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Master Thesis

Correlation between Exchange Rate Regimes and Macroeconomic Performance

How do Exchange Rate Regimes influence Countries' Development
and is a significant pattern detectable?
A Comparison between Advanced and Emerging Market Countries

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Management Summary

The question whether a country should fix or float their currency has been discussed in the literature for many years. Indeed, the choice of an exchange rate arrangement presents a major challenge to countries because their decision has not only significant monetary policy implications but also affects the development of the countries' growth. In general, policymakers differentiate systems between fixed and flexible exchange rates and each country has to decide which arrangement they want to employ.

In the following study, the correlation between the exchange rate regimes and the macroeconomic performance were explored. Therefore, the choice of an exchange rate regime and the consequent influence on the macroeconomic development were examined by taking a special focus on two groups of countries, namely advanced and emerging market / developing countries. The aim of the master thesis was to prove the hypothesis and to elaborate adequate results in respect of the choice of either flexible or fixed exchange rate system.

In a first step, the statistics used in this study were explained in order to ensure full understanding of the examined analyses and the corresponding interpretation of the results. Furthermore, fundamentals about flexible and fixed exchange rates in different contexts were presented as an introduction into the topic. In a second step, qualitative methods such as conducting research papers and empirical studies were considered to cover the current stage of science. In a third step, multiple regression models were executed on the two different groups of countries. According to the selected factors beforehand, a six-factor model was introduced with a dummy variable where 1 indicated fix exchange rate regimes and 0 indicated flexible exchange rate regimes. In the last step, the comparison of both groups of countries was taken into account.

Due to the conducted analyses, it can be said that the hypothesis can be accepted as clear patterns were identified. To be more precisely, the results of the regressions showed on the one hand a positive correlation between the flexible exchange rate regimes and macroeconomic growth, especially for emerging market / developing countries. On the other hand, a very weak and limited relationship of these factors was recognized within the group of advanced economies. Generally, this means that the choice of an exchange rate arrangement had a different impact on performance, which is dependent on the nations' stage of development. Therefore, more flexible arrangements boost the economy in emerging market and developed economies better than other regimes would.

With respect to the findings of this study each individual country has to take a variety of conditions, dynamics, opportunities and forces into consideration by making their choice of an appropriate regime. Hence, these results should be seen as an indicator and it may be proposed to

consider the determination of an exchange rate regime as an ongoing process in order to ensure a sustainable development with special considerations to the prevailing conditions.

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1 Introduction

Discussions on whether countries should fix or float their currency have been present in the literature of economists and academics for many years. Indeed, the choice of an exchange rate regime presents a major challenge to countries because their decision has not only significant monetary policy implications but also affects the economy overall, as well as the countries' growth in the short and medium term. Policymakers generally distinguish systems between fixed and flexible exchange rates. In the fixed model, this means that the monetary policy is subjected to the fixed exchange rate target which leads to the renunciation of the autonomous monetary policy. The flexible model indicates an internal economy oriented approach where the exchange rate fluctuation depends on supply and demand (Walser, 2015, p. 1).

One of the first international monetary and exchange rate system was formed in July 1944 after the Second World War in New Hampshire, United States of America (USA), namely the system of Bretton Woods (Blanchard, Amighini, & Giavazzi, 2013, p. 264). 44 countries designed international standards for the restoration of Europe as an economic center and important trading partner of the USA. The main goal was to stabilize the exchange rates between the currencies to encourage world trade. Furthermore, in addition to price stability, the maintenance of full employment was also an important requirement.

In general, the main aims of the Bretton Woods-System were to restore and to maintain the free interstate payment transactions based on stable exchange rates and convertible currencies. In addition, the possibility of exchange rate adjustments was provided in case of a severe deficit in the balance of payments. By doing so, they were able to prevent full employment without being compromised by monetary or fiscal policy measures. Despite the fact that the people in power recognized the necessity of price adjustments, they did not support flexible exchange rates. Based on past experience, they feared that a full opening of the exchange rates would encourage countries to devalue their currency in order to gain competitive advantage over other foreign countries. For the purpose of preventing such excessive price adjustments, the International Monetary Fund (IMF) was established to foster the stability of the monetary system overall (Schweizerische Nationalbank (SNB), 1981, pp. 79–81).

With this intention, a system was adopted in which the member countries were obligated to determine the value of their currency in relation to either the price of gold or the U.S. dollar. They had to ensure that the U.S. dollar rate did not deviate by more than one percent from the parity. To be more precisely, the central banks were able to achieve the stabilization of the exchange rates by buying and selling permanently the U.S. dollar against their own currency on the foreign exchange market. With this in mind, the national bank of the United States (Federal Reserve System) did not intervene in the market, but they were willing to buy or sell gold for

U.S. dollar 35 an ounce according to demand of other monetary authorities. Thus, the U.S. dollar became the most important intervention and reserve currency (SNB, 1981, p. 81).

This agreement allowed all members to trade without problems and possible trade barriers. The difficulties in payment transactions were also secured. With these intentions in mind, the measures should stimulate the overall economy even more and consequently trades and investments could also increase more (Blanchard et al., 2013, Chapter 12). Nevertheless, at the beginning of the 1970s, the Bretton Woods system came under pressure due to different currency crises and, as a matter of policymakers of the country, members struggled with the fixed dollar. A fundamental weakness of the Bretton Woods-System was found in the strength of the conflicts between internal and external objectives of the stabilization policy. In macroeconomic circumstances such as inflation or recession, the authorities were not able to combat them effectively whilst also maintaining a stable exchange rate. Although the IMF allows parity amendments, there was a considerable inhibition to adjust the exchange rates. As a consequence of the countries unwillingness to meet the external goal to adjust the balance of payments, the occurrence of the imbalance became a problem in the medium term (SNB, 1981, p. 83).

At the beginning of the seventies, the collapse of the Bretton Woods-System was inevitable. Different economic policy goals, mainly between Germany and the Unites States, were the main reason for the downfall. The United States weakened the dollar again through expansive monetary policy. In 1971, a severe currency crisis forced the Deutsche Bundesbank to invest billions of U.S. dollars on the foreign exchange market. Consequently, inflationary pressure occurred and they had to stop buying U.S. dollar, whereby the exchange rate of D-Mark was almost flexible (SNB, 1981, p. 86). The changeover to floating exchange rates was initiated by Switzerland due to strong pressure on the U.S. dollar. The announcement put a large amount of pressure on the U.S. dollar, meaning that in spite of a further devaluation of the U.S. dollar, the system of Bretton Woods with fixed exchange rates collapsed in 1973 (SNB, 1981, p. 88).

A similar example of an exchange rate agreement is the European Monetary System (EMS). Created in 1978, the system provided limited access to European countries. The structure of this system is comparable to the Bretton Woods approach but in the latter case, the Deutsche Mark took the role of the anchor. Nonetheless, according to the same reasons, the EMS also collapsed in September 1992. The differences between the monetary policy targets of Germany and the other European countries made them completely incompatible. Until the introduction of the Euro (EUR) on 1st January 1999, exchange rates in Europe fluctuated greatly. Based on past years' experience, Europeans were convinced that a uniform currency alone could solve their problems (Blanchard et al., 2013, pp. 426–427).

The past developments of exchange rate systems do not give an answer to the question of whether to fix or to float a country's currency. What they do show is that fixed agreements

bring limitations to a country's monetary policy. Under fixed exchange rates, countries give up two macroeconomic instruments: the interest rate and the exchange rate. Fixed exchange rates can also lead investors to ask for higher interest rates, if they anticipate devaluation. As a consequence, the country is placed under pressure due to bad economic development. Nevertheless, these two examples are both based on the theory and along with many other theories, support the view that an appropriate exchange rate leads to macroeconomic success. But each exchange rate arrangement, whether fixed or flexible, has advantages and disadvantages and it must be assessed individually based on the countries' macroeconomic circumstances (Blanchard et al., 2013, p. 277).

1.1 Issue to be explored

As the overall topic of the master thesis is defined as *"The Correlation between Exchange Rate Regimes and Macroeconomic Performance"*, the author explores the relationship between the choice of the exchange rate regime and the macroeconomic performance of the corresponding group of country. To find an appropriate solution, the focus lies on the emerging market / developing economies (152 countries) and also on the advanced economies (39 countries) (International Monetary Fund [IMF], 2016). This subdivision is taken into account because the author is interested in the different results of the two groups as well as identifying any particularly interesting and relevant findings between the different stages of development. The used methodology in this study will be introduced in chapter *1.4 Data and Methodology*.

As previously mentioned the choice of exchange rate regime and its impact on economic performance has been widely discussed in current literature and is one of the most controversial topics in macroeconomics. The relevance of the issue in a real-life context can be highlighted by the Economic and Monetary Union (EMU). In this particular exchange rate regime, the focus lies not only in the economic development of a single country, but also in a broadened international context. Based on the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), which provides a yearly description of the foreign exchange arrangements of all International Monetary Fund members, the exchange rate arrangements can be classified into different types and categories as illustrated in table 1.

Table 1: De Facto Classification of Exchange Rate Arrangements (IMF, 2016, own Illustration)

De Factco Classification of Exchange Rate Arrangements and Monetary Policy Frameworks	Monetary Policy Framework						
	Exchange Rate Anchor				Monetary Aggregate Target	Inflations-Targeting Framework	Other
	USD	EUR	Composite	Other			
No separate legal tender	8	3		3			
Currency board	8	2		1			
Conventional	15	18	4	5			2
Stabilized arrangement	4	1	2		7	1	3
Crawling peg	2		1				
Crawl-like arrangement		1	1		2	1	5
Pegged exchange rate within horizontal bands							1
Other managed arrangement	2		1		8		9
Floating					7	26	7
Free floating						10	21
Total number of countries:	39	25	9	9	24	38	48

This table shows a total of 192 registered and reported countries in the AREAER, despite the fact that the IMF comprises 189 country members. The reason for that small discrepancy can be explained by the additional information provided by the IMF Database on Hong Kong SAR (China) as well as Aruba, Curacao and Sint Maarten (all in the Kingdom of the Netherlands) (IMF, 2016, p. 1). Table one summarizes the IMF member countries' monetary policy framework combined with the classification of the de facto exchange rate arrangements, consisting of ten different categories. These classifications were made by IMF staff using methods such as a backward-looking approach on historical exchange rate data. They may diverge from the official (de jure) description set by the country itself. However, the AREAER provides also information about de jure arrangements as announced by each member country (IMF, 2016, p. 46). Such differentials are well known and occur because many countries say they float, but in fact intervene heavily in the foreign exchange market or countries under peg devalue at the first sign of trouble. But given that the author is interested in the actual implementation of the arrangement, the analysis will be based on the de facto classification in this study and therefore, the de jure data will left out. At the beginning of this chapter, it was indicated that the countries could choose whether to fix or float their exchange rate, but the classification categories go on to suggest that each country must specify exactly what kind of agreement they wish to reach.

As has been noted, the ten approaches can still be classified into fix or float arrangements which makes the analysis more comparable. Table 2 illustrates the classification of fixed or flexible:

Table 2: Allocation of Exchange Rate Arrangements (IMF, 2016, own Illustration)

Fixed Exchange Rates Arrangements	
Hard Pegs:	No Separate Legal Tender (Dollarization) and Currency Board
Softs Pegs:	Conventional Pegged, Pegged within Horizontal Bands, Stabilized Arrangement, Crawling Peg and Crawl-like Arrangement

Flexible Exchange Rate Arrangements	
Floating Regimes:	Floating, Free Floating and other Managed Arrangement

Given that the above summary addresses the multi-purpose possibilities which must be taken into account before reaching a final decision, is clearly that the process is not a simple one. Each country has their own challenges to manage and they require individual strategies to generate macroeconomic growth. But due to the globalization and dependencies, the countries must take some external factors into account. Each arrangement will be briefly explained in the following chapter.

Based on these initial ideas, it could be of interest to explore which exchange rate system has higher dependencies of macroeconomic performance to allow for correlation and comparison between groups of countries.

1.2 Objectives

The meaning of the master thesis is to enhance the practice-oriented research skills acquired in module 9, 10 and 11 of the Master of Science program in Banking and Finance at the Zurich University of Applied Science (ZHAW) by applying the attained theory in a real-life context.

The author examines the choice of the exchange rate regime and the consequent influence on the macroeconomic development, focusing on advanced and emerging market / developing countries. The derived hypothesis is as follows:

"How do Exchange Rate Regimes influence Countries' Development and is a significant pattern detectable? A Comparison between Advanced and Emerging Market Countries".

The aim of the master thesis is to prove the hypothesis that the choice of the exchange rate arrangement and other factors has a significant influence on the macroeconomic development of a group of country. The focus of this hypothesis lies on the countries' choice to employ either a flexible or fixed exchange rate system. In addition to the hypothesis, three further questions will be explored based on the general topic and the hypothesis.

The questions are as follows:

(1) Which exchange rate regime has a significant impact on the countries' performance and is a correlation detectable?

(2) Can differences be observed between the two groups (advanced and emerging market / developing countries) regarding the choice of exchange rate regime?

(3) In the case of financial instabilities or economic crises, which exchange rate regime can better absorb financial instabilities?

To answer the research questions, qualitative (conducting research papers) and quantitative (creation of a statistically proved multiple regression model) methods will be employed. It is intended that the results will enable the author to conduct a reasonable comparison between the different groups of countries. Question 1 and 2 will be examined on a qualitative and quantitative approach, whereas question 3 covers just research papers on a qualitative basis.

The supervisor of this master's thesis is Prof. Dr. Suzanne Ziegler, lecturer Banking & Finance at the Zurich University of Applied Sciences and she is supported by the co-supervisor. Dr. Stefan Kull, lecturer Banking & Finance at the Lucerne University of Applied Sciences and Arts.

1.3 Structure

In order to solve the research questions mentioned above and to test the validity of the hypothesis, the paper is divided into three parts. But before starting with the first part, which covers the empirical analysis, the statistics applied in this study are presented in order to provide the reader with a solid understanding of the conducted analyses. Afterwards, the author will introduce the topic by explaining theoretical fundaments about flexible and fixed exchange rates. Furthermore, the different exchange rate arrangements will be explained and in this context, the author will also refer to the Mundell-Fleming trilemma (also known as "the impossible trinity") and their corresponding trade-offs.

In the first part of the master thesis, an empirical study will be conducted to identify how the science of the exchange rate systems differ and to determine which system is most appropriate according to the context. In this section the focus lies on the importance of the choice of an exchange rate regime during normal market situations. Furthermore, the author intends to highlight distinctions between the two groups of countries and to attach importance to actual and controversial scientific papers. As an additional study, the author will also examine special market situations such as financial crises or macroeconomic vulnerability. It is possible that a specific exchange rate arrangement is more appropriate in difficult market circumstances to boost

the economy faster and there might be more effective regimes that can better absorb financial instabilities.

The second part of the analysis focuses on the descriptive statistic. For this purpose, several multiple regression models will be created, with the objective of identifying any dependencies between the choice of the exchange rate arrangement and macroeconomic growth. The multiple regressions will be executed for each group of countries in order to generate the correlation coefficient for the covered members of the IMF. As the GDP growth rate is defined as the dependent variable in the corresponding master's thesis, the author will consider different independent variables (such as inflation, unemployment rate etc.) and control variables (such as gross capital formation, general government consumption and expenditure etc.). This structure was chosen based on the idea that it is not only the exchange rate regime that stimulates the growth of an economy. Therefore, the multiple factor models will be constructed with a dummy variable where 1 indicates fix exchange rate regimes and 0 indicates flexible, respectively.

In the third part, the author will evaluate the results from the conducted analyses, comparing both groups of countries (advanced and emerging market / developing countries).

Finally, the last chapter will discuss the general findings and the extent to which the initial research question and hypothesis can be proven.

1.4 Data and Methodology

Real GDP per capita growth rate (percentage changes) will be presented as a comparable growth rate indicator of the listed advanced and emerging market / developing countries extracted from the data provider World Bank and will be used as the dependent variable. All other corresponding independent variables such as inflation, final consumption expenditure, gross capital formation, gross savings, unemployment rate etc. will also be procured by the data provider World Bank. The different applied exchange rate regimes of all IMF members can be found in the annual AREAER report. The time-period analyzed ranges between January 1st, 1980 and December 31, 2015. The data is cross sectional since the analyses do not take time into account.

The dataset collected from the World Bank shows the percentage changes of the chosen variables on a yearly basis. The data quality is mostly excellent which means that the analysis and investigations can be carried out without further optimizations. It is, however, important to note that the data structure of nearly one third of emerging market / developing countries is non-satisfying due to missing macroeconomic indicators. As the data quality for a quantitative analysis is essential, the author will in this case neglect countries with incomplete data. The necessary measures will be taken in order to avoid distortions in the analysis, however in case of negligence, the adjustments will be documented and justified.

Based on the country classification defined by the IMF, the selection of the members can be grouped into different categories. The comparison carried out by the IMF also consists of two groups:

Table 3: Official Classification of the Country Group (IMF, 2016, own spreadsheet)

Advanced Economies (38 countries)
Euro Area (19 countries)
Major Advanced Economies (7 countries)
Emerging Market and Developing Economies (151 countries)
Commonwealth of Independent States (12 countries)
Emerging and developing Asia (29 countries)
Emerging and developing Europe (12 countries)
Latin America and the Caribbean (32 countries)
Middle East, North Africa, