section 5.2.1 and the Equation 5.3 is re-stated below (see Equation 5.9) in the context of the framework developed here:

$$MV = P_t{}^{NT} Y \tag{5.9}$$

where M is the money supply, V is the velocity of money, and Y is the real GDP.

Taking the natural logarithm of Equation 5.9 and solving for prices gives the domestic prices as a function of money supply, real GDP and velocity (which usually declines with financial deepening, and thus has a negative time trend). This is given in Equation 5.10.

$$p_t{}^{NT} = m_t - y_t + \theta t + \eta \tag{5.10}$$

where θt is the time-trending velocity and η represents the disturbances of the velocity other than the time-trend component.

The overall price level in the economy is derived by taking the natural logarithm of Equation 5.8 and substituting it, together with Equation 5.10, into Equation 5.7, as specified in Equation 5.11.

$$p_t = f(e_t, p_t^f, m_t, y_t) \tag{5.11}$$

According to Equation 5.11, the overall price level is positively related to the NER changes (e), foreign prices (p_t) and the money supply (m), while negatively related to real GDP (y). An increase in real GDP is expected to depress inflation on the assumption that nominal GDP is fixed for a given money supply.

5.5.2 Model Specification, Data and Variables Definition

Following from Equation 5.11, the long-run inflation equation for the Maldives is specified in Equation 5.12:

$$p_t = \beta_0 + \beta_1 e_t + \beta_2 p_t^f + \beta_3 m_t + \beta_4 y_t \tag{5.12}$$

The definitions of the variables and their units of measurement included in Equation 5.12 are given in Table 5.1, below.

Table 5.1: Variable definitions

Variable	Description
p	Overall price level in the economy, measured by CPI (June 2004 = 100, log transformed)
e	The NEER, defined as foreign currency per unit of domestic currency (2000 = 100, log transformed)
p^f	Foreign prices, measured as the import-weighted PPI of the major trading partners (2000 = 100, log transformed)
m	Money supply, measured using broad money supply, M2 (in millions of rufiyaa and in logs)
y	Real income in the economy, proxied by tourist bed nights (in millions of bed nights and in logs)

In Equation 5.12, the overall CPI index for Male' is used as the general price level. As mentioned in the introduction, the CPI is the only price index available consistently for a reasonable period. The choice of CPI for Male' is dictated mainly by data availability. Since, the national CPI data is only available from 2005, and both the series follows the same trend, CPI for Male' is deemed appropriate for the inflation analysis for the country. It would also have been interesting to analyse the determinants of food inflation in the country, as this comprise about one-third of the consumer basket. However, given the lack of consistent time-series data, such an analysis was not possible.

The variable e is the NEER. The NEER is defined in terms of foreign currency per unit of domestic currency. This means that an increase in NEER is a depreciation of the local currency and a decrease in NEER is an appreciation. The NEER used here is an import-weighted exchange rate. A positive relationship is expected between the two variables and the larger the coefficient on NEER, the greater the ERPT.

The variable p^f represents the foreign prices that influence domestic inflation. As discussed in Section 5.5.2, there are a few choices for the foreign prices. While the best choice would be unit import prices as these would be more representative of the prices actually paid for the imports, such data are not available for the Maldives. Studies commonly use CPI or PPI of major trading partners, world food prices or international oil prices to represent foreign prices. Of these, this study has chosen to use an import-weighted average of the PPI of the major trading partners, since the dependent variable is the overall inflation. As for the relationship between the foreign prices and domestic prices, a positive relationship is expected. Given the price taker and import dependence assumptions of small open economies, as discussed in the theoretical model, a rise in foreign prices will lead to an increase in domestic prices.

The variable m is the money supply represented by broad money, M2. The theoretical literature does not provide any guidance on which monetary indicator to use and different studies use different monetary aggregates. This analysis uses M2 as the money supply variable, as it is more representative of the total liquidity available in the economy. It is expected that an expansion in money supply will induce higher inflation.

As the data on real GDP are available only on an annual basis, a proxy variable is used to represent real income in the economy, y, in the inflation model. Given that more than one-third of the GDP is directly attributable to the tourism sector and the growth in real GDP closely tracks the growth in the tourism sector, specifically tourist bed nights, the latter is used to proxy real GDP in the Maldives. This was seen as a more suitable option than interpolating annual data into monthly data, due to the absence of any related series (with the exception of tourist bed nights) that could be used for interpolating annual real GDP data into monthly data.

The relationship between inflation and real GDP is ambiguous, as it depends on which supply-side or demand-side factors are at play. The supply-side argument posits that if an increase in the supply of goods and services outmatches the demand, prices will decline. Conversely, if the demand for goods and services is not matched by supply, domestic prices will increase. In addition, in the case of the Maldives, tourism inflows affect the rate of inflation in the country through another channel. As mentioned on several occasions, the Maldivian economy is highly dependent on imports, but the foreign currency required to purchase imports is not always readily available. Dollar shortages are common and often commercial banks impose limits on the purchase of US dollars, especially at times of low foreign exchange inflows. Further, commercial banks in the Maldives only issue letters of credit to importers if they submit the required amount of US dollars. Importers sometimes resort to higher black market rates to obtain US dollars. These factors lead to the higher prices of imported goods in the domestic market. As foreign exchange inflows are directly linked to tourism inflows, improvements in the tourism flows ease the dollar shortages in the market. Given these factors, the relationship between the real GDP and inflation in the Maldives is ambiguous.

The empirical analysis is conducted using monthly data from January 1990 to December 2010 (240 observations). The data was obtained from the MMA (2009, 2011), with the exception of the PPI data. This was obtained from the IMF's International Finance Statistics online database (IFS Database, 2009). In addition to the variables included in the model, impulse dummies were included to capture the December 2004 tsunami impact. As mentioned in Chapter 4, three impulse dummies for the first three months of 2006 were also included to take into account the tsunami impact. The reason for including separate dummy variables for each month instead of one annual dummy was to capture the impact on each month, as the effects of the tsunami were stronger in the first month after the tsunami as compared to the subsequent months. In addition, two shift dummies and seasonal dummies were also included.

5.5.3 Methodology

The inflation equation is modelled using cointegration analysis and the ECM approach. This approach to econometric modelling is discussed in Chapter 4, and as the same methodology is used, it will not be discussed again in this chapter. The cointegrating analysis is based on an unrestricted VAR model, which can be specified as in Equation 5.13:

$$Z_t = A_1 Z_{t-1} + \ldots\ldots.. + A_k Z_{t-k} + Bx_t + \mu_t \tag{5.13}$$

where Z_t is a (n x 1) vector of endogenous variables used in the model, which is $Z_t = [p_t, e_t, p_t^f, m_t, y_t]'$, a (5 x 1) matrix, and each A_i and B representing an (n x n) or a (5 x 5) matrix of parameters. x_t is a (5 x 1) matrix of deterministic variables, such as constant and time trend, and μ_t is a (5 x 1) matrix of independently and normally distributed errors.

In this chapter, the short-run dynamics of the variables in the inflation model will be analysed using impulse response functions and variance decomposition analysis in a VECM framework. Impulse response functions (IRF) trace the effect of a one standard deviation shock to one endogenous variable on the other variables in the VECM. Therefore, the IRF will allow for identifying the magnitude and persistence of consumer prices changes to variations in its main determinants of inflation. The response of consumer prices from a shock to the exchange rate change will be used to calculate the ERPT to the CPI in the Maldives. As regards the variance decomposition, they are used to identify the percentage of the forecast variance in any variable that can be attributed to its own shocks versus shocks to other variables (Enders, 2004).

5.5.4 Empirical Results

Unit roots and order of integration

All the variables were tested for unit roots using the ADF test. As a plot of the time series would provide an indication of whether or not to use a constant, a constant and a trend, or none, a graphical representation of the time-series data for each variable was conducted (see Appendix 3, Figure A3.1). The plots of the data showed that all the variables fluctuated around a linear trend. Therefore, the test equation that includes both a time trend and a constant was used for testing unit roots for all the variables. To apply the ADF test, the number of lagged terms to be included in the test equation also had to be specified. This was determined based on the SIC, but additional lags were included when autocorrelation was found in the residuals, until it was eliminated. The results of the unit root tests shows that the null hypothesis of a unit root cannot be rejected at 5 per cent significance levels for the variables in levels. Therefore, unit root tests were carried out on the first difference of the variables, which showed that all the variables are stationary at first difference, indicating that each series is integrated at the same order—I(1). These results are shown in Table 5.2.

Table 5.2: Unit root tests

Variable	No. of Lags	Levels		First Differences		Result
		ADF test stat.	ADF critical val. at 5 %	ADF test stat.	ADF critical val. at 5 %	
p	6	-2.89	-3.43	-10.77	-3.43	I(1)
e	2	-3.17	-3.43	-9.06	-3.43	I(1)
p^f	1	-1.97	-3.43	-12.08	-3.43	I(1)
m	0	-2.29	-3.43	-16.18	-3.43	I(1)
y	13	-3.28	-3.43	-4.85	-3.43	I(1)

Note: The null hypothesis of unit root is rejected if ADF test statistic < ADF critical value. The ADF critical values are MacKinnon (1996) one-sided p-values, provided by EViews software.

Given that all the variables included in the model are non-stationary and integrated at I(1), cointegration tests allowed the identification of any long-run equilibrium relationships among the variables. As mentioned previously, Johansen's (1995) cointegration procedure is used to test for cointegration. As for the lag selection, the SIC information criteria is used, and the model that minimises the SIC and eliminates autocorrelation is a model with seven lags.

An unrestricted VAR model with seven lags and five variables (as identified in Equation 5.12 and including e_t, p_t^f, m_t, y_t as endogenous variables and a set of dummy variables) is estimated to conduct the Johansen cointegration test. The results of the cointegration test are presented in Table 5.3. Both the trace statistic and maximum eigenvalue strongly rejects the null hypothesis of no cointegration and at least one cointegrating vector, but does not reject the null that the number of cointegrating vectors is two. This means that there are two cointegrating vectors in the variables included in the model.

Table 5.3: Johansen cointegration test

Null Hypothesis	**Eigenvalue**	**Trace Statistic**	**5% Critical Value**
H_o: r = 0*	0.21	122.97	69.82
H_o: r ≤ 1*	0.18	66.33	47.86
H_o: r ≤ 2	0.04	19.08	29.80
H_o: r ≤ 3	0.04	8.90	15.49
H_o: r ≤ 4	0.00	0.21	3.84
Null Hypothesis	Eigenvalue	Max-Eigen Statistic	5% Critical Value
H_o: r = 0*	0.21	56.64	33.88
H_o: r ≤ 1*	0.18	47.24	27.58
H_o: r ≤ 2	0.04	10.18	21.13
H_o: r ≤ 3	0.04	8.68	14.26
H_o: r ≤ 4	0.00	0.21	3.84

** Denotes rejection of the hypothesis at the 0.05 level. The trace test indicates 2 cointegrating eqn(s) at the 0.05 level. The max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level*

The existence of two cointegrating vectors is in line with the theoretical foundations of the inflation model that has been specified for the Maldives. The first cointegrating vector can be interpreted as the long-run relationship between the NER, foreign prices and domestic consumer prices. The existence of a long-run relationship between these three variables can be taken as an indication that the absolute version of PPP holds for the Maldives in the long run. This is the equation established in Equation 5.1, which can also be regarded as an equation of external or imported inflation. The second cointegrating vector is taken as the long-run equilibrium between money supply, real income and domestic consumer prices. This is the money demand relationship given in Equation 5.3. Therefore, restrictions were imposed to split the model into two: an external inflation model and a monetary inflation model, which is consistent with economic theory.

The existence of cointegration means that the VECM specified in Equation 5.14 can be estimated. The VECM estimated using the variables specified in the inflation model is presented in Appendix 3, Table A3.1, and the results are discussed below. In terms of diagnostic tests, the VECM is checked for serial autocorrelation and normality. Both the Portmanteau test and LM test showed that residuals are free of serial correlation. However, the normality test of Jarque-Bera failed due to kurtosis in the residuals. As mentioned in Chapter 4, Gonzala (1994) and Hubrich (1999) show that the Johansen procedure for VECM is robust under non-normal residuals, and therefore the estimates remain valid.

Long-run cointegration relations

The long-run relationships for the two cointegrating relations identified by the VECM give the estimated long-run equations for the external inflation model and monetary inflation model. They are presented in Equations 5.15 and 5.16, with their t-statistics in brackets. All the variables are statistically significant.

$$p = -3.19 + 0.95e + 0.74\, p^f \tag{5.15}$$

$$(3.19) \quad (7.81)$$

$$m = 0.92 + 1.05p + 0.74y \tag{5.16}$$

$$(3.93) \quad (13.2)$$

In Equation 5.15, it can be seen that both the NEER (e) and foreign prices (p^f) positively influence consumer prices in the Maldives, as expected. Given that the variables are modelled in logs, the coefficients of the variables in the equations can be taken as long-run elasticities. As such, a 1 per cent depreciation (an increase in the coefficient of e is measured as depreciation) leads to an almost equal increase in inflation. This means that the pass-through is extremely high for the Maldives. This is as expected, given that the imports are invoiced in the exporter's currency and, as discussed in the literature review (see Section 5.3), when there is producer currency pricing, the ERPT is high.

In most small open economies, the ERPT is high—although not as high as this, except for in Jamaica, for which the estimated coefficient was 0.98 (McFarlane, 2002). In the case of Fiji, the pass-through coefficient was estimated at 0.45 for the period 1982–1986 and 0.37 for the period 1987–1991(Jayaraman & Choong, 2011b). As mentioned in the literature review, the pass-through coefficient was somewhat lower in Mauritius (0.23) mainly due to administered prices (Imam & Minoiu, 2005).

Given the high import content of the consumption basket, domestic prices are responsive to changes in foreign prices, as indicative of the large coefficient for the foreign prices in Equation 5.15. Similar results were obtained for other small island economies as discussed in Section 5.2.2. As regards the money demand equation given in Equation 5.16, this is normalised for domestic prices, p, which would give Equation 5.17:

$$p = 0.95m - 0.71y \tag{5.17}$$

$$(8.57)\ \ (-7.54\,)$$

As expected, money growth (m) increases domestic prices (p), while higher income (y) reduces prices. The responsiveness of prices to an increase in money supply is high for the Maldives, with the long-run money supply elasticity of prices at 0.95 per cent. This means that almost 95 per cent of an increase in money supply will be translated to higher inflation. In most studies on small island economies, monetary aggregates were either not included as a determinant of inflation or found to be insignificant in explaining inflation.

The importance of money supply in determining inflation in the Maldives is explainable from the developments in domestic credit in recent years. Since the year 2000, credit to the private sector has grown exponentially in the Maldives, while borrowings by the government from the banking system (see Figure 5.8 in Section 5.4.3) also grew rapidly, fuelling the money growth in the economy. Most of this translates to higher demand for goods and this is a typical case of the old adage 'too much money chasing after too little goods.' Given that this higher demand for goods is actually higher demand for imported goods, in an open economy such as the Maldives, the increased demand could easily be met by higher imports. However, there are several supply-side bottlenecks and capacity constraints, such as limited port and storage facilities, in the economy, as discussed earlier. In addition, the expansion in credit leads to 'foreign exchange bottlenecks', as posited by the structuralist view of inflation, and as discussed in Sections 5.2 and 5.5.2.

In contrast to the finding of Coppin (1993) for Barbados that tourism growth has an inflationary impact in tourism-dependent economies, the estimated equation for the Maldives shows that growth in tourism (which is used as a proxy for real income) has a dampening effect on inflation. One of the main reasons for this may be that higher tourism inflows mean higher foreign exchange inflows, which eases foreign currency demand in the importing sector. Given the fixed exchange rate, when foreign exchange inflows are low, importers face difficulties and delays in obtaining the foreign currency required for import payments. As a result, prices of imported goods in the domestic market increase. Therefore, rather than higher real output easing supply constraints, in the Maldives, this eases the foreign exchange market and import prices in the country.

The short-run dynamics of the inflation model are discussed below using IRF and variance decomposition analysis.

Short-run dynamics

The impulse response function shows the time path of the CPI to shocks from all the other four variables in the model. From the IRF, short-term elasticities, or in the case of exchange rate, ERPT can be calculated. The formula is given in Equation 5.18.

$$PT_{t,t+i} = \frac{p_{t,t+i}}{e_{t,t+i}} \tag{5.18}$$

where PT is the pass-through and p_{t+i} is the cumulative change in price indices and e_{t+i} is the cumulative change in NER between the months t and $t+i$ (Leigh & Rossi, 2002).

The Cholesky decomposition method was used for the IRFs and the variables were ordered as follows:

$$p^f \rightarrow e \rightarrow y \rightarrow m \rightarrow p$$

Other orderings were tried, but they did not change the results. Therefore, the above ordering was used. The inflation elasticities to the shocks to exchange rate, foreign prices and money supply on a two-year horizon (24 months) are shown in Table 5.4.

Table 5.4: Inflation elasticities to shocks

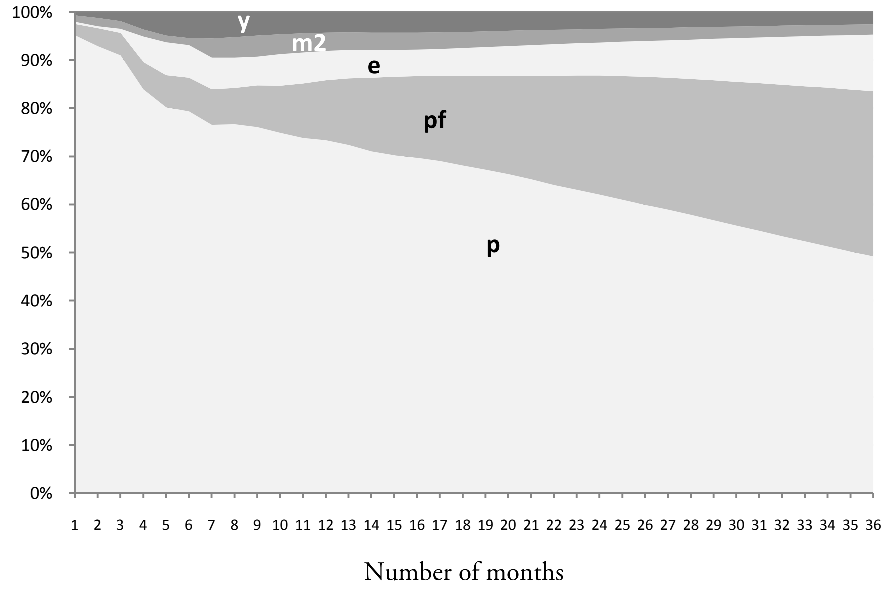
Months	e	p^f	m
1	0.00	0.00	0.00
3	0.03	-0.28	-0.04
6	0.66	-0.30	-0.02
9	0.86	-0.10	-0.01
12	0.82	0.13	-0.15
15	0.96	0.33	-0.26
18	0.99	0.59	-0.40

The results in Table 5.4 show that the ERPT in the first 3 months is very small, but then gains ground over the next three months to reach a high of 66 per cent. The ERPT is almost complete after 18 months. As discussed earlier, this is a very high level of pass-through. As regards the impulse response of inflation to shocks to foreign prices, the initial impact is negative in the first year. However, the domestic inflation starts to pick-up and within 18 months, approximately 60 per cent of the changes in foreign prices are passed on to domestic prices. By the end of the second year, the pass-through to domestic inflation is complete.

The lag in transmitting foreign price changes to domestic prices may reflect the price stickiness in the economy, as businesses are reluctant to change prices in the short run due to costs such as menu costs. However, why domestic inflation becomes negative in the first year following a shock to foreign prices is not clear. Shocks to money supply seem to bring a negative impact in the short run, which is counterintuitive. This may be due to the availability of credit, facilitating the production of short-term demand in goods and services, especially in facilitating import payments.

As regards the variance decomposition analysis, this shows the relative importance of the four explanatory variables in the model in explaining shocks to inflation. This is achieved by decomposing the error-forecast variance of inflation into components explained by each of the variables. Figure 5.11 shows the decomposition of inflation in this respect. It is clear that the shocks to inflation are largely explained as shocks to itself. Initially, about 95 per cent of variation is explained by its own shocks. This could be indicative of the existence of inflation inertia. Shocks to foreign prices explain about 12 per cent of variation in inflation by the end of the first year, and the exchange rate explains about 6 per cent over the same period.

Figure 5.11: Variance decomposition of inflation



The short-run analysis of inflation shows that changes in NER pass on to domestic prices very quickly, while shocks to inflation itself explain the variance in inflation, followed by shocks to foreign prices. Moreover, it is evident from the variance decomposition analysis, as seen in Figure 5.11, that external theories of inflation are dominant in explaining the inflation process in the Maldives.

5.6 Conclusion

This chapter examined the inflation process in the Maldives, using 21 years of monthly data from 1990–2010. The high and volatile inflation of the 1990s subsided in the following decade, until, in the post-tsunami period, inflation once again rose to double-digit level. However, these levels remained lower than the high levels of the 1990s. A review of the theoretical and empirical literature on inflation in small developing island economies, such as the Maldives, indicated the importance of three theories of inflation (external theory, monetary theory and wage theory) in explaining the dynamics of inflation.

Given the lack of data on wages in the Maldives and the relatively free and open labour market (due to the easy access to a cheap and abundant labour force of expatriates from neighbouring countries), the contribution of wage inflation is not expected to be large. Therefore, this chapter examined the importance of external and monetary determinants of inflation in explaining inflation in the Maldives. Special emphasis was placed on examining the role of the exchange rate in the inflation process, and more specifically, on determining the degree and the speed of ERPT to domestic consumer prices.

Since the time-series data used in modelling inflation were non-stationary, cointegration analysis together with VECM was used. The short-run dynamics were analysed using IRF and variance decomposition. The absolute version of PPP seems to hold in the long run for the Maldives, as a long-run relationship was found between nominal exchange rates and domestic and foreign prices, using cointegration analysis. According to the long-run inflation function based on the external theory of inflation, both nominal exchange rates and foreign prices influence domestic inflation in the Maldives significantly. The speed of ERPT, determined with the application of IRF, indicates that pass-through is complete in 18 months. Thus, the ERPT can be seen as very high, which is similar to the results obtained for other small island economies.

Given the high content of imports in the consumption basket (both directly as consumption goods, and indirectly as inputs to goods and services) and the inability to influence prices in the importing countries, domestic prices are highly responsive to changes in foreign prices, but suggest some price stickiness in the short run. According to the variance decomposition analysis, shocks to inflation are explained mostly by its own past values, suggesting inflation inertia. Shocks to foreign prices are the second most important source of the variation in domestic prices, followed by the nominal exchange rates.

The estimated long-run relationship based on the monetary theory of inflation showed that an increase in money supply is inflationary, possibly due to structural bottlenecks. As for the real income, proxied by tourist bed nights, this showed that an increase in real income reduces inflation in the long run. This may be due to the easing of foreign exchange markets, owing to higher exchange rate inflows from the increase in tourism activities.

The analysis in this chapter suggests that exchange rate and foreign prices have the most influence on the inflation dynamics in the Maldives. The high and fast ERPT suggests that changes to nominal exchange rates will be transmitted almost completely to the domestic prices over a short period. As discussed in the literature review, price-taking, small and open economies, with low trade barriers, high dependence on imports and fixed exchange regimes have a relatively higher and more rapid ERPT. As the Maldives possess these characteristics, the ERPT estimated for the country in this chapter supports the findings in the literature.

However, as most of the features of the economy leading to the high ERPT are inherent, except for the exchange rate regime, little can be done to lower the ERPT in the Maldives. The importance attached to the stability of inflation in small developing countries like the Maldives and the volatility associated with flexible exchange rate regimes, therefore lends more weight to the use of a fixed exchange rate regime in the country. Moreover, the empirical results obtained from the inflation analysis also shows that the real depreciation resulting from a nominal depreciation will be unwound in a short-time which will also reduce the advanatges of a flexible exchange rate regime. The analysis in this chapter also showed that there is a positive relationship between monetary expansion and inflation in the Maldives. Therefore, policy makers in the Maldives have to be mindful of the inflationary pressures emanating from monetary growth, especially from monetisation of budget deficits, as the other determinants of inflation in the Maldives are exogenous.

Chapter 6 Dollarization in the Maldives

6.1 Introduction

Dollarization[38] refers to the extensive use of foreign currency in a country, either in place of the local currency or alongside the local currency. Foreign currency may serve all three purposes of money; that is as the medium of exchange, a unit of account and a store of value. When the country has abandoned its local currency and uses a foreign currency as the legal tender, the country is officially or fully dollarized. Conversely, when a country uses foreign currency extensively for financial transactions and as holdings of financial assets, then the country is partially dollarized.

A thorough analysis of the degree and magnitude of partial dollarization in a country is important in evaluating the choice of exchange rate regime. This is because high levels of dollarization can undermine the effectiveness of monetary and exchange rate policy. Dollarization is also associated with high levels of ERPT. When there is a high ERPT, the effectiveness of achieving a real devaluation through a nominal devaluation is reduced. Therefore, the use of a flexible exchange rate will be highly limited. The high ERPT associated with high levels of dollarization is also believed to be a reason behind the 'fear of floating'[39] phenomenon faced by many developing countries. In addition, high levels of financial dollarization can create financial instability as there is an underlying risk of devaluation, which may lead to banking and currency crises. The magnitude of

[38] In this study, the term dollarization will generally be used to refer to partial or unofficial dollarization and official dollarization will be referred to as that or full dollarization.

[39] As explained in Chapter 2, fear of floating is a term coined by Calvo and Reinhart (2000) to explain the phenomenon in which some countries, while proclaiming to have adopted a floating exchange rate regime, continue to maintain their exchange rate within a narrow band with respect to some anchor currency to avoid large swings in exchange rates. This is because they perceive depreciations or devaluations to have detrimental effects on the balance sheets, especially when they have large foreign currency denominated debt.

costs and benefits of adopting official dollarization also depends on the degree and extent of partial dollarization already present in the economy. As Chapter 7 of this study evaluates the exchange rate option of official dollarization for the Maldives, a thorough understanding of the extent of the partial dollarization is necessary, as it affects the exchange rate regime choice. Therefore, the objective of this chapter is to examine the extent, causes and consequences of partial dollarization in the Maldives. To this end, in Section 6.2, this chapter will review the literature on dollarization, focusing on the definition, measurement, trends, determinants and consequences of dollarization. Section 6.3 analyses the extent of dollarization in the Maldives by examining different measures of dollarization. Section 6.4 provides an econometric analysis of dollarization in the Maldives, by using cointegration techniques to establish the existence of a long-run relationship between the degree of dollarization and its main determinants. The short-term dynamics of dollarization are analysed by estimating an error-correction model. Section 6.5 is a conclusion to this chapter.

6.2 Review of the Literature on Dollarization

6.2.1 Definition of Dollarization

Dollarization is the extensive use of a foreign currency by a country. The country may be using a foreign currency or foreign currencies, alongside the domestic currency or instead of the domestic currency. However, there is no consistency in the definitions of dollarization used in the literature on the subject. In the early literature on dollarization, the focus was on currency substitution and the term dollarization was used interchangeably to describe the same phenomenon. Calvo and Vegh (1992) define currency substitution as the use of multiple currencies as a medium of exchange—one of the three functions of money. They define dollarization as the use of a foreign currency to fulfil the other two functions of money—that is, to store value and as a unit of account. Currency substitution is normally the last stage of dollarization, following from widespread use of foreign currency as a store of value and unit of account.

The majority of studies on currency substitution have used money demand models and estimated money demand functions, especially in empirical studies, on Latin American countries. These models have tried to establish a relationship between dollarization and inflation, in which dollarization is positively linked to high levels of inflation. It has been generally accepted that dollarization falls as inflation rate subsides. However, when the dollariation rates did not decline with the fall in inflation rates in most of developing countries, the focus of dollarization was turned from currency substitution to asset substitution or, more broadly, to financial dollarization (Levy-Yeyati & Sturzenegger, 2003a). These terms are explained in the next paragraph.

There are three main types of dollarization: official dollarization, unofficial dollarization and semi-official dollarization. The term official dollarization or full dollarization is used when a country officially adopts a foreign currency for all its financial transactions. Countries in which a foreign currency is adopted as a legal tender, but in which domestic currency continues to be issued, are said to have semi-official dollarization. Several countries use foreign currency in place of their domestic currency, at varying degrees, without formally adopting a foreign currency (Levy-Yeyati & Sturzenegger, 2003a). This is termed unofficial dollarization or partial dollarization, and is very common in Latin American countries and among small developing countries. In these countries, businesses and individuals normally hold foreign currency bank deposits and/or notes as a hedge against high inflation and large depreciations or devaluations of the domestic currency. Unofficial dollarization can take place in the form of either currency substitution or asset substitution, or these may coexist.

Currency substitution, as noted earlier, occurs when foreign currency is used as a medium of exchange; that is, for the settlement of payments in the domestic economy. Currency substitution is also known as payments dollarization. In contrast, asset substitution occurs when residents of a country hold financial assets in a foreign currency as a means of storing value, rather than for settling payments. A recent strand of literature has focused on the dollarization of liabilities, and has broadened asset substitution to include liability dollarization (Levy-Yeyati, 2006). The dollarization of both assets and liabilities is referred to as financial dollarization (Levy-Yeyati, 2006). Another form of dollarization, which is less common, is real dollarization. Real dollarization involves the indexing of local prices and wages to the foreign currency, either officially or unofficially (De Nicoló & Honohan, 2003).

