The Effect of Real Exchange Rate Undervaluation on Economic Growth

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ABSTRACT

Over the years, economists have come to agree that a poorly handled exchange rate would do more harm than good to the growth efforts of any economy. However, the exact relationship between the exchange rates and the economic growth is not well understood. This study uses Rodrik (2008) paper on "the real exchange rate and economic growth" as a benchmark work to carry out a comprehensive analysis of the impact of currency undervaluation on economic growth. To this end this thesis is organized into four independent studies.

The first two are panel data studies where the economic growth is regressed on real exchange rate undervaluation. The two studies differ from each other mainly in two ways. One difference is the way that currency undervaluation is measured, and the second difference is the way the growth equation is modelled. In short, second study- which is referred as fundamental equilibrium exchange rate model- is intended to be an improvement on the first study –which is referred as the Balassa-Samuelson effect based Rodrik approach.

The third research examines how the real exchange rate undervaluation impacts economic growth by using time series analysis. The relationship studies for four countries, -namely Germany, South Africa, Mexico, and Cameroon- with different exchange rate regimes. The studies check if the relationships are symmetric or asymmetric; and accordingly uses ARDL or NARDL methodologies to investigate how the real exchange rate undervaluation impacts growth.

The fourth study looks at the contribution of the real exchange rate undervaluation, the tourism sector, and human capital development to the economic growth by using a panel data of selected microstates – many of which are small island nations-. In all four studies, the results are mainly in line with the theoretical expectations and/or with main previous empirical works. Our results provide evidence that real exchange rate undervaluation mainly has a positive impact on growth.

Keywords: Economic growth, Exchange rate, Balassa-Samuelson effect, asymmetric relation, Tourism, human capital.

ÖZ

Ekonomistler, yıllar geçtikçe kötü yönetilen bir döviz kurunun, herhangi bir ekonominin büyüme çabalarına iyi geleceğinden çok zarar vereceği konusunda hemfikirdirler. Bununla birlikte, döviz kurları ve ekonomik büyüme arasındaki kesin ilişki iyi anlaşılmamıştır. Bu çalışmada, döviz kuru değer düşüklüğünün ekonomik büyüme üzerindeki etkisinin kapsamlı bir analizini yapmak için "reel döviz kuru ve ekonomik büyüme" konulu Rodrik (2008) raporu kullanılmıştır. Bu amaçla, bu tez dört bağımsız kısım olarak düzenlenmiştir.

İlk iki kısımda, ekonomik büyümenin reel kurdaki değer düşüklüğünde gerilediği panel veri çalışmalarıdır. İki çalışma, birbirinden esas olarak iki şekilde farklılık gösterir. Birinci fark, para biriminin değer düşüklüğünün ölçülme şeklidir ve ikinci fark, büyüme denkleminin modellenme şeklidir. Kısacası, temel denge döviz kuru modeli olarak adlandırılan ikinci çalışma da Balassa-Samuelson etki temelli Rodrik yaklaşımı olarak adlandırılan ilk çalışmanın geliştirilmesi amaçlanmıştır.

Üçüncü kısımda, reel döviz kuru değer düşüklüğünün zaman serileri analizini kullanarak ekonomik büyümeyi nasıl etkilediğini Almanya, Güney Afrika, Meksika ve Kamerun olmak üzere dört ülke için incelemektedir. Çalışmamız da ilişkilerin simetrik mi yoksa asimetrik mi olduğunu kontrol etmek için ve buna bağlı olarak, reel döviz kuru değer düşüklüğünün büyümeyi nasıl etkilediğini araştırmak için ARDL veya NARDL metodolojileri kullanılmıştır.

Dördüncü kısımda, çoğu küçük ada ülkesi olarak seçilmiş mikro bölgelerin panel verilerini kullanarak reel döviz kuru değer düşüklüğünün, turizm sektörünün ve insan sermayesi gelişiminin ekonomik büyümeye katkısını incelemektedir. Dört çalışmanın hepsinde de sonuçlar temel olarak teorik beklentiler ve / veya önceki ana ampirik çalışmalar ile paraleldir. Sonuçlarımız, reel döviz kuru değer düşüklüğünün çoğunlukla büyüme üzerinde olumlu bir etkisi olduğuna dair kanıtlar sunmaktadır.

Anahtar Kelimeler: Ekonomik büyüme, Döviz kuru, Balassa-Samuelson etkisi, asimetrik ilişki, Turizm, beşerî sermaye.

DEDICATION

To My Family for all supports.

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Chapter 1

INTRODUCTION

This study aims to consider the effects of currency undervaluation on economic growth. It intends to do so far different sets of countries. More specifically it looks at the effects of currency undervaluation on growth for countries with different exchange rate regimes, different level of economic development, and/or different size and structure of economies.

Over the years, many economists and policymakers have come to agree that a poorly handled exchange rate would do harm to the growth efforts of an economy and that a proper exchange rate level or a regime could improve the growth rates. However, there is no consensus on the proper role of exchange rate play on economic growth. Indeed, the linkage between the GDP growth and exchange rates has been investigated on various perspectives; and it can be studied further.

One perspective is that one can study the effects of exchange rate regimes on economic growth in order to decide if a specific regime could help increase the economic growth rates. The regimes could vary from fixed exchange rate systems to pegged currencies, from floating exchange rates to managed flexible exchange rates. Another perspective that can be investigated is the variability in the exchange rates and its influence on GDP growth. Here, the expectation is that relatively stable exchange rates would increase international investments and trade, and thus, help improve the growth rates.

Yet one another approach – a third approach- is the look at the level of exchange rates and its impact on GDP growth. Here the aim is to investigate the effects of currency undervaluation on the economic growth. This thesis has adopted this third approach to demonstrate the link between the currency undervaluation and its effect on GDP growth.

In this approach, one challenge is that one needs to be able to define and measure currency undervaluation or overvaluation. In this study, we have overcome this issue by adopting the methodologies suggested by Balassa-Samuelson-based Rodrik approach (2008) and the fundamental equilibrium exchange rate model (FEER).

A nominal exchange rate is simply the price of a foreign currency expressed in domestic currency. A real exchange rate is then calculated as the product of the nominal exchange rate and the ratio of price levels in foreign and home countries. As such, the real exchange rate is the exchange rate adjusted for different price levels in different countries. As a result, it measures the prices of commodities (or a basket of commodities) when expressed in the same currency.

Unity in the real exchange rate would imply the prices are the same in both countries and it names purchasing power parity. According to 'law of one price' for tradable goods, one could hypothesize such unity in real exchange rates (RER). When RER is bigger than one, it would imply that the price in a foreign country is higher than the home country. In other words, it would imply that the domestic currency is undervalued which would boost the home country exports. Theoretically, it is difficult to observe absolute purchasing power parity because of non-tradable goods and services, transportation costs, tariffs, differences in taxes, and different weights in CPI baskets.

As for the empirical measurement of currency undervaluation, one needs to look at the Balassa-Samuelson effects which state that productivity gains in tradable sectors lead to wage increases in both tradable and non-tradable sectors. This leads to increase in the ratio of non-tradable prices to tradable prices, which essentially means an appreciation in the real exchange rate. Thus, as countries industrialize and become richer, their currencies are observed to appreciate. This is called the Balassa-Samuelson effect.

Our study adopts this approach as suggested by Rodrik 2008 as well as the one highlighted in FEER methodology as presented in Berg and Miao (2010). FEER model essentially uses a similar regression model to explain the long-run estimation of the real exchange rate but with some more explanatory variables included.

While the measurement of currency undervaluation is of critical importance, the results in these types of studies are further complicated by the choice of time periods and type of countries. Several authors conclude that RER undervaluation has a positive impact on GDP growth for emerging economies but not for developed countries. Similarly, some studies report that exchange rate effects on growth are more significant right after economic crises rather than during or before crises. For example, Klein and Shambaugh (2010); Rose (2011); and Ghosh et al. (2014) concluded that selection of exchange rate regimes and/or levels of exchange rates would play a central role in post-crisis economies, and especially for emerging economies. Similarly, Dani Rodrik

(2008) finds that undervaluation of a currency has a growth-enhancing effect for the developing countries but not for the developed countries.

Furthermore, there might be complications of non-linearity and reverse-causality. For example, William Easterly (2005) argues that a 'high' overvaluation would impede economic growth while a modest one would not have a significant effect on growth. Overvaluation, in general, is expected to cause a slowdown in growth because almost always it leads to unsustainable current account deficits. As for reverse-causality between the exchange rates and the growth, one only needs to look at the Balassa-Samuelson effect as mentioned in previous paragraphs. Indeed Woodford (2008) highlights this and states the difficulty of assuming the exogenity of real exchange rates.

As stated before, the purpose of this thesis is to investigate the effects of RER undervaluation on GDP growth. To this end, we employ four different case-studies on growth. In the first study, we have utilized a panel data set consisting of 82 countries for 5 five-year periods from 1990 to 2014 to investigate the effect of Balassa-Samuelson type currency undervaluation on economic growth for developing and developed countries combined together as well as separately. This study is based on the works of Rodrik 2008.

The second case study has utilized a panel data set consisting of 93 countries and 27 years from 1990 to 2016. The study includes both developed and developing countries, but unlike the first study, this is a yearly panel data rather than periodic panel data. In this study, we measure the undervaluation in two different ways: one is the Balassa-Samuelson-based Rodrik model (as in 1st study) and the 2nd one is fundamental equilibrium exchange rate model (FEER) based on Berg and Miao (2010). The purpose of this study is to check how improvements in the estimation of currency undervaluation affect the results of growth studies.

The third study uses a time series analysis rather than a panel data from 1984 to 2016 for Mexico, Cameroon, South Africa, and Germany. The selection of these countries has been done so to represent countries with different exchange rate regimes and different economic structures. The study identifies symmetries and asymmetries in relationships among the variables, and thus, uses accordingly ARDL and/or NARDL approaches for time-series analysis.

Lastly, the fourth study investigates the contribution of the exchange rate undervaluation and tourism sector to the economic growth for selected microstates – many of which are small island countries- over the period 1995-2015 to do so, this study uses second generation panel approach.

Thus, the overall organization of this thesis is as follows: In chapter 2, we present the literature review on the topic. In chapter 3, 4, 5, and 6, we present the case studies 1, 2, 3, and 4 respectively, for which the highlights have been provided in the previous paragraphs. Chapter 7 presents the overall conclusion.

Chapter 2

LITERATURE REVIEW

Most of the researches show that the real exchange rate (RER) has a relation with GDP growth, especially for low development countries. RER undervaluation increases the export and economic growth in low development countries because of their economic structures. As Dani Rodrik (2008) mentioned RER undervaluation is the most robust factor for the fewer developed countries. His findings confirmed the David Dollar (1992), Sachs and Warner (1995) that economic growth is largely dependent on the degree of undervaluation. He mentioned that the biggest effect of undervaluation can appear on tradable goods and it affects the growth.

William Easterly (2005) argue that overvaluation has an adverse impact on economic growth. Overvaluation means that foreign currency has a shortage and there is a large current account deficit which is dangerous for growth. But Rodrik (2008)claim that it is not the whole story, and undervaluation is an efficient factor for growth. There is much evidence to show that RER undervaluation boosts GDP growth as same as a decrease in overvaluation while the sample includes the developing countries.

Berg and Miao (2010) suggest that RER matters for GDP growth in the medium run. They used the results of Washington Consensus (2010) and Williamson (1994) that summarized in the following sentence, if RER is sufficiently competitive to increase the export growth rate, the economic growth will be maximum. They confirmed the

Rodrik finding for the relation between undervaluation and growth but they claim that the exchange rate is not in itself a policy instrument.

Bo Tang (2015) worked on RER and GDP growth in China and could not find the direct correlation between RER and GDP growth in the long run, while the Chinese economy includes the exports, imports, foreign trade and investment that all these factors have a significant relation with RER. But Sokolov et al. (2011) offer that the flexible exchange rate policy has a positive influence on growth and because of fixed exchange rate policy in China, Tang (2015) could not find a direct correlation between undervaluation and growth.

Horst Feldmann (2011) makes use of data related to industrial countries and shows that volatility of exchange rate causes the unemployment rate. Belke and Kaas (2004) regressed the data of Central and Eastern European emerging countries and they mentioned that RER volatility decreases the employment growth. Aghion et al. (2009) find RER causes to a negative effect on long-run productivity growth in underdeveloped countries. Bagella et al. (2006) find that real exchange rate volatility has a significant effect on the growth of per capita income.

In Korinek and Servén (2010) RER undervaluation can increase the economic growth with externalities. They advise that foreign reserves accumulation decrease the RER to encourage export and growth without direct subsidies. But, this impact is decreased as more countries include this sort of strategy. Although, big misalignments of the RER decrease the GDP growth. Its explanations outline the RER equilibrium is the guarantee for macroeconomic equilibrium. They discuss that RER undervaluation leads to inflation and it is harmful to the economy. Additionally, they mention that the market forces should determine the real exchange rate and those big misalignments create distortions and instability. Also, Aguirre and Calderón (2005) argue that big RER overvaluation and undervaluation are harmful to economic growth. The bigger misalignment causes a larger decline in growth.

Curiously, Glüzmann et al. (2012) failed to discover a meaningful effect of RER undervaluation on exports and imports, but they discover the positive impacts of RER undervaluation on employment, savings, and investment, similar to the finding in Levy-Yeyati and Sturzenegger (2007).

Eichengreen (2008) suggest a good overview of the discussion, inclusive of the relationship between RER volatility and regimes. There is a relatively large study suggesting a relationship between RER and GDP growth. We focus on the most important and recent researches which are closer to the objectives of this study. Aizenman and Lee (2010), Benigno et al. (2015) and McLeod and Mileva (2011) mention that RER undervaluation should support the production of tradable goods because the effect of RER undervaluation is equivalent by a subsidy on production for firms.

According to Di Nino at al. (2011), decreasing of the nominal exchange rate has chronic actual effects on GDP growth. Additionally, it is shown by Gluzmann et al. (2012) where an RER undervaluation causes higher saving and investment through lower labor expenses and income redistribution. They mention that RER undervaluation promotes savings and investment levels.

Most empirical studies tend to show a positive effect of RER undervaluation on GDP growth. In Razin and Collins (1997), Aguirre and Calderon (2005), both high undervaluation and overvaluation are harmful to GDP growth, even as medium undervaluation increases GDP growth. In addition, Hausmann et al. (2005) confirm that RER undervaluation is often correlated with growth acceleration.

Additionally, the authors claim that RER undervaluation supports GDP growth via an increase in export, mainly from productive sectors, in Italy. Kappler et al. (2011) work on nominal and real overvaluation and find a statistically insignificant relationship between RER overvaluation and GDP growth. Farrant and Peersman (2006) also in the significant relationship between real exchange rate undervaluation growth.

However, Nouira and Sekkat (2012) discover no evidence that real exchange rate undervaluation increases GDP growth for developing countries, after excluding overvaluation episodes. Bussiere et al. (2015) argue that the RER undervaluation is caused by productivity growth. Also, they mention that economic growth and productivity growth are increasing at the same time.

Nowadays, the concept of international trade changed and there is a strong relationship between foreign transaction and trade, hence currency, economic, and political stability are key variables for trade. Currency undervaluation has a significant effect on international trade. Therefore, we can see many studies and researches on the field of the exchange rate and the relation of the exchange rate with economic growth and other important variables of macroeconomics. One of the favorite issues on exchange rate area is measuring the RER undervaluation and estimating of RER undervaluation effect on GDP growth.

Dani Rodrik (2008) examined the relationship between RER and economic growth. He claims that overvaluation is harmful to GDP growth, and undervaluation is useful for GDP growth. The instability of the RER from its equilibrium can have either a positive or negative effect on economic growth. In order to explore and investigate the RER equilibrium in depth, several researchers have used various terms, such as RER misalignment, to describe the changes in the RER. Exchange rate misalignment simply describes the fluctuation of RER from its equilibrium level.

Tharakan (1999) and Vieira et al (2013) claim that a high RER volatility has an adverse impact on GDP growth, while a medium RER volatility has a positive impact on GDP growth. RER Undervaluation or overvaluation is a key variable for emerging economies. If the estimated exchange rate is smaller than the real exchange rate, we can name it "undervaluation", and if the estimated exchange rate is higher thanthe real exchange rate, we can name it "overvaluation". RER undervaluation has been found to have positive effects on economic growth (Rodrik, 2008; Abida, 2011), while RER overvaluation reduces economic growth (Elbadawi and Kaltani, 2012). But Gluzmann et al (2012) found that there is no relationship between RER undervaluation and exportation in developing countries.

Additionally, Cottani et al (1990) claim that there is a negative relationship between economic growth and RER. In the same vein, Dollar (1992) discovered that the relationship between RER volatility and GDP per capita is negative. After that, Berg and Miao (2010) found the same results with Rodrik's (2008) research but they mentioned that there is a problem in Rodrik's work. They claim that Balassa-Samuelson based undervaluation which Rodrik (2008) used on his growth model is not suitable to estimate the economic growth and cannot explain the impact on long-term growth. However, in the analysis of the Washington Consensus, the variation from the RER fundamental was found to explain the growth in long-run.

Eichengeen (2008) investigated the effect of the RER on GDP growth and the link between these variables. He claims that there is a relationship between RER and GDP growth that is not harmful but he could not explain significance level of this link.

Berg and Miao (2010) suggest that the real exchange rate is a key variable for GDP growth in the medium run. They used the results of Washington Consensus (2010) and Williamson (1994) that summarized in the following sentence, if the real exchange rate is sufficiently competitive to increase the export growth rate, the economic growth will be maximum. They confirmed the Rodrik finding for the relation between undervaluation and growth but they argue that the exchange rate is not in itself a policy instrument.

Although, Razmi et al. (2012) found a robust linkage between RER and GDP growth. They claim that the negative impact of overvaluations is rather than a positive impact of RER undervaluation on GDP growth according to their analyzing.

Chapter 3

THE EFFECTS OF REAL EXCHANGE RATE UNDERVALUATION ON ECONOMIC GROWTH

3.1 Introduction

This case study intends to look at the effects of RER undervaluation on GDP growth and to identify if these effects vary with the level of economic development of the countries. To do so, the study uses a framework presented by Rodrik 2008, but also employs newer econometric methodologies to check the validity of the conclusion of Rodrik, and/or to improve on that paper.

Recent studies have found a positive relation between RER undervaluation and GDP growth. As pointed out by Dani Rodrik (2008) RER is important for GDP growth and the growth-enhancing the effect of real exchange rate undervaluation is found in developing countries.

Previous studies have employed several econometric models to analyze the impact of RER on GDP growth, but to the best of the author’s knowledge, only a few studies have used the FMOLS and DOLS techniques in investigating the relationship between the RER undervaluation and economic growth.

This study uses panel data of 82 countries from 1990 to 2014. The data is periodic data with 5 sets of 5-year-periods. The study investigates the effects of currency undervaluation on growth for developed and developing countries separately as well as a combined set. As mentioned earlier, the novelty of this study is its use of newer econometric methodologies in estimation. More specifically the study uses Fully Modified Ordinary Least Square (FMOLS) and Dynamic Ordinary Least Square (DOLS) panel estimation techniques to confirm and/or to improve on the results of Rodrik 2008.

3.2Theoretical Background

In this section, let us review some of the concepts related to real exchange rates and currency undervaluation. Let's do so, first by looking at the concept of the real exchange rate.

3.2.1 Real Exchange Rate

Nominal exchange rates may have two different versions of definition: One definition is "the price of one foreign currency in terms of domestic currency" so that if the home country is assumed to be the USA, then the nominal exchange rate, for example, will be 1.3 USD for a British Pound. Let us denote this nominal exchange rate as $E_{d/f}$.

An alternative definition is "the amount of foreign currency we can buy with one unit of domestic currency" so that if the USA again is assumed to be the home country, then the nominal exchange rate, for example, will be 0.99 Swiss Frank for a USD. Let us denote this version of the nominal exchange rate as $E_{f/d}$.

Based on these two different versions of the nominal exchange rate, the real exchange rate (RER) can be calculated as

$$RER = \frac{P_d}{E_{f/d}P_f} \qquad \text{eq 1}$$

$$RER = \frac{E_{d/f}P_f}{P_d} \qquad \text{eq 2}$$

where, P_f and P_d shows the price levels in the foreign and home economy respectively. Thus, the real exchange rates (RER) are the rates adjusted for different price levels in two countries. As such the RER in eq 1 measures the domestic prices relative to those in the foreign country while the RER in eq 2 measures the foreign prices relative or in comparison to those in the home country.

Since the nominal exchange rate $E_{f/d}$ and thus the real exchange rate in eq2 are more common among the world countries, we would adopt this version only in this thesis so that a decrease (increase) in the nominal and/or real exchange rate would mean a appreciation (depreciation) of the home currency.

3.2.2 Purchasing Power Parity and Currency Undervaluation

When we try to compare the domestic and foreign prices of a single commodity "' i " we expect that the Law of One Price (LOP) to hold provided that certain conditions such as negligible transportation costs do hold. Therefore, if LOP holds, then we can write as:

$$\frac{E_{d/f}P_f^i}{P_d^i} = 1 \text{ or} \qquad \text{eq 3}$$

$$P_d^i = E_{d/f}P_f^i \qquad \text{eq 4}$$

which states that the prices of commodity i in the domestic and foreign country are the same when they are expressed in the same currency.

Absolute purchasing power parity (PPP) is the extension of this LOP to a basket of goods and services so that the prices are the average prices of the baskets. Thus eq 3 turns into:

$$RER = \frac{E_{d/f}P_f}{P_d} = 1 \qquad \text{eq 5}$$

which states that the baskets would cost the same amount in home and foreign countries when measured by the same currency. Absolute PPP would hold under several assumptions such as the baskets in foreign and home country include exactly the same goods and services with the same weights; every product is tradable; there is no limitation for trade, transportation cost is negligible and so on.

Breakdown of most of these assumptions implies that the absolute PPP does not hold in reality. Nevertheless, an alternative version, relative PPP is considered a long-run equilibrium level for exchange rates. In relative PPP, the RER is equal to a constant number such as 2 but not equal to 1:

$$RER = \frac{E_{d/f} P_f}{P_d} = constant \qquad \text{eq 6}$$

which indicates that the prices of the baskets would be a certain ratio of each other but not exactly the same. If this is considered to be a long-run equilibrium level for the exchange rates, then a deviation from this equilibrium would lead to an undervaluation or an overvaluation of the currency. More specifically, if the home currency depreciates so that RER turn out to be higher then the long-run equilibrium constant, this would imply undervaluation of the domestic currency as well as higher relative prices for the foreign goods.

Relative PPP is more plausible provided that the price of non-tradable do not move differently in two different countries. However, one also needs to look at the changes in relative prices of the non-tradable in both countries before talking about the long-run equilibrium of exchange rates. If the relative price of non-tradable is changing differently in different countries, it would be impossible to expect that the ratio of basket prices is non-changing constant given that the baskets do include non-tradeable goods and services.

Let us now look at the study of Balassa-Samuelson in order to understand the effects of the price of non-tradable on the long-run equilibrium of exchange rates, and thus on currency undervaluation.

3.2.3 Price of Non-tradables and Real Exchange Rates

The Balassa-Samuelson hypothesis relaxes the assumptions of identical production functions and factor price equalization. Therefore, the equality of non-traded good prices does not hold even in the long run. Moreover, the movement in the relative price of non-tradable is determined by the relative productivity growth in the tradable goods sector in each country. Relatively high productivity growth in the tradable leads to higher wages, and thus, to higher non-tradable good prices so that the result is an appreciated exchange rate (Asea and Corden, 1994).

3.2.4 Balassa-Samuelson Effect

In the Balassa-Samuelson model, the relative price of non-tradable, and thus, the real exchange rate movements, depends on the relative productivity growth rate in the traded and nontraded sectors.

In a small open economy, where the price of tables is fixed at world prices, higher productivity growth in the tradable sector leads to higher wages both in tradable and non-tradable sectors since the labor is mobile across the sectors. However, higher wages in the non-tradable, without a corresponding higher productivity in the sector, leads to higher relative prices for non-tradable. This, in turn, leads to an appreciation of the home currency.

Balassa-Samuelson effect then states that as countries achieve rapid productivity growth in tradable sectors, transitioning them from a lower income to higher income status, their prices of non-tradable increase and their currencies appreciate. Hence higher income countries are expected to have more appreciated currencies.

The validity of Balassa-Samuelson (BS) theorem is investigated extensively in the international economics literature. One of the most distinguished papers on this issue is Canzoneri et al. (1999). The authors claim that the BS theorem is not always successful to explain both short-term and long-term (20 years or longer) movements within the real exchange rate.

Similarly, studying pound sterling to dollar RER for even larger time horizons, Lothian and Taylor (2008) have concluded that the Balassa-Samuelson model is unsuccessful to explain the RER movements except in the very long run. The authors show that forty percent of the movements in the real exchange rate is accounted for via the Balassa-Samuelson effect in a sample of one hundred eighty years. While the Balassa-Samuelson effect is tested in shorter time horizons ranging from one year to ten years, its effect is much smaller.

On the other hand, Berka and Devereux (2010) discover that the movements in the RER and the domestic relative prices of non-traded goods are extraordinarily correlated. Devereux et. al. (2014) also study the Balassa-Samuelson effect for a set of European countries. They understood that productivity increases in the tradable sector relative to the non-tradable sector have a positive relationship with RER appreciations. Furthermore, Zhang (2017) finds that there is a positive link between a country's per capita income and its home price level.

Despite these mixed results on the validity of Balassa-Samuelson effects, we base our studies according to Rodrik (2008) and Berg and Maio (2010) which attempts to measure the currency undervaluation on the basis of Balassa-Samuelson effects. Lets now look at these reference papers.

3.2.5 Rodrik Model

Rodrik (2008) is one of the pioneering works which has to look at the effects of currency undervaluation on economic growth. His conclusion is that currency undervaluation promotes the growth of developing countries, but not for developed countries.

Let's now review the models used in this study: RER is calculated as the nominal exchange rates (XART) is adjusted for the PPP conversion rates (PPP) from the Penn World Tables (PWT) as shown in the equation below where each country and each time are represented respectively with subscripts i and t.

$$(RER)_{it} = (XRAT_{it}/PPP_{it}) \quad \text{eq 7}$$

Prices of non-tradable goods are lower in low-income countries according to Balassa-Samuelson theorem, Rodrik estimates a long-run equilibrium level of RER via the regression below:

$$\ln(\widehat{RER})_{it} = \alpha_0 + \alpha_1 \ln(RGDPPC)_{it} + f_t + e_{it} \quad \text{eq 8}$$

Above, RGDPPC is the per-capita real GDP from Penn World Tables, f_t is the time fixed effect, and e_t is the error term. RER undervaluation is calculated as the deviation of the observed RER and estimated one (eq 8).

$$Underval_{it} = \ln(RER)_{it} - \ln(\widehat{RER})_{it} \quad \text{eq 9}$$

An index value bigger than 1 indicates a RER undervaluation.

Then, Rodrik used the following regression model initially to investigate the relation between currency undervaluation and economic growth.

$$Growth_{it} = \gamma_0 + \gamma_1 \ln(INIRGDPPC)_{it} + \gamma_2 Underval_{it} + f_t + f_i + e_{it} \qquad \text{eq 10}$$

Where f_t is the time dummies, f_i is country dummies, and where initial or the lag of real GDP per capita is used to capture the effects of convergence.

3.3Empirical Specification and Data

In the previous section, we have already presented the estimation models used in our benchmark study (Rodrik 2008). In this section, we present our empirical specification and data; and explain the variables used in the model.

3.3.1 Empirical Specification

This study uses exactly the same measurement of currency undervaluation and also uses exactly the same explanatory variables for regression of growth as in Rodrik (2008) for comparison reasons. In Chapter 4, we will improve this regression by augmentation of further explanatory variables. Thus, in this Chapter, the currency undervaluation is estimated as in Equation 9:

$$Underval_{it} = \ln(RER)_{it} - \ln(\widehat{RER})_{\iota t} \qquad \text{eq 9}$$

while the growth regression is estimated as in Equation 10:

$$Growth_{it} = \gamma_0 + \gamma_1 \ln(INRGDPPC)_{it} + \gamma_2 Underval_{it} + f_t + f_i + e_{it} \qquad \text{eq 10}$$

where Growth stands for percentage increase in real GDP for country i, at time t. $INIRGDPPC_{it}$ stands for initial real GDP per-capita and it captures for convergence effects. $Underval_{ued}$ is the measurement of undervaluation of currency. f_t and f_i are the time and country-specific dummy variables.

3.3.2 Data

This study uses panel data of 82 countries from the year 1990 to 2014. The data is periodic data of 5 sets of 5-years-period. “Growth” is the percentage increase in real

GDP and is directly obtained as a growth rate from the World Bank database. The growth rate is the average of growth rates of 5 years in each period.

“INIRGDPPC” is the first year real GDP per capita in each time period. “Underval” is the currency undervaluation and is measured as highlighted in eq 9 where RER (real exchange rate) are obtained as directly from the World Bank databases. The growth rate is a percentage number and thus is not in the logarithmic form. INIRGDPPC and Underval, on the other hand, are used in natural logarithmic forms.

3.4 Methodology and Results

In this section, we present the highlights of the methodologies we used and give out the results of the tests and regression. Let us now start with the panel unit root tests.

3.4.1 Panel Unit Root Tests

There are several unit root tests that one can carry out to perform a panel unit root test. Levin-Lin-Chu (2002) is one of the panel unit root test that was built on the premise that all observations have a homogenous level of integration. Maddala and Wu (1999) on the other hand, came up with the various specification of panel unit root test, where they employed distinct panel unit root processes. A similar test was created by Im, K., Pesaran, M. H., & Shin, Y. (2001) (IPS), while Hadri, K. (2000) suggested a different hypothesis. Hadri carried out the stationarity of the panel observations against the existence of a unit root.

In Table 1, we present the unit test results based on three different methods: i) Im-Pesaran-Shin (IPS); ii) Levin-Lee-Chu (LLC) and iii) Augmented Dickey Fuller-Fisher (ADF-Fisher) tests. While IPS and ADF-Fisher tests assume individual unit root processes, LLC assumes identical (common) unit root processes across the cross-sections. All three tests have a null hypothesis that there exists a unit root.

Table 1: Panel Data Unit Root Test (level data)

Variable	**IPS** Test Statistics (P-Value)	**LLC** Test Statistics (P-Value)	**ADF-Fisher** Test Statistics (P-Value)
Growth	-0.13 (0.45)	14.76 (1.00)	264.7 (0.00)*
RGDPPC	0.09 (1.00)	-2.37 (0.01)*	116.6 (0.99)
Underval	-1.29 (0.05)	3.44 (0.99)	155.08 (0.29)

Source: Author's computation. Note1: (*), (**) and (***) indicate that the estimated parameters are significant at the 1%, 5%, and 10% significance level respectively. Note 2: Null hypothesis is that there exists unit root.

Table 1 presents the results of the panel unit root test at level data. Majority of the test results fail to reject the null hypothesis for all their variables, thus providing evidence for the non-stationarity of the level data. That is, the variables were found to be non-stationary at levels.

These results bring about the application of the FMOLS and DOLS techniques. They basically require variable to be in a non-stationary state at levels. Since this satisfies the condition to evaluate long-run relationships between variables, it becomes expedient to carry out panel co-integration technique to evaluate whether there is a long-run equilibrium relationship among the non-stationary observations in their level forms.

3.4.2 The Panel Co-integration Test

In order to investigate if a co-integration relationship exists between the variables, we employ the techniques presented by Pedroni (1999). This method uses four-panel statistics (within-dimension) and three group statistics (between dimensions) for its hypotheses testing. Failing to reject the null hypothesis indicates no co-integration between the variable against its alternative hypothesis of the presence of co-integration. For the four panel statistics, the AR1 is the same (common) across sections, while in the group statistics, the AR coefficient is permitted to change across sections. Rejection of the null hypothesis based on panel statistics implies that the variables are cointegrated for all observations. However, rejection of the null hypothesis based on group statistics implies that co-integration between the variables only exist for probably one observation. For the co-integration analysis, 3 lags were chosen based on VAR Lag Order Selection Criteria. In Table 2, looking at the statistics, we can conclude that, the variables are co-integrated for all observations, as we reject the null hypothesis of no co-integration relationship based on Phillip-Perron (PP) and Augmented Dickey-Fuller (ADF) statistics.

Table 2: Panel Co-integration Test

	Panel Statistics	**Panel Weighted Statistics**	**Group Statistics**
Variance ratio	-0.4435	-5.3766	
RHO	1.2192	-0.3149	5.5781
PP	(-6.3365)*	(-17.3329)*	(-14.4241)*
ADF	(-6.0665)*	(-14.038)*	(-13.1732)*

Source: Author's computation. Note1: (*), (**) and (***) indicate that the estimated parameters are significant at the 1%, 5%, and 10% significance level respectively.

3.4.3 Panel FMOLS and DOLS Models

Once a co-integration relationship has been found, the use of Pooled Least Square (PLS) techniques would become problematic. This is because, at that point, the use of

PLS can easily lead to biased estimations which are as a result of endogeneity and serial correlation problem. Panel FMOLS and DOLS techniques have been found efficient method to remove these problems. DOLS is a parametric technique that is mostly used to acquire the long-run coefficient of the parameter estimate by taking into account the lagged and the lead values of the variables. FMOLS, on the other hand, is a technique used in removing autocorrelation impact by employing a non-parametric transformation to the model residuals obtained from the co-integration regression. FMOLS and DOLS methods make it easy to use regression analysis, without establishing the first difference of the co-integrated variables. Therefore, analysis can be carried out without losing any information regarding the dependent and independent variables.

3.4.4 Panel Estimation Results

In this section, we report the estimation results from using both the Fully Modified Ordinary Least Square (FMOLS) and Dynamic Ordinary Least Square (DOLS). Our focus here is the effect of currency undervaluation on the changes in economic growth rates across countries.

Table 3: Panel Estimation Results.

Dependent Variable: Growth		
	DOLS	**FMOLS**
Ln(INIRGDPPC)	-0.32329 (-15.782)*	-0.1029 (-2.834)*
Ln(Underval)	0.4492 (8.306)*	0.1488 (1.382)

Source: Author's computation. Note1: the number in parenthesis are t-statistics. Note2: (*), (**) and (***) indicate that the estimated parameters are significant at the 1%, 5%, and 10% significance level respectively.

Table 3 present the FMOLS and DOLS estimation results according to Balassa-Samuelson. The panel estimation using the FMOLS and the DOLS was justified, based on the fact that the level data observations are having unit root process. DOLS results are reported in the first column while the FMOLS results are reported in the second column.

DOLS results show that both initial GDP per capita and the currency undervaluation variables are of the correct sign and statistically significant at 1% significance level. Initial GDP per capita has a negative coefficient in accordance with convergence theory, which implies that countries with initially high GDP per capita have a smaller economic growth rate.

On the other hand, currency undervaluation has a positive coefficient, implying that undervaluation currencies help boost economic growth. In fact, results show that 1% increase in undervaluation leads to 0.44 % increase in growth rates.Table 3 also shows that FMOLS results are not as strong as DOLS results are. In FMOLS results, the coefficient of "Underval" is not statistically significant at all while the coefficient of initial GDP per capita is statistically significant at 5% and of correct sign.

The results presented in Table 3 show that the coefficient estimate of currency undervaluation based on FMOLS is statistically insignificant. This convinced us to rerun the same regressions by using an alternative measurement of the real exchange rate, and thus, an alternative measurement of currency undervaluation. We did this still based on the reference work of Rodrik (2008). In that study, Rodrik tried to eliminate any biases due to the fact that the Balassa-Samuelson effect involves adjustments based on factors affecting both price levels and GDP per capita. The alternative measurement of the real exchange rate is calculated as

$$RER = \frac{XRAT}{CPI} \qquad \text{eq 11}$$

where XRAT is the nominal exchange rate and the CPI is the consumer price index. Undervaluation is measured as before in Equation 9 but by using the new RER series.

Table 4 below presents results based on this alternative measurement of currency undervaluation.

Table 4: Panel Estimation Results (Alternative Undervaluation measurement).

Dependent Variable: Growth		
	DOLS	**FMOLS**
Ln(INIRGDPPC)	-0.1036 (-8.034)*	-0.1177 (-8.026)*
Ln(Underval)	0.5073 (2.0582)**	0.1824 (7.0932)*

Source: Author's computation Note1: the number in parenthesis are t-statistics. Note2: (*), (**) and (***) indicate that the estimated parameters are significant at the 1%, 5%, and 10% significance level respectively.

The results in Table 4 show that the coefficient estimates for initial GDP per capita (and hence for convergence) is statistically significant at 1% significance level and of correct sign under both DOLS and FMOLS estimations, while the currency undervaluation is of correct sign and statistically significant at 5% significance level under DOLS and 1% significance level under FMOLS estimation.

More specially FMOLS coefficient estimate for Undervaluation is 0.1824 with a t-statistics of 7.09, which shows that 1% increase in currency undervaluation leads to 0.18% increase in GDP growth rates. This shows an improvement over the results presented in Table 3. Moreover, from DOLS results in Table 4, we can infer that 1 percent undervaluation would boost growth by 0.50 percent point.

DOLS and FMOLS estimation results presented in Table 3 and 4 show us that currency undervaluation has a positive effect on GDP growth rates. This result is in line with our reference paper Rodrik (2008) and many others in the literature.

In the final section of this chapter, we would like to investigate if this result depends on the selection of countries. More especially we want to know if the positive impact of currency undervaluation on GDP growth rates are valid for the samples of developed countries only and developing countries only separately.

To carry out this work, we divide our panel data into 2 sub-sets: (1) developed countries only and (2) developing countries only. We did this by using the categorization based on the definitions used in the works of the United Nations.

Table 5 presents the FMOLS and DOLS estimation results for developed and developing countries separately. For developing countries, the results are supportive of the theoretical expectations. In other words, the coefficient estimates for Ln(INIGDPPC) and for Ln(Underval) are both statistically significant at 1% significance level and of correct sign, based on both DOLS and FMOLS estimations. Moreover, the coefficient estimates for currency undervaluation are bigger compared to the ones presented in Tables 3 and 4, indicating that currency undervaluation may play a bigger role in boosting GDP growth rates for developing countries.

On the other hand, results for currency undervaluation in developed-countries-only are statistically insignificant under both FMOLS and DOLS estimation. This is also a well-documented phenomenon in the literature and definitely so in our reference article Rodrik (2008).

Table 5: Panel Regression Results (Developing and Developed Countries Separately)

Dependent variable: Growth	**Developing countries**		**Developed countries**	
Independent variables	**DOLS**	**FMOLS**	**DOLS**	**FMOLS**
Ln(INRGDPPC)	-0.3823 (-14.384)*	-0.1938 (-7.997)*	-0.09315 (-8.7165)*	-0.0307 (-0.1015)
Ln(Underval)	0.6733 (9.992)*	0.2466 (4.229)*	-0.4476 (-0.5965)	-0.8056 (-0.6251)

Source: Author's computation. Note1: The numbers in parenthesis are t-statistics. Note2: (*), (**) and (***) indicate that the estimated parameters are significant at the 1%, 5%, and 10% significance level respectively. Observations are average for 5 years period. Regressions output are generated using reviews 10. All regressions include FMOLS and DOLS.

Economic growth as seen above for the developing economies over a long time, using the DOLS and FMOLS tends to increase with the currency undervaluation and decrease with the initial real GDP per capita. For the developed economies with respect to undervaluation, this is not the case. As said earlier, the coefficient estimates for the currency undervaluation are statistically insignificant even at 10% significance level. Most crucial for this study, the estimated coefficient on the undervaluation of developing countries is highly statistically significant both for the DOLS and FMOLS. This is comforting and interesting results as it affirmed Rodrik (2008) that undervaluation would enhance economic growth in the developing countries rather than in the developed countries.

3.5 Conclusion

The concept and impact of the real exchange rate are important and mostly felt especially in open economies. These are economy that embarks on exportation and importation of goods and service. Since economic growth is usually measured by the monetary value of output produced in an economy, the impact of the exchange rate would be enormous on their level of growth. The basic point of this study can be briefly stated. In developing countries, tradable economic activities are perceived as crucial and special. Tradable economic are goods and services which are either exportable or importable.

Chapter 4

IMPROVING ON RODRIK MODEL

4.1 Introduction

Dani Rodrik (2008) is one of the pioneering and cornerstone work in the field of currency undervaluation and its impact on growth. In chapter 3, we mainly reproduce his work, but by using relatively newer estimation techniques. Nevertheless, our results confirmed the validity of his results and conclusions.

However, Rodrik (2008) (and thus our work in chapter 3) has suffered from a number of shortcomings which were highlighted by the subsequent literature. One problem was that measurement of currency undervaluation involves estimation of the equilibrium level for the real exchange rate. This is by itself a massively challenging work. Rodrik based his real exchange rate equilibrium estimation on Balassa-Samuelson effect which is briefly presented in section 3.2.4.

However several studies - including Berg and Miao (2010); and Beck and Coskuner (2007)- show that the estimation of RER equilibrium can be substantially improved by inclusion of several other explanatory variables (trade openness, government consumption size, tax rates, and so on) in addition to using real GDP per capita or relative productivities in non-tradables which captures only the Blassa-Samuelson effect.

Another problem in Rodrik (2008) paper is that growth regression is likely to suffer from omitted variable bias as that regression included only initial real GDP per capita (capturing convergence effect) and the currency undervaluation as the only explanatory variables. This problem is also addressed by Berg and Miao (2010) paper, and the model is improved by the inclusion of several control variables which are well known in growth literature.

Finally, another improvement on Rodrik (2008) came from the authors Razmi, Rapetty, and Skoth (2012) which tried to capture the effects of lags of undervaluation on the current growth rates.

In this chapter, we try to improve the Rodrik model by taking into account the issues raised by Berg and Miao (2010) and Razmi, Rapetty, and Skoth (2012) as highlighted in the previous paragraphs. More specially, the purpose of this study in this chapter is to improve the original Rodrik model in three folds: (1) to estimate the equilibrium level of real exchange rate based on fundamental equilibrium exchange rate model (FEER) as presented by Berg and Miao (2010), (2) to improve the growth regression by inclusion of well-known growth explanatory variables, and (3) to capture the effects of the lags of currency undervaluation on GDP growth rates. We do this to check how much these new methodologies improve the original Rodrik paper. To do so, we employ a panel data of 93 countries from the year 1990 to 2016.

This research, to the best of the authors' knowledge, is one of the first studies which intends to compare the effects of currency undervaluation measured based on FEER and Balassa Samuelson (BS) effects; and to use the lags of undervaluation on the Rodrik growth model. This paper, among the few studies, is one of the first to use dynamic panel estimation on Rodrik approach. The findings of the study support Rodrik's conclusion that undervaluation has a significant impact on GDP growth, although the results of FEER are more significant than those of BS. Furthermore, the first lag of RER undervaluation has a significant effect on GDP growth.

4.2 Fundamental Equilibrium Exchange Rate Model (FEER)

FEER was first introduced by Williamson (1994). FEER is essentially a new empirical modeling for estimating a more proper equilibrium level for real exchange rates via the inclusion of several important variables, as discussed by Cline (2008), Jeong, Mazier, and Saadaoui (2010), Carton and Hervé (2012) as well as Berg and Miao (2010).

Berg and Miao (2010) suggest that although Rodrik used the Balassa-Samuelson effect only on his estimation of RER equilibrium, this is not sufficiently reliable because of some important missing variables. Hence, Berg and Miao (2010) used the FEER model in accordance with the Washington Consensus by adding terms of trade, trade openness, government consumption, and investment variables to real GDP per capita (the BS effect) to estimate an effective real exchange rate undervaluation.

4.3 Empirical Specification and Data

In this section, let us present our improved empirical specifications, followed by the information on data used in this study.

4.3.1 Empirical Specifications

As mentioned earlier, the purpose of this chapter is to improve on the original work of Rodrik (2008) on several dimensions. To this end, we make use of the following models:

First of all, the equilibrium level of the real exchange rate is estimated in 2 different ways:

One is the based on Balassa-Samuelson effect only, as in original Rodrik (2008) and as presented in chapter 3 in Equation 8,

$$\ln(\widehat{RER})_{it} = \alpha_0 + \alpha_1 \ln(RGDPPC)_{it} + f_t + e_{it} \qquad \text{eq 8}$$

The second one is the FEER model which is presented in eq 11,

$$\ln(\widehat{RER})_{it} = \beta_0 + \beta_1 \ln(RGDPPC)_{it} + \beta_2 \ln(TOT)_{it} + \beta_3 OPEN_{it} + \beta_4 GOVT_{it} + \beta_5 INVT_{it} + f_t + e_{it} \qquad \text{eq 11}$$

where RGDPPC stands for real GDP per capita, TOT stands for terms of trade, OPEN stands for trade openness, GOVT stands for government consumption size as a percentage of GDP, INVT stands for investment rate as a percentage of GDP, f_t is the time dummy while e_{it} is the error term. The currency undervaluation is then calculated as presented in chapter 3 in Equation 9,

$$Underval_{it} = \ln(RER)_{it} - \ln(\widehat{RER})_{it} \qquad \text{eq 9}$$

However, please note that when we use the RER estimation based on the Balassa-Samuelson effect, we superscript the undervaluation as $Underval_{it}^{BS}$. When we use the RER, estimation based on FEER, we superscript the undervaluation as $Underval_{it}^{FEER}$.

After addressing the issues in RER equilibrium determination, we move to focus on improving the growth regression equation. Here, too, we use 2 different augmented growth equations: one with $UNDERVAL^{BS}$ and one with $UNDERVAL^{FEER}$ so that the empirical specification for growth equation becomes:

$$Growth_{it} = \delta_0 + \delta_1 \ln(RGDPPC)_{i,t-1} + \delta_2 Underval_{it}^{BS} + \delta_3 \ln(TOT)_{it} + \delta_4 OPEN_{it} + \delta_5 GOVT_{it} + \delta_6 INVT_{i,t-1} + \delta_7 \ln(INF)_{it} + \delta_8 \ln(LIFE)_{it} + \delta_9 Growth_{i,t-1} + f_t + f_i + e_{it} \quad \text{eq 12}$$

Where $RGDPPC_{i,t-1}$ is the lag value of real GDP per capita for country i to capture the effects of convergence. $Underval^{BS}$ is the currency undervaluation based on Balassa-Samuelson effects. TOT is the terms of trade, OPEN is the trade openness, GOVT is the government size (government consumption as a percentage of real GDP), INVT is the investment rate as a percentage of real GDP, INF is the inflation rate, LIFE is the life-expectancy (used for proxy for human capital development), $Growth_{i,t-1}$ is the lag values of GDP growth rate to capture the effects of dynamic panel estimation, f_t and f_i are the time and country-specific dummies while e_{it} is the error term.

Equation 12 is estimated again after $UNDERVAL^{BS}$ is replaced by $UNDERVAL^{FEER}$ so that we can identify if FEER-based undervaluation measurements improve the coefficient estimations of the growth equation.

4.3.2 Data

In this chapter we use a panel data of 93 countries for 27 years from 1990 to 2016. In Chapter 3, our data was a periodic panel data whereas in this chapter the data is yearly panel data so that 27 years of observations are used for each country. This increases the number of observations available to the growth regression. However, this also brings about a change in capturing the effects of convergence. In other words, the initial real GDP per capita (INIRGDPPC) is replaced by the lag values of real GDP per capita ($RGDPPC_{i,t-1}$).

All data were obtained from the World Bank databases. In our regressions, we use the natural logarithm form of the following variables: lag of real GDP per capita ($RGDPPC_{i,t-1}$), currency undervaluation (UNDERVAL), terms of trade (TOT), life expectancy (LIFE), and inflation rate (INF). For inflation rate, percentage values are added to one, before taking the natural logarithm form. This transformation is needed to avoid logs of possible negative numbers. All other variables are used as it is, that is without natural logarithm form. These are the lag of GDP growth rate ($Growth_{i,t-1}$), trade openness (OPEN), government size (GOVT) (as a percentage of real GDP), and the lag of investment rate ($INV_{i,t-1}$).

4.4 Methodology and Results

In this section, we present the methodologies used in this chapter and outline their main advantages. This is followed by our estimation results.

4.4.1 Methodology

This chapter uses Berg and Miao (2012) paper as a benchmark paper. In their work, the authors have employed relatively older panel estimation techniques.

However, we attempt to improve on this paper by using more recent and superior estimation techniques in this chapter. More especially we use panel OLS in our RER equilibrium analysis while using GMM (general method of moments) in our growth regression analysis.

The GMM provides the speedy and correct estimations of unknown parameters. Additionally, when extra samples are given or it includes higher order moments, the variance of the estimator will decrease (see Lück and Wolf (2016)). Wooldridge (2001) mentions that GMM may be attractive due to the fact in many circumstances, regressions of unknown parameters are correct and reliable.

4.4.2 Estimation Results

Let us now present our estimation results. Table 6 shows the result of unit root test. According to table 6, there is no unit root on variables at level except of RGDPC.

Table 6: Panel Data Unit Root Test (level data)

Variable	IPS Test Statistic (P-Value)	LLC Test Statistic (P-Value)	ADF-Fisher Test Statistic (P-Value)
Growth	-16.2854 (0.00)*	-15.6194 (0.00)	622.193 (0.00)
RGDPPC	7.3873 (1.00)	0.2915 (0.6174)	61.169 (1.00)
TOT	-7.38316 (0.00)	-7.97885 (0.00)	405.101 (0.00)
OPEN	-0.9552 (0.01)	-2.1426 (0.01)	196.301 (0.02)
GOVT	-6.1243 (0.00)	-5.6963 (0.00)	282.632 (0.00)
INVT	-5.3586 (0.00)	-3.5279 (0.00)	302.463 (0.00)
INF	-20.1296 (0.00)	-22.8700 (0.00)	693.592 (0.00)
LIFE	-9.9254 (0.00)	-24.0886 (0.00)	586.411 (0.00)

*Source: Author's computation. * Null hypothesis is that there exists unit root.*

The results of regression on RER equilibrium are presented in Table 7, followed by our growth regression results. First, we attempt to estimate the equilibrium level of RER according to two different methods; namely the RER based on (1) BS effect and (2) FEER model. Table 7 shows the result of these two models.

Table 7**:** Estimation of Equilibrium Level for RER

Dependent variable: real exchange rate		
	Balassa–Samuelson (BS)	Fundamental Equilibrium Exchange Rate (FEER)
Ln(RGDPPC)	−0.07365 (−2.537556)*	−0.08706 (−2.106156)**
Ln(TOT)		−0.07625 (2.353947)**
OPEN		0.01750 (2.380280)**
GOVT		0.0293 (2.13193)**
INVT		−0.44040 (−8.017593)*

Source: Author's computation. Note1: the number in parenthesis are t-statistics. Note2: (*), (**) and (***) indicate that the estimated parameters are significant at the 1%, 5%, and 10% significance level respectively.

Under both Balassa-Samuelson-based and FEER-based RER equilibrium estimations, we find that there is a negative relationship between the real exchange rate and the real GDP per capita. These results are statistically significant at 5% significance level and are correct sign as they imply that when real GDP per capita increases, RER goes down indicating an appreciation of the home currency. This is theoretically in line with what is called the Balassa-Samuelson effect.

More specifically in the BS-based approach, the coefficient estimate for the natural log of RGDPPC is (- 0.0736) implying that 1% increase RGDPPC causes 0.07% appreciation in local currency. The results are similar in the FEER model where 1% increase RGDPPC causes 0.08% appreciation in local currency. The estimate for RGDPPC according to Balassa-Samuelson approach is statistically significant at 1% significance level but RGDPPC is statistically significant at 5% according to the FEER model.

In FEER-based RER estimation in Equation 11, we added terms of trade (TOT), trade openness (OPEN), government size (GOVT), and investment (INVT) to Balassa-Samuelson equation. The results show that all four variables are statistically significant in estimating the equilibrium level of the RER.

More specifically, the coefficient estimates for TOT (Terms of trade) has a negative sign and is statistically significant at 5% significance level. The sign is of the theoretically correct sign because as the TOT improves (implying higher prices for the exports and lower prices for the imports) we expect that the home currency will appreciate which is represented by a decrease the real exchange rate. Indeed, the results show that if TOT increases by 1%, RER will decrease by 0.07%.

The theoretically expected signs of trade openness and investment are ambiguous. The theoretically expected sign for trade openness is ambiguous as the openness may arise from either increasing exports or increasing imports, which affects exchange rates differently. Similarly, the theoretically expected sign for investment is also ambiguous as it depends on the shares of tradable and non-tradable goods in the relevant spending basket. For example, if the share of non-tradable goods is higher, the real exchange rate will decrease, implying an appreciation of the home currency.

Our results show that the coefficient estimate for trade openness (OPEN) has a positive sign so that when OPEN increases by 1%, the home currency depreciates by 0.017% approximately. This result is statistically significant at 5% confidence interval. On the other hand, the coefficient estimate for Investment (INVT) has a negative sign so that when INVT increases by 1%, RER will decrease by 0.44%, implying an appreciation of the home currency accordingly. INVT is statistically significant at 1% significance level.

Finally, the results for the coefficient estimate for the Government Size (GOVT) show that it has a positive sign and this is statistically significantly so at 5% significance level. Unfortunately, this is against our theoretical expectation. It is well known that the majority of government consumption goes to non-tradable local services, raising the relative price of non-tradables and thus causing the appreciation of the home currency. This odd result is beyond the focus of this thesis but nevertheless shows that there might be a room for improvement in estimating the equilibrium level for RERs.

After estimation of RER equilibrium via two different methods, we turn our focus on growth equation. Table 8 below, presents three different regression results: (1) according to initial Rodrik model, (2) augmented growth estimation where RER is measured via Balassa-Samuelson-based Rodrik approach, and (3) augmented growth estimation where RER is measured via FEER-based approach.

First of all, we want to focus on the first column which shows the initial Rodrik's growth model. The lag of real GDP per capita (RGDPPC) has a negative effect on economic growth. This is a theoretically expected sign in line with the convergence theorem. More specifically, if the real GDP per capita in the earlier period is 1% higher, this leads to the GDP growth rate to decrease by 0.66% approximately. Also, the estimate for the RGDPPC is statistically significant at 1% significant level.

Table 8: Estimating the Growth models

Dependent Variable: Growth (RGDP Growth Rate)			
	Initial Rodrik Growth model	Augmented Growth (BS-approach)	Augmented Growth (FEER-approach)
Lag of growth		0.066378 (42.59829)*	0.056282 (26.98620)*
Ln (RGDPPC)	−0.65915 (−271.3714)*	−0.79738 (−50.02754)*	−0.7680357 (−39.25344)*
Ln ($Underval^{BS}$)	0.022504 (49.61075)*	0.022007 (6.628207)*	
Ln ($Underval^{FEER}$)			0.067886 (14.50232)*
Ln (TOT)		0.409500 (5.330905)*	0.278745 (2.678558)*
OPEN		0.051521 (48.16377)*	0.052211 (45.11895)*
GOVT		−0.758011 (−44.63065)*	−0.837546 (−32.30611)*
INVT		0.154141 (124.6659)*	0.147419 (122.3304)*
Ln (INF)		−0.11526 (−40.70463)*	−0.11125 (−42.58425)*
Ln (LIFE)		0.03753 (3.991404)*	0.051097 (3.704361)*

Source: Author's computation. Note1: the number in parenthesis are t-statistics. Note2: (*), (**) and (***) indicate that the estimated parameters are significant at the 1%, 5%, and 10% significance level respectively.

$UNDERVAL^{BS}$ (undervaluation of home currency) is also of correct sign according to Rodrik model and statistically significant at 1% significance level. 1% increase of $UNDERVAL^{BS}$ leads to boost the GDP growth rate by 0.02%.

The second column of Table 8 shows the results from the improved Rodrik model where the growth equation is augmented with further explanatory variables as presented before. Similar to the first column, RGDPPC and $UNDERVAL^{BS}$ are a correct sign and statistically significant at 1% significance level. The estimate for RGDPPC is -0.7974 with a t-statistics of -50.03 which implies statistical significance at 1%. The coefficient estimate implies that if real GDP per capita in the earlier period is 1% higher, this leads to 0.79% decrease in GDP growth rate.

$UNDERVAL^{BS}$ estimate is 0.022 with a t-statistics of 6.63 which implies statistical significance at 1%. The coefficient estimate implies that if the currency undervaluation increases by 1% , this leads to 0.022% increase of GDP growth rate.

Terms of trade (TOT) is a ratio of a country's export price to import price. Thus, an improvement in the terms of trade helps to boost the real GDP growth rates; in the sense that higher TOT means better prices for export products and lower prices for imports. Our results show that TOT has – as theoretically expected- a positive relationship with the GDP growth rate. TOT estimate is 0.41 with a t-statistics of 5.33, which implies that the coefficient estimate is statistically significant at 1% significance level. Moreover, it means that 1% increase in TOT will improve the GDP growth rate by 0.41%.

Trade openness (OPEN) is defined as a ratio of sum of the exports and imports over GDP. High trade openness should then have a positive impact on economic growth rates since all the fundamental trade theories states that the bigger is the trade, the bigger are the benefits from trade and the richer are the nations. According to Table 8 results in column two, the coefficient estimates for OPEN is 0.051 with t-statistics 48.16. in the other word, if OPEN increases by 1%, the GDP growth rate will increase by 0.05% and this result is statistically significant at 1% confidence interval.

The results in Column 2 in Table 8 also show that GOVT and INF have negative impact on economic growth and this is statistically significant at 1% significance level, probably implying the disturbances caused by macro-economic mismanagements. On the other hand, investment in physical capital (INVT) as well as in human capital – captured by Life-expectancy (LIFE) have a positive impact on economic growth rates. These are statistically significant so at 1% significance level.

The results in Column 3 in Table 8 shows very similar results for all explanatory variables. Therefore, they will not be further explained. However, we want to note that the estimation in Column 3 uses a currency undervaluation based on FEER model. The results show that currency undervaluation - according to both the BS-approach and FEER-model - promotes growth, but the coefficient estimate for $Underval_{it}^{FEER}$ is bigger and more significant than $Underval_{it}^{BS}$.

Finally, we attempt to check the robustness of the results in Table 8 by augmenting the model by adding two lags of currency undervaluation on both type of regressions (that is the one where RER equilibrium is measured according to the BS-approach and the one where RER equilibrium is measured according to the FEER-approach. This allows us to observe the effects of currency undervaluation on economic growth in line with the method used by Razmi et al. (2012).

Table9 shows the results of the regressions where the growth is estimated by the inclusion of the lag values of currency undervaluation. For all explanatory variables, the results are statistically significant and very similar to the results presented in Table 8. As for the currency undervaluation and its lags, the results show that undervaluation and its first lag have a positive and significant effect on growth for both under the BS-approach and the FEER-approach. On the other hand, the second lag of the undervaluation is statistically insignificant in explaining the economic growth under both approaches.

Table 9**:** Estimating the Growth models (Lags of Undervaluation included)

Dependent variable: Growth (Real GDP Growth Rate)		
	Balassa–Samuelson (BS)	Fundamental equilibrium exchange rate (FEER)
Lag of growth	0.080532 (3.200852)*	0.066378 (2.578059)*
Ln (RGDPPC)	−0.567079 (−8.447694)*	−0.704878 (−11.75093)*
Ln ($underval^{BS}$)	0.049007 (6.878234)*	
Ln ($underval^{BS}$, first lag)	0.045055 (3.161220)*	
Ln ($underval^{BS}$, second lag)	−0.010895 (−0.875955)	
Ln ($underval^{FEER}$)		0.05312030 (1.96230)**
Ln ($underval^{FEER}$, first lag)		0.068762 (2.507721)**
Ln ($underval^{FEER}$, second lag)		−0.064953 (−1.458096)
Ln (TOT)	0.335980 (1.985105)**	0.318136 (1.987476)**
OPEN	0.052030 (5.806908)*	0.054152 (5.873012)*
GOVT	−0.806478 (−10.55525)*	−0.857318 (−10.82669)*
INVT	0.173679 (8.021967)*	0.162230 (6.438624)*
Ln (INF)	−0.092598 (−6.877168)*	−0.09125293 (−6.584923)*
Ln (LIFE)	0.060348 (2.963552)*	0.094059 (4.302232)*

Source: Author's computation. Note1: the number in parenthesis are t-statistics. Note2: (*), (**) and (***) indicate that the estimated parameters are significant at the 1%, 5%, and 10% significance level respectively.

4.5 Conclusion

The concept and impact of the RER are important, particularly in open economies, that is, economies that embark on exportation and importation of goods and services. Since

GDP growth is usually measured by the monetary value of output produced in an economy, the effect of the exchange rate on their level of growth will be substantial.

The basic point of this study can be stated briefly. In developing countries, tradable economic activities – goods and services that are either exportable or importable – are perceived to be crucial and special. However, these tradable activities suffer from the market and institutional failures that keep most developing countries poor. Persistent depreciation of the currency enhances the relative profitability of tradable investment on the one hand, and curbs or reduces the economic cost of these distortions on the other hand. In one way or another, this accelerates the process of structural change in a manner that stimulates growth. This is one basic reason why undervaluation is highly correlated with speedy economic growth.

Chapter 5

SYMMETRIC OR ASYMMETRIC EFFECT OF EXCHANGE RATE UNDERVALUATION ON ECONOMIC GROWTH

5.1 Introduction

There is an abundance of empirical literature which has firmly established the negative effect of poor exchange rate policy on economic growth and development. However, little attention has been paid to the conditions or the factors which the way the RER affect GDP growth depends on. For example, one wonders if the RER undervaluation plays the same exact role in developed as in developing countries. We had attempted to partly answer this question in our previous chapters.

However, we also wonder if the role of RER undervaluation on GDP growth is conditional on several other factors. For example, the role may not be the same in trade-surplus countries as in trade deficit countries; it may not be the same in pre-crisis time periods as in post-crisis periods, and surely it may not be the same for different exchange rate regime countries. Moreover, we could question if the currency undervaluation has a similar effect as the overvaluation does; and even if the relationship is a linear one or a nonlinear one.

As it can be seen, the questions are several. However, in this chapter, we mainly attempt to answer only two of these questions. More specifically one, we want to know if the exchange rate regime makes a difference in the way the undervaluation impacts the growth; and two if the upward fluctuations and downward fluctuations in RER have similar effects on growth. To this end, this chapter employs time series analysis for four selected countries.

More specifically, this study uses non-linear autoregressive distributed lags model (NARDL) and autoregressive distributed lags (ARDL) model to find the asymmetric or symmetric relations between RER and economic growth in Germany, South Africa, Mexico, and Cameroon.

The selection of these four countries is mainly to represent the diversity in exchange rate regimes. Germany is a developed country with a flexible exchange rate regime and with huge trade surpluses. More specifically it is the strongest economy in Europe and the 4th strongest economy in the world in nominal terms. On the other hand, both South Africa and Mexico are middle-income, developing countries with also floating exchange rate regimes. South Africa is the second largest economy and by far the largest GDP per capita in sub-Saharan Africa. Mexico is the second strongest economy in Latin America and the 15th strongest economy in the world in nominal terms.

Finally, Cameroon is a low-income developing country but it is the strongest economy in Central Africa. It uses common Central African CFA franc as its currency, which is also pegged to the euro. Therefore, with its fixed exchange rate regime, Cameroon is substantially different from the previous three countries selected.

As said earlier, in this chapter we employ 4 time series analysis –one for each country – in order to see if such difference in country characteristics –mainly exchange rate regime and the level of development – play a role in altering the way economic growth response to currency undervaluation; and that if the exchange rate undervaluation affects the economic growth asymmetrically or symmetrically. Having said that, we also want to note that the results we obtain are valid for each specific country used in the study and not necessarily for the broader country groups.

5.2 Data and Methodology

In this section, let us first present our data, followed by the details of the methodology used for the time series analysis.

5.2.1 Data

Data consist of yearly time series for four countries from 1984 to 2016. The selected countries are Germany, Mexico, South Africa, and Cameroon. ARDL and NARDL relationships are analyzed between the variables GDP growth and RER undervaluation where the definition of both variables has been highlighted in previous chapters. The data necessary for the calculation of the variables have come from the World Bank databases.

As for the selected countries, the selection of these four countries is mainly to represent the diversity in exchange rate regimes and the level of economic development. Germany is a very high-income country with a GDP per capita (on PPP) exceeding 50,000 USD. It has a flexible exchange rate regime. After China, it is the world's second largest exporting country, with the world's second largest trade surplus which exceeds 300 billion USD annually. By nominal GDP measurements, it is the strongest economy in Europe and the 4th strongest in the world.

Mexico is the 2nd strongest economy in Latin America. It is a middle-income, developing the country with a GDP per capita (on PPP) of around 20,000 USD. As for the total GDP, it ranks as the 11th largest in the world in terms of GDP on PPP; and 15th largest nominal terms. Currently, it has a small trade deficit and it has a floating exchange rate regime.

South Africa is the 2nd strongest economy and by far the largest GDP per capita in sub-Saharan Africa. Its GDP per capita (on PPP) is approaching to 15000 USD. Recently is trade balance has moved from a small deficit to a small surplus. Like Mexico and Germany, it has a floating exchange rate regime.

Finally, Cameroon is a low-income developing country with a GDP per capita (on PPP) of around 4000USD. Nevertheless, it is the strongest economy in Central Africa. It uses common Central African CFA franc as its currency, which is also pegged to the euro. Therefore, with its fixed exchange rate regime, Cameroon is substantially different from the previous three countries selected.

With the selected four so different countries, we attempt to examine the symmetric and asymmetric effect of RER undervaluation on GDP growth. We do so in order to find out if the way the economic growth responds to currency undervaluation does change with changing economic conditions and structures. In other words, we attempt to check the validity of our previous chapter's and Rodrik's results under different economic structures.

5.2.2 Methodology

This chapter, implement the autoregressive distributed lag (ARDL) model to evaluate the GDP growth as a function of RER undervaluation. This methodology, developed by Pesaran et al. (2001) in the symmetric item and improved by Shin et al. (2014) for the asymmetric item to investigate the short-run and long-run effects. One important advantage of this methodology is applicability even if the variables are integrated, stationary or mutually cointegrated. Hence it is not necessary all variables are integrated in the same order to find a cointegrating relationship among the variables. Another advantage is that this methodology has a good statistical property in small samples (see Delatte and Lopez-Villavcencio, 2012).

A non-linear ARDL (NARDL)model estimated according to Shin et al. (2014). The NARDL is based on the eq 13:

$$\Delta Growth_t = c + \alpha_0 Growth_{t-1} + \alpha_1^+ Underval_{t-1}^+ + \alpha_1^- Underval_{t-1}^- + \theta_i \sum_i^p \Delta Growth_{t-i} + \gamma_i^+ \sum_i^q \Delta Underval_{t+1-i}^+ + \gamma_i^- \sum_i^q \Delta Underval_{t+1-i}^- + \varepsilon_t \quad \text{eq 13}$$

where “Underval” is real exchange rate undervaluation, p and q are the lag orders of the dependent and independent variables, respectively. The superscripts (-) and (+) in Equation 13 show the negative and positive partial sum decomposition of lagged levels and first differences of real exchange rate undervaluation as Apergis and Vouzavalis (2018) mentioned, and as presented here in Equations 14 and 15.

$$Underval_t^+ = \sum_{j=1}^T \max(\Delta P_j, 0) \quad \text{eq 14}$$

and

$$Underval_t^- = \sum_{j=1}^T \min(\Delta P_j, 0) \quad \text{eq 15}$$

Alphas are the long-run parameters and null hypothesis is:

$H_0 = \alpha_0 = \alpha_1^+ = \alpha_1^- = 0$

Additionally, asymmetries in the long and the short run can be tested as follows:

$H_0 = \alpha_1^+ = \alpha_1^-$

and

$$H_0 = \sum_{i=0}^{q-1} \gamma_i^+ = \sum_{i=0}^{q-1} \gamma_i^-,$$

The coefficients γ^+ and γ^- capture the short run adjustment of RER undervaluation to GDP growth as Cuestas and Gil-Alana (2018) mentioned on their article.

5.3Empirical results

First of all, we carry out unit root tests that were developed by Ellioett et al. (1992) as a modification of Augmented Dickey–Fuller (1979) test to examine the stationary property of economic growth (Growth) and real exchange rate undervaluation (Underval). The results are presented in Table 10 below.

Our results in Table 10 indicate that there is no unit root on economic growth rates (Growth) and real exchange rate undervaluation (Underval) in these four countries. , The P-values for Growth and Underval for these four countries are less than 0.05, which means that we reject the null hypothesis and conclude that there is no unit root. More specifically, these results are statistically significant at 1% for “Growth” and at 5% for “Underval”.

Table 10: Unit root test results

Country	Growth Test Statistic (P-Value)	Underval Test Statistic (P-Value)
Cameron	-3.407 (0.0107)*	-2.757 (0.0402)*
Mexico	-5.573 (0.0000)*	-2.871 (0.0488)*
South Africa	-4.310 (0.0004)*	-2.686 (0.0271)*
Germany	-4.917 (0.000)*	-2.784 (0.0487)*

Source: Author’s computation. Note1: Null hypothesis is that there exists unit root. Note2: (*), (**) and (***) indicate that the estimated parameters are significant at the 1%, 5%, and 10% significance level respectively.

Table 11 presents the results of model diagnostics test for these four countries. The first column shows the Portmanteau test that was introduced by Ljung and Box (1978) and it is available to test the autocorrelation in the residuals of a model. As we see, P-value for these selected countries is higher than 0.05 and it means that we cannot reject the null hypothesis of no autocorrelation (H_0: No autocorrelation). Thus, we conclude that there is no autocorrelation problem between the variables.

The second column shows the Breusch / Pagan test that was developed by Breusch and Pagan (1979) to test the heteroscedasticity. P-value of our results are higher than 5% and we cannot reject the null hypothesis of no heteroscedasticity (H_0: No heteroscedasticity). The Ramsey Regression Equation Specification Error Test (RESET test) was developed by James B. Ramsey (1969) to check the linearity of the model. According to the results in Table 11, we fail to reject the null hypothesis and thus conclude that our data satisfy the linearity assumption.

Jarque and Bera (1980) introduce a method a test of whether sample data have the skewness and kurtosis matching a normal distribution. Except in Germany, three other countries have a normal shape with two equal tail. Although, this test is not very important and cannot change the value of regression results.

Our results in Table 11 indicate that there is no autocorrelation, heteroscedasticity, non-linearity between the variables for these selected countries. All selected countries except Germany have a normal distribution with the standard skewness and kurtosis.

Table 11: Model diagnostics

Country / P-Value	Portmanteau test up to lag 15 (chi2)	Breusch/Pagan heteroscedasticity test (chi2)	Ramsey RESET test (F)	Jarque-Bera test on normality (chi2)
Cameron	0.3173	0.2564	0.3275	0.9259
Mexico	0.7433	0.9356	0.0566	0.0901
South Africa	0.7376	0.4962	0.3986	0.9116
Germany	0.9313	0.7858	0.1326	0.0003

Source: Author's computation. Note1: The numbers presented in the Table are p-values.

Next, we turn our attention to asymmetry tests. An asymmetry test basically tests if the equation coefficients are equal or not. If they are equal then there is no asymmetry and if they are not equal then there is evidence of asymmetry. Table 12 presents the results for our selected countries.

Table 12: Asymmetry test statistics

Country / P-Value	Long-run effect [+]	Long-run effect [-]	Long-run asymmetry	Short-run asymmetry
Cameron	0.000	0.000	0.000	0.006
Mexico	0.802	0.668	0.606	0.858
South Africa	0.285	0.150	0.924	0.890
Germany	0.453	0.721	0.231	0.961

Source: Author's computation. Note1: Long-run effect [-] refers to a permanent change in the exogenous variable by -1. Note2: Null hypothesis: Variable is not significant.

According to Table 12, there is an asymmetric relation between RER undervaluation and GDP growth in Cameroon both for the short-run and the long-run. The effect of

RER undervaluation on GDP growth in the short run is significant because P-value is 0.006 that is less than 0.05. As for the long run effect of undervaluation, positive shocks in the long run, and negative shocks in the long run are significantly based on the zero P-values. Also, Our results show that there is a symmetric relation between the variables for Mexico, South Africa, and Germany in both short run and long run with positive and negative shocks. According to these findings, we use non-linear ARDL (NARDL) model for Cameroon because of the asymmetric effect and the ARDL model for the remaining three countries. Table 13 shows the estimation results of NARDL model with two lags of independent variables for Cameroon.

Table 13: Estimation for Cameroon - NARDL with SR and LR asymmetry

Variable	**Test statistic (P-Value)**
$Growth_{t-1}$	0.124258 (0.000)*
$Underval_{t-1}$ [+]	-0.87501 (0.000)
$Underval_{t-1}$ [-]	-0.65426 (0.000)
$\Delta Growth_{t-1}$	0.12396 (0.307)
Δ $Underval_{t-1}$ [+]	-0.92416 (0.000)
Δ $Underval_{t-2}$ [+]	-0.46684 (0.049)
Δ $Underval_{t-1}$ [-]	-0.38468 (0.001)
Δ $Underval_{t-2}$ [-]	0.13621 (0.028)
Constant	3.27512 (0.006)
Number of observation	33
F (8, 30)	17.46
P-Value	0.0000
R-Squared	0.8431
Adjusted R-Squared	0.7948

Source: Author's computation.

According to Table 13, $Growth_{t-1}$ is statistically significant (P-value = 0.0000). it means that lag of growth in the long run is an efficient variable and if the lag of growth increases by 1%, growth will increase by 0.12%. $Underval_{t-1}$ [+] show the positive shocks of RER undervaluation in the long run which is statistically significant. Test statistic is -0.87 that mean 1% increase in $Underval_{t-1}$ [+] leads to a decrease in Growth by 0.87%. $Underval_{t-1}$[-] shows a negative effect of RER undervaluation in the long run and it has a significant negative effect on growth.

As we see these two effects are not equal and have a different effect on economic growth because of the asymmetric relation of real exchange rate undervaluation and growth. UNDERVAL has a negative effect on growth because of the fixed exchange rate regime. RER undervaluation has a negative impact on the GDP growth of countries with fixed exchange rate regime as Tang (2015) and Sokolov et al. (2011) mentioned.

$\Delta Growth_{t-1}$ explains the lag of growth in the short run and our results show that it is not statistically significant because P-value is equal to 0.3. $\Delta Underval_{t-1}$[+] is the first lag of RER undervaluation with positive shocks in the short run that 1% increase in $\Delta Underval_{t-1}$[+] leads to decrease the economic growth by 0.92%. $\Delta Underval_{t-2}$[+] is the positive shocks of the second lag of real exchange rate undervaluation. If $\Delta Underval_{t-2}$[+] increases by 1%, growth will decrease by 0.47% approximately. $\Delta Underval_{t-1}$[-] shows the negative shock of the first lag of RER undervaluation in the short run and if increases by 1%, causes to decrease in growth by 0.38%. finally, $\Delta Underval_{t-2}$[-] shows the negative shocks of the second lag of RER undervaluation. 1% increase in $\Delta Underval_{t-2}$[1] causes to increase in growth by 0.13%.

Next let us analyze the results of the ARDL model for Mexico, South Africa, and Germany. Our findings show a symmetric relation between RER undervaluation and GDP growth for these countries.

Table 14 shows the results of the ARDL model for Mexico. Mexico is a developing country with a managed floating exchange rate regime and we expect the positive relation between RER undervaluation and GDP growth based on the existing literature.

Table 14: Estimation results for Mexico - ARDL (1 , 1) Regression

Variable	**Test statistic (P-Value)**
$Growth_{t-1}$	0.03342 (0.018)*
$Underval_{t}$	0.34680 (0.001)
$Underval_{t-1}$	0.26828 (0.001)
Constant	2.62024 (0.000)
Sample	1984 - 2016
Number of observations	33
F (3, 30)	6.15
P-Value	0.0023
R-Squared	0.6887
Adjusted R-Squared	0.6255

Source: Author's computation.

The test statistic of $Growth_{t-1}$ in Table 14 is 0.3342. It means if $Growth_{t-1}$ increases by 1%, Growth will increase by 0.33%. Lag of growth is statistically significant because P-value is less than 0.05. Both $Underval_{t}$ and $Underval_{t-1}$ have a positive impact on GDP growth and results are statistically significant. These results confirm the Rodrik

(2008) and show that RER undervaluation increases the GDP growth in Mexico as a developing country.

Table 15 includes the results of regression for South Africa. Both lags of growth and RER undervaluation has a positive effect on GDP growth. 1% increase in $Growth_{t-1}$ leads to 0.34% increase in growth approximately and this result is statistically significant. Our findings show that the effect of RER undervaluation on GDP growth is positive but it is not statistically significant (P-value is higher than 5%). South Africa is a country with an emerging economy but we can see RER undervaluation cannot affect the economic growth in South Africa. This result is not in line with our theoretical expectation that currency undervaluation affects economic growth positively. This result might arise due to the economic structure of this specific country.

Table 15: Estimation results for South Africa - ARDL (1 , 0) Regression

Variable	**Test statistic (P-Value)**
$Growth_{t-1}$	0.33998 (0.05)
$Underval_t$	0.03949 (0.545)
Constant	1.6462 (0.003)
Sample	1984 – 2016
Number of observations	33
F (2, 30)	1.89
P-Value	0.1683
R-Squared	0.1120
Adjusted R-Squared	0.0528

Source: Author’s computation.

In other words, this happens because of the import-dependent nature of the South African economy. The increase in the real exchange rate (depreciation of home currency) brings about increase in net import and transmit negatively to the economic growth of the country. This is contrary to the conclusion of Rodrik (2008) that undervaluation will increase net export and promote economic growth. While Rodrik conclusion might stand for export-dependent country, it may not hold for an import-dependent country like South Africa considered in this case.

Table 16: ARDL (1 , 0) Regression- Germany

Variable	**Test statistic (P-Value)**
$Growth_{t-1}$	0.12957 (0.0471)
$Underval_t$	-0.19061 (0.258)
Constant	1.62634 (0.002)
Sample	1980 – 2016
Number of observations	33
F (2 , 30)	1.02
P-Value	0.3734
R-Squared	0.636
Adjusted R-Squared	0.011

Source: Author's computation.

Germany is one of the most developed countries which have managed to stay as a stable economy during two last economic crises. Table 16 shows the results of ARDL model for Germany. Lag of growth is stastistically significant and has a positive impact on GDP growth. 1% increase in Growtht-1 causes to 0.13% increase in growth approximately. UNDERVALt is not significant and it confirms the Rodrik (2008) that mentioned that RER undervaluation is not a good policy for developed countries to promote economic growth.

Rodrik (2008) argued that RER undervaluation cannot improve the GDP growth in a strong economy. The biggest reason for this insignificant relation is the economic structure. Services as non-tradable goods are the big part of GDP in the developed countries, hence RER undervaluation does not have an effect on GDP growth.

5.4 Conclusion

We used NARDL model for Cameroon and ARDL model for Mexico, Germany, and South Africa because of asymmetric statistics that had shown the asymmetric relationship between the variables for Cameroon. In general, we find that RER undervaluation has an effect on economic growth in developing countries but it does not have an effect on developed countries and emerging market. However, this effect can be positive or direct on the developing countries with floating exchange rate regime and negative or indirect on the countries with a fixed exchange rate regime.

Chapter 6

THE EFFECTS OF REAL EXCHANGE RATE UNDERVALUATION ON ECONOMIC GROWTH IN TOURISM-LEAD MICROSTATES

6.1 Introduction

For several countries, the tourism sector is one of the big components of the economy. For many other countries development, strategies involve planning and growth in the tourism sector. Indeed, for many small (island) countries tourism may be identified as a leading economic sector.

This chapter tries to investigate the effects of the real exchange rate undervaluation and tourism sector on economic growth for ten small countries by using a panel data over the period 1995-2015 and using second generation panel approach that accounts for cross-sectional dependence. The model also incorporates investment in human capital as an additional explanatory variable. The causal relationship between exchange rate undervaluation, tourism, economic growth, and investment in human capital is examined by employing the Granger causality testing approach introduced by Dumitrescu and Hurlin (2012). Our empirical findings show tourism induced growth; human capital induced growth, and currency undervaluation induced growth.

6.2 An Overview of Tourism and Human Capital Development in the Microstates

Tourism has been identified as a potential economic growth sector in microstates. As a growth sector, tourism offers one of the rare opportunities for economic diversification (see Lin and Sung, 1984; Sharpley, 2002; and Morakabati, Beavis and Fletcher, 2014), especially in microstates. Tourism has various interconnections with other economic sectors in such a way that if the sector is adequately incorporated into any nation's strategic developmental plans, with sufficient provisions for intersectoral connections, it would contribute positively to the economic growth. Currently, the magnitude or scope of tourism activities in microstates differs extensively between countries and/or geographical regions. Similarly, the economic gains obtained from the sector are numerous. In some microstates, tourism has become the principal contributor to real GDP, whereas in others, it remains somewhat primitive (UNEP, 2006).

Katircioglu (2009) claim that the exchange rate affects the tourism sector and economic growth. Akadiri and Akadiri (2019) mentioned that the exchange rate can induce economic growth over the period 1995–2016 for sixteen island microstates. But Armstrong and Read (2003) argue that exchange rate changing is not successful on microstates and it is not a good policy to adopt the currency of bigger neighboring state, hence most of the microstates try to choose fixed exchange rate system or manage floating system rather than flexible system (Imam, 2010).

Microstates are at distinct phases of development with health, education and per capita income measures varying significantly from nation to nation (Knowles and Owen, 1995; Webber, 2002). With such variability, however, microstates share common geographic and economic attributes that pose grievous concerns for their efforts to develop available human resources (UNESCO, 1996). Contemporary studies conducted on the vulnerability of microstates confirm that the microstates are affected by their population size. Majority of these microstates have populations less than a million inhabitants and even in some instances, less than half a million. Bringing in the dependency ratios of these microstates, one would realize that their economically active labor force is very small. For some microstates, their indigenous technical capacity is negligible. For example, the workforce involved in research and development (R&D) in all sectors of Kiribati is 3, Tonga 15, Seychelles 33 and 366 in Cyprus (UNESCO, 1996). Over the years, these statistics have increased for Seychelles (146) and Cyprus (1032). In addition, with a very small labor force and population on which endogenous capacity will be built, microstates face higher challenges in developing indigenous expertise to meet the growing and diverse demands of sustainable development.

The regional or geographical features of microstates, on the other hand, appear to exasperate the difficulties mentioned above. The microstates have small landscapes coupled with a few forms of scattered archipelagos. In addition, their geographic designs, most especially in the archipelagic microstates with small populations, make it difficult to achieve economies of scale in both social and economic infrastructure. This situation stimulates an increase in the cost of producing public services. In as much as human resources are concerned, it further creates more demands, both in technical and administrative levels. This leads to additional operational impediments of enhancing and providing education, training and health care services (Global Environment Facility Quarterly Report, 1996)

Conclusively, the importance of tourism and human capital development in microstates has been recognized by the governments, individuals and private institutions. Public authorities, regional organizations and the UN system in the microstates have placed a priority on tourism and human capital development, as demonstrated in the drives by microstates' governments and support action programs by both the UN and regional organizations. However, the unique economic, geographic and demographic constraints faced by microstates necessitate a strengthening of the combined efforts at human capital development. In addition, policy measures by some microstates' governments towards educational reform, training, institutional building and geographical collaboration in environmental management yield practical experiences. This should be shared among other larger states in their quest to develop and execute human capital development policies.

6.3 Data and Methodology

In this section, let us provide information on data used as well as the methodologies employed in this Chapter.

6.3.1 Data

There are various possible ways one can measure the level of tourism. One of the means is through tourist receipts. Tourist receipts account for the level of earnings generated by international tourists or foreign visitors. Another means is through the number of days or nights spent by foreign visitors and also through the number of international tourist arrivals.

For the panel countries, the data on real GDP, tourist arrival and tourist receipt is obtained on the World Bank Database (online) while the data on human capital for the period 1995–2015 based on data availability for countries such as Barbados, Cuba, Cyprus, Dominican Republic, Fiji, Haiti, Iceland, Malta, Mauritius, and Trinidad and

Tobago is from United Nations Development Programme (UNDP, 2006). We make use of tourist arrival to proxy for tourism. This is done in order to eradicate the possibility of running into multicollinearity problem when tourist receipt is employed, considering the fact that the tourism induced growth hypothesis is about the contribution of tourism sectors towards economic growth.

The data for the real exchange rates is obtained from the World Bank database and the currency undervaluation has been calculated according to methodologies presented in Chapter 3.

The major objective of this study is to examine whether the real exchange rate undervaluation and tourism induced growth hypothesis of the period 1995–2015 is still valid in the case of microstates.

6.3.2 Methodology

6.3.2.1 Cross-Sectional Dependence (CSD)

The common occurrence that is usually observed when working with macro panel data is the presence of cross-sectional dependence (CSD). Once observed, this implies there is a presence of common unobserved factors that affect the rise of countries' variables over their individual time path. In addition, the peculiarity of countries can lead to the existence of fixed effects. Though it is expected that countries that prioritized travel and tourism should share specific characteristics, this necessitates caution in the choice of estimators, bearing in mind that these countries should be able to deal with biased results, model misspecification, and inefficiencies of the estimates. Panel unit root (PURT)

The presence of cross-sectional dependence across cross-sections necessitates the use of the second-generation panel data techniques. The statistical techniques of testing for stationarity of a series is through unit root tests. Recent studies suggest that the panel-based unit root tests have higher power when compare to time series-based unit root tests (see Baltagi, 2008). There are several second-generation panel-based tests of unit root that can be applied for a panel data analysis (see Maddala and Wu, 1999; Pesaran, 2007) The Maddala and Wu (1999) Fisher-type and Pesaran (2007) are simple unit root tests that allow for cross-sectional dependency. These tests were developed to asymptotically eradicate the cross-sectional dependence problem in the series. The CIPS test proposed by Pesaran (2007) has the required property of being robust to heterogeneity under the null hypothesis of non-stationarity. In order to observe the order of integration, the first[1] and the second-generation panel unit root tests were carried out.

6.3.2.2 Panel Cointegration Test (PCT)

The use of panel cointegration methods to examine the existence of a long-run cointegration relationship across integrated variables with both cross-sectional dimension and time dimension has recently gained growing attention, specifically in the empirical literature. One specific and crucial reason out of many that justify this growing attention is the increased power that perhaps would benefit by accounting for both time series dimension and the cross-sectional dimension of a series. Despite this, several studies have failed to reject the null hypothesis of no cointegration, even when the cointegration relationship is vehemently proposed by the theory.

[1] For the sake of brevity, we could not report the first generational panel unit root tests in text. Results will be made available upon request.

The reason behind this is that both time series and panel data analyses necessitate that the long-run parameter estimates for any variables in their level form should be equal to that of the short-run parameter estimates in their first difference. However, Westerlund and Edgerton (2007) developed and introduced four new panel cointegration tests to correct these inherent problems. The newly introduced panel cointegration test is not based on residuals unlike the others but on structural dynamics. Thus, it does not impose any common factor restriction. The reason behind this test is to examine the null hypothesis of no cointegration by assuming that the error-correction term in a conditional panel error correction model is equal to zero. The P_a and P_t are developed to test the alternative hypothesis (i.e. the whole panel model is cointegrated) for the entire model, while the other two (G_a, G_t) test the alternative hypothesis that at least one unit out of the panel model is cointegrated.

$$\Delta y_{it} = C_i + a_{oi}\left(y_{i,t-1} - b_{ixit-1}\right) + \sum_{j=1}^{k_{i1}} a_{11j}\Delta y_{i,t-j} + \sum_{j=-k_{2i}}^{k_{3i}} a_{2ij}\Delta x_{it-j} + \mu_{it} \qquad \text{eq 16}$$

a_{oi} is the speed of adjustment term (error term)? It is worthy to note that, the penultimate term includes leads and lags of Δx, else we need to presume exogeneity of *x*.

6.3.2.3 Panel Granger Causality Test (PGCT)

Dumitrescu and Hurlin (2012)[2] Granger causality test can be put to use when cross-section dimension is growing and the time dimension is constant, although one can also apply this test when T is larger than N or vice versa. The test is built on vector autoregressive model (VAR) and it presumes the absence of cross-sectional dependence, though the Monte Carlo simulations generated by this method reveal that

[2] Also read Hurlin, C., & Dumitrescu, E. (2012). Testing for Granger non-causality in heterogeneous panels.

even with the presence of cross-sectional dependence, this causality test still generates strong results. This causality test is applied to both heterogeneous and balanced panels. Two distinct distributions are present in this test the asymptotic and the semi-asymptotic. The asymptotic distribution is employed when *T* is larger than *N*, and the semi-asymptotic distribution when *N* is larger than *T*. In the presence of cross-sectional dependence, the simulated and estimated critical values derived from duplication are used. For panel data model, the linear model is given as follows:

$$z_{i,t} = \alpha_i + \sum_{j=1}^{J} \lambda_i^j z_{i.t-j} + \sum_{j=1}^{J} \beta_i^j T_{i,t-j} + \varepsilon_{i,t} \qquad \text{eq 17}$$

Where *j* depicts the lag length, $\lambda_i^{(j)}$ is the autoregressive parameter while $\beta_i^{(j)}$ represent the regression coefficient that varies within the groups. In addition, the DH causality test does not make use of a random process. It is a fixed type of test and generates a fixed coefficient model. All individual reminders for the individual cross-sectional unit are independent. DH causality test is normally distributed and allows for heterogeneity.

For the DH test, homogenous non-stationary hypothesis (HNC) is used for causality relationship analysis with heterogeneous models. The null hypothesis and alternative hypothesis for the HNC are given below:

$$H_0 : \beta_i = 0 \qquad \forall_i = 1, ...N$$

$$H_1 : \beta_i = 0 \qquad \forall_i = 1, ...N_1$$

$$\beta_i \neq 0 \qquad \forall_i = N_1 + 1, N_1 + 2, ...N$$

Here, N_1 represent the unknown parameter but it satisfies the condition $0 \leq N_1 / N \prec 1$

In any situation, the ratio of N_1 / N should be inevitably inferior to 1, because if $N_1 = N$, this implies no causality relationship for any of the individual (cross-section) in the panel. That is, we fail to reject the null hypothesis of HNC. On the other hand, when $N_1 = 0$, this indicates causality relationship for all the individuals in the panel.

However, for our study, the dynamic causality relationship models are specified as follows**:**

$$\Delta RGDP_{it} = \theta_{1j} + \lambda_{1t}\varepsilon_{it-1} + \sum_k \theta_{11,ik}\,\Delta RGDP_{it-k} + \sum_k \theta_{12,ik}\,\Delta tourism_{it-k} + \sum_k \theta_{13,ik}\Delta HCap_{it-k} + \sum_k \theta_{14,ik}\Delta Underval_{it-k} + \mu_{1,it} \quad \text{eq 18}$$

$$\Delta tourism_{it} = \theta_{2j} + \lambda_{2t}\varepsilon_{it-1} + \sum_k \theta_{21,ik}\,\Delta tourism_{it-k} + \sum_k \theta_{22,ik}\,\Delta RGDP_{it-k} + \sum_k \theta_{23,ik}\Delta HCap_{it-k} + \sum_k \theta_{24,ik}\Delta Undeval_{it-k} + \mu_{2,it} \quad \text{eq 19}$$

$$\Delta HCap_{it} = \theta_{3j} + \lambda_{3t}\varepsilon_{it-1} + \sum_k \theta_{31,ik}\Delta HCap_{it-k} + \sum_k \theta_{32,ik}\,\Delta tourism_{it-k} + \sum_k \theta_{33,ik}\,\Delta RGDP_{it-k} + \sum_k \theta_{34,ik}\,\Delta Underval_{it-k} + \mu_{3,it} \quad \text{eq 20}$$

$$\Delta Underval_{it} = \theta_{4j} + \lambda_{4t}\varepsilon_{it-1} + \sum_k \theta_{41,ik}\Delta Underval_{it-k} + \sum_k \theta_{42,ik}\,\Delta tourism_{it-k} + \sum_k \theta_{43,ik}\,\Delta RGDP_{it-k} + \sum_k \theta_{44,ik}\,\Delta HCap_{it-k} + \mu_{4,it} \quad \text{eq 21}$$

k is the optimum lag length, selected through Akaike Information Criteria (AIC).

6.4 Empirical Results

In this section, we discuss the results obtained from the panel empirical estimations. Before reporting the Granger causality analysis, we estimate the cross-sectional dependence, panel unit root tests, and the cointegration test.

In order to capture the characteristics of cross-sections, that is, the countries and panel series, the cross-sectional dependence test should be performed. Table 17 reports the cross-sectional dependence results.

Table 17: Cross-sectional dependence test

Variable	CD-Test	P-value	Corr.	Abs(corr.)
RGDP	16.36***	0.000	0.532	0.782
Tourism	21.81***	0.000	0.709	0.709
Human Capital	29.64 ***	0.000	0.964	0.964
Underval	12.87	0.000	0.419	0.444

*Note: H_0: cross-sectional independence *** $p<0.01$ significant level*

The cross-sectional dependence test strongly indicates that the countries share common features for the variables of interest. The presence of cross-sectional dependence suggests an interdependence among the cross-sections. According to Eberhardt and Teal (2011) in panel data analysis, panel countries mostly share common shocks. There are two basic types of dependence that exist between cross-sections as discussed in the literature the spatial and the long-range dependence (Anselin, 2001; Moscone and Tosetti, 2010). The former takes into account distance between cross-sections while the latter arises when cross-sections respond in the same way to shocks. Regardless, the presence of interdependence across the cross-sections the assumption of no serial correlation still remains.

For the unit root, we perform the Maddala-Wu (1999) and Pesaran (2007) tests. The estimated results from these unit root tests are reported in Table 18. For both tests, the null hypothesis of order $I(0)$, that is, the variables are integrated of zero order, the estimated statistic tests are found to be lower than the critical values at the standard significance levels; thus, the null hypothesis that each variable is stationary at level was rejected. This implies that the variables are non-stationary at levels. However, when we carry out stationary tests at first difference, we found that the variables are integrated at first order i.e. *I*(I). It is paramount to always pay attention to the stationarity and integration properties of data to avoid the possibility of making a false or spurious inference.

Table 18: Pesaran & Fisher Panel unit root tests

Variable	Pesaran		Fisher	
	Constant	Trend	Constant	Trend
RGDP	-0.829	-1.541	11.894	13.443
Tourism	-1.209	-1.721	23.870	28.480
Human Capital	-1.334	-2.985	9.099	21.392
Underval	-2.369	-2.521	54.79	43.44

Note: variables are not stationary at level but first difference.

Pedroni (1999, 2004) first generation panel cointegration test is commonly applied to investigate cointegration relationship. This cointegration test of Pedroni runs under the null hypothesis of no cointegration, although Pedroni (1999) cointegration tests take into consideration independence and heterogeneity within the cross-sections. The presence of cross-sectional dependence implies that Pedroni test is inappropriate for cointegration testing. According to Eberhardt and Presbitero (2013), if the presence of cross-sectional dependence is not controlled for, this could arouse vague estimates and grievous identifications problem. We also compute the Kao (1999)[3] cointegration test. The Kao test indicates no cointegration relationship as we could not reject the null hypothesis which is specified under the assumption of coefficients homogeneity. In a

[3] For the sake of brevity, we could not report the estimated results for both Pedroni (1999) and Kao (1999) in the main text. Results will be made available upon request.

nutshell, both the Pedroni and Kao cointegration test rejects the null hypothesis of cointegration relationships among the cross-sections.

To confirm our results, we compute the second-generation panel bootstrapping cointegration testing approach proposed by Westerlund and Edgerton (2007). As discussed earlier, this test deals with dynamic structure and no residuals. Having confirmed the presence of cross-sectional dependence, the Westerlund and Edgerton (2007) panel bootstrapping cointegration testing approach automatically becomes an appropriate technique to examine cointegration relationship among the cross-sections. Table 19 reports the cointegration results obtained from the panel bootstrapping cointegration method that generates sound coefficients, confidence interval, standard errors and robust critical values. Since it is necessary in sound econometric doctrine to advocate for resampling to be conducted in order to obtain robust results, 400 repetitions were conducted for estimation accuracy purpose. As reported in Table 19, we could not reject the null hypothesis of no cointegration.

Table 19: Westerlund and Edgerton's panel bootstrapping cointegration test

Statistic	Value	Z-value	P-value
G_t	-0.975	2.268	0.988
G_a	-3.277	2.295	0.989
P_t	-0.857	2.523	0.994
P_a	-1.729	1.272	0.898

Bootstrapping regression with 400 repetitions. Gt and Ga test the cointegration for each country individually, while the Pa and Pt test cointegration of the panel as a whole. xtwest stata command was used. (p-value obtained is greater than all the conventional significance levels, i.e. 0.01, 0.05 and 0.10 respectively) This signifies no cointegration at all levels.

The results show the absence of cointegration relationships, under the assumption of cointegration as a whole and within the individual cross-sections. One explanation for this might be due to the short study coverage period, although in this study, we do not place emphasis on the long-run cointegration relationship but rather on the direction of causality relationships that exist between the variables of interest. After considering the cointegration relationship whether a long-run equilibrium relationship exists between the variables, we then analyze the potential causal relationship that exists among the variables.

We employ a causality test proposed by Dumitrescu and Hurlin (2012) which has been reported to produce a stable and reliable result even in the presence of cross-sectional dependence. Following the results reported in Table 20, we found bidirectional causality relationship running from tourism to real GDP. That is, tourism Granger, causes real GDP, and vice versa at ($p < 0.01$) significance level. By implication, tourism and real GDP appear to have predictive power over one another. This result confirms the tourism-induced growth hypothesis in the case of the microstates. Enhancement of the tourism sector with sound and efficient policy in place appears to play a role in the level of economic growth in this region, and vice versa. This result answers our research question and is in line with the findings of Akadiri *et al.* (2017) and Roudi *et al.* (2018) for selected small island developing states.

Table 20: Causality test based on Dumitrescu and Hurlin Panel techniques

Null hypothesis	W-stat	Zbar-stat	P-value	Causality
Tourism → RGDP	1.779***	1.743	0.041	*Yes*
RGDP → Tourism	3.955***	6.608	0.000	*Yes*
Tourism → Human Cap.	3.392***	5.348	0.000	*Yes*
Human Cap. →Tourism	2.369***	3.0612	0.002	*Yes*
RGDP → Human Cap.	8.682***	17.178	0.000	*Yes*
Human Cap. →RGDP	1.352***	0.7878	0.043	*Yes*
Underval →RGDP	3.651***	5.9271	0.000	*Yes*
RGDP → Underval	1.063***	0.1407	0.888	*No*
Underval → Human Cap.	2.563***	3.495	0.001	*Yes*
Human Cap. → Underval	1.351***	0.785	0.433	*No*
Tourism → Underval	0.875***	-0.279	0.779	*No*
Underval → Turism	1.992***	2.2174	0.027	*Yes*

*Note: the notation ≠> implies that the variable does not Granger cause one another. Causality is confirmed at *** 0.01 percent significant level.*

In addition, our empirical results show a bidirectional causality running from tourism to investment in human capital in the case of the microstates, over the sampled period at (p < 0.01) significance level. The implication of this is that tourism and investment in human capital have predictive power over one another in this region. A well-developed tourism sector would enhance the human capital development of the host countries. This is evident through the transfer of knowledge, either through technology importation, managerial skills or educating (both formal and informal education) the local residents by their international visitors. Increased investment in human capital in these microstates also has a reverse role to play in tourism sector development. This result is in line with studies by Fayissa et al. (2008) and Bennett et al. (2012), and it also confirms tourism-induced human capital development hypothesis in the case of the microstates.

Also, from the Granger causality results presented in Table 20, we also found evidence to support human capital development induced growth hypothesis in the case of the panel countries. Our empirical results show that the real GDP Granger cause investment in human capital, and vice versa at ($p < 0.01$) significance level. That is, increased investment in human capital development and economic growth have predictive power over one another. It appears that diversification of the microstate's economy from a tourism-dependent economy to increased investment in human capital has been productive over the years. Increased investment in human capital seems to be a suitable alternative growth determinant in these regions. This finding confirms the results presented earlier in Table 19 and is in line with the findings of Benhabib and Spiegel (1994), Barro (2001), Krueger and Lindahl (2001), and Lucas (2015).

Lastly, exchange rate undervaluation induced tourism sector, growth, and human capital unilaterally. These results support the hypothesis and show that exchange rate undervaluation is matter on microstates and policymakers shouldn’t omit it on their decision.

6.5 Concluding Remarks

The real exchange rate undervaluation and tourism induced growth hypothesis were analyzed within the context where the level of tourism, economic growth, exchange rate undervaluation and investment in human capital across microstates were controlled for. To establish reliability and trustworthiness of employing the recent panel data techniques which are sensitive to the asymptotic attribute of time, we make use of annual frequency data for the available periods. We take into consideration cross-sectional dependence in order to observe the presence of common unobserved shocks that are mostly inherent in panel data analysis. Results from the cross-sectional dependence tests indicate the presence of interdependence among the variables. Thus, the decision to involve second generation panel data that generate sound, reliable and robust results even in the presence of cross-sectional dependence constitutes a logical contribution to the literature of the real exchange rate undervaluation and tourism induced growth hypothesis in the case of microstates.

Chapter 7

CONCLUSION

The concept and impact of the real exchange rate are important and mostly felt especially in open economies. These are economy that embarks on exportation and importation of goods and service. Since economic growth is usually measured by the monetary value of output produced in an economy, the impact of the exchange rate would be enormous on their level of growth. The basic point of this study can be briefly stated. In developing countries, tradable economic activities are perceived as crucial and special. Tradable economic are goods and services which are either exportable or importable.

Though, these tradable activities lack the market and institutional failures that mostly keep developing countries poor. Persistent undervaluation of currency enhances the relative profitability of tradable investment and on the other hand, curb or reduce the economic cost of these distortions. This is one way or another accelerates the process of structural change in a manner that stimulates growth. This is one basic reason why the adventure of undervaluation is highly related to speedy economic growth. It may be valuable to conclude this short review of positive and negative impacts of real exchange rate undervaluation on economic growth.

The concept and impact of the RER are important, particularly in open economies, that is, economies that embark on exportation and importation of goods and services. Since

GDP growth is usually measured by the monetary value of output produced in an economy, the effect of the exchange rate on their level of growth will be substantial.

The basic point of this study can be stated briefly. In developing countries, tradable economic activities – goods and services that are either exportable or importable – are perceived to be crucial and special. However, these tradable activities suffer from the market and institutional failures that keep most developing countries poor. Persistent depreciation of the currency enhances the relative profitability of tradable investment on the one hand, and curbs or reduces the economic cost of these distortions on the other hand. In one way or another, this accelerates the process of structural change in a manner that stimulates growth. This is one basic reason why undervaluation is highly correlated with speedy economic growth. Also, according to our regression evidence, the deviations from FEER are more important than deviations from BS. Nevertheless, undervaluation is also good for growth, confirming the findings of Rodrik (2008). It is better to identify undervaluation using FEER rather than BS, and not to omit the first lag of undervaluation, because undervaluation and its first lag have a significant and positive effect on GDP growth.

Otherwise, the study finds that RER undervaluation affects the GDP growth in developing countries but it does not affect the GDP growth in developed countries and emerging market. However, the effect is asymmetric on the basis of the exchange rate regime. It is positive or direct on the developing countries with floating exchange rate regime and negative or indirect on the countries with a fixed exchange rate regime.

Additionally, our empirical results show that tourism, RER undervaluation, and human capital induced GDP growth most especially in the microstates over the period 1995–

2015. Additionally, RER undervaluation induced tourism and human capital too. Hence, policymakers in microstate can focus on exchange rate policy to increase the number of tourists, improve the human capital. RER undervaluation is a key variable on the development of these countries.

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