6.2.2 Measurement of Dollarization

The most common measurement of dollarization is the ratio of foreign currency deposits in the domestic banking system to broad money, which will be referred to as DR1.[40] Another related measure is the ratio of foreign currency deposits to total deposits, referred to as DR2. However, these measures of dollarization may be grossly underestimated, as they cover only the foreign currency deposits in the banking system. The foreign currency deposits in the banking system are generally a good indicator of the extent of dollarization in a country. However, foreign currency in circulation in the domestic economy (which will show the level of currency substitution) and foreign currency deposits held abroad by the country's residents are equally important to gauge the full extent of dollarization in the country. Due to the predominance of the US dollar in the Maldivian economy, it is widely accepted that foreign currency holdings and transactions outside the banking system are common, and so is the holding of foreign currency deposits abroad. However, in most of the developing countries, as is the case in the Maldives, data on foreign currency in circulation and foreign currency deposits held abroad by residents are not available. The lack of such data has been one of the serious impediments in the empirical research on developing countries. As Calvo and Vegh (1992, p. 21) noted:

> In the final analysis, the relevance of currency substitution is an empirical issue … At the empirical level, the study of currency substitution faces a

[40] Since there are several measures of and no standard names for different measures, in this study, dollarization ratios are labelled as DR1, DR2, DR3, DR4, DR5 and DR6, for ease of use.

> fundamental problem: there is usually no data available on foreign currency circulating in an economy. Therefore, the importance of currency substitution is basically unobservable.

However, there have been various attempts to calculate the amount of foreign currency in circulation indirectly. Erasmus, Leichter, & Menkulasi (2009) used the local currency multiplier as a proxy for the foreign currency multiplier to estimate the foreign currency in circulation in Liberia. By using the foreign currency in circulation, a broader measure of dollarization was obtained—DR3—which is the ratio of foreign currency in circulation and foreign currency deposits to Effective Broad Money (EBM). EBM differs from broad money in that the former includes foreign currency in circulation. A measure of loan dollarization (DR4), which is the ratio of loans denominated in foreign currency to total loans, is also a useful indicator. Public debt dollarization (DR5) is another indicator of dollarization, and is measured as the ratio of foreign currency denominated public debt to the total public debt of the country (Levy-Yeyati, 2006).

Reinhart, Rogoff and Sevastano (2003) used a much broader measure of dollarization (DR6) in a study of dollarization in developing countries, by constructing a composite index of three indicators of dollarization. These are foreign currency bank deposits as a percentage of broad money; total external debt as a percentage of GNP; and foreign currency denominated or linked domestic debt of the government as a percentage of total domestic debt of the government. Each of these indicators are measured as indices that have a value from 0 to 10, allowing for a composite index to measure the degree of dollarization on a scale of 0 to 30.

The various indicators of dollarization that have been used to analyse dollarization are summarised in Table 6.1. It should be noted at the outset that not all of the dollarization measures listed in Table 6.1 could be calculated for the Maldives, as required data was not available. This is because foreign currency in circulation is not available for the Maldives. Some studies have attempted to calculate foreign currency in circulation by using the local currency money multiplier, assuming that it will be the same as the foreign currency multiplier. However, given that in the Maldives, domestic transactions in foreign currency are not widespread, it is unrealistic to assume that the money multipliers for the two currencies will be the same. The dollarization ratio DR5 is also not calculable for the Maldives, as data on foreign currency denominated public debt are not available. Nor is the dollarization ratio DR6, which is the composite index of dollarization put forward by Reinhart et al. (2003), able to be constructed for the Maldives, as the data on the foreign currency denominated domestic debt of the government has some data issues that cannot be resolved. Therefore, only DR1, DR2 and DR4 are constructed for the Maldives, and these are discussed later in this chapter.

Table 6.1: Measures of dollarization

Dollarization ratio	Definition
DR1 = FCD/BM	Foreign currency deposits (FCD) in the domestic banking system as a percentage of broad money (BM) which is M2
DR2 = FCD/TD	FCD in the domestic banking system as a percentage of total deposits (TD)—this ratio is known as deposit dollarization
DR3 = (FCC+FCD)/EBM	Foreign currency in circulation (FCC) and FCD as a percentage of EBM—EBM is BM plus FCC
DR4 = FCL/TL	Loans denominated in foreign currency (FCL) as a percentage of total loans (TL)
DR5 = FCPD/TPD	Foreign currency denominated public debt (FCPD) as a percentage of total public debt (TPD)
DR6 = Composite Index (DR1; ExD/GNP; FCDDG/TDDG)	Composite index of three indicators of dollarization: i) foreign currency bank deposits as a percentage of BM; ii) total external debt (ExD) as a percentage of GNP; and iii) foreign currency denominated or linked domestic debt of government as a percentage of total domestic debt of the government (TDDG)

6.2.3 Dollarization Trends in Developing Countries

Dollarization is a commonly prevalent phenomenon in many developing countries. While Latin American countries are more known for their dollarized economies, partly due to academia's focus on this region, the phenomenon is equally common in several emerging market economies, transition economies, African countries and Asian countries (Levy-Yeyati, 2006). Reinhart, Rogoff and Savastano (2003) argue that the commonly used measurements of dollarization are too narrow and are insufficient to gauge the true extent of dollarization in the developing countries. As such, using a broader definition of dollarization[41] they estimate dollarization ratios as a composite index[42] (DR6) for a large sample of developing countries. They also classify the countries studied into four categories to differentiate between the various types of dollarization encountered. This classification is based on two criteria: the degree of domestic dollarization and private sector foreign borrowings. The first criterion is measured as the ratio of foreign currency deposits to broad money and the ratio of domestic government debt in foreign currency to total domestic government debt. Degree of domestic dollarization is further divided into two groups, countries in which both these ratios are at less than 10 per cent, and countries in which at least one of the ratios is higher than 10 per cent. The second criterion is measured as the ratio of private sector debt to total external debt. The countries that have this ratio higher than 10 per cent are categorised into one group, while those that have a ratio less than 10 per cent are placed in another group. Based on this classification, Type I dollarization refers to countries that have both domestic dollarization and external liabilities in the private sector. Type II is limited to domestic dollarization. Type III indicates predominantly external liabilities. Finally, in Type, there is no significant level of domestic dollarization and the external debt is largely owed by the government.

Based on their classification of 108 countries using this method during the period 1980–1985, Reinhart et al. (2003) reported the following dollarization type breakdown. Only six countries had Type I dollarization, four had Type II dollarization, 26 have Type III or high external liabilities and 72 countries (67 per cent of the total) did not have significant levels of domestic dollarization or private

[41] As before, dollarization here also refers to the widespread use of any foreign currency, not just US dollars. In recent years, the term ‘eurorisation’ has also been used to refer to the use of the Euro or the adoption of the Euro in a country.

[42] See Section 6.2.2 for details on their definition of dollarization and the variables included in their composite index of dollarization.

sector foreign liabilities. In contrast, during the period 1996–2001, countries in the Type I category increased to 29 and those in Type II increased to 43. Conversely, the number of countries of Type III and Type IV decreased to 18 and 53, respectively. Reinhart et al. also found that, in contrast to other regions, African countries had mostly Type IV dollarization. All of the 11 South American countries and 26 transition countries, and the majority of countries in the Middle East (12 out of 14) had Type I-III dollarization. In the Asia region, 16 of the 26 countries were also in these categories.

South America is also the most dollarized region according to the composite dollarization index. On a scale of 0–30, the region received a score of 14, followed by Africa and the transition economies at nine and the Middle East at eight. Degree of dollarization based on the composite dollarization index for individual countries for the period 1996–2001 reveals that half of the countries in the very high category (with a score of 14 or higher) are from the Western hemisphere, and of these the majority are South American countries.

There are very few countries that are officially dollarized. Most of these are very small, independent (but formally colonised) states and administered territories, highly integrated with a larger neighbouring country. These countries are generally very small, in terms of both population and GDP. Typically, their decision to dollarize officially was based on historical and political reasons, rather than on the relative merits of dollarization. The exceptions are Panama, Ecuador and El Salvador. Panama adopted the US dollar as their legal tender for political reasons after gaining their independence in 1904. More recently in 2000, Ecuador replaced their national currency with the US dollar, amid severe political and financial crises that led to a widespread loss of credibility in Ecuador's political and monetary institutions. Conversely, El Salvador adopted the US dollar in 2001, based on the relative merits of dollarization over their exchange rate peg, and in a generally favourable and stable macroeconomic environment (Levy-Yeyati & Sturzenegger, 2001a).

6.2.4 Determinants of Dollarization in Developing Countries

There is a large volume of literature on dollarization,[43] with the majority focusing on Latin America. However, in recent years there has been a growing body of literature on dollarization in transition economies. The literature on dollarization can be broadly divided into two categories: studies that analyses the costs and benefits of dollarization in terms of macroeconomic performance and policies; and studies that empirically analyse the various factors or determinants of dollarization.

Several studies have looked at the consequences of both official or full dollarization as well as partial dollarization. Berg and Borensztein (2003) provide a good analysis of the relative value of official dollarization. They discuss the benefits of dollarization in the context of the elimination of exchange rate risks and greater economic and financial integration. Further, they analyse the costs of dollarization associated with the loss of seigniorage; the 'lender of last resort' function for the central bank; and the 'exit' option in the event of a major economic shock. Like many other studies (Baliño, Bennett, & Borensztein, 1999; Bogetic, 2000; Calvo, 2002; Chang, 2000; Eichengreen, 2002), Berg and Borensztein (2003) also did not reach a clear consensus on official dollarization and on whether the costs outweigh the benefits. One reason for the lack of consensus is the limited number of countries that are fully dollarized, which severely limits the historical and empirical evidence to support official dollarization (Edwards, 2001a). The costs and benefits of official dollarization are further discussed in Chapter 7 in the context of the Maldives.

As regards the literature on the consequences of partial dollarization, empirical analyses are much more extensive, as there are a large number of countries experiencing different levels of dollarization. In the 1990s, high levels of dollarization were most common in the Latin American countries. More recently, transition

[43] See Giovanni and Turtleboom (1992) and Calvo and Vegh (1996) for a review of theoretical and empirical literature on currency substitution and dollarization.

economies, following the liberalisation of economic policies in these countries, have experienced high levels of dollarization, providing many opportunities for empirical analysis. One of the main issues that has been investigated is the impact of dollarization on the effectiveness of monetary policy, and ultimately on the inflation outcome. More recently, the impact of dollarization on the financial sector in terms of financial fragility and financial depth in dollarized economies has been the subject of empirical study.[44]

The popular belief that high dollarization hinders the effectiveness of monetary policy is based on the following argument. When a foreign currency or currencies co-circulate with the domestic currency in the economy, and given that the central bank can only influence the domestic currency component, the total money supply in the economy is not set by the central bank and is not even known to the central bank. This makes conducting monetary policy very complicated, and less effective in achieving a low-inflation outcome (Baliño et al., 1999). Using data for 122 developed and developing countries, Levy-Yeyati (2006) found that there is greater instability in money demand in financially dollarized economies, which would make monetary policy less effective.

In contrast, in the study by Reinhart et al. (2003), using a sample of 85 developing countries, found no evidence to support this argument. Reinhart et al. looked at the past performance of these countries in targeting inflation and growth, and found that the degree of dollarization did not show any 'discernible effects on the duration of the disinflation' (2003, p. 29). In addition, disinflation in these countries did not lead to a fall in the dollarization ratio. While inflation was higher and more volatile in the dollarized economies, dollarization did not alter the monetary transmission mechanism or hinder the efforts to lower inflation. However, Reinhart et al. did find evidence to support the theory of 'fear of floating', as high dollarization rates were associated with high ERPT, which limits the effectiveness of exchange rate policy.

[44] See Aghion, Bacchetta and Banerjee (2001), Cespedes, Chang and Velasco (2000), Chang (2000), Krugman (1999) and Levy-Yeyati (2006).

In the previously mentioned study by Levy-Yeyati (2006), evidence was found to support the argument that high dollarization is associated with financial fragility. However, no positive effect of financial dollarization on the financial depth of a country, as claimed by the advocates of dollarization, was observed. Further, financial dollarization was seen to be detrimental to a country's economic growth. The association of financial fragility with dollarization is also supported by De Nicoló and Honohan (2003) and De Nicoló, Honohan and Ize (2005). However, in contrast to the Levy-yeyati's study, the latter two studies found that dollarization promotes financial deepening, but in high-inflation economies.

The literature explaining the factors that contribute to dollarization investigates the contribution of two main categories of variables: economic variables and institutional variables. Economic variables, such as interest rates on local and foreign currency deposits and bonds, and expected devaluation, are commonly used. However, due to the difficulty in obtaining data on expected devaluation, other proxies that give a good measure of expected devaluation are often used in econometric studies. Such variables include the actual rate of devaluation or its lagged values, RERs, domestic inflation rates, current account deficits and foreign reserves of central banks (Vetlov, 2001). Some of the key institutional factors that have been included in the literature include the openness of the economy; institutional constraints or regulations on holding foreign currency and capital controls; the depth of the financial market; the exchange rate regime; and degree of policy credibility (De Nicoló & Honohan, 2003; Levy-Yeyati, 2006; Savastano, 1996). The variables that have been selected from these for the empirical analysis later in this chapter are further discussed in Section 6.4.1.

As mentioned earlier, in the early literature on dollarization, dollarization was regarded mainly as a currency substitution phenomenon, which postulates a negative relationship between the demand for local currency and the rate of inflation. One of the earliest and most prominent studies on currency substitution was an empirical study on Canada by Miles (1978). He used data on foreign currency balances in the banking system to regress against the rate of inflation and currency depreciation. He found a statistically significant negative relationship between the dependent variable (foreign currency balances) and a set of independent variables. This was taken as evidence of currency substitution. Several studies on Latin America, such as those of Ramirez-Rojas (1985) on Argentina, Mexico and Uruguay, Savastano (1996) on Mexico, Peru and Uruguay and Ortiz (1983) on Mexico, have also found evidence to support currency substitution in these countries.

However, these studies have been subjected to many criticisms over the past two decades. The main criticism being that the dependent variable used is more accurately described as a measure of asset substitution, rather than one of currency substitution. This is because it is rarely possible to observe currency substitution, as data on foreign currency circulating in an economy are not available. Even when it is available, the estimates of the variable suffer serious limitations. Therefore, econometric studies use measures on financial dollarization when analysing currency substitution. As currency substitution models are usually money demand models, a core problem with the empirical analysis is that they use interest-bearing assets, which are generally the largest part of the measured dollarization, to estimate money demand equations. The currency substitution view was further challenged when dollarization rates continued to persist even after inflation declined and macroeconomic stability was achieved. This was seen to be the result of the presence of hysteresis, or a ‘ratchet effect’, in the dollarization process, which results in model misspecification. This has seriously limited the validity of earlier studies on currency substitution (Calvo & Vegh, 1992).

One reason for the hysteresis effect is that once people have established themselves in using a foreign currency as a means of payment, there is less incentive for them to switch to the local currency even after inflation worries are abated. This is due to the existence of fixed costs associated with it, such as sunk costs of switching currencies and learning by doing. Another reason for hysteresis is that people have long-lasting memories of past inflation, which leads to expectations of higher inflation in the future (Savastano, 1996). More studies explaining the hysteresis effect have emerged to explain dollarization, and recent literature includes the hysteresis effect in modelling the dollarization process (Sturzenegger, 1997; Uribe, 1997).

A fundamental problem with the currency substitution view is that it assumes wages and prices of domestic goods and services are switched to foreign currency payments. However, it has been observed that even at the height of dollarization, except for in the case of big-ticket items (such as real estate), domestic prices and payments are in local currency (Levy-Yeyati, 2006).

The limitation of the currency substitution view led to the development of several other approaches. Of these, one of the most widely recognised views in terms of explaining the determinants of dollarization is the portfolio view. This view is based on the minimum variance portfolio (MVP) model put forward by Ize and Levy-Yeyati (2003) and Levy-Yeyati (2006) to explain financial dollarization. As investors are risk averse, they will choose the level of currencies they will hold in each currency based on their optimal risk/return profile. In an environment of high and unstable inflation, currency instability and RER depreciation, dollarization is seen as a natural outcome. This is because economic agents try to protect their assets from a variety of risks that these economic conditions pose. Therefore, the MVP model explains financial dollarization as a function of macroeconomic uncertainty. As such, if expected volatility in inflation relative to expected volatility in RER remains high, then financial dollarization may continue to persist at high levels even when the macroeconomic conditions have stabilised. When there is expectation of higher volatility in inflation relative to volatility in RERs, economic agents set wages and prices in dollars to safeguard their real incomes, as nominal prices and wages are downwardly rigid.

Ize and Levy-Yeyati (2003), using a portfolio model framework, derived a MVP that depended on the relative volatility of inflation and real depreciation rates. Their study provided evidence on the persistence of dollarization in a sample of five Latin American countries, even after inflation has declined. This shows that, as the MVP model predicts, the volatility in inflation relative to the volatility in the RER has remained high. Using a broad sample of countries, Levy-Yeyati (2006) also found evidence to support the portfolio view in explaining dollarization. Further, he found that institutional variables played a key role in explaining dollarization in these countries. The variables used in the Levy-Yeyati study include: average past inflation (to reflect currency substitution view); dollar share of MVP; correlation between RER and real GDP growth (as a proxy to identify the correlation between the probability of default and RER changes); GDP per capita (as a proxy for the development of domestic currency markets); a restriction variable that measured the legal restriction on foreign currency deposits; an exchange rate peg dummy; and a composite index that averaged six governance indicators to reflect the institutional development of the country. While empirically significant links were identified between most of the above variables and dollarization, the exchange rate peg was not significant and had the wrong sign, implying that the exchange rate regime is not significant for explaining dollarization.

Similarly, De Nicolo et al. (2005) used a similar set of institutional and economic variables to model the determinants of dollarization on a large sample of countries. They also found that both macroeconomic and institutional variables are important in determining dollarization. Institutional factors, such as the levels of foreign exchange and capital controls, which influence public decisions and the ability to hold foreign currencies, were also found to be a major determinant in the dollarization process by Savastano (1996), whose empirical study analysed five highly dollarized Latin American countries, during the period 1970–1993. The importance of institutional factors in explaining dollarization lies in the fact that institutional failure, such as the low credibility of government, exacerbates the dollarization in the country (Levy-Yeyati, 2006).

As regards the dollarization in transition countries, Vetlov (2001) conducted an econometric analysis of dollarization for Latvia. He used only interest rates on foreign currency and local currency deposits as explanatory variables, arguing that the interest rates in Latvia reflect the major economic and institutional developments in the country. As such, these two variables were seen to explain the dollarization process in Latvia effectively.

El-Erian (1988) empirically assessed the determinants of currency substitution in Egypt and Yemen, using a reduced-form demand for money function, with explanatory variables such as interest rate differentials, exchange rate expectations, a variable to capture political disruptions and a lagged variable to reflect possible lags in the adjustment of desired foreign currency holdings. All the variables, except the interest rate differential, were significant, and explained the currency substitution in both countries. The lack of significance for the interest rate differential may be attributed to the rigidities in the financial system (such as regulated interest rates), which prevents interest rates from fully reflecting market rates.

On the dollarization process in Turkey, Civcir (2003) used an extended portfolio model to include interest rate differentials, expected exchange rate, exchange rate risk (measured as exchange rate misalignment) and a variable measuring the credibility of macroeconomic policies. While all the variables had significant explanatory power, he found that the interest rate differential and the expected exchange rates were the key determinants of dollarization in Turkey. From the positive linear trend in the latter two variables and the dollarization, he inferred that there is evidence of hysteresis in Turkey. In one of the few studies on Sub-Saharan Africa, Yinusa (2009), using 18 Sub-Saharan African countries with annual data from 1980–2004, looks at the relationship between macroeconomic fluctuation and deposit dollarization. He finds that inflation, political risk factors, changes in US monetary policy, domestic interest rates, exchange rate volatility and exchange rate expectations are important determinants of dollarization in these countries. Further, a variable relating inflation to capital account restrictions was also highly significant in the dollarization process, especially in the 1980s, when there was financial repression and capital control in these countries.

There are very few studies on small island developing economies like the Maldives. One study on Jamaica, by Bailey (2005), investigated the relationship between financial dollarization and inflation, using a VAR analysis. The empirical estimation revealed a positive relationship between inflation and financial dollarization in Jamaica, signalling that a relatively stable exchange rate is required to reduce dollarization in the country. Another study on Jamaica, using a portfolio approach, concluded that dollarization is mainly influenced by the high volatility of inflation relative to the volatility of the REER (Haughton, 2004).

6.3 Dollarization in the Maldives

6.3.1 Background

The currency of the Maldives, the rufiyaa, is the legal tender in the country. The current monetary regulation of the Maldives, which came into effect in March 1987, stipulates that all financial transactions in the country be carried out in rufiyaa. However, the regulation makes an exception to this rule in the case of payment of taxes, fees and levies by foreign income earning sectors and foreign parties in the country. These payments have to be made in foreign currency if mandated by the government. According to the monetary regulation, an annual license (known as the moneychanger's license) from the MMA is required if a business wishes to engage in the selling and buying of foreign currencies. Moreover, US dollars can only be bought and sold at rates specified by the MMA and no commissions can be charged in foreign exchange dealings. They are also required to submit a monthly statement of foreign exchange transactions to the MMA before the 10th of the following month. However, there are no restrictions on the holding of foreign currency by residents or non-residents and no capital controls. There are also no restrictions on maintaining foreign currency accounts both at home and abroad, and businesses and individuals often hold rufiyaa and US dollar accounts in domestic banks.

While most big businesses and larger retailers hold moneychanger's licenses if they deal with foreign exchange, smaller businesses, retailers and individuals still conduct foreign exchange transactions without a license, as it is impossible to monitor them. For example, a taxi driver would readily accept a payment in US dollars (but most likely not in other currencies) if the customer is willing to pay in dollars, and the same goes for transactions in shops and cafes, for example.

While the moneychangers are required to submit a monthly statement of foreign exchange transactions, these statements are not used for any purpose, and no monitoring or analysis of the transactions is carried out. When this requirement was initially imposed in the late 1980s, there was some monitoring of the foreign exchange transactions. At that time, there was some pressure on the US dollar exchange rate. In addition, the number of moneychangers and the amount of transactions were relatively small, compared to the current situation.

In the Maldives, the US dollar is extensively used alongside the rufiyaa and, as explained, the dollar serves to fulfil the three basic functions of money. Therefore, both currency substitution (foreign currency used as a medium of exchange and unit of account) and asset substitution or financial dollarization (foreign currency used as a store of value) are prevalent in the country. Anecdotal evidence suggests that it is common for domestic prices to be indexed to US dollars, although the actual transactions are conducted in rufiyaa. For example, in the high-end rental market, rental prices are quoted in dollars and payments can be made in either dollars or rufiyaa. It is difficult to gauge the level of foreign currency in circulation in the country, as no data or information is available.

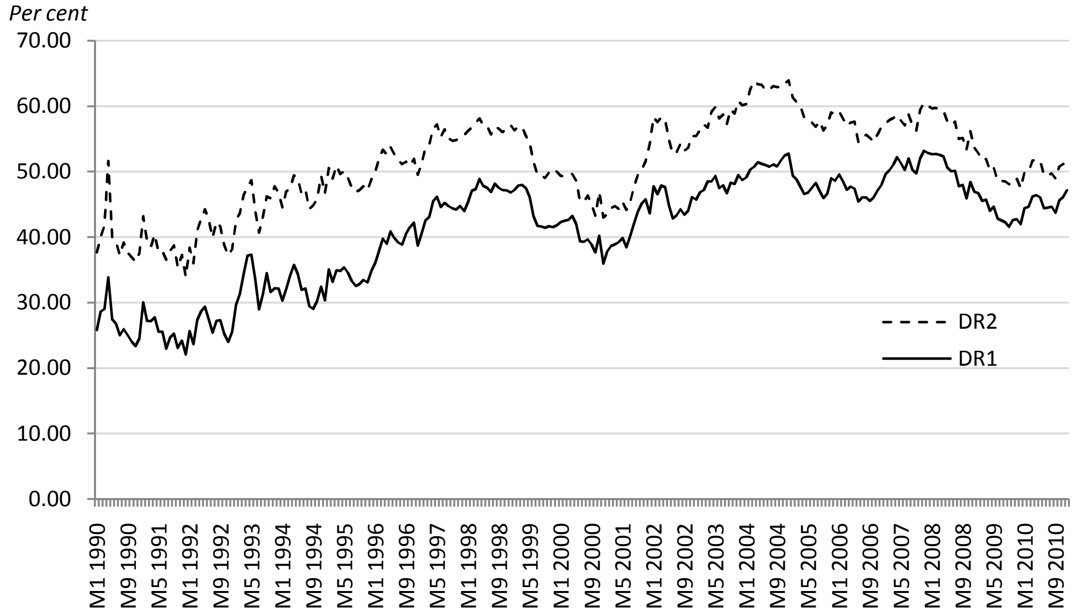
In addition, a number of taxes, charges and fees levied by the government on the tourism sector and other sectors linked to the international sector are charged in US dollars. For example, tax and non-tax revenue from the tourism sector accounts for more than 40 per cent of government revenue.

6.3.2 Degree of Dollarization in the Maldives

According to Baliño, et al.(1999), a dollarization ratio, as measured by the ratio of foreign currency deposits to broad money, higher than 30 per cent indicates that the economy is highly dollarized. In the Maldives, the dollarization rate has remained over 30 per cent since the mid-1990s. This measure of dollarization only includes onshore deposits, necessarily excluding offshore deposits and foreign currency in circulation in the economy because such data are not available for the Maldives. In this section, the various measures of dollarization identified in Section 6.2.2 are calculated for the Maldives and their trends are discussed.

As mentioned before, the ratios of foreign currency deposits (onshore) to broad money (DR1) and foreign currency deposits (onshore) to total deposits (DR2) are the most easily available and used indicators of dollarization. The developments in these ratios are shown in Figure 6.1. In the analysis of dollarization in the Maldives, this study will use DR2, as this is a better indicator than DR1. This is because DR1 underestimates the relative weight of foreign currency in the banking system as broad money includes only the local currency in circulation and not the foreign currency in circulation. The levels of dollarization in the Maldives are seen, in Figure 6.1, to have remained extremely high, especially over the last decade. The high dollarization ratios can be attributed to several factors, including the dominance of the tourism sector, the import dependence of the economy and the lack of restrictions on holding foreign currency and foreign currency accounts in commercial banks. Three episodes of declines in dollarization ratios are observed in Figure 6.1. The first episode started in early 1999, but the decline became more pronounced in the year 2000, before rising again in mid-2001. The second episode of decline in the dollarization rate started after the 2004 Indian Ocean tsunami, when there was an abrupt decline in tourism flows. The rate rose again in late 2007, but not to the pre-tsunami levels, and again started declining over 2008 and 2009.

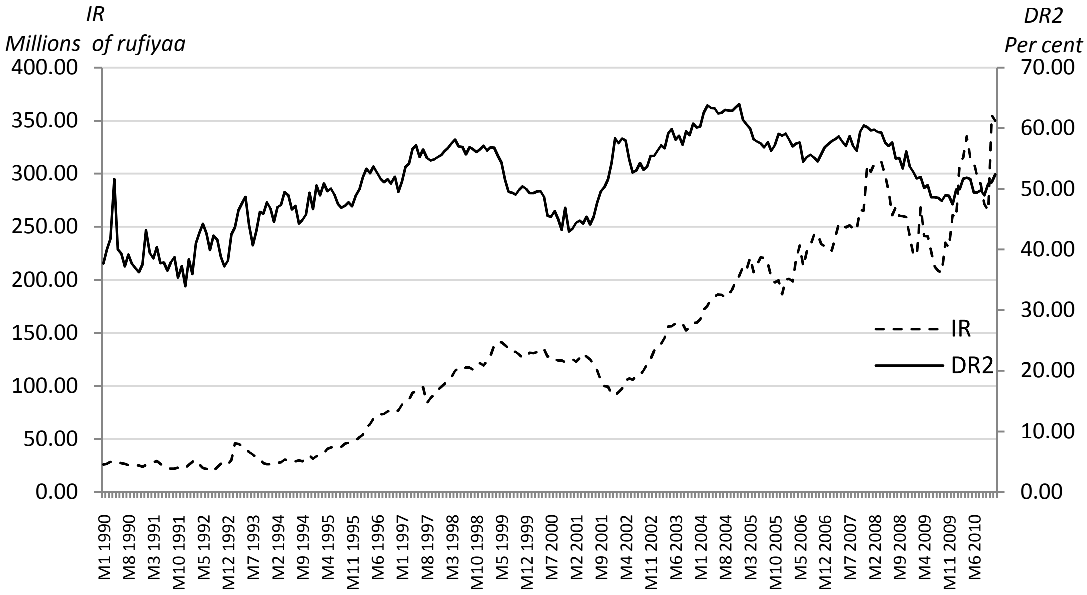
Figure 6.1: Degree of dollarization in the Maldives, 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

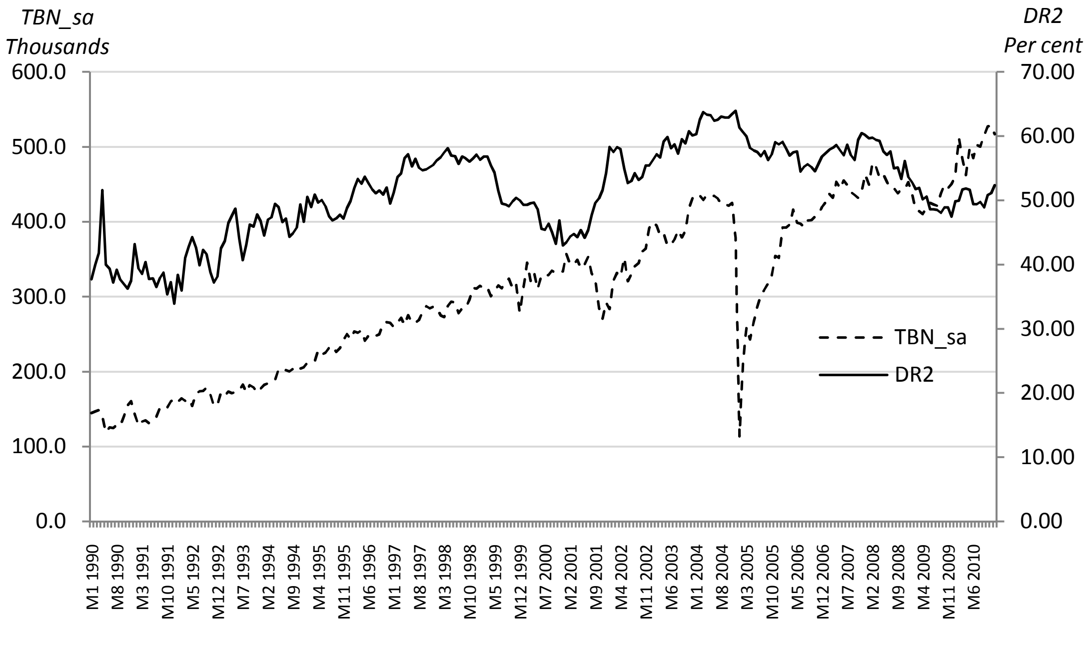
In the dollarization literature, a fall in the dollarization ratio is taken as an indication of macroeconomic stability and low inflation (Levy-Yeyati & Sturzenegger, 2001a). However, in the case of the Maldives the fall in dollarization ratios are associated with macroeconomic instability, especially following shocks to the tourism sector and international reserves. This can be seen in Figures 6.2 and 6.3. The dollarization ratio tracks both international reserves and tourism flows (indicated by seasonally adjusted bed nights) relatively closely.

Figure 6.2: Dollarization ratio (DR2) and international reserves (IR), 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

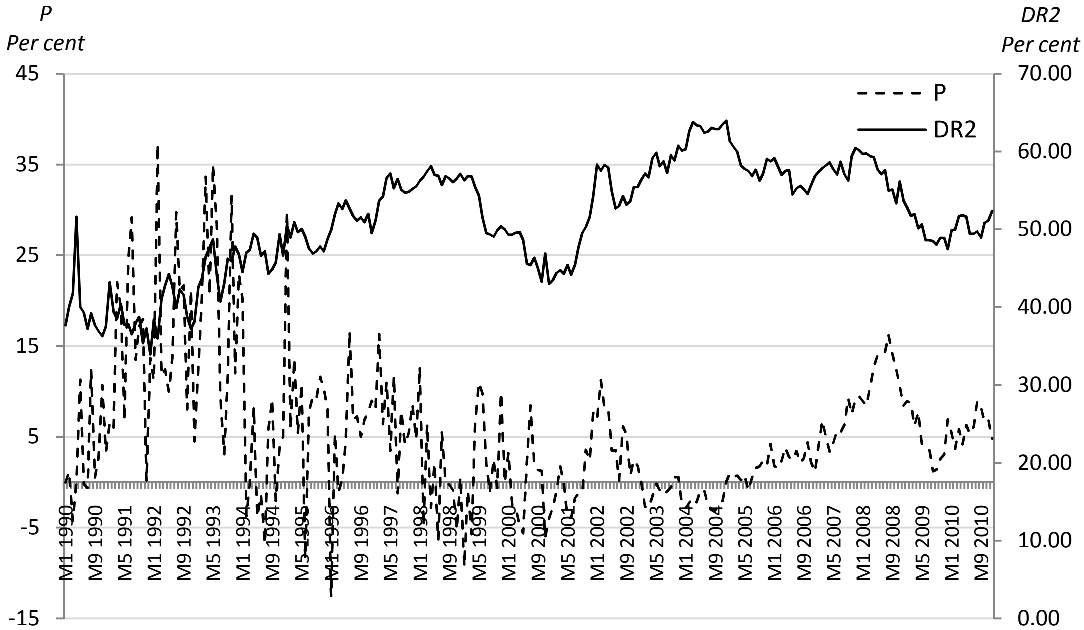
Figure 6.3: Dollarization ratio (DR2) and tourist bed nights, seasonally adjusted, (TBN_sa), 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

There should be a strong positive relationship between the dollarization ratio and the inflation rate. However, this relationship is not strong for the Maldives, as can be seen from Figure 6.4.

Figure 6.4: Dollarization ratio (DR2) and inflation rate (P), 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

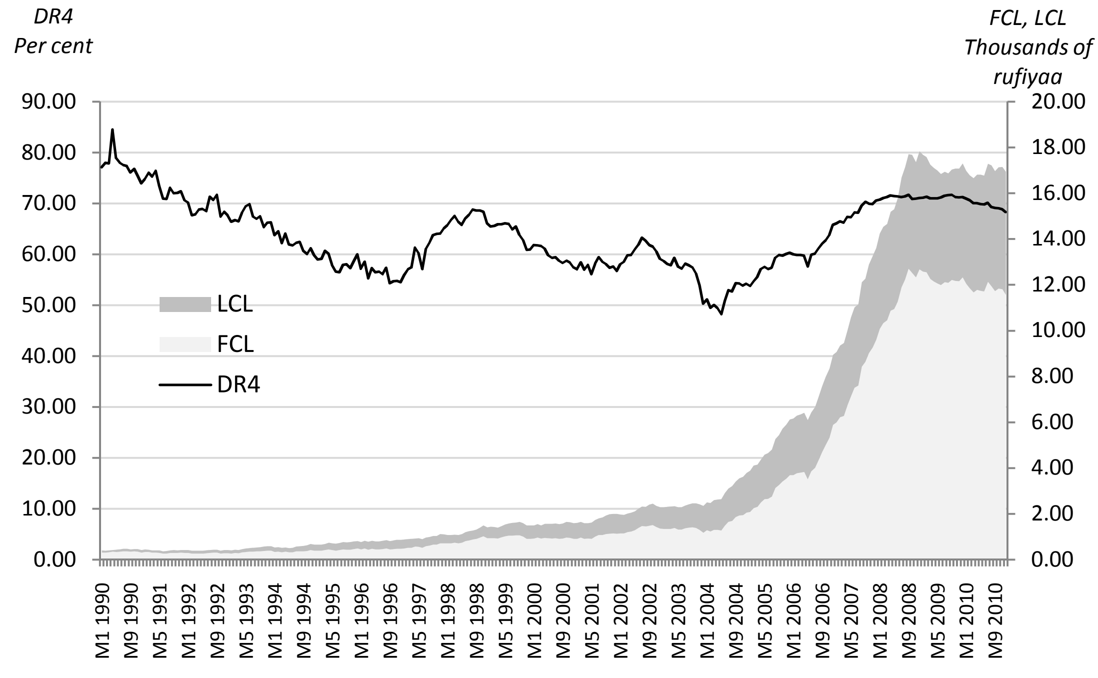
Table 6.2 shows simple correlation coefficients between the dollarization ratio and inflation, tourist bed nights and international reserves. Inflation has a weak and negative relationship with dollarization in the Maldives. Meanwhile, as also observed from the graphs above, both international reserves and tourist bed nights are positively and highly correlated with DR2.

Table 6.2: Correlation coefficients

	Dollarization ratio (DR2)
International Reserves	0.6
Tourist Bed Nights (seasonally adjusted)	0.7
Inflation Rate	-0.3

The dollarization of loans, normally referred to as credit dollarization, is also high in the Maldives. Figure 6.5 show the levels of foreign currency and local currency loans together with the loan-dollarization ratio, DR4. This is simply the ratio of foreign currency loans to total loans by the commercial banks in the Maldives. Close to 70 per cent of commercial banks' loans to the private sector have been in foreign currency, although over the years, loans in rufiyaa have also been increasing.

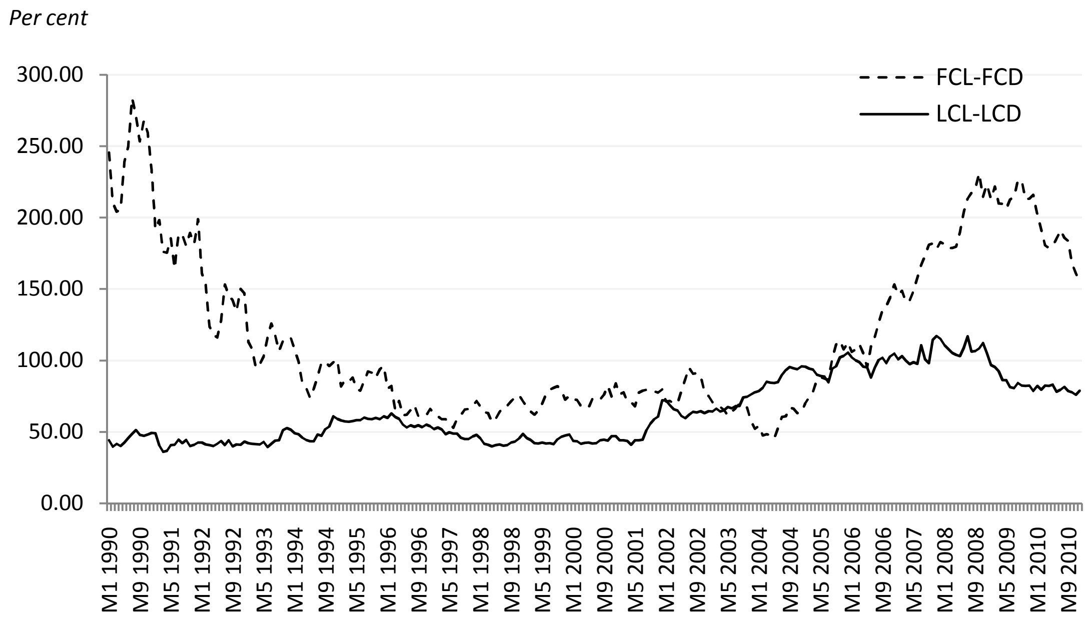
Figure 6.5: Dollarization ratio, foreign currency loans and local currency loans, 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

The main reason for the high credit dollarization in the Maldives is the low level of domestic savings and the dominance of foreign banks in the financial sector. The Maldives financial sector is very small and consists of six commercial banks, a leasing company, a housing finance institution and a few insurance companies and securities market intermediaries. The banking sector dominates the financial sector of the country, holding about 76 per cent of the total financial sector assets. Of the six commercial banks, only one is a domestic bank (51 per cent owned by the government), while the remaining five banks are branches of foreign banks (MMA, 2010b). Therefore, due to the limited ability to mobilise domestic savings, commercial banks mainly borrow from their headquarters to on-lend to the domestic market. Over 70 per cent of credit extended by the commercial banks is denominated in foreign currency (US dollars) and of that, about 70 per cent goes to the tourism sector. Given this high level of credit dollarization, the loan to deposit ratio of commercial banks in foreign currency remain high, leaving the banking system vulnerable to dollar liquidity shocks. This is shown in Figure 6.6, which also shows the loan to deposit ratio in domestic currency, which has remained at relatively moderate levels.

Figure 6.6: Foreign currency loan to foreign currency deposit ratio and domestic currency loan to local currency deposit ratio, 1990–2010

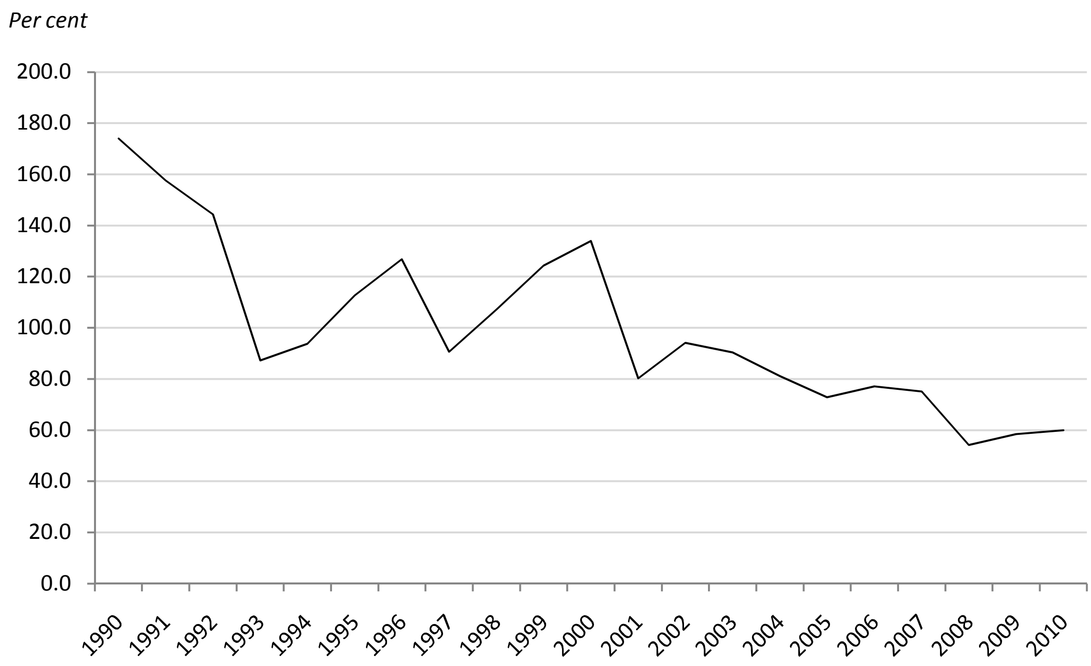


Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

The high level of dollarization in the country raises important issues for the financial sector of the country, in terms of the management of liquidity and solvency risks in the banking system. In a highly dollarized economy, the function of the central bank to act as a lender of last resort is limited. This is because the central bank cannot directly control the foreign currency component of the broad money and the money supply becomes endogenous. As a result, the banking system is required to keep sufficient international reserves to cover foreign currency deposit liabilities.

As regards the solvency risks, this may be because of balance-sheet effects of exchange rate changes due to a currency mismatch between the assets and liabilities of the banks, or due to the effect of foreign currency lending on non-foreign currency earning sectors. The latter poses a threat to financial sector viability in the event of an exchange rate devaluation, which would essentially increase the repayment burden for borrowers of foreign currency loans (Goldstein & Turner, 2004). In the case of the Maldives, as discussed above, over 70 per cent of the foreign currency loans are extended to the largest foreign currency earning sector—the tourism sector. However, the remaining 30 per cent, which was equivalent to about 15 per cent of GDP in 2010, continue to carry a risk for the banking sector in the event of a devaluation of the exchange rate.

Figure 6.7: International reserves coverage of foreign currency deposits, 1990–2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

As seen in Figure 6.7 above, the international reserves coverage of foreign currency deposits in the banking system has declined substantially over the period 1990–2010. Since 2001, the international reserves of the currency as a share of foreign currency deposits have been below 100 per cent. In the last few years (2008–2010), the ratio has fallen to around 60 per cent. This poses a liquidity risk to the banking system, indicating that the central bank would currently be unable to prevent a liquidity crisis in the event of a sustained shock to the country's balance of payments.

6.3.3 Factors Influencing Dollarization in the Maldives

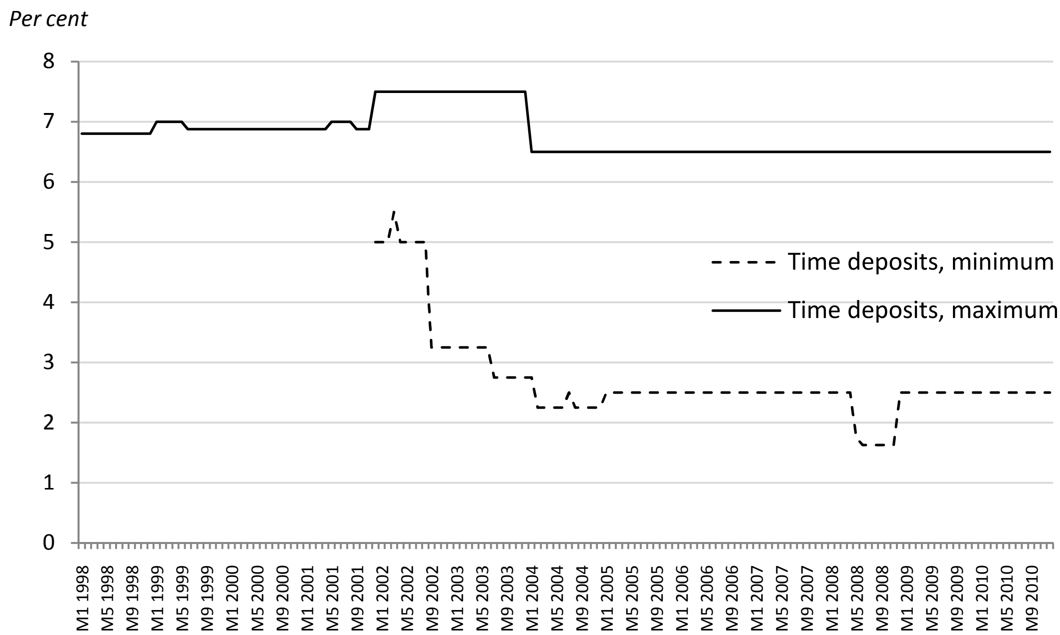
As discussed in Section 6.2.4, there are several factors, both institutional and economic, that contribute to dollarization in the developing countries. This section will look at the factors that have been used in empirical studies of other developing countries in the context of dollarization in the Maldives. This will help to identify the factors that influence dollarization in the Maldives.

Interest rates

The empirical literature on dollarization shows a significant relationship between interest rates and the demand for foreign currency deposits, especially the interest rate differential between domestic and foreign currency deposits. The higher the yield on foreign currency deposits relative to domestic currency assets, the higher will be the ratio of dollarization, as the public shift their portfolio choice to maximise returns and minimise losses.

Nominal interest rates in the Maldives have not shown much volatility, as shown by the limited variation in the rates during the period 1986–2010 (see Figures 6.7 to 6.9). There are two main reasons for this; the first being the data collection format that has been used. Interest rates are reported as a range with minimum and maximum values, and variation between the maximum and minimum values are not known. The difference between the two values has been as much as 5 percentage points in recent years. The second reason is that, due to the relative underdevelopment of the financial markets in the Maldives, coupled with limited competiveness in the banking sector, interest rates do not respond to market changes or the macroeconomic environment. Since interest rates on deposits are not available separately for foreign currency and domestic deposits for an adequate time series,[45] it will not be possible to use interest rates to determine their role in the dollarization process in the Maldives. The movements in the minimum and the maximum interest rates for time deposits (6–12 months)[46] are shown in Figure 6.8.

Figure 6.8: Interest rates on time deposits, maximum and minimum rates, 1998–2010



Source: Maldives Monetary Authority (2009, 2011)

It is obvious from Figure 6.8 that there is a large difference between the minimum and the maximum values. Moreover, there has been very little change in the interest rates over the years. Interest rates on time deposits for rufiyaa and dollar deposits (6–12-month long deposits) are available from January 1998. Figure 6.9

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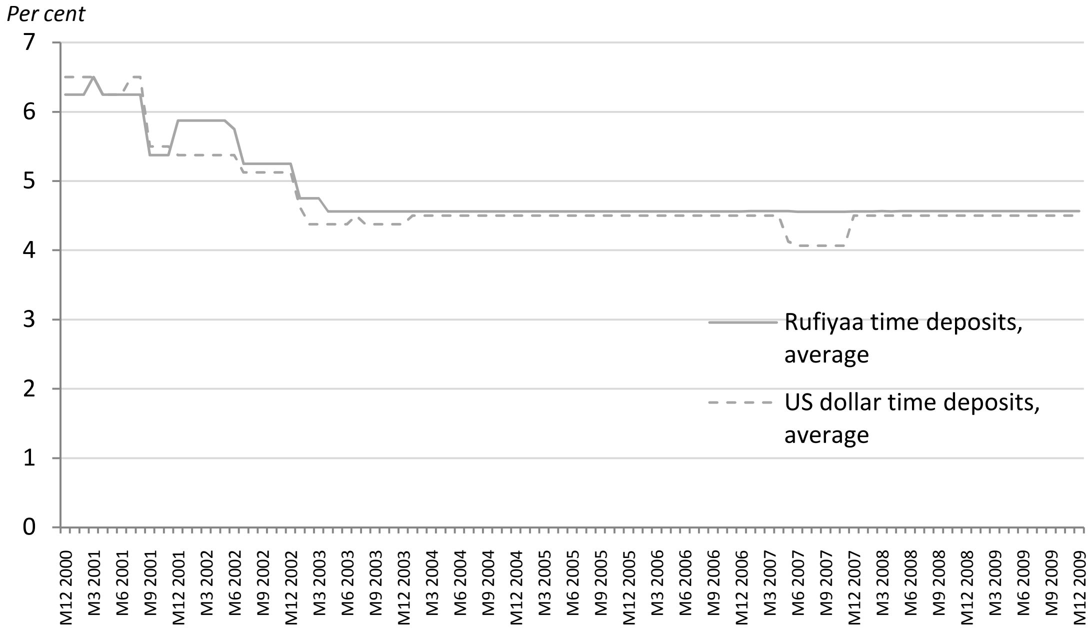
[45] Interest rates on foreign currency and rufiyaa deposits separately are only available from January 1998.

[46] Time deposits are for less than 6 months, 6–12 months, 1–3 years, 3–5 years and over 5 years. Interest rates reported for these lengths of deposit do not differ significantly.

shows an average of maximum and minimum interest rates for each currency from January 1998 to December 2010.

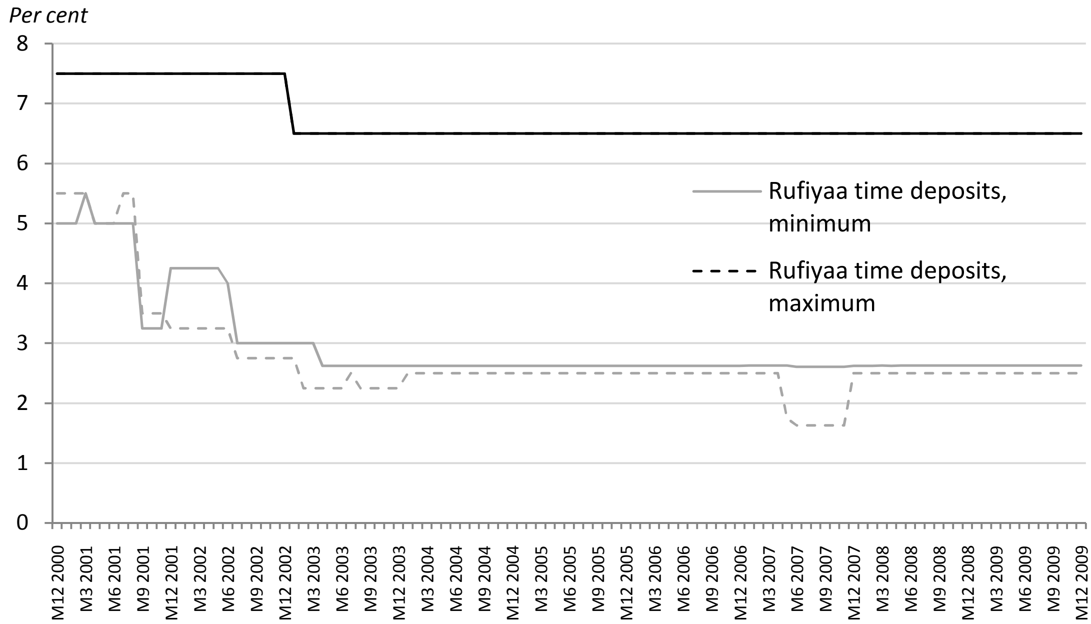
Figure 6.9: Average interest rates of rufiyaa and US dollar deposits, 2000–2009



Source: Maldives Monetary Authority (2009, 2011)

Figure 6.10 also shows that there has been very little movement in interest rates over the years, and that the spread between the two rates has been zero for most of the time. A look at the minimum and maximum interest rates for both currencies, as shown in Figure 6.9, shows that while the maximum for both currencies is the same, minimum values for dollar deposits are slightly lower than rufiyaa deposits.

Figure 6.10: Minimum and maximum interest rates for rufiyaa and foreign currency deposits, 2000-2009



Source: Maldives Monetary Authority (2009, 2011)

While theoretical and empirical evidence shows a strong and positive relationship between dollarization and interest rates for most developing countries, the significance of the variable for the Maldives is questionable. As the figures on interest rates above show, interest rates have been rigid in recent years, despite the absence of any regulations on interest rates. This is because interest rates in small developing countries like the Maldives do not always reflect market conditions, due to limited financial development and thin financial markets. Further, the data on interest rates themselves is problematic. Consequently, interest rates will not be used to determine the dollarization process in the Maldives.

Expected exchange rates

As the Maldives exchange rate has been pegged to the US dollar since 1994, the NER remains unchanged, except for 9 per cent devaluation in July 2001. Prior to the pegging of the US dollar, the exchange rate regime was officially a managed float, but de facto reflected a crawling peg. The REER shown here is calculated using a trade-weighted basket and its movements are shown in Figure 6.11.

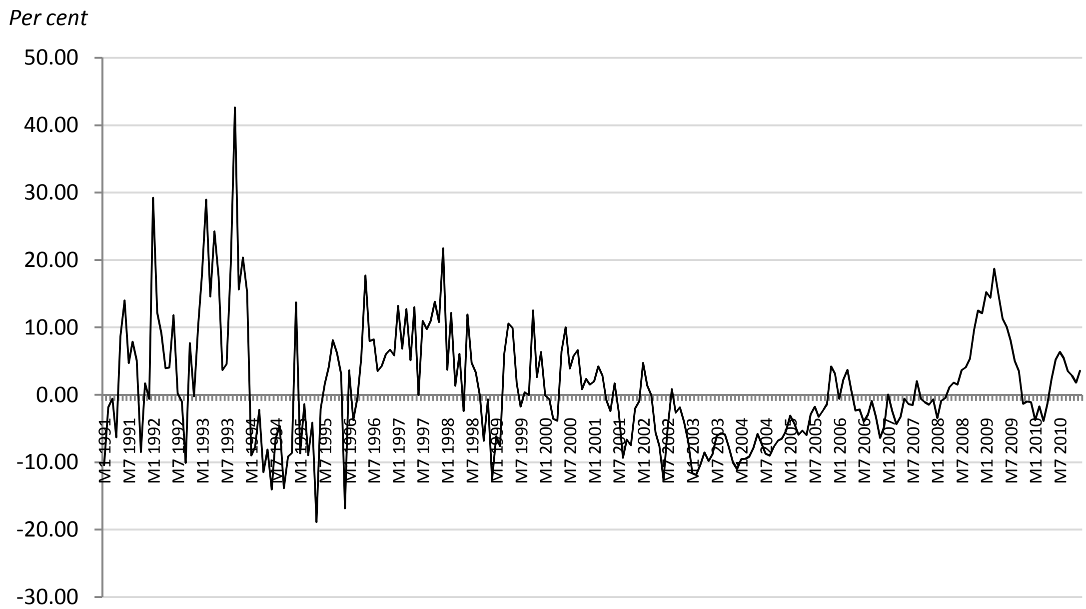
Figure 6.11: Real effective exchange rates, 1990–2010

Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Exchange rate expectations are believed to influence dollarization in the country and there is a positive relationship between the two variables. This is because an increase in expected depreciation would increase the demand for foreign currency relative to local currency. However, if there were restrictions on foreign currency holdings or currency convertibility, the behaviour of economic agents would not be as expected. Under such circumstances, there might not be a positive relationship between the two variables and expected exchange rates may not be significant.

The changes in RER shown below (see Figure 6.12) have been used in some studies as a proxy for expected depreciation in exchange rate. The hypothesis is that the yield on dollar assets relative to local currency deposits is largely determined by the expected exchange rate depreciation of the local currency relative to the US dollar. This influences dollarization through portfolio adjustments by economic agents.

Figure 6.12: Changes in real effective exchange rates, 1991-2010



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Inflation

Inflation in the Maldives has shown episodes of high inflation in the past. According to empirical studies, the 'hysteresis' in dollarization is associated with historically high inflation, as high inflation in the past that led to dollarization is not undone when inflation comes down. As discussed in Section 6.2.4, the long lasting memory of inflation and sunk costs associated with switching to dollar assets discourages economic agents from de-dollarizing, even when inflation declines and the risks to their assets are reduced. In the Maldives, inflation rates have remained at an annual average rate of about 5 to 6 per cent, except in the years 1992 to 1994, when it reached 20 per cent.

As discussed in Section 6.3.2, the relationship between inflation and dollarization in the Maldives is negative and not highly correlated. The negative relationship can be explained by the public regarding high inflation as a sign of macroeconomic instability leading to dollar shortages in the country. This may drive foreign currency deposits offshore or out of the domestic banking system. Given that the dollarization measure used in the study excludes the offshore foreign currency deposits and foreign currency in circulation, the positive relationship between inflation and dollarization may not be evident, even if such a relationship truly exists.

Inflation volatility

Not only high inflation leads to dollarization. Inflation volatility has also been a major determinant of dollarization, as this is taken as a reflection of a risky and unstable macroeconomic environment, making dollar deposits more attractive. However, the same argument for the inflation relationship for the Maldives holds for inflation volatility.

Tourism flows

Tourism growth naturally leads to greater foreign exchange flows and the dollarization of deposits. As the main inputs to tourism require dollars (imports and the wages of expatriates) as do taxes paid to the government, deposit dollarization is inevitable. The relationship between dollarization and tourism flows has been discussed in Section 6.3.2.

Foreign exchange restrictions

In the Maldives, while there are no official restrictions on foreign currency convertibility, there have been times when the fixed exchange rate has come under pressure. During these times, economic agents face difficulties, delays and limits in converting rufiyaa to US dollars, creating black markets. The depth of the black market depends on the degree of foreign currency shortages in the economy. Further, anecdotal evidence shows that during these periods, commercial banks restrict the amount of foreign currency sold to the public. As the central bank limits the sale of US dollars to commercial banks during periods of foreign exchange shortages, commercial banks also place daily limits on their sale of foreign currency to the public. In addition, individuals as well as businesses, during these times, often find it difficult to access their own foreign currency deposits held in the commercial banks. This also leads to significant delays in making international foreign currency transactions, especially import payments. Anecdotal evidence suggests that due to these reasons, businesses, as well as individuals, may be discouraged from holding their foreign currency deposits in domestic banks, preferring to hoard dollars privately or keep their deposits offshore. However, no data exists on such behaviour and these assertions are based on anecdotal evidence.

A commonly used indicator of the vulnerability of an economy is the ratio of official reserves in months of imports, which is a reflection of how adequately a central bank can respond to an external shock. If the ratio is high, it will give the public confidence about the economy and this ratio will have a negative relationship with the dollarization ratio. Similarly, this ratio can be used to reflect the unofficial restrictions on foreign currency because, during times of foreign currency shortages, official reserves held by the MMA would also be lower. In addition, the demands of commercial banks to buy US dollars from the MMA would not be fully met, thus creating foreign exchange restrictions for the public. Higher restrictions are associated with higher rates of dollarization. However, this relationship might not be clear using the dollarization ratios used in this study. This is because restrictions might not contribute to higher dollarization if the tightness of the foreign exchange market drives away foreign currency holdings from the domestic banking system.

One problem with the reserves in months of imports is that they can be greatly influenced by a sudden surge in imports, which might not reflect the tightness in the foreign exchange market. Another indicator to gauge this could be the official international reserves, which, as shown in Section 6.3.2, have a high correlation with the dollarization ratio.

Degree of openness

The Maldives is a highly open economy, largely dependent on international tourism as the main source of foreign exchange earnings. In addition, the economy is heavily dependent on imports both for domestic consumption and to cater for the large tourism industry. As a result, trade openness is high for the Maldives. Consequently, economic agents will tend to keep higher foreign currency deposits to facilitate trade. This is especially important in the Maldives, where importers need to have foreign currency to make payments for their goods and where it is not easy to convert rufiyaa to dollars in significant amounts. Therefore, higher openness to trade will have a positive relationship with dollarization. However, the relationship can also be negative, given that the depreciation of the US dollar against the currencies of major importing countries means that importers have to pay more for imports, leading to lower dollar savings.

6.4 Modelling the Dollarization Process in the Maldives

The empirical analysis in this section is undertaken to shed light on the dollarization process in the Maldives by identifying the relationship between the dollarization ratios and the factors influencing it in the country. As discussed briefly in Section 6.2.4, there is an extensive empirical literature on dollarization. Most of the empirical models used to determine the dollarization process are based on simple money demand models and portfolio-balance models. The main theoretical underpinning of these models is that the demand for foreign currency by economic agents in an economy depends largely on the interest rate differentials and the exchange rate risk. However, given the fact that the dollarization process in most countries cannot be explained by simple money demand and portfolio-balance models, these models have been extended to include other macroeconomic and institutional variables (see Civcir, 2003; El-Erian, 1988; Yinusa, 2009).

This study uses an extended version of the simple money demand model used by Rojas-Suerez (1992) and Ortiz (1983) as a basic model, to which other important variables have been added, as suggested by the dollarization literature on developing countries. From the basic money demand model, the following functional form of a demand for foreign currency is specified (Rojas-Suerez, 1992):

$$m_t - p_t = \alpha_0 + \alpha_1 E(p_{t+1} - p_t) + \alpha_2 y_t + \mu_t \tag{6.1}$$

where m is the log of the money supply, p is the log of the price level and y is the log of aggregate real income. The term $E(p_{t+1} - p_t)$ is the opportunity cost of holding money and it is given as expected inflation rate. This assumption is valid for countries with thin financial markets in which interest rates do not respond to market conditions, such as in the Maldives, as discussed in Section 6.3.3. Finally, μ is the error term of the relationship. It is assumed stationary if Equation 6.1, above, denotes a meaningful long-run relationship.

The empirical model used in this study will be a model based on Equation 6.1, augmented with other macroeconomic variables relevant to the study of the dollarization process in the Maldives, as drawn from the theoretical and empirical literature on dollarization. The reason for this is that the theoretical and empirical models used for most developing countries may not always provide an adequate framework for empirical analysis for small island economies such as the Maldives, given the different macroeconomic features of the country and the limited availability of time series and good quality data. Therefore, the empirical models for these countries are usually modified to account for the specific features of the countries to generate a well-specified model. Therefore, the empirical estimation in this study follows the Hendry approach (also known as the LSE approach), which combines time-series methods with econometric theory for econometric modelling (Hendry & Ericsson, 2004). This means that while the relationship between variables in the econometric model formulated is guided by economic theory, it is not the sole basis of model formulation, and the inclusion and exclusion of some of the variables in the model are based on data availability and country specifics.

6.4.1 Model Specification

The empirical analysis is conducted using monthly data from January 1991 to December 2010 (240 observations), which were obtained from the MMA (2009, 2011).

Following from Equation 6.1 and the empirical models on dollarization in developing countries, an econometric specification for a dollarization equation suitable for the Maldives is written as:

$$dr1_t = \beta_0 + \beta_1 inf_t + \beta_2 ir_t t + \beta_3 tour_t + \beta_4 open_t + \mu_t \tag{6.2}$$

The definitions of the variables included in Equation 6.2 are given in Table 6.3. This is followed by a discussion on the variables included in the model and the expected relationship between the dependent and independent variables. Apart from these variables, other variables such as inflation differentials, inflation, expected exchange rates and reserves in months of imports, as discussed in Section 6.3.3, were tried in the preliminary model estimation. However, they did not provide any robust results.

Table 6.3: Variable definitions

Variable	Description
DR2	Dollarization ratio as measured by the ratio of foreign currency deposits to total deposits in the banking system (in logs)
inf	Inflation volatility, measured as annual change in inflation
ir	Unofficial restrictions on foreign exchange (measured as official international reserves, in logs)
tour	Tourism inflows (measured as number of tourist bed nights, in logs)
open	Openness of the economy (measured as the share of exports and imports of goods as a percentage of GDP, in logs)

In Equation 6.2, the dollarization ratio used is the dollarization ratio as measured by the ratio of foreign currency deposits to total deposits in the banking system, DR2. As mentioned previously, the dollarization ratio DR2 is preferred to DR1 in this study, as the latter would underestimate the relative weight of foreign currency in the banking system as broad money (the denominator in the DR1 ratio) includes only the local currency in circulation and not the foreign currency in circulation. It is important to note that DR2 is still an incomplete and narrow measure and may underestimate the actual level of dollarization in the country. However, according to Clements and Schwartz (1993), such a ratio can be used in a ‘strict’ sense on the basis that the institutional and legal structure has not changed during the period under analysis. Given that the legal and institutional environment in the Maldives has not changed significantly during the period of analysis, in the absence of a better indicator, this measure of dollarization is taken as a sufficient measure for the empirical analysis carried out here. Apart from a few studies that have used a measure including both offshore foreign currency deposits and foreign currency in circulation, the majority of studies use the narrow definition used in this study. Moreover, even in some studies that estimated the broader measure of dollarization, the narrow measure of dollarization is still used due to the unreliability and lack of robustness in the estimates of foreign currency in circulation and offshore foreign currency deposits.

The variable inf is measured as the annual change in inflation rates. Inflation volatility is a reflection of a risky and unstable macroeconomic environment, which might induce economic agents to switch to foreign currency assets to minimise their portfolio risks. Therefore, a positive relationship is expected between the two variables. The reason for choosing inflation volatility over inflation differential is that the latter is more an opportunity cost of holding foreign currency. Given the interest rate developments in the Maldives as discussed in the previous section, it is expected that dollarization in the Maldives is not influenced by returns on assets. Rather it may depend on the macroeconomic environment, which is reflective from inflation volatility.

The variable ir is included as a proxy for tightness in the domestic foreign exchange market. The hypothesis here is that when the foreign exchange market is tight, the public will hoard foreign currency in the expectation of future difficulties in acquiring foreign currency from the banking system. Therefore, a decline in international reserves will increase dollarization in the economy, as this will be a sign of foreign exchange tightness in the market. However, as explained in Section 6.3.3, due to the difficulties in accessing foreign currency during these periods, the effect on the dollarization ratio as measured here, using only the foreign currency deposits held in the banking system, may not show this positive relationship. In fact, a negative relationship is possible if people hoard their foreign currency holdings or switch to offshore accounts.

The variable $tour$ is the number of tourist bed nights, to approximate the foreign currency inflows into the country. It is expected that higher tourism flows induce higher dollarization ratios and a positive relationship is expected between the two.

The variable $open$ is the ratio of openness of the economy and, as explained in Section 6.3.3, it is related to higher foreign currency deposits to facilitate trade. However, if greater openness is associated with higher import payments (for example, the depreciation of the US dollar against the currencies of major importing countries), meaning that importers have to pay more for imports, there will be fewer saving in dollars, effectively reducing the dollarization ratio. In this case, the relationship would be negative.

6.4.2 Methodology

The analysis of the time-series properties of the variables used in the model show that all the variables are non-stationary. However, they become stationary after taking their first differences. Therefore, this study employs the econometrics techniques of cointegration and ECM to estimate the relationship between dollarization and its main determinants in the Maldives. This approach identifies both the long-run relationship and the short-run dynamics of the estimated model (see Section 4.4.2).

6.4.3 Empirical Results

Unit roots and order of integration

All the variables were tested for unit roots using the ADF test. The time-series data were plotted to get a graphical representation of the data to determine which ADF test equation to use in the unit root tests. The plots of the data (see Appendix 4, Figure A4.1) showed that except for the variable *open*, all other variables fluctuated around a linear trend. The variable *open* fluctuated around a non-zero mean, and therefore the test equation included a constant. The test equation that includes both a time trend and a constant was used for all other variables. To apply the ADF test, the number of lagged terms to be included in the test equation was determined based on the SIC, but additional lags were included if autocorrelation was found in the residuals, until it was eliminated. The results of the unit root tests shows that the null hypothesis of a unit root cannot be rejected at 1 per cent significance levels for the variables in levels. Therefore, unit root tests were conducted on the first difference of the variables, which showed that all the variables were stationary in first difference, indicating that each series is integrated at the same order—I(1). These results are shown in Table 6.4.

Table 6.4: Unit root tests

Variable	**No. of lags**	**Levels**		**First Differences**		**Result**
		ADF test statistic	ADF critical val. at 5 %	ADF test statistic	ADF critical val. at 5 %	
DR2	2	-2.38	-3.43	-11.29	-3.43	I(1)
inf	4	-2.53	-3.43	-6.80	-3.43	I(1)
ir	4	-2.46	-3.43	-7.00	-3.43	I(1)
tour	13	-3.29	-3.43	-4.84	-3.43	I(1)
open	6	-2.25	-2.87	-8.28	-2.87	I(1)

Note: The null hypothesis of unit root is rejected if ADF test statistic < ADF critical value.The ADF critical values are MacKinnon (1996) one-sided p-values, provided by Eviews software.

After establishing the non-stationarity of the variables, Johansen's (1995) cointegration procedure was applied to test for cointegration of the variables. Based on a VAR model of 12 lags, the Johansen cointegration test was conducted and the results are presented in Table 6.5. Both the trace statistics and maximum eigenvalue strongly rejects the null hypothesis of no cointegration, but does not reject the null that the number of cointegrating vectors is one. This means that there is one cointegrating vector in the variables included in the model.

Table 6.5: Johansen cointegration test

Null Hypothesis	**Eigenvalue**	**Trace Statistic**	**5% Critical Value**
H_o: r = 0*	0.15	72.44	69.82
H_o: r ≤ 1	0.08	36.12	47.86
H_o: r ≤ 2	0.06	17.30	29.80
H_o: r ≤ 3	0.01	4.01	15.49
H_o: r ≤ 4	0.00	0.72	3.84
Null Hypothesis	Eigenvalue	Max-Eigen Statistic	5% Critical Value
H_o: r = 0*	0.15	36.32	33.88
H_o: r ≤ 1	0.08	18.82	27.58
H_o: r ≤ 2	0.06	13.29	21.13
H_o: r ≤ 3	0.01	3.29	14.26
H_o: r ≤ 4	0.00	0.72	3.84

** Denotes rejection of the hypothesis at the 0.05 level . The trace test indicates 1 cointegrating eqn(s) at the 0.05 level. The max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level*

Long-run model

The cointegration test provided the coefficients for the long-run relationship of the model, as specified in Equation 6.2. Therefore, the estimated long-run equation is presented in Equation 6.3, with the t-statistics in brackets. All the variables except, *open*, are statistically significant.

$$DR2 = -0.68 - 0.012inf - 0.365ir + 0.52tour - 0.061open \qquad (6.3)$$

$$(-3.15) \quad (-4.03) \quad (3.07) \quad (-0.80)$$

The sign in *inf*, which is the inflation volatility, does not have the expected sign. As the inflation differential represents the stability of the macroeconomic environment, an increase in the variable indicates a worsening of the economic environment and a possible devaluation of the currency. Therefore, theory postulates that economic agents would want to switch to foreign currency deposits, which should raise dollarization. However, the semi-elasticity of inflation volatility estimated in Equation 6.3 is a negative 1.2 per cent. This implies that if inflation volatility rises by one percentage point, then dollarization would fall by almost the same percentage point.

While this is counterintuitive, this negative relationship is consistent with the expected behaviour of economic agents in the Maldives, where macroeconomic instability is associated with tightness in the foreign currency market, as discussed in Section 6.3.3. Again, it is important to note that the dollarization ratio in the model includes only the foreign currency deposits in the banking system and does not include residents' offshore deposits and cash held domestically outside the banking system. This may explain the negative relationship between dollarization and inflation volatility. This is because high inflation and exchange rate devaluation expectations indicate a relatively tight foreign exchange market in the Maldives, which leads to dollar shortages, difficulties in accessing one's own foreign currency deposits in banks and the creation of black markets for dollars, as discussed earlier. As a result, the public may hold back their foreign currency from the banking system or transfer money to offshore accounts. The long-run negative relationship between inflation and the dollarization ratio is also common in other countries. One example is the case of Tanzania, where the dollarization ratio continued to rise even after inflation fell from over 30 per cent to single-digit levels (Kessy, 2011).

The tourism variable *tour* is of the expected sign, as more tourism inflows would mean higher dollarization. Tourism is the main driver of dollarization in the Maldives, as decisions on foreign currency holdings (especially within the banking system) are mainly driven by the institutional and structural factors in the Maldivian economy. These factors are high import dependence, tax payments in foreign currency and the liberal capital account of the country. These were discussed in Section 6.3.

Regarding the negative sign for variable *ir*, this implies that a 1 per cent increase in reserves leads to a 0.4 per cent decline in the dollarization ratio. This is as expected, because, as the official reserve position improves, the foreign exchange market becomes less tight and acquiring foreign currency becomes less difficult. Therefore, economic agents have less need to increase their foreign currency holdings. As regards the openness of the economy, the variable was not significant.

The short-run model

To model the short-run dynamics of the dollarization model using a single-equation error-correction model, a weak exogeneity test was carried out to ensure that all the right-hand-side variables were exogenous and the left-hand-side variable, endogenous. The tests for weak exogeneity of the variables are shown in Table 6.6 and they reveal an asymptotically distributed χ 2 (1) test under the null hypothesis of the existence of weak exogeneity (Harris & Sollis, 2003). The results of the tests show that all the variables *inf*, *ir*, *tour* and *open* are weakly exogenous, while DR2 is endogenous to the system.

Table 6.6: Weak exogeneity tests

	DR2	**inf**	**ir**	**tour**	**open**
Chi-square(1)	14.92	0.32	5.03	4.65	0.30
Probability	0.00	0.57	0.02	0.03	0.58

The test for weak exogeneity runs under the assumption of one cointegrating equation. The failure to reject the null hypothesis is evidence of weak exogeneity of the variable of interest.

The weak exogeneity of the right-hand-side variables, coupled with one cointegrating equation, enables the short-run dynamics of dollarization to be modelled through a single-equation approach. The error-correction model is specified in Equation 6.4.

$$
\begin{aligned}
\Delta dr1_t = \alpha_0 &+ \sum_{i=1}^{12} \alpha_1 \, \Delta dr1_{t-i} + \sum_{i=1}^{12} \alpha_2 \, \Delta inf_{t-i} + \sum_{i=1}^{12} \alpha_3 \, \Delta ir_{t-i} \\
&+ \sum_{i=1}^{12} \alpha_4 \, \Delta tour_{t-i} + \sum_{i=1}^{14} \alpha_5 \, \Delta open_{t-i} + \delta_6 D93 \\
&+ \delta_7 D01 + \delta_8 D05j + \sum_{i=1}^{3} \delta_9 \, D05_i + \sum_{i=1}^{11} \delta_{10} \, S_i \\
&+ \theta_{12} ect_{t-1} + \mu
\end{aligned}
\tag{6.4}
$$

The variables in the model shown in Equation 6.4 are as described in Table 6.2 and Δ denotes the difference of that variable. The term ect_{t-1} represents the error-correction term in the model. Further, the model contains two step dummies, three impulse dummies and a set of seasonal dummies. The shift dummy variable D93 is to capture the 1993 macroeconomic crisis, while D01 is the shift dummy for the exchange rate devaluation in July 2001. D05 is the impulse dummy for the December 2004 tsunami impact, which is specified individually for the first three months of the year 2005. The reason for including separate dummy variables for each month instead of one annual dummy is to capture the impact of each month, as the effects of the tsunami were stronger in the first month after the tsunami as compared to the subsequent months. In addition, due to the seasonality in tourism data, monthly seasonal dummies were also included.

The model was initially estimated with 12 lags using OLS. The general-to-specific methodology was followed to achieve a parsimonious model, dropping insignificant lags and variables at each level while checking for model adequacy. The final error-correction model estimated is a very simple model, which passes diagnostic tests for normality, no serial correlation, homoscedasticity and correct functional form, as seen in Table 6.7.

Table 6.7: Diagnostic tests

Serial Correlation	Breush-Godfrey LM test	3.416 [0.06]
Functional Form	Ramsey RESET test	0.068 [0.79]
Normality	Jarque-Bera	1.771 [0.41]
Heteroscedasticity	White test	0.501 [0.90]

The stability tests for the model were used to check whether the parameters of the model were stable across various subsamples of the data used in the model. The recursive residual plot show that residuals lie within a band of +/_ two standard errors, indicating that parameters in the equation are stable. This is further confirmed by the plots of the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMsq) with 5 per cent critical bands. In both plots, cumulative sums are within the critical bands. These plots are shown in Appendix 4, Figure A4.2. All three tests support the stability of the estimated model. The results of the model are presented below, in Table 6.8.

Table 6.8: Short-run dynamics of dollarization model

Dependent variable is dDR2

Variable	Coefficient	Standard Error	t-statistic	Prob.
$dDR2_{t-8}$	0.096	0.057	1.683	0.09
$dinf_{t-1}$	0.002	0.001	3.349	0.00
dir_{t-3}	0.041	0.016	2.598	0.01
$dtour_{t-3}$	0.019	0.005	3.744	0.00
$dopen_{t-4}$	0.012	0.005	2.710	0.01
D05*jan*	-0.04	0.0146	-2.5116	0.01
D05*feb*	-0.03	0.0149	-1.8026	0.07
S_1	0.01	0.0034	2.2899	0.02
S_3	0.01	0.0033	2.3611	0.02
S_6	-0.01	0.0035	-3.2716	0.00
ect_{t-1}	-0.04	0.0106	-3.6592	0.00

The d in front of the variables denotes the difference variables.

The results of the final short-run model show that the error-correction term, ect_{t-1} , has the right sign (negative) and is highly significant. The estimated value of the error-correction term of -0.04 indicates that the speed of adjustment to the long-run equilibrium is 4 per cent per month, in response to a disequilibrium caused by shocks in the short run.

All the variables in the model are significant, but at various lags. Apart from the tourism variable, all the other variables have different signs to the long-run model. However, this is expected, as the long-run behaviour of economic agents may differ considerably from their short-run behaviour, which influences their decisions on foreign currency holdings (that is, in the banking system). In the case of inflation volatility, the expected positive relationship is seen in the short-run model. This may result from economic agents, seeing this as a short-term effect, choosing to increase their foreign currency holdings in the banking system to protect their assets, instead of withdrawing or keeping foreign currency holdings outside the banking system, which they seem to be doing in the long run.

The lagged dollarization ratio gives some indication of the past dollarization affecting current rates, with the variable indicating that a 1 per cent increase in the dollarization ratio eight months previous has an impact of 0.1 per cent increase on the current dollarization ratio. The positive relationship between openness and dollarization suggests that higher external trade increases the demand (in the case of imports) and supply (in the case of exports) of foreign currency, thus driving up the dollarization ratio.

As in the long-run model, an increase in tourism increases the dollarization ratio. The positive relationship between international reserves and dollarization is harder to interpret if the former is taken as a proxy for the condition of foreign exchange market. An increase in international reserves will mean the foreign exchange market will be less tight, reducing the need to hold foreign currency and decreasing dollarization. However, if the international reserves variable is taken as a volume measure of foreign exchange inflows into the country, there will be a positive relationship.

As regards the dummy variables, only two impulse dummies and three seasonal dummies are significant. The dummies for January 2005 and March 2005, immediately following the tsunami in December 2004, are negative, as expected, indicating a fall in foreign currency inflows into the economy due to the sharp drop in tourist arrivals. The three seasonal dummies also have the expected signs, with the dummy variables for the months of January and March (the high season in the tourism sector), indicating the dollarization ratio is high in these months. The dummy for the month of June (the off-peak season in the tourism sector), has a negative sign.

The dollarization model estimated here might not be fully representative of a theoretical model. However, the estimated relationship between dollarization (albeit a narrow definition of dollarization) and the main factors influencing dollarization in the Maldives has produced important information on the dollarization process in the Maldives.

6.5 Conclusion

In the Maldives, dollarization is not primarily driven by economic factors. Like in other highly dollarized economies, in the Maldives, economic agents increase their holdings of foreign currency as a means of protecting their assets (fear of exchange rate depreciation or devaluation) during times of macroeconomic instability and distress in the country. However, additional features of the economy encourage (or force) economic agents to keep high levels of foreign currency holdings. As discussed previously, the Maldives in heavily dependent on imports. To make import payments, importers need foreign currency, which is often difficult to obtain from commercial banks. Moreover, during times of macroeconomic instability and tightness in the foreign exchange market, it is very difficult to acquire foreign currency from the banking system. Even accessing personal foreign currency deposits in the banks is difficult during such period, and international payments are often delayed. In addition, the government requires taxes and charges from sectors such as tourism—the largest taxpayer—to be paid in US dollars.

In the light of this, the dollarization ratio as measured by the ratio of foreign currency deposits to total deposits has remained high in the Maldives. The dollarization ratio used in this study is limited in the sense that it does not include foreign currency in circulation and offshore foreign currency deposits by residents. However, it still provides an adequate indicator for analysing the dollarization process in the country, given that the legal and institutional framework has not changed significantly during the period under analysis.

The analysis of the degree of dollarization conducted here showed that it has remained high in the Maldives over the past decades. Unlike in most other highly dollarized economies, in which dollarization rose following severe macroeconomic imbalances and high and persistent inflation rates, such economic factors do not appear significant for the Maldives. Rather, dollarization has followed the growth in tourism and it has been driven by institutional and structural factors in the economy.

An empirical model using cointegration analysis and an error-correction model was estimated to understand the relationship between long-run and short-run dynamics of the dollarization process in the Maldives. While empirical estimation on small countries like the Maldives suffers due to a lack of quality and longer time-series data, the empirical model estimated here provided robust results. The results showed that the tourism inflows, macroeconomic stability and the conditions of the foreign exchange market are the main factors influencing the dollarization process in the Maldives in the long run. In the short run, the openness of the economy has an effect.

A high level of dollarization in an economy undermines the effectiveness of monetary policy. The main benefit from a flexible exchange rate of an independent monetary policy cannot be efficiently used in the presence of such high and persistent levels of dollarization, such as in the Maldives. Given that the dollarization in the Maldives has not been driven by past macroeconomic instability, but has followed the growth in the tourism sector, dollarization ratios are unlikely to come down. In this context, a flexible exchange rate with more exchange rate volatility would only further escalate the dollarization in the economy, as economic agents switch to dollar assets from local currency assets to avoid exchange rate risks. The presence of such high levels of dollarization in the economy lends supports to a fixed exchange rate regime in the Maldives.

Chapter 7 | Exchange Rate Regime Considerations for the Maldives

7.1 Introduction

The choice of exchange rate regime is one of the most important macroeconomic policies for any country. This is even more important for small and open economies, such as the Maldives, that are highly dependent on international trade. Therefore, the choice of exchange rate regime is crucial for the macroeconomic development of these countries. The fixed exchange rate regime that the Maldives has maintained over the last two decades has served the country well. However, it is imperative that the choice of exchange rate regime be evaluated periodically, as the macroeconomic and structural characteristics of a country change over time. Based on the examination of the main issues related to the current exchange rate regime of the Maldives as in the preceding chapters, this chapter evaluates the appropriateness of the pegged exchange rate regime of the Maldives.

As discussed in Chapter 2, there are several determinants of exchange rate regime choice, including those stemming from OCA theories, the financial view and the political view. According to the OCA theory, the smaller a country is and the more open it is to international trade (high dependence on imports and exports), the greater the benefit from a fixed exchange rate. Likewise, if a country trades more with the country to which its currency is pegged, the stronger the case is for a fixed exchange rate. As regards the exposure to shocks, countries that face real shocks (such as natural disasters and reversal of capital flows and TOT) may be better able to adjust under a flexible exchange rate regime (Isard, 1995). The financial approach is linked to the hypothesis of the 'impossible trinity', which states that an open economy can at most control two out of three of monetary policy, capital mobility and exchange rate. In addition, countries that are highly dollarized are more likely to opt for fixed exchange rate arrangements. Meanwhile, the political view holds that countries that lack institutional credibility may use fixed exchange rate regimes to lower inflationary expectations (Levy-Yeyati et al., 2006).

While there is a large amount of literature aimed at identifying the determinants of the choice of exchange rate regime, there are very few empirical studies on how to quantify these determinants. To evaluate the choice of the exchange rate regime for a country, the determinants of exchange rate regime have to be quantified to determine the right choice for a country. For example, to quantify the theory that a fixed exchange rate regime is the more appropriate option for a highly open economy, it is necessary to know what the measure of openness of the economy is and what level is considered 'high'.

Given the problems of quantifying the determinants of the exchange rate regime and the limited literature on the subject, this chapter adopts the empirical framework developed by Husain (2006, p. 3). This framework provides 'a broad set of quantitative indicators based in analytical factors that have been identified in the literature as having important effects on the performance—and hence the choice—of exchange rate regime'. This framework is discussed further in Section 7.2.

The evaluation of the exchange rate regime in Section 7.2 shows that a fixed exchange rate regime—and hence the US dollar exchange rate peg—is appropriate for the Maldives. As an alternative option for a fixed exchange rate regime, the adoption of official dollarization for the Maldives is examined in Section 7.3, given that official dollarization is one of the hardest forms of fixed exchange rate regime, and that the unofficial or partial dollarization of the Maldivian economy is already significant.

7.2 Evaluation of the Current Exchange Rate Regime

The evaluation of the current exchange rate regime of the Maldives is undertaken using the quantitative framework developed by Husain (2006), which is based on a sample of 51 countries of various sizes and at different stages of development. The indicators included in the analytical framework include the main factors identified in the literature as the main determinants of exchange rate regimes, including the OCA factors, financial factors and political factors. These factors were discussed in Chapter 2.

In the case of the framework of Husain (2006), the determinants of exchange rate regime are divided into four broad six categories, with two or three quantifiable indicators under each category. The scores for each indicator range from 1–5, with a score of 1 for an indicator meaning a strong case for a fixed exchange rate, and a score of 5 meaning a strong case against a fixed exchange rate peg. As for the other scores, a 3 indicates that the result is neutral, and a 2 and 4 indicate a case for a fixed exchange rate and a case against a fixed exchange rate, respectively (but are not as strong as 1 and 5). The values for each level of a criterion were determined from the distribution of the results of a cross-country analysis of the 51 countries included in the sample. For example, if a high degree of trade orientation was observed, the country received a score of 1, and the values associated with a score of 1 (or 5) are determined as the highest (lowest) values for the top (bottom) 10 per cent of the countries. These values for each of the criteria for a fixed exchange rate regime are presented in Appendix 5, Table A5.1.

Within this framework, the determinants of exchange rate regime choice and their quantitative measures in the context of the Maldives are discussed below. This analysis is further substantiated with other important determinants of exchange rate regime found in the literature. The indicators included in the analytical framework are calculated for four different periods: 1990–2010 (the whole sample period), 1990–1999, 2000–2010 and 2006–2010. This was to see if the results change in different periods.

7.2.1 Economic Integration

There are three indicators to measure economic integration: trade openness, trade concentration and cyclical synchronicity with trade partner. McKinnon (1963) argued that the degree of openness is an important criterion for exchange rate regime choice, as changes in NERs are quickly reflected in domestic prices and wages. As a result, NER is not a useful instrument in economic adjustment, as exchange rate changes do not have much effect on RER. Therefore, the more open a country is, the greater the benefit of having a fixed exchange rate regime. This is because a fixed exchange rate provides stable bilateral exchange rates, enhancing gains from trade. Small economies such as the Maldives tend to be more open, as they have to rely heavily on foreign trade due to their small internal markets and limited resources.

The degree of economic openness is most commonly measured as the ratio of a country's exports and imports of goods and services to GDP. This ratio is high for the Maldives, at 161 per cent on average during the period 1990–2010 and 176 per for 2006–2010. The high openness indicator provides a strong case for a fixed exchange rate regime in the Maldives.

When a country's trade is heavily integrated with members of a currency area, or a country trades mostly with the country to which its currency is pegged, a fixed exchange rate regime enhances trade by reducing financial transactions costs and bilateral exchange rate volatility (Levy-Yeyati et al., 2006). Apart from the degree of openness, McKinnon (1963) also asserted that countries that trade extensively with one another find it more beneficial to have a fixed exchange rate regime.

As regards the trade integration or trade concentration, the Maldives do not have a dominant trading partner. As discussed in Chapter 3, the major exporting partners of the Maldives are the European countries, accounting for over 70 per cent of exports (goods and services). Of these, the most important are the UK and Italy. The Maldives' major importing trading countries are primarily Asian, including Singapore (22 per cent), India (11 per cent) Malaysia (7 per cent) and Sri

Lanka (6 per cent) during the period 2005-2010. Recently, imports from UAE have been increasing rapidly, accounting for 19 per cent of imports during the period 2005-2010. However, in the Maldives, as in the case of most of their Asian trading partners, the use of US dollars for international payments is common and extensive.

Trade concentration in the analytical framework is measured as the weight of the top currency in total exports. On this basis, the currency with the most weight in imports of goods in the Maldives is the US dollar, according to an analysis carried out on the imports of goods during the period 2005–2009. This study showed that 79 per cent of imports of goods were invoiced in US dollars, despite only 3 per cent of imports of goods being sourced from the US. Based on this imports currency invoicing data alone, there is a strong case for a fixed exchange rate. However, in most cases, the US dollar price is export prices in the producer's currency converted to US dollars at the prevailing market rates for ease of invoicing. The currency invoicing for exports of goods and services is not available, but given the dominance of the US dollar in the economy, it is expected that it would be similar for those as well.

For an OCA, or in the case of unilateral pegs, for the pegged exchange rate regime to work, an important criterion is symmetry of shocks. This means that the home country and the anchor currency, in the case of fixed exchange rate, should face more symmetric shocks and less asymmetric shocks. For example, country A's exchange rate is pegged to country B, which means that country A does not have an independent monetary policy, instead 'importing' the policy effects of country B. Suppose country B is faced with a demand shock due to expansionary fiscal policy and wants to tighten their monetary policy. The tight monetary policy leads to a contraction in money supply and an increase in interest rates. Country A, on the other hand, does not want a tighter monetary policy, as their economy did not face a demand shock. However, if the exchange rate is pegged, country A has to tighten their monetary policy and increase their interest rates, which would depress investment and may result in an unnecessary recession in country A. Therefore, asymmetric shocks are costly when a country's exchange rate is pegged. In contrast, if two countries face the same demand shocks, the policy response of both the countries would be similar. Moreover, if labour is mobile and wages are flexible between the two countries, then there is no need for an adjustment in exchange rate in the face of asymmetric shocks, as they adjust automatically under these conditions to restore equilibrium in the economy. Therefore, an independent monetary policy becomes redundant.

Most authors of studies on exchange rate regimes agree that when two countries face asymmetric demand and supply shocks, exchange rate adjustments are the best way to achieve equilibrium. Therefore, in these situations, flexible exchange rate regimes are preferable. However, this is only if the shocks are real. If the country faces predominantly nominal shocks, a fixed exchange rate works better (Guðmundsson, Pétursson, & Sighvatsson, 2000).

The symmetry of shocks can be seen in the business cycle synchronisation of a country with its major trading partners. This is measured as the correlation between the annual growth in a country's GDP and that of the anchor currency country, in the case of an exchange rate peg. In the case of the Maldives, the correlation between the annual GDP growth of the Maldives and that of the US is estimated. This indicated a correlation coefficient of 0.37 for the period 1990–2010, a negative 0.05 per cent for the first half of the 1990s and a positive and high 0.42 for the period 2000–2010 (which was even higher for the last five years, at 0.67). This synchronisation of the business cycle is a reflection of the exposure of the Maldivian economy to international fluctuations in economy given the economy's dependence on tourism. It should be noted that this is a very simplified measure of business synchronisation, and the use of annual data may overstate the correlation between the two countries.

In general, two out of the three indicators that are used to measure trade integration in the Maldives provide strong support for the fixed exchange rate regime.

7.2.2 Financial Integration

The level of development of the financial sector is important in determining the choice of exchange rate regime. A flexible exchange rate requires a deep and well-functioning financial sector if it is to be used effectively. This argument has been stressed by authors such as Black (1976) and Branson and Katseli-Papaefrstratiou (1980). Developing countries characterised by thin financial markets often do not have forward exchange facilities, have limited stock market activities and have a financial sector dominated by the banking system, which itself is very small. As a result, these countries may not have sufficient market participation for effective conduct of foreign exchange markets. In addition, the trade sector may be controlled by a few powerful agents who may influence the market, leading to uncompetitive behaviour and market dominance.

According to studies undertaken by Rogoff et al. (2004) and Husain et al. (2005), developing countries that are less integrated with world capital markets can maintain fixed exchange rates without compromising stability and the rate of economic growth. They also asserted that there is a positive relationship between the benefits of flexible exchange rate and institutional developments and financial integration. According to Rogoff et al. (2004), the level of financial integration of a country can be determined from the inclusion or exclusion of a country in the Morgan Stanley Capital International emerging market index. In the case of the Maldives, the country is not included in this index or in any other similar indices. Based on that, the Maldives is not integrated with international capital markets.

Other indices that are used to identify small economies that are financially integrated but not included in the emerging markets index include stock market capitalisation (IFC uses a threshold of $2 billion) and stock market turnover (above US$1 billion). As mentioned previously, the financial sector in the Maldives is relatively small, consisting of five commercial banks (of which one is a local bank and the rest branches of foreign commercial banks), a few insurance companies, a finance leasing company, a specialised housing finance institution, money services businesses and securities market intermediaries. There are only four companies listed in the Maldives Stock Exchange, which was established in 2002. Only a very small number of shares are traded in the Maldives Stock Exchange. Market capitalisation was at around US$167 million during the period 2007–2010, which is significantly below the thresholds of financially integrated markets (Maldives Monetary Authority, 2010b).

Level of financial integration is also measured by the ratio of money to GDP, known as the monetisation ratio. If this ratio is low, it indicates that the financial market is not very developed (Husain, 2006). In contrast to the previous two indicators of financial integration, the monetisation ratio for the Maldives is high, at 48 per cent in the period 1990–2010. Moreover, the ratio has risen to 73 per cent on average during the last 5 years. This suggests a high level of exposure to capital flows volatility, and thus does not support a fixed exchange rate regime for the country.

7.2.3 Economic Diversification

According to Kenen (1969), product diversification is important in determining the choice of exchange rate regime. A well-diversified economy reduces the costs associated with fixed exchange rates. The more diversified the economy is, the lower the potential effect to the aggregate economy of a shock to a single sector. Therefore, the need for exchange rate adjustments is also lower in this situation. In contrast, if an economy is dependent on one or a few commodities, exchange rate adjustments are needed to deal with world commodity prices. This would contain spill over effects to other sectors. Frankel (2003) recommends countries dependent on a single commodity to peg their exchange rate to the world price of the commodity (for example, oil). However, this is not the same situation as a fixed exchange rate against any currency.

One of the three indicators used to measure trade diversification in the analytical framework is the volatility in a country's TOT. Since TOT data were not available, they were constructed in Chapter 4 of this study. Given the importance of the tourism sector and the insignificant merchandise exports, as mentioned earlier, the TOT index for the Maldives includes tourism prices as export prices. The volatility of TOT was calculated using monthly data and then averaged for annual values. TOT volatility does not seem to be very high for the Maldives, and has been ranked at 3 in scale used for the analytical framework, suggesting that it does not provide a case either for or against a fixed exchange rate regime.

The second indicator used to measure trade diversification is the share of primary commodities in a country's GDP. The economic base of the Maldives is very narrow, with merchandise exports consisting principally of fish, which are mainly exported unprocessed as fresh or frozen fish. Fish exports accounted for less than one-third of total exports of the country during the period 1990–2010 and this ratio falls to less than a quarter when only the years 2000–2010 are considered. Moreover, the sector has accounted for only 3 per cent of GDP in recent years. In contrast, the tourism sector contributes over 70 per cent of foreign exchange earnings in the Maldives and accounts for almost one-thirds of the country's GDP. Most of the other industries, such as transport and communications (together accounting for about 20 per cent of GDP), are linked to the tourism sector and the dependence of the economy on the tourism sector, as a result, is very high. Therefore, the share of tourism in total exports and GDP is a better indication of trade diversification for the Maldives, and this clearly shows that the Maldivian economy is not diversified. As such, the country is not a good candidate for a fixed exchange rate according to this criterion.

The third indicator of trade diversification is the correlation of a country's economic cycle with the world price cycle of the primary commodity it exports. However, given that the Maldives economy is tourism based, this is not a very appropriate measure for the Maldives. Therefore, this has not been calculated.

Based on the moderate TOT volatility and the high dependence of exports and GDP on one sector, it is clear that the Maldivian economy is not diversified. This indicates that a fixed exchange rate would not be suitable for the Maldives.

7.2.4 Macroeconomic Stabilisation

The type of exchange rate regime that provides macroeconomic stabilisation depends on the nature of economic shocks and the degree of capital mobility. As regards the degree of capital mobility, the Maldives do not have any capital controls, and both residents and non-residents may freely import and export capital. Moreover, the residents do not require permission to maintain foreign currency accounts either at home or abroad. There is also no distinction made between foreign nationals' or non-residents' accounts held with the banks in the Maldives. The only regulation is that foreign direct investments coming into the country require initial approval from the government. However, once permission has been granted, there are no restrictions on the transferring of profits. Most of the capital inflows into the country are in the form of foreign direct investment, and there are very few short-term capital inflows. The level of capital mobility is measured in the analytical framework as the ratio of gross capital flows to trade flows. For the Maldives, this indicates a moderate level of capital mobility. Given the weakness in the capital flows data in the balance of payments statistics in the Maldives, this may be very much underestimated. Therefore, the capital mobility may be higher than this, which means that it will be difficult to maintain a fixed exchange rate in such an environment.

The second factor in choosing an exchange rate regime that stabilises the macroeconomic environment of a country is the nature of economic shocks that a country faces. An economic shock is an unexpected exogenous disturbance that generates significant effect on the economy. They come in a variety of forms, including demand and supply shocks, real and nominal (monetary) shocks, and domestic and external shocks. Economic shocks that have a lasting effect on the output of the economy are called permanent shocks, and those with temporary effects are called transitory shocks.

Within a Mundell-Fleming framework, countries that are more prone to real shocks, such as TOT shocks or natural disasters are better suited to adopt floating exchange rate regimes, as they provide better insulation from real shocks (Kenen, 1969). This is because under a flexible exchange rate regime a change in demand for exports or TOT will lead to an exchange rate adjustment, restoring external balance. Conversely, countries that face nominal shocks predominantly will be better off with a fixed exchange rate regime. Both Mundell (1963) and Fleming (1962) argued that exchange rate adjustments are not required when a country is faced with nominal shocks, as money supplies automatically adjusts to changes in money demand, without a need for changes in interest rates or price level.

When an economy is hit by a positive aggregate demand shock, with capital immobile and a fixed exchange rate, imports rise and reserves fall. This leads to a contraction in money supply, if not sterilised will offset the initial shock. With a flexible exchange rate and capital immobile, the shock will lead to exchange rate depreciation, worsening the initial condition. If capital is highly mobile and the exchange rate is fixed, an aggregate demand shock raises interest rates, thereby attracting more capital inflows and offsetting the loss in reserves. This would increase money supply and worsen the initial condition. When exchange rates are flexible and capital is mobile, higher capital inflows appreciate the exchange rate and offset the initial shock to some extent (Husain, 2006).

Based on the Mundell-Fleming framework, which assumes perfect capital mobility, it is not possible for a country to achieve exchange rate stabilisation, capital market integration and independent monetary policy simultaneously, as postulated by the phenomenon of the impossible trinity. These arguments are also supported by Boyer (1978), Henderson (1979), McKinnon (1981) and Poole (1970).

Several studies have been undertaken to empirically test the relationship between economic shocks and exchange rate regime. Edwards and Levy-Yeyati (2005) evaluated data from 183 countries over the period 1974–2000 (though due to data limitations, they used two sub-samples of 96 and 100 countries). They used a de facto exchange rate regime they constructed, as the de jure exchange rate regimes were found to be significantly different from the de facto regimes. Their results also suggest that countries with flexible exchange rate regimes tend to accommodate external real shocks better than countries with less flexible exchange rate regimes. Moreover, a negative shock was found to effect output more significantly in a flexible exchange rate regime than did a corresponding positive shock for a country with a fixed exchange rate regime. It was found that a 10 per cent deterioration in a country's TOT leads to a 0.4 per cent real contraction, but for a country with a fixed exchange rate, the contraction is almost double. They also found that economic growth is higher in countries with flexible exchange rate regimes, compared to fixed exchange rate regimes. Similar results were achieved by Hoffman (2007), who also found that flexible exchange rates work better for macroeconomic adjustments following an external negative shock.

Two indicators are used to assess the nature and importance of shocks in the Maldivian economy. The first indicator is the coefficient of variation of the money velocity. If nominal shocks are large, then the value for this indicator would be high, which would mean that fixed exchange rates are more feasible. The second indicator measures the relative importance of nominal shocks compared to real shocks, by scaling the volatility in money by the TOT volatility. A smaller value indicates that real shocks are more important and vice versa. In the case of the Maldives, monetary shocks have been relatively moderate, and the ratio of monetary shocks to real shocks indicates that both are equally prevalent. Therefore, neither of these indicators provides support for or against a fixed exchange rate.

7.2.5 Central Bank Independence and Credibility

The exchange rate regime choice literature of the 1980s emphasised the use of exchange rate as a nominal anchor to gain credibility for countries with a history of high inflation. Giavazzi and Giovannini (1989) and Dornbusch (2001), among others, suggested that by adopting fixed exchange rates, countries could induce discipline and make their monetary policy credible. This would avoid the time-inconsistency problem[47] that central banks often face (Bordo, 2003).

To check if a country had a history of high inflation rates, Husain (2006) assessed its inflation history by calculating the proportion of months over the past decade in which inflation exceeded 10 per cent on a year-on-year basis. A threshold of 8 per cent was also used. In the case of the Maldives, the proportion of months that had an inflation rate over 10 per cent in the period 1990–2010 was 21. This means that the inflation rate was higher than 10 per cent 21 per cent of the time during that period. When the inflation rate threshold is set as 8 per cent, the proportion of the period during which inflation was higher than 8 per cent is 31 per cent. Over the period 2005–2010, the inflation rate was higher than 10 per cent in 15 per cent of the months, while it was higher than 8 per cent in 32 per cent of the months during the same period. The history of inflation in the Maldives does not suggest the need for a nominal anchor to gain credibility. Within the framework used here, the history of inflation in the Maldives as an indicator is neutral in the case for and against a fixed exchange rate regime.

7.2.6 Fear of Floating and Balance-Sheet Effects

The choice of exchange rate regime also depends on the 'fear of floating' and balance-sheet effects. As discussed in Chapter 3, 'fear of floating' refers to the phenomenon in which some countries, while proclaiming to have adopted a floating exchange rate regime, continue to maintain their exchange rate within a narrow band with respect to some anchor currency. This is to avoid large swings in exchange rates, as they perceive depreciations or devaluations to have detrimental effects on the balance sheets, especially when they have large foreign currency denominated debt (Calvo & Reinhart, 2000). The high ERPT associated with high

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[47] Time inconsistency problems refer to situations in which a policy maker announces a policy and later reneges on the policy in favour of another. Knowing this, economic agents would discredit any policy announcements, making it difficult to reduce inflation (Agénor & Montiel, 2008).

levels of dollarization is also believed to be a reason behind the 'fear of floating' phenomenon faced by many developing countries (Reinhart et al., 2003).

The dollarization ratio, as measured by the ratio of foreign currency deposits to broad money supply, is very high for the Maldives, at levels above 50 per cent. As discussed in Chapter 6 of this study, apart from deposit dollarization, the country also has high levels of credit dollarization and foreign currency denominated public debt. This provides a strong case for a fixed exchange rate, as exchange rate volatility from a flexible exchange rate will be costly to the country when a large proportion of a country's assets and liabilities are denominated in foreign currency.

The balance-sheet effects in the analytical framework of Husain (2006) are calculated as the correlation between the growth in nominal effective exchange rate and the lagged growth in economic activity. A high and positive correlation between the two variables suggests that balance-sheet effects will be significant and that a fixed exchange rate would be more appropriate. Conversely, a low and negative correlation supports the case against a fixed exchange rate. This is not a very common method of measuring balance-sheet effects, but is calculated here for comparison. A more commonly used measure is discussed later. The correlation between a change in NEER and the lagged growth in economic activity in the Maldives shows a positive but not very high correlation between the two.

While a simple correlation between the two variables may not be very reflective of the balance-sheet effects in a highly dollarized economy such as the Maldives, another more commonly used indicator of balance-sheet effects, as discussed in Chapter 6, is the currency mismatch between the assets and liabilities of the banking system in the Maldives. The balance-sheet effects as measured by the ratio of foreign currency loans to foreign currency deposits are very high, at over 100 per cent in the period 1990–2010, and at about 176 per cent during the period 2006–2010. This suggests that balance-sheet effects of changes in nominal exchange rates will be highly significant in the Maldives.

The third and last indicator in the analytical framework is the degree of ERPT. In Chapter 5 of this study, ERPT was estimated for the Maldives, which showed that the pass-through is very high, at 90 per cent for the period 1990–2010. While there are no separate estimates for the sub-periods in the analytical framework, it is not expected that this would be significantly different for the other periods. This provides a case for a fixed exchange rate as a high ERPT means that the more volatile the NER is, the higher the variability in inflation will be. In addition, any real exchange depreciation resulting from a nominal depreciation will be quickly eroded, thus minimising its expansionary effects. The fear of floating and balance-sheet effects indicators suggest a strong case for a fixed exchange rate regime for the Maldives.

7.2.7 Summary of Results

The scores for the indicators that were calculated to evaluate the choice of an exchange regime for the Maldives as discussed above are summarised in Table 7.1. (The detailed results are included in Appendix 5, Table A5.2). The scores are computed for the period 1990–2010 and then for the three sub-periods of 1990–1999, 2000–2010 and 2006–2010. This will reveal whether the scores have changed over the years.

The assessment of the exchange rate regime using the analytical framework presented in Table 7.1 broadly supports the case for a fixed exchange rate regime for the Maldives, for the shole sample period and the sub-periods. Most of the indicators support the case for a fixed exchange rate or are neutral. However, it should be noted that exchange rate assessment based on the key determinants of the exchange rate regime is a complex issue. As there is no single indicator that can quantify a given determinant of an exchange rate regime, several indicators have to be used that would usually give conflicting results, as seen in the discussion in the previous section.

Table 7.1: Evaluation of the Maldives exchange rate regime

Exchange rate regime Indicator	1990–2010	1990–1999	2000–2010	2005–2010
Economic integration	1	2	1	1
Trade openness	1	1	1	1
Trade concentration	1	1	1	1
Cyclical synchronicity	2	5	2	2
Financial integration	2	1	2	2
Inclusion in major indices	1	1	1	1
Stock market cap.	1	1	1	1
Financial development	3	2	3	4
Economic diversification	4	4	4	3
TOT volatility	3	3	3	2
Comm. dependence—GDP	4	4	4	4
Commodities—activity				
Macroeconomic stabilisation	3	3	3	3
Capital versus trade flow	2		3	3
Monetary volatility	3	3	3	4
Real v. nominal shocks	3	3	3	3
Credibility	3	3	3	3
Inflation history—8 per cent	3	3	3	3
Inflation history—10 per cent	3	3	3	3
Fear of floating type effects	2	2	2	2
Dollarization	1	1	1	1
Balance sheet effects	3	4	3	3
ERPT	1	1	1	1
Average score	2	3	2	2

Scores: 1 = Strong case for a fixed exchange rate; 2 = Case for a fixed exchange rate; 3 = Neutral; 4 = Case against a fixed exchange rate; 5 = Strong case against a fixed exchange rate

Apart from the determinants of exchange rate regime choice included in the analytical framework presented in Table 7.1, there are also other factors that are important in the choice of an exchange rate regime. According to McKinnon (1963), fixed exchange rate regimes are better for small economies. Countries that are small in terms of their economic size are better served by a fixed exchange rate regime, as the gains from trade would be higher and the cost of giving up an independent monetary policy would be minimal. Moreover, as small economies are often very open economies, the use of foreign currency is substantial. Therefore, if the exchange rate is flexible and there are exchange rate fluctuations, economic agents will tend to use less of the national currency and more of foreign currencies, which may reduce the effectiveness of monetary policy. In contrast, if the exchange rate is fixed, the use of national currency is greater (Isard, 1995). With regard to economic size, the Maldives economy is very small, with a GDP of just US$878 million in 2010. Most literature on the size of the economy considers economies with GDPs of less than US$5 billion as small economies (Imam & Minoiu, 2005).

Apart from capital mobility, labour mobility is also important in determining the exchange rate regime choice. According to Mundell (1961), fixed exchange rate regimes work better among countries between which there is greater factor or labour mobility (see Section 2.5.1 for an explanation of this effect). Along with labour mobility, Mundell also stressed the importance of price and wage flexibilities. Therefore, the presence of labour mobility and price and wage flexibilities reduces the need for relative exchange rate adjustments in the face of shocks to the economy, and an independent exchange rate becomes less important. However, due to factors such as migration costs, retraining costs and language barriers, labour mobility tends to be low, even for currency union areas. Therefore, the costs of maintaining a fixed exchange rate are higher when there is low labour mobility, as it is difficult to respond to conditions of higher unemployment and inflation due to changes in aggregate demand.

In the Maldives, there is high international inward mobility of labour. Due to the small size of the domestic labour force and structural problems with the local labour force in the Maldives, a large number of expatriate workers are employed in the country. At the end of December 2008, the number of expatriates in the country totalled 81,000, accounting for approximately 41 per cent of total employment. The majority of expatriates are employed in the construction and tourism sectors (about 60 per cent) and over 75 per cent are in low-skilled jobs. Foreign workers are required to obtain a work permit through their employer or an employment agency prior to their arrival to the Maldives. The employer is required to pay a work permit fee and lodge a financial deposit with the Maldivian government for the duration of their stay. Work permits are usually granted for one year and can be renewed. There are restrictions on the number of workers that can be employed in a given sector by an individual employer. In the tourism sector, it is required that 50 per cent of the workers are local, although many businesses do not comply with this regulation, due to a lack of availability of local workers for the required jobs. While there is inward mobility in labour, very few Maldivians go to other countries for work. This is partly due to the small size of the Maldivian labour force, ample job opportunities in the Maldives for those who are willing to work and have the necessary skills and restrictions on migration imposed by most countries. Therefore, it cannot be said that the labour mobility criteria is met by the Maldives.

The levels of international reserves that a country can maintain and the opportunity cost of holding them needs to be considered when choosing an exchange rate regime for a small open and developing economy. In a fixed exchange rate regime, adequate levels of foreign currency reserves are required to support the exchange rate peg (Frenkel, 1980). This is even more important if there is no credibility of the government and if there are large macroeconomic imbalances, such as large budget and current account deficits. In the case of the Maldives, the level of reserves that the country has been able to maintain over the past two decades has been relatively low. There are several measures used to determine the adequacy of international reserves to support an exchange rate peg. Some of the most commonly used are reserves in months of imports; ratio of reserves to broad money; ratio of reserves to base money; and ratio of short-term external debt to reserves (Dehesa, Pineda, & Samuel, 2009). In the case of the Maldives, the computed values of the first three indicators are shown in Table 7.2 for the same periods used above. The ratio of short-term external debt to reserves is not computed, as the data on short-term debt are not available.

Table 7.2: International reserves, 1990–2010 (%)

	1990–2010	1990–1999	2000–2010	2006–2010
Reserves in months of imports	3.1	2.7	3.4	3.1
Ratio of reserves to broad money	38.3	40.1	36.7	31.0
Ratio of reserves to base money	68.0	58.0	76.2	72.0

Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

As regards the international reserves in months of imports, an adequate level of reserves is considered three months of import coverage. For the Maldives, this level is just reached for most periods, except for the 1990s. The ratios of reserves to monetary aggregates, which show the extent to which a central bank can back its liabilities to maintain the fixed exchange rate, are not very high for the Maldives. The ratio of reserves to broad money averaged 38 per cent during the period 1990–2010, and the ratio was much lower at 31 per cent in the last five years. The ratio of reserves to base money was higher but still less than 100 per cent, at 68 per cent during the period 1990–2010 and 72 per cent for 2006–2010.

To compare these results with countries similar to the Maldives, the results from an IMF working paper by Dehesa et al. (2009) are used. In that paper, these ratios were computed for the ECCU countries, small tourism-dependent countries and Caribbean countries (excluding ECCU) for the year 2008. They showed that both the reserves in months of imports and reserves as a percentage of broad money are close to the levels of the Maldives, while the ratio of reserves to base money was over 100 per cent for all the country groups. While it is traditionally argued that an adequate level of reserves are required to maintain a fixed exchange rate, a country with a low level of reserves can also maintain a fixed exchange rate if there is credibility of the government's policies and there is confidence in the government's ability to maintain the exchange rate peg (Sarno & Taylor, 2002a).

The additional determinants of exchange rate regime choice discussed above do not provide conclusive answers to the choice of exchange rate regime. However, the discussion of these additional determinants and the determinants discussed in the context of Table 7.1 points to the optimality of a fixed exchange rate regime for the Maldives.

7.3 Assessment of an Alternative Exchange Rate Regime for the Maldives—Official Dollarization

The assessment of the exchange rate regime choice presented in the previous section based on the economic and structural characteristics of the Maldivian economy provides support for a fixed exchange rate regime for the country. Given that the exchange rate regime analysis was undertaken in the context of the existing US dollar exchange rate peg that the country has maintained since 1994, it can be concluded that the analysis in Section 7.2 provides support for the optimality of the US dollar exchange rate peg for the Maldives.

However, as discussed in Chapter 2, there are several variants of the fixed exchange rate regime including currency union, official dollarization, currency board, unilateral peg, peg to a basket of currencies, pegged within bands, crawling peg and target zone within a band. Therefore, to provide an assessment of an alternative fixed exchange rate option to the current US dollar exchange rate peg, this section evaluates the adoption of official dollarization in the Maldives. The reason for choosing official dollarization as an option is two-fold. The first is that dollarization, apart from currency union, is the hardest form of a fixed exchange rate regime, and the most credible. This is because the uncertainty of devaluation of the exchange rate is not present when a country gives up its own currency and adopts another country's currency in the case of official dollarization (Sarno & Taylor, 2002a). The same benefits are accrued in the case of a currency union, but for the case of the Maldives, this is not an option in the near future. This is because forming a currency union is a long process and requires a high level of regional integration. This is lacking among the eight countries of South Asia: Afghanistan, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka, which forms the regional organisation of SAARC. The SAARC countries do not have the necessary economic conditions or political will to form a currency union.

The second reason for evaluating the option of adopting official dollarization is that partial dollarization is very high and persistent in the Maldives. Indeed, the Maldives is classified as a highly dollarized economy, as discussed in Chapter 6. In contrast to other highly dollarized economies in which dollarization has been a consequence of severe macroeconomic imbalances and high and persistent inflation rates, in the Maldives, dollarization has arisen due to the economic structure of the country, in particular, due to the dominance of the tourism sector. Therefore, the partial dollarization of the economy has followed the growth of tourism, and likely to persist in the future.

This section will first evaluate the costs and benefits of adopting the US dollar as the legal tender in the Maldives. Then, an evaluation of the preconditions for adopting official dollarization will be given. This is followed by a brief discussion on the operational and practical issues that the Maldives may face when adopting the US dollar as their national currency. There are several arguments for and against dollarization. The literature on dollarization identifies three main benefits of dollarization, the first three of which are discussed below. A fourth benefit is also briefly mentioned. Following that, the costs of dollarization are discussed.

7.3.1 Benefits of Official Dollarization

Reduction in transaction costs

This is based on the traditional OCA theory, which stipulates that a fixed exchange rate provides a stable bilateral exchange rate by reducing exchange rate volatility. The adoption of official dollarization is believed to enhance gains from trade, by eliminating the cost of currency conversion and hedging against exchange rate risks (Levy-Yeyati & Sturzenegger, 2003a).

Enhanced policy credibility

When a country adopts another country's currency, especially in the context of past or current high inflation with serious credibility issues, it forces the adopting country to be passive in their monetary policy and follow the monetary policy and the 'inflation fighting credibility' of the currency issuers' country. However, given the high structural fiscal deficit and the weak macroeconomic situation in the US, the adoption of the US dollar may not bring such credibility to the economy, at the present time. As regards the domestic fiscal policy, the adoption of another currency will force greater fiscal discipline on the government as automatic financing of the budget by printing more money is no longer possible. While this would not eliminate or even reduce budget deficits, it would make the financing of budgets more transparent. This is because, when the government does not have its own currency, they cannot print money to finance the budget deficit. Instead, the budget has to be financed through higher taxes or increased government debt, which are less inflationary. This might also help to bring inflation down if it is high, as public gain credibility in the economy (Salvatore, Dean, & Willett, 2003).

Sound financial sector and financial deepening

The domestic financial system will deepen with official dollarization, as banks would find it easier to borrow from abroad as the currency risk and currency mismatches are eliminated. When there is high inflation, instability in the exchange rate and the risk of devaluations, depositors tend to keep their financial assets abroad. This is to safeguard their assets from losses due to devaluation or a forced conversion of foreign currency deposits to local deposits by the government. Such forced conversion of foreign currency deposits to local currency deposits has occurred in countries such as Mexico and Bolivia in 1982 and Peru in 1985 (De Nicoló et al., 2005), leading to a sharp contraction in domestic financial intermediation (Balino et al., 1999; Savasatano, 1996). Official dollarization encourages depositors to keep their deposits onshore, thus increasing the financial intermediation in the domestic economy. However, empirical evidence on official dollarization and financial deepening are non-existent and studies that deal with these issues are limited to cases of partial dollarization. As mentioned in Chapter 6, De Nicolo et al. (2005) empirically tested the impact of partial dollarization on financial deepening and found that dollarization has a positive effect on the financial depth of a country, but only in high-inflation countries. Extending this research, Rengifo, Court, & Ozsoz (2010) also examined the impact of deposit dollarization on financial deepening and found that dollarization has a significantly negative effect on financial depth, regardless of inflation levels. However, they also found that in high-inflation countries, dollarization moderates the adverse effects of inflation on financial deepening.

Limit currency and balance of payments crises

Without a domestic currency, there are no currency and balance of payments crises.

7.3.2 Costs of Official Dollarization

There are several consequences or costs of official dollarization, and the extent to which a country faces these consequences will depend on the degree of dollarization in the country. The main consequences of official dollarization are discussed below.

Loss of seigniorage

One of the biggest drawbacks of official dollarization comes from the loss of seigniorage. Seigniorage is the revenue received from issuing the national currency. The net seigniorage is the difference between the cost of printing money and the revenue received from issuing the money, as the money is sold at face value. The revenue from seigniorage is substantial in most developing countries and such revenue would be lost completely in the case of official dollarization. When there is unofficial or partial dollarization, revenue from seigniorage would be reduced, as domestic currency is substituted for foreign currency (Jacome & Lonnberg, 2010).

Both the stock and flow revenue losses from seigniorage are important when a country officially adopts dollarization. When the domestic currency is officially replaced by a foreign currency, the stock of domestic currency needs to be withdrawn from circulation and the authorities would need to purchase the equivalent foreign currency to replace the domestic stock. The flow revenue is the loss of seigniorage from the increase in the domestic monetary base in each year, which would now accrue to the country of the adopted foreign currency.

There are a few different ways of measuring seigniorage. The simplest and most common measure is the monetary seigniorage, normally defined as an increase in the monetary base divided by the price level (Berg & Borensztein, 2003), which is given by:

$$sM = dM/P \tag{7.1}$$

where dM is the change in monetary base and P is the price level. The monetary seigniorage can be decomposed to real seigniorage and inflation tax and can be shown as follows:

$$st = (mt - mt - 1) + mt - 1(Pt - Pt - 1)/Pt \tag{7.2}$$

where m_t is the real holding of the monetary base, defined as M_t/P_t. The first term on the right-hand-side of the equation is the real seigniorage and the second term is the inflation tax (Berg & Borensztein, 2003).

Another measure of seigniorage takes the opportunity cost concept and measures seigniorage as the amount of revenue that the central bank or the government may receive as interest if the monetary base is invested at the market interest rate (Berg & Borensztein, 2003). Equation 7.3 specifies the seigniorage according to the opportunity cost concept:

$$Sopp = iM/P \tag{7.3}$$

where *i* is the market interest rate, M is the monetary base and P is the price level.

Klein and Neumann (1990) and Neumann (1995) use a broader measure of seigniorage, which is the total gross seigniorage, defined as the real gross revenue that accrues to the issuing authority from the increase in the monetary base. Equation 7.4 is expressed to measure this total gross seigniorage, s:

$$s = sM + (iP\, AP + iF\, AF)/p + G/p \tag{7.4}$$

where *sM* is the monetary seigniorage as defined in Equation 7.1; iP is the interest rate on private sector debt; AP is the private sector debt; iF is the interest rate on foreign debt; AF is the foreign debt, defined in domestic currency; G is the revenue from the central bank's operations; and p is the general price level. The first term in Equation 7.4, sM, is the monetary seigniorage that the central bank receives from creating base money. The second term in Equation 7.4 is the revenue from interest charged on private sector and foreign debt held by the central bank. The third term is the seigniorage raised from central bank operations.

Neumann (1995) also developed a framework for estimating seigniorage from the perspective of uses of seigniorage. The uses of seigniorage are specified as:

$$s = sC + sNI + sG \tag{7.5}$$

where *sC* is the cost of issuing money and the operations of central bank, which is given by:

$$\text{sC} = (\text{CCoin} + \text{CCB})/\text{p} \tag{7.6}$$

where *CCoin* is the cost of coinage and CCB is the cost of printing money and central bank operations. In Equation 7.5, *sNI* is the net investment by the central bank in non-government debt (sNI = (AP +AF)/p); *sG* indicates fiscal seigniorage and this is the component that is used to finance the budget deficits. Neumann (1995) discusses the specifications of these equations. Therefore, it is not necessary to replicate such a discussion here, as this equation has not been used for the Maldives.

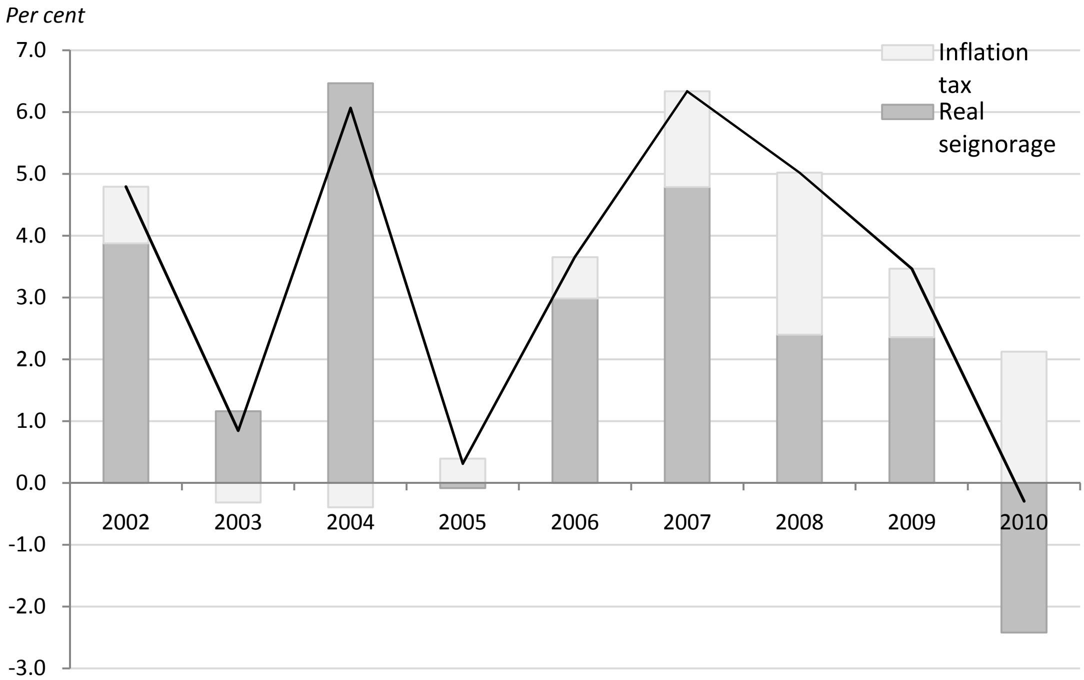
While Equations 7.4 and 7.5 provide a broader estimation of seigniorage, the monetary concept identified in Equation 7.2 is more appropriate for the Maldives, as this concept is more relevant for countries that have underdeveloped financial markets and monetisation of fiscal deficits. The monetary concept assumes that the cost of printing money is negligible, and in the Maldives, too the cost of printing money is not substantial. Therefore, for the Maldives, seigniorage is calculated using the monetary concept with the results shown in Table 7.3 and Figures 7.1 and 7.2. The seigniorage estimates are based on annual data from 2002 to 2010 that have been collected from the annual balance sheets of the Maldives Monetary Authority (2010a).

Table 7.3: Estimates of seigniorage for the Maldives, 2002–2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010
				in millions of rufiyaa					
Monetary base (M)	2268.7	2344.8	2948.0	2978.1	3423.6	4374.1	5382.4	6143.9	6063.9
CPI (P)	103.0	101.7	100.0	101.3	104.1	111.2	124.6	130.2	142.3
GDP	8201.0	8863.2	9938.7	9596.1	11717.4	13496.1	16130.9	16879.0	18941.2
Govt. revenue	2582.4	2964.3	3351.8	3788.3	5286.7	6527.2	6939.5	5313.3	6087.9
Real seigniorage	317.5	102.9	642.5	-8.1	349.5	645.8	386.5	397.6	-458.5
Inflation tax	75.6	-28.1	-39.5	37.8	78.3	209.2	422.9	187.3	402.3
Total seigniorage	393.0	74.8	603.0	29.8	427.9	855.0	809.4	584.9	-56.2
				% of GDP					
Real seigniorage	3.9	1.2	6.5	-0.1	3.0	4.8	2.4	2.4	-2.4
Inflation tax	0.9	-0.3	-0.4	0.4	0.7	1.6	2.6	1.1	2.1
Total seigniorage	4.8	0.8	6.1	0.3	3.7	6.3	5.0	3.5	-0.3
				% of Government Revenue					
Real seigniorage	12.3	3.5	19.2	-0.2	6.6	9.9	5.6	7.5	-7.5
Inflation tax	2.9	-0.9	-1.2	1.0	1.5	3.2	6.1	3.5	6.6
Total seigniorage	15.2	2.5	18.0	0.8	8.1	13.1	11.7	11.0	-0.9

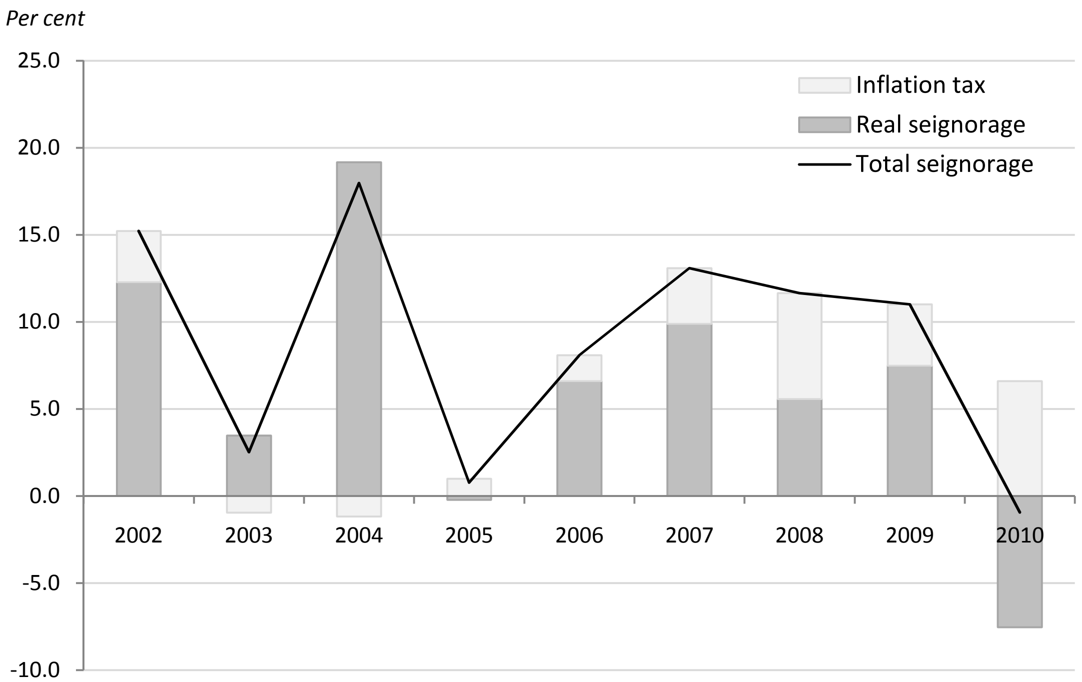
Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Figure 7.1: Seigniorage as a percentage of GDP



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Figure 7.2: Seigniorage as a percentage of government revenue



Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

The total seigniorage as a percentage of GDP shows a variation from year-to-year as shown in Figure 7.1. However, on average it accounts for about 3 per cent of GDP over the period 2002–2010. Moreover, revenue from seigniorage accounts for an average of 9 per cent of government revenue during the period, as shown in Figure 7.2.

The above estimates of seigniorage show the annual flow revenue from issuing domestic currency and provide a benchmark for the extent of loss in revenue as a percentage of GDP, as well as government revenue, in the event of official dollarization. As mentioned earlier, there is an additional cost associated with official dollarization; that is, the cost of replacing the existing stock of national currency with foreign currency. Fischer (1982) expresses this cost of the initial purchase of foreign currency as the currency in circulation as a percentage of GDP. In the case of the Maldives, the stock cost of official dollarization (using 2010 data) accounts for about 10 per cent of GDP, which represents a significant cost. In terms of international reserves consumed to purchase the currency in circulation, this amounts to US$ 146.0 million as at 2010 and accounts for 46 per cent of international reserves. To cover all the local currency deposits in the banking system would cost an additional US$531.7 million. The international reserves amounted to only US$350.0 million in 2010—clearly not enough to cover even half of the local currency deposits in the banking system. The only option then would be to borrow the money to cover the deposits, but this would be a considerable cost to bear for a small country like the Maldives.

Loss of monetary policy autonomy

One of the arguments against dollarization is the loss of monetary policy effectiveness. The interest rates are closely tied to those of the currency issuing country. In the case of the US dollar, interest rates are tied to those of the US, and the central bank in the Maldives cannot control its domestic money supply. With the loss of monetary policy independence, a country loses its ability to respond to domestic shocks that arise independently from anchor currency country. This argument is formed based on currency substitution literature, which showed that dollarization is often associated with greater money demand volatility as economic agents switch from one currency to another. A study by Levy-Yeyati (2006) on dollarized economies showed that inflation in these types of economies is sensitive to monetary expansion. However, he stresses that this cannot be taken as ineffectiveness of monetary policy in dollarized economies, as this could be showing the causality between inflation and dollarization in the opposite direction, implying that high inflation causing dollarization. The fact that many highly dollarized countries have effectively brought down inflation while dollarization has remained persistent, supports the view that monetary policy is not totally ineffective when an economy is dollarized. It is important to note that dollarized economies used in the empirical analysis of Levy-Yeyati (2006) refer to countries that are partially dollarized and not officially dollarized economies.

The proponents of official dollarization argue that in developing countries with underdeveloped markets, exchange rate flexibility does not necessarily guarantee monetary policy effectiveness as the monetary transmission mechanism is weak in most of these countries. In the case of Maldives, as fixed exchange rate entails the same loss of monetary policy effectiveness, moving from the current exchange rate peg to official dollarization would not incur any cost in terms of the loss in monetary policy effectiveness.

Loss of lender-of-last-resort function

Central bank provides short-term credit to the banking system when there is a liquidity risk, to maintain a stable banking system. The ability to print the national currency to mitigate a banking system distress created by short-term liquidity shortfalls would be lost in the case of official dollarization. However, several alternative mechanisms to substitute the lender of last resort function have been suggested in the literature (Antinolfi, Huybens, & Keister, 2001; Calvo, 2002; Chang, 2000). These include the central bank holding foreign reserves to cover such liquidity shortfalls, the establishing of a deposit insurance fund with contributions from the banks, the introduction of higher liquidity requirements in the banking system and the establishing of a contingent credit line with foreign banks. Further, in small developing countries like the Maldives, in which the banking system is dominated by foreign banks (four out of the five banks in the country are foreign banks), liquidity shortages can be easily be met by borrowings from the banks' head offices. Therefore, the loss of lender of last resort function cannot be regarded as a significant cost to the Maldives.

7.3.3 Preconditions for Adopting Official Dollarization

As the Maldivian economy is already highly dollarized, with the US dollar acting as a dual currency, the option to officially dollarize would be in the form of a unilateral dollarization by adopting the US dollar as the official currency in place of the Maldivian rufiyaa. Several factors influence the decision to adopt official dollarization in a country. These are discussed below.

Robust financial system

A financial system that is robust and that has strong supervision and enforceable regulations of the banking system is necessary to cushion any negative external shocks that the country may face. This also minimises the loss (or reduction) of lender of last resort function of the central bank. Additionally, a strong financial system is better able to sustain any interest rate changes that may arise following the change in currency regime. According to the IMF's review of the Maldives in 2010 (IMF, 2011, p. 2) published in their Public Information Notice:

> The banking system as a whole is well capitalized, but vulnerabilities remain. Non-performing loans have continued to increase, reflecting banks' exposure to large tourism related borrowers hit by the global crisis, and this has affected bank profitability.

In addition, commercial banks in the country are exposed to the sovereign debt of the government. This indicates that the financial system in the Maldives at present remains weak.

Strong fiscal conditions

Dollarization, like other forms of fixed exchange rate, requires sustainable fiscal conditions to pursue the exchange rate regime effectively. A sustainable level of fiscal deficits would provide assurance to the market of the government's strong commitment to sustain the exchange rate regime and credibility in the economy (Corbo, 2002). However, in the case of the Maldives, budget deficits have been consistently large: 29 per cent of GDP in 2009 and 17 per cent of GDP in 2010, leading to macroeconomic imbalances in the economy. The present situation would not foster a strong commitment to official dollarization.

Flexible labour markets

Flexible labour markets are required in the absence of an exchange rate mechanism to adjust to external shocks. As such, the nominal wages should be downwardly adjustable, and there should be relaxed mobility of labour between sectors and regions in the country (Roubini, 2001). However, while the Maldives has an open labour policy, allowing thousands of expatriate workers to come to work in the country, labour movements between sectors and regions are relatively rigid. In addition, as in the case of most countries, nominal wages are downwardly rigid.

Political support

The decision to dollarize is highly political, despite being based on an economic evaluation of the feasibility of the exchange rate regime. To have a successful transition to official dollarization, political support from the government and the ruling party as well as from the opposition parties is important. Further, the public needs to be educated on the features and uses of the adopted currency, as a country's currency can be revered by some as a national symbol, potentially generating hostility towards dollarization. It is important that there are no deep divisions in the country regarding the adoption of a foreign currency because, in a politically unstable environment, a new government may come to power and decide to reverse dollarization (Roubini, 2001).

Reserve coverage of monetary base

To convert domestic currency to foreign currency, foreign reserves are required to cover the monetary base of the country. Such stock costs were discussed and estimated earlier in Section 7.3.2. As such, the level of foreign reserves held by the central bank at the end of 2010 is sufficient to cover the monetary base, which accounts for about 46 per cent of foreign reserves. However, the reserves would provide very little coverage of the total local currency deposits in the banking system, in the event of a massive withdrawal of local currency deposits from the banking system.

Degree of partial dollarization

Transition to official dollarization is easier the greater the degree of partial dollarization. The costs associated with official dollarization are reduced if there is already partial dollarization. In addition, the public would be more familiar with the use of foreign currency and would be more welcoming of such a move. As discussed in Chapter 6 and Section 7.2.6 of this chapter, the Maldives is already partially dollarized to a large degree, especially in terms of financial dollarization, and the use of US dollars is substantial in the economy.

7.3.4 Recommendation

Based on the above factors and the evaluation of the costs and benefits of dollarization, it is hard to conclude quantitatively whether the Maldives should officially dollarize. However, the significant costs associated with the loss in seigniorage revenue and the weaknesses in the financial system and in the fiscal conditions currently preclude official dollarization as a viable option for the Maldives.

7.4 Conclusion

The evaluation of the current exchange rate regime provided support for a fixed exchange rate regime for the Maldives. The case for the current exchange rate peg is supported by the smallness and openness of the economy, the limited financial integration of the economy, the high level of partial dollarization and the high degree of ERPT to inflation in the country.

Given the appropriateness of a fixed exchange rate regime for the Maldives, this chapter also provided an assessment of an alternative fixed exchange rate regime: official dollarization. This is considered an option because of the high degree of fixity and credibility official dollarization provides and the already high level of partial dollarization of the Maldivian economy. However, there are substantial costs in adopting official dollarization. The most important cost and the one that is often the decisive point for policy makers is the loss of seigniorage. In the case of the Maldives, the loss of seigniorage would amount to about 3 per cent of GDP and about 9 per cent of the total government revenue.

In addition to the costs and benefits, this chapter also analysed whether the country meets the preconditions for adopting official dollarization. The analysis suggested that the Maldives does not currently meet these preconditions, in that the financial system, fiscal conditions and political support is weak. The overall analysis suggests that at this time official dollarization is not a viable option for the Maldives. Therefore, the optimal exchange rate option for the Maldives is the current exchange rate peg to the US dollar.

Chapter 8 | Conclusion

The Maldives has maintained a pegged exchange rate regime to the US dollar in the past 17 years. During this period, the institutional and macroeconomic structures of the country have undergone several changes. The exchange rate regime has weathered both easy and stressful conditions. The importance of the exchange rate in influencing the conditions in the domestic market is also never contested. However, there is no empirical research carried out on the exchange rate of the Maldives. Even the basic tools for monitoring the behaviour of the exchange rate are not available for the country. Against this background, this research has provided a comprehensive empirical analysis of the issues related to the exchange rate and the current exchange rate regime. This study examined the behaviour of the equilibrium real exchange rates and its misalignments; inflation and exchange rate pass-through; dollarization; the appropriateness of the current exchange rate regime; and an assessment of an alternative exchange rate regime for the Maldives. This chapter summarises the main findings of this study and discusses the limitations of the study. Some directions for future areas of research that can be extended from this study are also highlighted.

8.1 Summary of Findings

The objective of this study was to examine the issues related to the exchange rate regime in the Maldives and evaluate the appropriateness of the current exchange rate regime. The three main issues related to the exchange rate that have been examined in this study are ERER and RER misalignments; inflation dynamics and ERPT; and the partial dollarization in the Maldives. The analysis of these three issues, together with the analytical framework on the determinants of the choice of the exchange rate regime, has provided a thorough assessment of the appropriateness of the current exchange rate of the Maldives. This assessment is discussed below.

The RER, which is the cornerstone for most analyses of exchange rates, is not available for the Maldives. For the purpose of this study, NEERs and REERs were required for the empirical analyses of the different exchange rate issues examined in this thesis. Therefore, Chapter 3 discussed the estimation of the effective exchange rates and constructed time-series indices for NEERs and REERs for the period 1990–2010. The constructed REERs were then used to estimate the ERER and identify the RER misalignments for the Maldives. This helped to answer the question of whether the RER of the Maldives is misaligned.

The ERER is defined as the real rate that, for given values of 'economic fundamentals', is compatible with simultaneous achievement of internal and external equilibrium. The exchange rate misalignment is a sustained departure of the actual REER from its ERER. The equilibrium exchange rates for the Maldives were estimated using a single-equation approach, which links the RER to a set of fundamental variables. The approach taken in this study is based on the ERER models put forward by Edwards (1988) and Elbadawi (1994). Based on the theoretical determinants of the REER and the economic characteristics of the Maldives, the fundamental variables (economic fundamentals) chosen for modelling the determinants of REER for the Maldives were the TOT, the openness of the economy, net foreign assets as a percentage of GDP, and government expenditure as a percentage of GDP. The long-run model was estimated using a cointegration approach, as the time-series data were not stationary. As the ERER is a long-run concept in which only permanent effects should be present, the transitory components from the fundamental variables were removed using the HP filter and MA method. The ERER were then estimated and exchange rate misalignments calculated for the Maldives for the period 1990–2010. The RER misalignment, which is calculated as the percentage deviation of the REER from the ERER, can be either overvalued or undervalued. A positive deviation is a real exchange overvaluation and a negative deviation is an undervaluation. The following general conclusions can be made from the analyses regarding the misalignment of the RER of the Maldives, during the period under analysis:

- The REER of the Maldives has experienced varying levels of misalignments over the last two decades.
- There have been periods of undervaluation and overvaluation of the currency, with more volatile levels of exchange rate misalignments during the early 1990s, prior to the adoption of the fixed exchange rate.
- During the year 2000, and in the first half of 2001, the REER became sharply overvalued, leading to a nominal devaluation of the official exchange rate of the US dollar peg by the government.
- Nominal devaluation did not bring the REER to its equilibrium level. It only reduced the level of misalignment temporarily.
- A sharp overvaluation of the RER was observed in 2008 and the early part of 2009. While the level of misalignment was reduced in the subsequent months, the exchange rate remained misaligned.
- Large current account and budget deficits has been associated with periods of RER misalignments.

During the period under analysis (1990–2010), the RER was misaligned a little more than one-third of the time. In terms of the type of misalignment, the RER was overvalued 20 per cent of the time, and undervalued 16 per cent of the time. These findings suggest that, most of the time, the RER was close to its equilibrium level, without any significant misalignments (although, during the period of overvaluations, the level of overvaluation was high). Moreover, there is very little evidence that fixed exchange rates have led to significant RER misalignments in the Maldives.

Inflation and the ERPT is the second main exchange rate-related issue examined in this study. The heavy dependence on imports, both for local consumption and tourism consumption in the Maldives, links the country's inflation to external factors. Therefore, it is important to identify the factors that drive inflation in the

Maldives, and the relative role that the exchange rate plays in influencing inflation as compared to other factors, such as foreign prices. Moreover, the degree and speed of ERPT is an important determinant of exchange rate regime.

Fixed exchange rate regimes are often associated with low inflation rates. A simple analysis of the history of inflation in the Maldives revealed that the annual inflation rate in the Maldives during the period 1990–2010 averaged around 5 per cent. Excluding the double-digit inflation rates recorded during the years 1991–1993, annual inflation averaged around 3 per cent. Based on the classification of Choudri and Hakura (2006), who consider a country to have a low-inflation history if the annual average inflation is less than 10 per cent, the historical inflation rates of the Maldives are low. The determinants of the inflation in the Maldives were analysed by estimating a simple model of price determination for a small open economy based on the theoretical underpinnings of the external theory of inflation and monetary theory of inflation. The main determinants of inflation were identified as NEER, foreign prices, money supply and national income. The key findings of the analyses are listed below:

- All the determinants of inflation included in the model play a significant role in the inflation process in the long run.
- The ERPT is very high and is similar to the results obtained in other small island economies.
- ERPT is complete within 18 months, which is a high, rapid result.
- Inflation inertia, foreign prices and NERs are the main sources of inflation in the Maldives.

The high and rapid ERPT in the Maldives suggests the suitability of a fixed exchange rate regime for the Maldives. A large ERPT reduces the effectiveness of a flexible exchange rate regime. The high ERPT is a result of the high degree of openness of the economy; the large share of imported goods in the consumer basket; imports invoiced in producer currency prices; low PTM; low trade barriers, high dollarization and the fixed exchange rate regime. The inflationary pressures emanating from the money supply growth were identified as likely due to structural bottlenecks such as foreign currency shortages, inadequate port facilities and limited inter-island transportation. As for the real income, it was revealed that an increase in real income reduces inflation in the long run. The main policy implication from the inflation analysis conducted in this study is that the main determinants of inflation in the Maldives are exogenous and the only variable that can be controlled domestically is monetary growth, especially that which results from the monetisation of the budget deficits.

The third issue related to the exchange rate that was discussed in this study is the issue of dollarization in the Maldives. The partial dollarization, often simply referred to as dollarization, is the extensive use of foreign currency in a country, either in place of the local currency or alongside the local currency. The dollarization rate is high in the Maldives by international standards. The high level of dollarization was shown to contribute to the high ERPT, making monetary and exchange rate policy ineffective. In the Maldives, the dollarization has remained high regardless of the macroeconomic conditions in the country. In most other countries, dollarization rose following severe macroeconomic imbalances and high and persistent inflation rates. However, in the Maldives, dollarization has followed the growth in tourism and no evidence was found that high levels of dollarization originated from macroeconomic imbalances. Rather, the macroeconomic, institutional and structural factors in the country have contributed to the high level of dollarization. Such factors include the high import dependence of the economy; difficulties in acquiring foreign exchange for imports; and government taxes on sectors related to the external sector, such as the taxes levied on the tourism, required to be paid in US dollars.

Measuring dollarization is not an easy task and several possible measures can be used. In this study, dollarization is measured as the foreign currency deposits in the banking system as a percentage of broad money. However, this is an incomplete measure, as it does not include foreign currency in circulation and offshore deposits. Due to the lack of data on foreign currency in circulation and offshore deposits, most studies use this narrow definition. The dollarization ratio measured as the ratio of foreign currency deposits to broad money has remained extremely high in the Maldives, with the ratio above 40 per cent since 1993. In the dollarization literature, a fall in dollarization ratio is taken as an indication of macroeconomic stability and low inflation. However, in the case of the Maldives, the fall in dollarization ratios are associated with macroeconomic instability, especially following shocks to the tourism sector or international reserves.

As regards the other measures of dollarization, credit dollarization (the ratio of foreign currency denominated loans to total loans) is also high in the Maldives, at around 70 per cent. While two-thirds of the foreign currency loans are extended to foreign exchange earning sectors, the remaining one-third (which was equivalent to about 15 per cent of GDP in 2010) would pose problems to the banking system if large exchange rate changes were to occur. The main reasons for the high credit dollarization in the Maldives are the low levels of domestic savings; the small financial sector; and the dominance of foreign banks in the financial sector.

The high level of dollarization in the country raises important issues for the financial sector of the country in terms of the management of liquidity and solvency risks in the banking system. In a highly dollarized economy, the function of the central bank to act as a lender of last resort is limited. This is because the central bank cannot directly control the foreign currency component of the broad money and the money supply becomes endogenous. As a result, the banking system is required to keep sufficient international reserves to cover foreign currency deposit liabilities.

The determinants of dollarization in the Maldives were also empirically estimated in this study using a set of macroeconomic determinants based on the theoretical and empirical literature. The determinants included in the empirical model are inflation volatility, unofficial restrictions on foreign exchange, tourism inflows and the openness of the economy. All the variables, except the openness of the economy, were significant in the long-run model, while in the short-run model, all variables were significant. As noted earlier, macroeconomic stability does not seem to influence dollarization in the Maldives. This is evident from the empirical results, which showed that the increased inflation volatility, which is used to represent the macroeconomic stability, had a negative effect on dollarization. This is despite the fact that there should be a positive relationship between the two, as economic agents will switch to foreign currency deposits if the macroeconomic environment is unstable.

The negative relationship found in the empirical analysis for the Maldives was determined to be potentially attributable to the tightness of the foreign exchange market that is usually associated with macroeconomic instability in the country. The tightness in the foreign exchange market that arises from macroeconomic instability leads to dollar shortages, difficulties in accessing one's own foreign currency deposits in the banks and the creation of black markets. Consequently, the public may hold back their foreign currency from the banking system and transfer money to offshore accounts. Again, it is important to note that the dollarization ratio in the model includes only the foreign currency deposits in the banking system and does not include residents' offshore deposits and cash held domestically outside the banking system. The long-run negative relationship between inflation and dollarization ratio was also found to be common in other developing countries.

As expected, the empirical results also revealed that tourism flows have a positive effect on dollarization. Moreover, the unofficial restrictions on foreign exchange rate proxied by international reserves, in which an increase in reserves reflects a decline in restrictions and a decrease in reserves reflects a rise in restrictions, showed that when there are fewer restrictions in the foreign exchange market, dollarization falls.

This analysis of dollarization in the Maldives highlighted the influence of various factors, the most important of which was shown to be the dominance of the tourism sector in the economy. So long as the tourism sector dominates the economy, which is expected to continue to be the case, the dollarization levels in the Maldives will remain high. Therefore, a fixed exchange rate regime is more suitable for the country in the presence of such persistently high dollarization levels.

Chapter 7 evaluated the appropriateness of the currency exchange rate regime, based on an analytical framework of the determinants of the choice of exchange rate regime in small developing countries. Evaluation of exchange rate regimes is a complex issue, as it is not easy to quantify the determinants of exchange rate choice. However, given the need to evaluate the exchange rate regime of the Maldives, this study adopted a quantitative framework developed in an IMF working paper by Husain (2006). This framework was developed from a sample of 51 countries of various sizes and at different stages of development to derive quantifiable indicators for the determinants of exchange rate regime choice. The indicators included in the analytical framework include the main factors identified in the literature as the main determinants of exchange rate regimes, including OCA factors, financial factors and political factors.

The small size and the openness of the Maldivian economy provide a compelling case for a fixed exchange rate regime. However, economically undiversified economies such as the Maldives, which is heavily concentrated on the tourism sector, feel economic shocks in greater depth throughout the economy. A fixed exchange rate would preclude any NER adjustments to minimise the effect of economic shock on the domestic economy. Therefore, for an undiversified economy, a flexible exchange rate regime would be more suitable. An exchange rate regime that provides the most macroeconomic stabilisation is also important in choosing an exchange rate regime. This depends on the type of economic shock to which a country stands to be exposed and the level of capital mobility. A country that predominantly faces external (nominal or monetary) shocks and has a high (low) degree of capital mobility is better served by a flexible (fixed) exchange rate regime.

In the case of the Maldives, the economy faces both external and monetary shocks and has a liberal capital account. The country does not have capital controls and regulations on capital inflows are minimal. While there are no accurate data on capital flows, the capital mobility in the country is expected to be high. A fixed exchange rate regime is often adopted in countries in which the credibility of the central bank and the government is low. Credibility is often measured by the level of historical inflation rates. In the case of the Maldives, the country has experienced low levels of inflation most of the time, which suggests that credibility is not an issue for the country.

While some of the determinants of the exchange rate regime choice do not provide support for a fixed exchange rate regime in the Maldives, the majority of the determinants do. Moreover, the most important determinants of the choice of exchange rate regime for a small open economy like the Maldives are the degree of ERPT and the level of dollarization of the economy. As shown in Chapters 5 and 6, the high levels of these two determinants provide strong support for a fixed exchange rate regime. In addition, the analysis of the RER misalignments in Chapter 4 showed that the periods of significant misalignments in the past two decades have not been excessive. This provides further support for a fixed exchange rate regime, as this type of regime has not been associated with large exchange rate misalignments in the Maldives. Therefore, the current exchange rate peg for the Maldives seems appropriate for the country.

Chapter 7 also presented an assessment of an alternative exchange rate regime option for the Maldives—the adoption of full or official dollarization. Although the current exchange rate peg for the Maldives can be regarded as suitable for the country, it was deemed important to assess this more firmly fixed type of exchange rate regime. The outcome of this assessment was that there is no compelling case for abandoning the local currency, the rufiyaa, and adopting the US dollar as the official currency of the Maldives. This finding was based on the potentially significant loss in seigniorage revenue and the lack of certain preconditions for official dollarization, such as a strong financial sector and sound fiscal conditions. However, it should be noted that the viability of any exchange rate depends on sound macroeconomic policies.

8.2 Limitations and Future Directions for Research

The main limitation of this study is the limited availability of macroeconomic data for the Maldives and the poor quality of the existing data. As discussed in Chapter 1 and throughout this study, some of the important macroeconomic data used here had to be constructed especially for this thesis, due to the inadequacy of the existing available data. Therefore, considerable effort and time was spent on constructing the data, as the necessary inputs were not easily and readily available. A large amount of time was also spent in searching for appropriate inputs for the creation of a new data series, as the inputs normally found in the literature were not available for the Maldives. As such, much research went into finding the most appropriate inputs for the Maldives and then obtaining them from various sources. Moreover, macroeconomic data from small and developing countries like the Maldives are often plagued with outliers. The majority of the data used in this study were obtained from the MMA in Microsoft Excel format. Since MMA still maintains most of their data series in Excel files, errors in the data are common. Therefore, each of the outliers had to be checked to determine whether it was in fact an outlier, or an error in the data. In many instances, the outliers due to errors were corrected by returning to the source of the data or crosschecking with data from earlier publications.

Another important limitation of the study was the necessary exclusion of domestic interest rates from the dollarization model due to the unavailability of data. The domestic interest rates in the Maldives were compiled as a range, with a minimum and a maximum until 2010. As the range is wide, very little change is seen in the interest rate data and it could not be used for analysis. The unavailability of data on the foreign currency in circulation in the Maldives and on the offshore deposits held by Maldivians is another shortcoming in the empirical analysis. The analysis on dollarization would have been more comprehensive if a complete measure of dollarization, including foreign currency in circulation and foreign currency deposits, both onshore and offshore, was used instead of the narrow definition of dollarization. The estimation of foreign currency in circulation and residents' offshore deposits to develop a complete measure of dollarization to estimate the dollarization model used in this study is one area on which future research could build.

In the ERPT analysis, it would have been interesting to know the initial pass-through of exchange rate changes to import prices, which are then passed to domestic consumer prices. Since data on import prices are not available, this was not possible. This is another area for further research.

In this study, only one approach was used to estimate the ERER due to the lack of data required for other approaches. Therefore, in future analysis of equilibrium exchange rates, such data could be constructed and other approaches could be used to estimate equilibrium exchange rates. This would verify whether exchange rate misalignments are different when different approaches are used to measure equilibrium exchange rates. For policy-making in an area as sensitive as exchange rate, this is highly desirable. A further area of research that could be extended from this study is examining the impact of RER changes and RER misalignments on international trade flows. Of particular importance would be the effect of RER changes and exchange rate misalignments have on the tourism sector.

The research on the exchange rate issues and the exchange rate regime in the Maldives undertaken in this study provides a better understanding of the workings of a small island economy in relation to exchange rate issues. This study has provided a starting point for much-needed research on the important issues related to the exchange rate in the Maldives.

Appendices

Appendix 1: Table A1.1 Trade weights

	Imports(IM)				Exports (X)			
	1990-1994	1995-1999	2000-2004	2005-2010	1990-1994	1995-1999	2000-2004	2005-2010
Euro	4.0	4.7	5.6	4.3	9.2	9.5	7.0	20.0
Indian Rupee	9.1	14.6	13.0	14.0	0.0	0.0	0.0	0.0
Japanese Yen	0.0	0.0	0.0	0.0	5.3	10.6	9.3	9.8
Malaysian Ringgit	2.5	7.3	10.7	9.3	0.0	0.0	0.0	0.0
Sing. dollar	63.9	40.1	32.5	27.7	4.5	5.9	3.5	2.0
Sri Lanka rupee	7.9	11.2	17.0	7.8	24.1	20.8	17.1	18.1
Swiss Franc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thai Baht	3.6	3.4	4.8	6.2	12.2	10.7	14.9	37.0
US dollar	4.9	13.6	13.7	28.6	19.1	21.8	38.6	1.0
Sterling Pound	4.1	5.0	2.7	2.3	25.6	20.8	9.5	12.1
	100	100	100	100	100	100	100	100

	Tourism (T)				Aggregate Trade Weights (TW)			
	1990-1994	1995-1999	2000-2004	2005-2010	1990-1994	1995-1999	2000-2004	2005-2010
Euro	65.1	56.0	53.3	42.8	27.9	27.5	26.2	18.9
Indian Rupee	5.5	4.1	2.5	3.2	6.4	8.5	7.1	9.2
Japanese Yen	10.5	12.7	10.5	7.3	4.7	6.6	5.5	3.2
Malaysia Ringgit	0.0	0.0	0.0	0.0	1.2	3.4	4.9	5.4
Sing. dollar	0.0	0.0	0.0	0.0	31.2	19.2	15.4	16.2
Sri Lanka rupee	0.0	0.0	0.0	0.0	7.2	7.3	9.7	5.7
Swiss Franc	7.4	7.4	6.8	5.2	2.8	3.2	2.9	1.8
Thai Baht	0.0	0.0	0.0	0.0	3.5	2.7	3.8	6.1
US dollar	0.0	2.4	6.5	19.1	5.1	9.5	13.3	23.4
Sterling Pound	11.6	17.4	20.3	22.4	10.0	12.0	11.0	10.0
	100	100	100	100	100	100	100	100

Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

Appendix 1: Table A1.2 Annual real and nominal effective exchange rates (REER and NEER), 1990-2010 (in domestic currency terms, 2000=100)

	REER (M)	REER (X)	REER (T)	REER (TW)	NEER (M)	NEER (X)	NEER (T)	NEER (TW)
1990	129.71	146.39	159.68	142.33	92.91	108.44	101.36	97.64
1991	128.61	145.33	155.64	140.30	100.40	115.33	105.75	103.93
1992	119.89	128.05	145.23	129.60	105.31	112.97	110.29	107.56
1993	103.25	112.19	119.95	111.21	108.21	116.58	105.30	107.78
1994	114.72	122.23	129.21	120.75	116.31	123.08	114.21	115.88
1995	118.06	123.26	136.77	125.48	122.07	125.92	124.14	123.10
1996	111.71	121.65	127.76	118.89	120.45	121.66	120.01	120.32
1997	105.13	109.67	110.48	107.08	115.79	116.60	109.87	113.00
1998	100.70	107.84	111.28	105.16	105.78	109.54	107.66	106.78
1999	98.25	105.36	107.52	102.10	104.38	109.31	105.93	105.29
2000	99.69	107.09	99.76	99.75	101.53	105.60	95.49	99.09
2001	102.67	109.84	101.46	102.14	101.66	104.46	95.97	99.26
2002	104.62	111.30	110.10	106.38	105.30	109.00	106.11	105.32
2003	110.34	121.24	127.92	117.85	107.37	112.87	120.15	113.02
2004	116.62	129.29	143.56	127.90	108.26	115.07	129.91	117.54
2005	120.25	133.55	139.96	127.46	111.73	116.41	124.12	115.81
2006	122.72	135.57	145.93	132.46	110.58	116.33	131.57	119.28
2007	123.10	136.01	147.99	133.35	114.22	120.01	139.10	124.14
2008	117.65	139.35	134.68	127.33	114.65	125.00	133.28	124.69
2009	111.41	122.74	127.95	118.88	112.44	118.67	133.81	121.30
2010	108.50	117.48	120.80	113.43	115.77	120.67	134.65	122.82

Table A1.2 Monthly real and nominal effective exchange rates (REER and NEER), 1990-2010 (in domestic currency terms, 2000=100)

	REER (M)	REER (X)	REER (T)	REER (TW)	NEER (M)	NEER (X)	NEER (T)	NEER (TW)
M1 1990	124.84	140.19	160.68	137.87	88.63	102.14	94.23	91.39
M2 1990	133.07	148.23	165.42	144.96	88.84	101.70	94.08	91.37
M3 1990	124.36	138.21	151.23	134.37	87.90	100.15	92.43	90.11
M4 1990	116.12	129.25	142.49	125.90	89.74	102.09	94.99	92.19
M5 1990	132.22	146.72	153.46	140.48	91.93	104.82	97.78	94.64
M6 1990	133.61	148.61	150.94	140.66	92.69	106.09	97.92	95.25
M7 1990	123.59	139.33	146.88	132.77	94.74	109.32	101.82	98.09
M8 1990	143.76	161.87	171.72	154.69	97.54	112.50	106.78	101.64
M9 1990	142.40	159.96	172.23	153.84	97.89	112.35	106.94	101.84
M10 1990	123.67	140.11	159.74	136.95	97.87	112.47	108.35	102.33
M11 1990	132.23	149.09	165.66	144.73	97.64	111.65	108.86	102.26
M12 1990	133.72	151.33	169.74	147.14	96.97	111.19	108.40	101.70
M1 1991	139.06	158.69	178.92	153.97	99.70	115.36	111.78	104.83
M2 1991	133.54	150.55	172.29	147.69	103.21	118.28	116.18	108.50
M3 1991	124.02	138.57	153.99	135.11	99.16	111.98	107.08	102.46
M4 1991	124.41	139.86	150.30	134.36	97.48	110.05	102.46	99.76
M5 1991	119.83	135.08	143.98	129.23	97.61	110.23	102.06	99.71
M6 1991	115.61	129.14	135.43	123.37	97.39	108.92	99.28	98.44
M7 1991	118.56	133.97	139.04	126.82	97.40	110.48	98.99	98.57
M8 1991	134.02	150.27	157.88	143.39	100.63	113.14	102.69	101.84
M9 1991	136.21	152.93	162.47	146.41	105.02	118.39	108.53	106.81
M10 1991	138.74	155.81	167.08	149.65	105.79	118.90	109.73	107.68
M11 1991	131.05	147.24	160.73	142.28	105.39	118.12	111.30	107.91
M12 1991	135.80	153.14	168.13	148.03	104.87	118.28	112.44	108.07
M1 1992	109.74	122.30	135.05	119.13	103.45	115.15	110.04	106.07
M2 1992	121.79	135.14	148.36	131.64	101.43	112.30	106.21	103.33
M3 1992	114.75	127.73	138.87	123.81	99.25	109.88	102.95	100.77
M4 1992	119.56	133.38	145.38	129.26	99.15	109.90	103.50	100.91
M5 1992	114.45	128.05	140.45	124.20	101.84	113.13	107.59	104.13
M6 1992	100.88	114.07	125.82	110.30	106.05	118.46	114.02	109.21
M7 1992	114.76	129.10	147.11	126.60	109.69	122.76	121.33	114.14
M8 1992	130.55	147.79	169.52	144.82	114.98	129.35	128.56	120.21
M9 1992	148.28	164.40	189.09	162.87	119.07	130.90	130.92	123.27
M10 1992	128.45	139.01	158.70	138.95	114.35	122.72	121.90	116.62
M11 1992	133.32	143.79	159.96	142.64	108.08	115.37	111.89	108.99
M12 1992	125.44	136.20	150.29	134.30	105.55	113.01	109.36	106.52
M1 1993	93.50	101.19	111.74	101.06	105.18	111.74	105.38	105.08
M2 1993	96.46	103.98	112.54	102.07	103.47	109.67	103.70	102.89
M3 1993	101.19	111.80	119.99	108.07	101.69	110.86	103.41	102.03

M4 1993	96.30	106.78	117.22	104.03	104.12	114.09	108.51	105.61
M5 1993	98.89	109.49	117.48	105.72	109.10	118.93	111.16	109.56
M6 1993	100.19	111.39	117.08	106.42	111.44	121.66	111.86	111.22
M7 1993	115.38	126.03	131.58	121.09	109.94	118.06	107.79	108.47
M8 1993	115.48	126.38	132.07	121.36	109.64	117.88	107.78	108.30
M9 1993	107.70	117.68	125.81	114.18	109.81	118.13	110.31	109.47
M10 1993	114.64	123.37	130.92	120.19	110.21	117.12	108.49	108.80
M11 1993	113.76	123.19	127.77	118.51	109.14	116.29	106.11	107.21
M12 1993	111.97	121.54	125.39	116.54	108.93	115.83	105.83	106.95
M1 1994	106.92	116.76	118.96	111.05	108.53	115.70	104.79	106.31
M2 1994	106.35	116.18	118.69	110.60	109.32	116.45	105.92	107.23
M3 1994	105.57	115.75	119.69	110.56	110.43	117.67	108.31	108.88
M4 1994	112.49	123.21	126.82	117.52	112.17	119.39	109.81	110.49
M5 1994	109.88	119.14	124.87	115.06	114.71	121.62	113.27	113.36
M6 1994	118.20	127.75	134.61	123.84	117.51	124.61	116.70	116.41
M7 1994	123.20	131.86	141.99	129.60	119.53	126.71	120.05	118.97
M8 1994	121.30	129.71	138.83	127.21	120.57	127.37	120.32	119.64
M9 1994	126.28	134.35	145.05	132.56	121.07	128.27	121.21	120.33
M10 1994	125.75	133.85	145.19	132.30	120.88	128.60	121.75	120.50
M11 1994	124.32	131.39	140.91	129.69	120.56	126.90	119.61	119.29
M12 1994	98.80	104.96	110.29	102.47	120.52	126.19	117.72	118.41
M1 1995	116.62	124.12	131.90	121.63	121.11	126.90	119.84	119.64
M2 1995	107.04	113.93	122.41	112.16	121.08	126.92	120.86	120.06
M3 1995	114.80	122.68	134.24	121.47	122.62	129.23	124.77	122.64
M4 1995	115.65	123.86	135.70	122.58	123.80	130.27	126.79	124.13
M5 1995	134.45	144.33	155.97	141.86	123.88	129.57	126.06	123.80
M6 1995	119.84	128.62	139.10	126.47	123.81	129.26	126.33	123.85
M7 1995	120.70	128.95	140.72	127.56	123.63	128.92	126.72	123.89
M8 1995	116.80	122.72	133.75	122.30	122.70	126.40	123.26	121.77
M9 1995	116.77	123.58	134.30	122.58	120.89	125.72	121.87	120.27
M10 1995	117.97	125.27	137.49	124.57	120.82	125.80	123.84	121.05
M11 1995	119.35	126.06	138.69	125.81	120.94	124.50	123.98	121.04
M12 1995	116.88	124.22	135.75	123.26	120.71	124.25	123.30	120.63
M1 1996	110.44	120.87	128.82	117.33	119.61	120.39	119.82	118.43
M2 1996	110.86	117.57	127.83	116.53	119.95	123.34	121.91	119.60
M3 1996	116.79	122.87	133.07	122.02	120.85	123.17	121.19	119.68
M4 1996	112.00	117.24	125.71	116.18	120.95	122.43	119.94	119.11
M5 1996	116.62	122.94	129.59	120.53	120.74	122.85	119.24	118.75
M6 1996	113.51	119.52	125.69	117.12	120.61	122.44	119.28	118.67
M7 1996	113.79	119.67	127.13	117.85	120.22	122.41	120.22	118.90
M8 1996	113.59	119.77	128.06	118.15	120.21	122.70	121.50	119.48
M9 1996	113.46	119.24	126.88	117.55	120.17	122.19	120.56	119.00
M10 1996	113.61	119.76	126.42	117.49	120.16	122.55	120.09	118.83
M11 1996	113.84	120.51	126.97	117.90	120.49	123.57	121.14	119.54

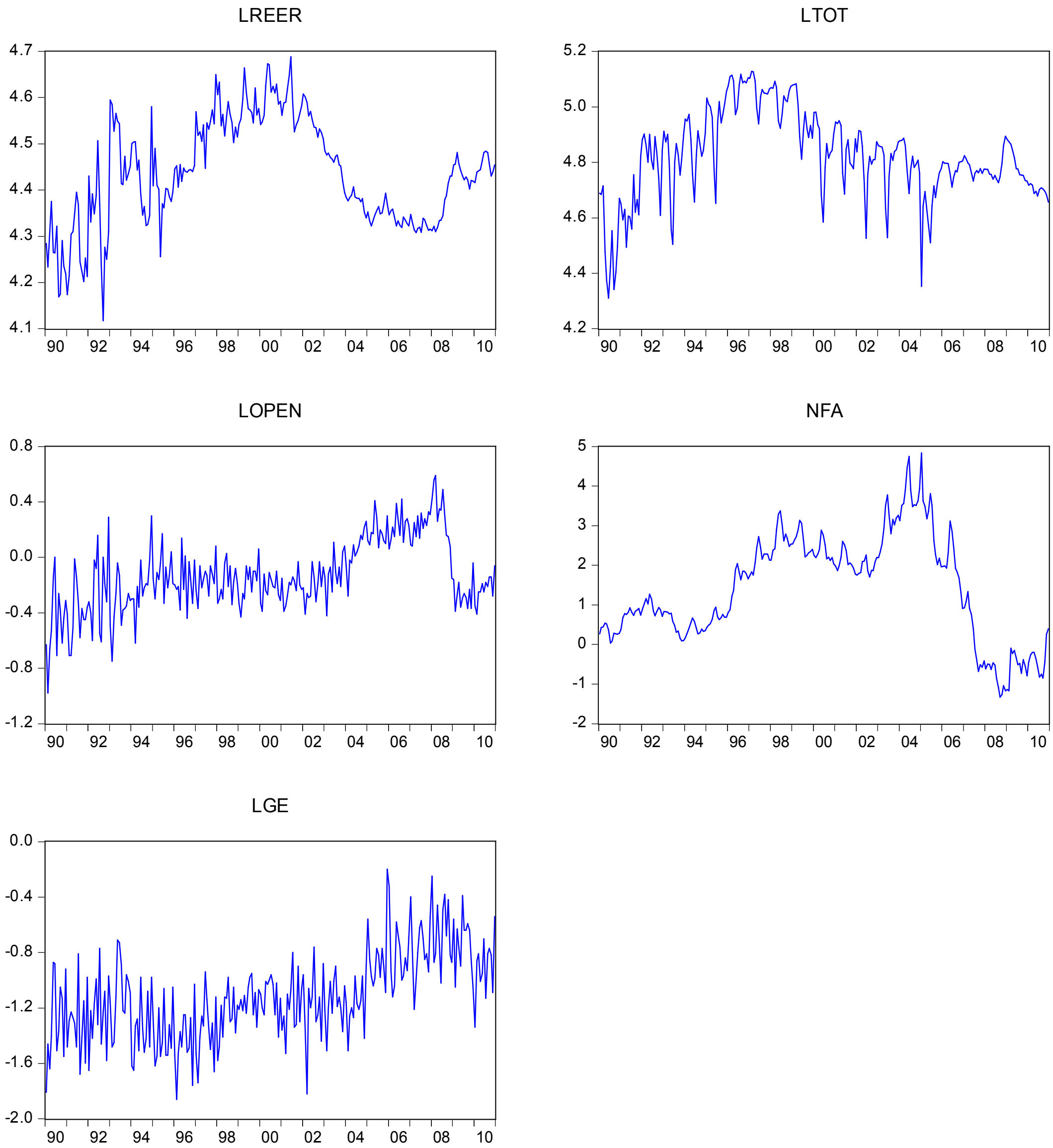
M12 1996	113.06	119.59	124.60	116.47	120.44	123.28	119.69	118.86
M1 1997	101.82	105.76	109.67	103.64	119.97	120.71	116.50	116.98
M2 1997	108.47	112.07	113.77	109.06	119.49	119.77	113.07	115.15
M3 1997	107.90	111.70	112.58	108.26	119.00	119.44	111.80	114.33
M4 1997	110.26	113.97	114.82	110.52	118.66	118.71	111.32	113.89
M5 1997	105.89	110.52	111.20	106.64	118.76	119.71	112.31	114.49
M6 1997	116.46	122.24	121.87	117.17	118.96	120.64	112.26	114.64
M7 1997	106.31	110.06	109.82	106.20	117.54	117.61	109.81	112.61
M8 1997	107.93	112.05	111.02	107.65	115.43	115.62	107.54	110.47
M9 1997	104.87	108.93	110.99	105.92	113.67	113.89	109.11	110.23
M10 1997	100.76	106.26	109.68	103.20	112.19	114.21	110.98	110.43
M11 1997	103.24	109.14	113.95	106.41	110.95	113.03	111.68	110.05
M12 1997	92.45	98.19	102.80	95.65	107.44	109.88	109.32	107.12
M1 1998	95.87	102.57	108.19	99.91	103.57	106.94	107.81	104.41
M2 1998	94.43	100.10	103.94	97.24	106.97	109.46	108.35	106.45
M3 1998	104.25	111.03	113.39	106.85	108.12	111.02	107.85	106.91
M4 1998	101.86	108.14	110.37	104.19	108.44	110.99	107.70	106.98
M5 1998	106.03	113.47	116.62	109.26	107.50	110.60	108.64	106.93
M6 1998	100.99	108.17	112.56	104.69	104.78	108.11	107.83	105.09
M7 1998	97.65	104.39	109.32	101.40	104.05	107.78	107.86	104.74
M8 1998	99.64	106.68	113.29	104.19	103.01	107.12	108.18	104.33
M9 1998	100.38	108.13	116.80	106.11	104.64	109.60	112.45	107.14
M10 1998	104.28	112.85	122.59	110.78	106.52	112.22	116.07	109.80
M11 1998	101.68	109.74	117.36	107.12	106.36	111.88	114.14	108.88
M12 1998	103.28	112.64	120.44	109.42	106.01	112.30	114.78	109.03
M1 1999	100.59	108.70	117.50	106.44	105.54	111.53	114.79	108.62
M2 1999	100.16	109.70	114.60	105.29	104.73	111.15	111.53	106.97
M3 1999	96.18	105.40	109.11	100.74	104.10	110.48	109.44	105.73
M4 1999	90.54	99.14	101.22	94.23	104.24	110.34	108.25	105.29
M5 1999	95.89	104.83	106.20	99.38	104.11	110.09	107.41	104.85
M6 1999	99.90	108.99	109.21	102.93	103.80	109.60	105.60	103.89
M7 1999	100.10	108.74	109.73	103.22	103.99	109.68	105.97	104.14
M8 1999	99.97	108.61	111.34	103.80	104.17	109.83	107.78	105.01
M9 1999	101.99	110.97	114.18	106.14	103.75	109.56	107.97	104.86
M10 1999	94.39	102.62	106.21	98.44	104.19	109.96	109.25	105.65
M11 1999	101.14	109.68	111.16	104.39	104.16	109.65	106.83	104.58
M12 1999	99.94	108.80	109.10	102.88	104.09	109.82	105.97	104.20
M1 2000	103.61	112.64	112.86	106.55	104.02	109.74	105.82	104.10
M2 2000	104.03	113.04	110.88	105.97	103.32	108.84	103.11	102.53
M3 2000	102.84	112.08	108.75	104.44	102.99	108.64	102.11	101.92
M4 2000	97.17	105.64	101.15	97.99	102.94	108.36	100.60	101.22
M5 2000	93.89	101.67	94.79	93.40	102.12	106.95	96.75	99.02
M6 2000	92.77	100.88	96.63	93.57	101.42	106.37	99.56	99.88
M7 2000	98.87	107.12	102.13	99.33	101.04	105.77	98.62	99.24

M8 2000	98.93	106.56	99.32	98.12	100.99	105.17	95.89	97.97
M9 2000	100.77	108.52	100.21	99.53	100.48	104.59	94.21	96.93
M10 2000	99.45	106.68	97.66	97.65	99.89	103.71	92.70	95.92
M11 2000	103.93	111.16	101.90	101.95	99.60	103.14	92.31	95.56
M12 2000	102.11	109.78	102.74	101.35	99.80	103.54	95.24	96.99
M1 2001	104.58	112.46	106.73	104.45	99.66	103.20	97.30	97.80
M2 2001	102.02	109.82	103.61	101.68	99.06	102.36	96.27	96.99
M3 2001	102.16	109.68	103.16	101.54	98.63	101.85	95.03	96.21
M4 2001	99.53	106.96	100.03	98.73	97.58	100.73	93.69	95.04
M5 2001	96.87	104.21	96.44	95.71	97.08	99.95	92.42	94.18
M6 2001	93.74	100.91	91.88	92.00	96.97	99.73	90.99	93.47
M7 2001	103.76	111.39	102.03	101.95	101.16	104.18	95.41	97.74
M8 2001	109.10	116.67	109.76	108.22	106.64	109.61	102.67	103.94
M9 2001	107.06	115.01	108.51	106.59	106.80	109.99	103.81	104.54
M10 2001	105.69	114.23	107.76	105.56	105.60	109.40	103.03	103.60
M11 2001	104.84	113.01	105.42	104.06	104.96	108.68	101.35	102.51
M12 2001	102.74	110.95	104.05	102.30	104.88	108.66	101.59	102.57
M1 2002	100.58	105.99	101.43	99.69	104.49	106.94	100.55	101.73
M2 2002	101.54	109.48	101.01	100.32	104.63	108.04	99.91	101.67
M3 2002	102.64	111.12	102.49	101.61	104.56	108.36	100.26	101.82
M4 2002	104.94	114.02	106.35	104.59	104.38	108.45	101.39	102.24
M5 2002	103.31	112.66	106.02	103.56	104.88	109.41	103.69	103.55
M6 2002	104.09	114.20	109.15	105.38	105.35	110.70	106.93	105.27
M7 2002	104.94	115.67	112.16	107.16	106.06	112.17	109.79	106.95
M8 2002	105.39	115.59	111.95	107.28	105.91	111.43	108.56	106.29
M9 2002	107.32	117.58	114.59	109.47	105.74	111.07	108.72	106.24
M10 2002	105.53	115.24	112.58	107.56	105.35	110.24	108.26	105.78
M11 2002	106.37	115.91	113.47	108.39	105.67	110.53	108.90	106.22
M12 2002	106.84	116.86	116.29	109.86	106.00	111.08	111.38	107.45
M1 2003	108.81	119.66	120.61	112.82	106.46	112.17	114.70	109.15
M2 2003	109.57	120.15	122.08	113.82	106.27	111.63	114.86	109.06
M3 2003	108.98	119.65	121.81	113.38	106.18	111.73	114.75	108.99
M4 2003	109.62	120.45	123.29	114.35	105.89	111.61	115.01	108.94
M5 2003	108.50	119.80	126.12	114.85	106.80	112.92	120.03	111.53
M6 2003	109.20	120.50	126.92	115.57	106.95	113.11	120.39	111.76
M7 2003	108.62	119.35	124.23	114.12	106.66	112.59	118.16	110.68
M8 2003	108.82	119.43	123.07	113.77	106.73	112.36	116.45	110.00
M9 2003	110.66	122.80	126.30	116.29	107.33	114.26	118.16	111.18
M10 2003	109.58	122.51	128.51	116.59	107.95	115.80	121.92	113.15
M11 2003	113.17	126.45	132.91	120.48	107.81	115.75	122.32	113.23
M12 2003	114.52	128.58	138.28	123.44	108.16	116.57	126.29	115.05
M1 2004	115.05	129.46	140.71	124.71	108.31	117.15	128.45	116.01
M2 2004	115.94	130.26	141.98	125.72	108.51	117.31	129.12	116.39
M3 2004	115.82	129.97	139.74	124.78	108.41	116.78	126.59	115.31

M4 2004	116.18	129.54	137.63	124.11	108.75	116.41	124.88	114.77
M5 2004	113.84	126.85	135.65	121.91	107.82	115.39	125.27	114.35
M6 2004	116.01	129.76	139.21	124.65	107.43	115.22	125.93	114.40
M7 2004	116.11	129.60	140.09	125.02	107.01	114.92	126.58	114.41
M8 2004	116.27	129.42	139.98	125.04	106.73	114.25	125.57	113.80
M9 2004	117.41	130.40	140.65	125.96	107.12	114.42	125.78	114.10
M10 2004	116.00	128.92	140.53	125.06	107.49	114.88	127.70	115.07
M11 2004	118.27	132.28	146.56	128.83	108.22	116.44	132.07	117.27
M12 2004	118.76	133.43	149.80	130.41	108.85	117.45	135.15	118.86
M1 2005	120.38	138.71	148.92	128.71	112.68	122.41	132.52	117.77
M2 2005	120.73	135.29	148.82	131.33	109.74	118.34	133.42	118.81
M3 2005	121.84	136.51	150.67	132.67	109.83	118.11	133.79	118.96
M4 2005	120.69	134.38	148.28	131.07	109.28	116.80	132.70	118.18
M5 2005	120.06	132.97	145.15	129.64	109.12	115.68	130.16	117.23
M6 2005	119.75	131.46	142.02	128.39	108.42	113.69	126.73	115.60
M7 2005	119.33	129.44	139.59	127.24	108.08	112.06	125.31	114.82
M8 2005	120.83	131.58	142.60	129.25	108.62	113.12	127.33	115.86
M9 2005	120.62	131.46	142.19	128.99	108.18	112.89	127.09	115.49
M10 2005	118.88	129.24	139.02	126.77	107.74	112.26	125.77	114.77
M11 2005	116.38	125.58	134.76	123.62	107.16	110.93	123.79	113.70
M12 2005	118.96	128.23	138.01	126.43	107.58	111.01	124.04	114.04
M1 2006	121.61	132.08	141.74	129.53	108.93	113.32	126.52	115.83
M2 2006	121.02	130.82	139.67	128.43	109.01	112.82	125.26	115.45
M3 2006	120.47	130.71	139.20	127.94	109.17	113.21	125.66	115.71
M4 2006	122.02	133.80	142.70	130.22	109.80	114.96	128.25	117.03
M5 2006	123.14	136.78	147.85	132.70	110.47	116.86	132.58	118.90
M6 2006	122.09	134.97	145.76	131.26	109.74	115.48	131.11	117.89
M7 2006	123.25	136.09	147.17	132.50	109.83	115.82	131.63	118.13
M8 2006	123.49	137.17	148.58	133.16	110.09	116.61	132.80	118.71
M9 2006	120.95	134.14	144.67	130.15	110.20	116.50	132.16	118.58
M10 2006	122.00	134.75	145.41	131.09	110.18	115.92	131.82	118.41
M11 2006	122.45	135.93	147.41	132.06	110.94	117.23	134.09	119.68
M12 2006	122.65	136.60	148.83	132.66	111.71	118.38	135.96	120.81
M1 2007	120.32	132.73	144.03	129.45	111.81	117.38	134.47	120.35
M2 2007	122.28	134.66	146.65	131.62	112.01	117.71	135.23	120.73
M3 2007	123.90	137.70	149.54	133.75	112.34	118.92	136.34	121.37
M4 2007	124.49	137.88	151.27	134.65	113.33	119.44	138.69	122.72
M5 2007	123.68	136.25	149.46	133.47	113.63	119.08	138.58	122.86
M6 2007	123.28	136.13	149.08	133.09	113.30	118.89	138.34	122.56
M7 2007	124.61	137.68	150.79	134.57	114.02	120.36	140.32	123.71
M8 2007	120.78	133.83	146.29	130.50	113.51	120.28	139.83	123.24
M9 2007	120.76	134.06	147.78	130.94	113.90	120.65	141.73	124.07
M10 2007	122.22	134.98	149.89	132.56	115.42	121.42	144.35	125.86
M11 2007	123.07	137.08	152.37	133.99	116.22	123.27	147.09	127.32

M12 2007	123.06	136.84	150.95	133.56	116.27	123.01	145.48	126.87
M1 2008	121.93	146.82	149.76	134.06	115.72	128.85	143.10	127.46
M2 2008	122.64	137.67	149.12	132.79	117.51	125.33	146.77	128.21
M3 2008	122.94	140.77	152.94	134.40	118.28	128.49	151.32	130.34
M4 2008	121.92	139.31	151.31	133.15	118.86	128.52	152.30	131.03
M5 2008	120.15	138.08	148.68	131.11	117.87	127.49	150.84	129.88
M6 2008	120.20	137.55	148.55	131.07	117.38	126.12	150.89	129.51
M7 2008	119.06	135.27	147.21	129.81	117.58	126.10	152.10	130.03
M8 2008	116.31	129.50	139.89	125.37	116.23	123.26	145.97	127.04
M9 2008	115.78	129.14	137.70	124.28	114.51	121.54	142.06	124.59
M10 2008	114.27	126.05	130.95	120.88	112.27	118.38	134.02	120.35
M11 2008	113.24	123.61	127.95	119.10	111.09	115.76	129.92	118.10
M12 2008	112.23	122.81	129.97	119.15	111.87	116.93	133.20	119.75
M1 2009	110.53	119.76	125.21	116.32	111.38	115.77	130.25	118.39
M2 2009	111.10	120.21	123.57	116.10	110.47	114.30	126.53	116.47
M3 2009	107.62	117.34	121.66	113.20	109.71	114.16	127.45	116.33
M4 2009	109.74	119.58	125.28	115.85	110.46	114.63	129.42	117.49
M5 2009	110.71	121.74	128.82	117.78	112.08	117.46	134.20	120.25
M6 2009	111.54	123.81	130.92	119.11	112.75	119.27	136.62	121.57
M7 2009	112.59	124.67	131.78	120.09	112.56	119.58	136.90	121.56
M8 2009	111.84	123.64	131.15	119.36	112.83	119.77	137.47	121.93
M9 2009	112.10	124.23	132.62	120.06	113.23	120.50	139.30	122.82
M10 2009	114.26	126.29	135.61	122.50	114.50	121.77	141.66	124.46
M11 2009	112.17	123.98	133.20	120.28	114.79	122.15	142.31	124.88
M12 2009	112.67	124.44	132.69	120.44	114.52	121.47	140.26	123.99
M1 2010	113.91	124.79	131.63	120.84	114.75	121.02	138.71	123.59
M2 2010	112.20	122.15	127.10	118.10	114.03	119.16	134.73	121.70
M3 2010	112.12	121.83	126.38	117.79	114.78	119.74	134.61	122.16
M4 2010	112.31	120.94	125.29	117.47	115.70	119.73	134.20	122.58
M5 2010	111.65	118.95	120.14	115.14	114.71	117.47	128.68	119.94
M6 2010	110.02	117.48	117.63	113.20	114.31	117.04	127.34	119.21
M7 2010	108.92	116.88	118.69	112.90	115.01	118.97	131.28	121.10
M8 2010	109.20	117.44	118.90	113.17	115.75	119.96	131.94	121.83
M9 2010	111.66	121.00	122.13	115.96	116.65	121.87	133.55	123.03
M10 2010	113.81	124.62	126.92	119.13	118.17	124.87	138.02	125.65
M11 2010	113.44	123.70	124.98	118.17	118.00	124.17	136.22	124.89
M12 2010	112.07	121.58	122.36	116.32	117.64	123.14	134.34	123.97

Appendix 2: Figure A2.1: Plots of variables in ERER model



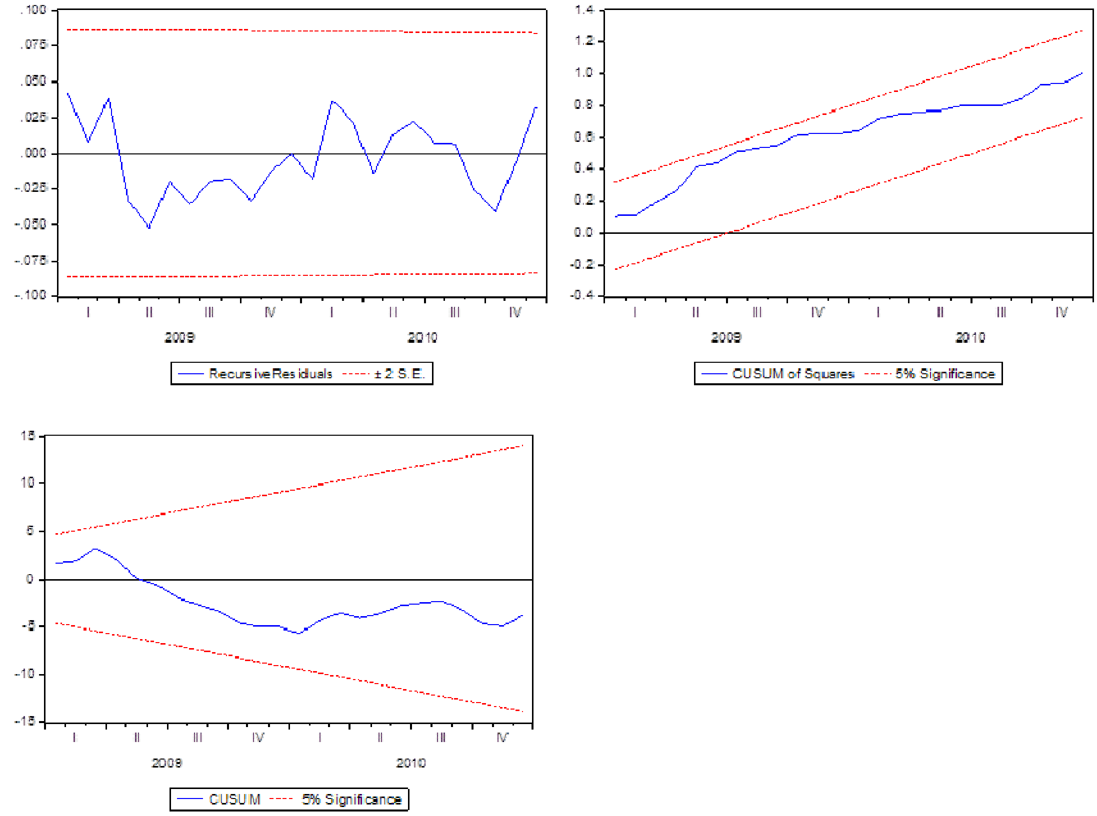
Appendix 2: Table A2.1 Vector error correction model of ERER

Vector Error Correction Estimates
Sample (adjusted): 1990M06 2010M12
Included observations: 247 after adjustments
Standard errors in ( ) & t-statistics in [ ]

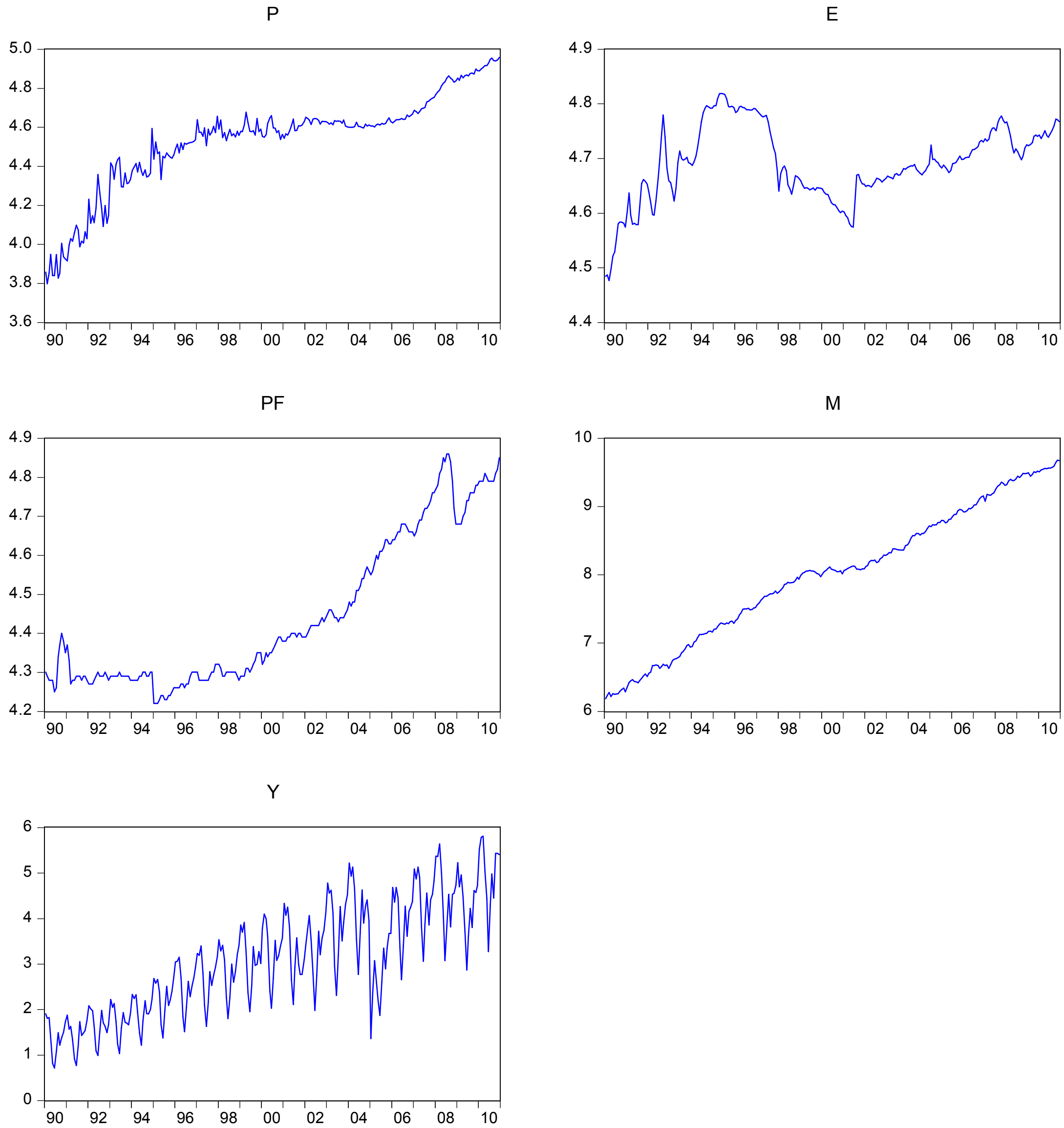
Cointegrating Eq:	CointEq1
lreer(-1)	1
ltot(-1)	-0.69318
	-0.1541
	[-4.49829]
lopen(-1)	0.596642
	-0.12138
	[4.91565]
nfa(-1)	-0.03982
	-0.01605
	[-2.48101]
lge(-1)	-0.42086
	-0.11919
	[-3.53108]
C	-1.42968

Error Correction:	D(lreer)	D(ltot)	D(lopen)	D(nfa)	D(lge)
CointEq1	-0.09166	0.044729	-0.31105	-0.04753	0.334437
	-0.03735	-0.04247	-0.11842	-0.16017	-0.15644
	[-2.45422]	[1.05313]	[-2.62677]	[-0.29671]	[2.13777]

Appendix 2: Figure A2.2 Stability plots of ERER model



Appendix 3: Figure A3.1: Plots of variables in inflation model



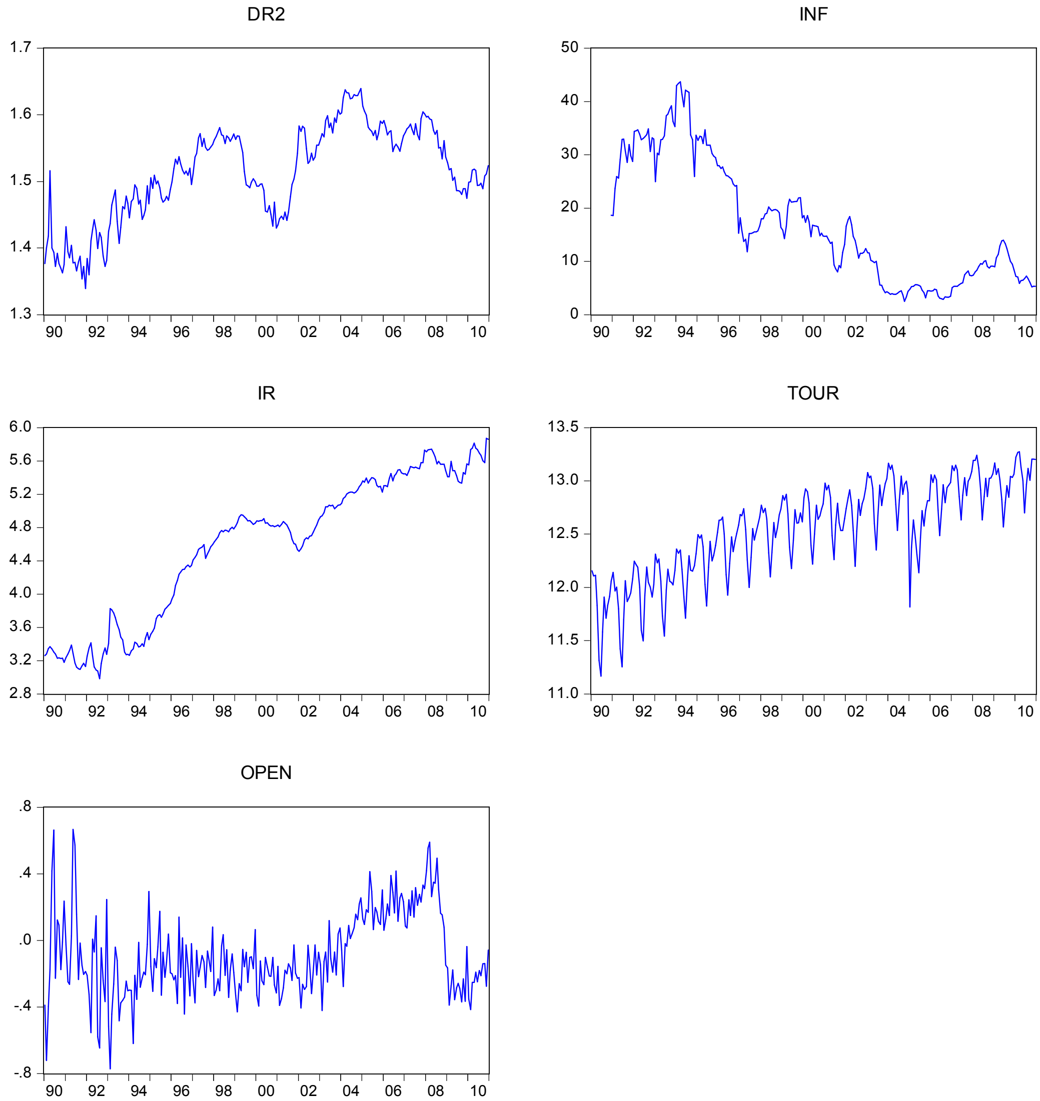
Appendix 3: Table A3.1 Vector error correction model of inflation

Vector Error Correction Estimates
Sample (adjusted): 1991M01 2010M12
Included observations: 240 after adjustments
Standard errors in ( ) & t-statistics in [ ]

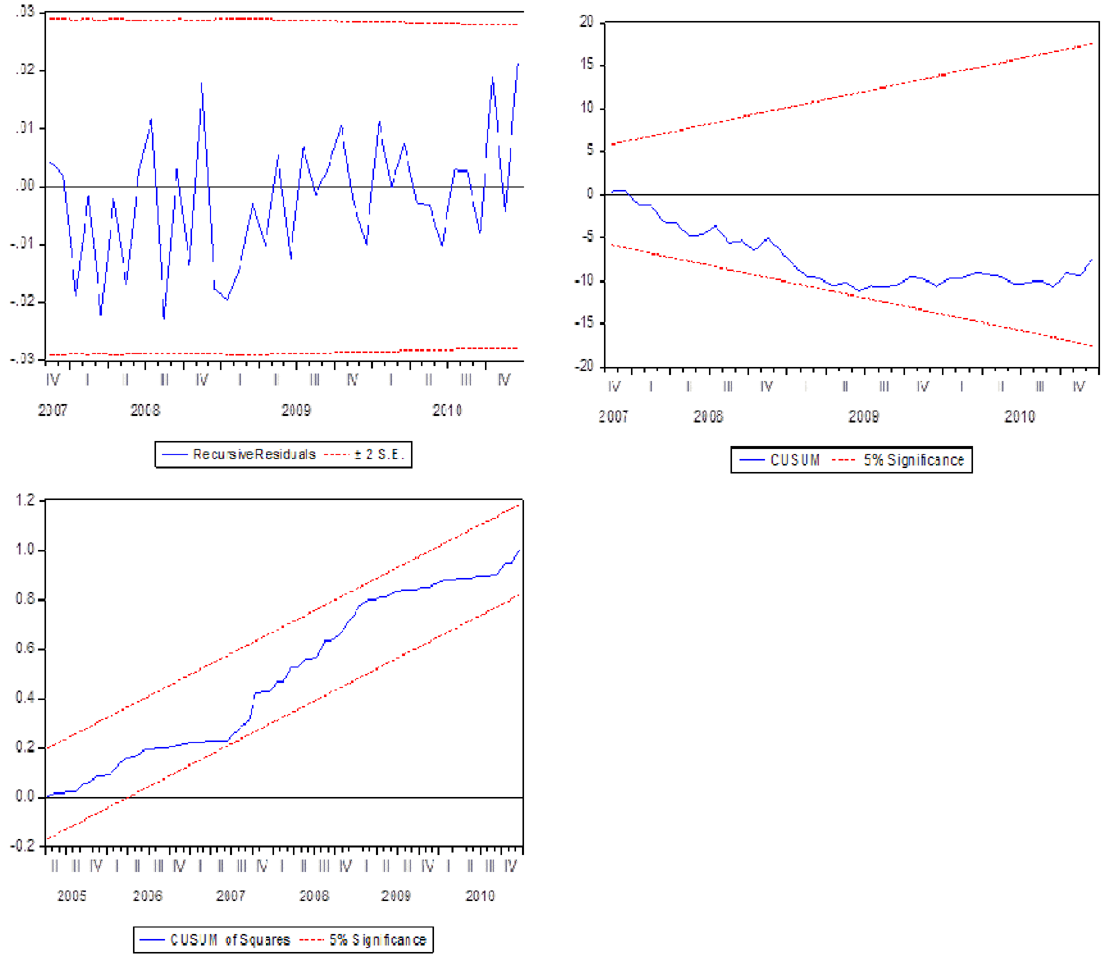
Cointegrating Eq:	CointEq1	CointEq2
p(-1)	1	-1.05465
		-0.26785
		[-3.93748]
e(-1)	-0.94658	0
	-0.29694	
	[-3.18777]	
pf(-1)	-0.74365	0
	-0.09518	
	[-7.81325]	
m(-1)	0	1
y(-1)	0	-0.74392
		-0.05621
		[-13.2344]
C	3.194453	-0.92375

Error Correction:	D(p)	D(e)	D(pf)	D(m)	D(y)
CointEq1	-0.11366	-0.00867	0.013878	-0.02278	0.4144
	-0.02379	-0.00691	-0.00845	-0.01437	-0.17079
	[-4.77704]	[-1.25467]	[1.64337]	[-1.58451]	[2.42633]
CointEq2	0.010068	-0.0023	0.001017	-0.01155	0.703027
	-0.01579	-0.00458	-0.0056	-0.00954	-0.11334
	[0.63767]	[-0.50221]	[0.18143]	[-1.21024]	[6.20293]

Appendix 4: Figure A4.1: Plots of variables in dollarization model



Appendix 4: Figure A4.2: Stability plots of dollarization model



Appendix 5: Table 5.1: Analytical framework

	5	4	3	2	1
Economic integration					
Trade openness	18-27	27-41	41-72	72-111	111-272
Trade concentration	22-26	26-32	32-53	53-64	64-77
Cyclical synchronicity	-0.4–0.2	-0.2- -0.1	-0.1-0.3	0.3-0.8	0.8-0.9
Financial integration					
Inclusion in major indices					
Stock market capitalization	63-198	7-63	0.4-7	0.4-0.1	0-0.1
Financial development	103-228	64-103	33-64	17-33	9-17
Economic diversification					
Terms of trade volatility	0.32-0.6	0.16-0.32	0.06-0.16	0.03-0.06	0.01-0.03
Comm. dependence–GDP	0.24-0.4	0.08-0.24	0.03-0.08	0.01-0.03	0-0.01
Commodities – activity	0.44-0.7	0.24-0.44	-0.04-0.24	-0.04—0.32	-0.6–0.32
Macroeconomic stabilization					
Capital versus trade flow	0.4-1.34	0.25-0.4	0.14-0.25	0.09-0.14	0.02-0.09
Monetary volatility	0.03-0.05	0.05-0.08	0.08-0.17	0.17-0.27	0.27-0.32
Real vs. nominal shocks	0.2-0.7	0.7-1.2	1.2-2.5	2.5-6	6-20.2
Credibility					
Inflation history < 8%	0-1	0-0.04	0.04-0.49	0.49-0.78	0.78-1
Inflation history < 10%	0-0	0-0.01	0.01-0.39	0.39-0.70	0.70-1
Fear of floating type effects					
Dollarization	< 0	0-6	6-9	9-13	13-22
Balance sheet effects	-0.6–0.92	-0.6-0.3	-0.3-0.2	0.2-0.5	0.5-0.8
Exchange rate pass-through	0.5-0.8	0.1-0.5	-0.6-0.1	-0.8–0.6	-0.8–0.9

Source: Husain (2006)

Appendix 5: Table A5.2: Evaluation of the Maldives exchange rate regime

	1990-2010	1990-1999	2000-2010	2006-2010	1990-2010
Economic integration					
Trade openness	160.81	153.29	167.66	175.85	160.81
Trade concentration				79	
Cyclical synchronicity	0.37	-0.05	0.41	0.67	0.37
Financial integration					
Inclusion in major indices					
Stock market capitalization					
Financial development	48.04	32.73	61.96	73.19	48.04
Economic diversification					
Terms of trade volatility	0.08	0.09	0.07	0.04	0.08
Comm. dependence–GDP	0.21	0.22	0.20	0.19	0.21
Commodities – activity					
Macroeconomic stabilization					
Capital versus trade flow	0.13		0.15	0.22	0.13
Monetary volatility	0.12	0.14	0.09	0.07	0.12
Real vs. nominal shocks	1.51	1.58	1.20	1.82	1.51
Credibility					
Inflation history < 8%	0.31	0.46	0.17	0.32	0.31
Inflation history < 10%	0.21	0.35	0.08	0.15	0.21
Fear of floating type effects					
Dollarization	51.07	47.14	54.64	54.37	51.07
Balance sheet effects	0.01	-0.02	0.04	0.15	0.01
Exchange rate pass-through	0.9				0.9

Source: Constructed from data obtained from Maldives Monetary Authority (2009, 2011)

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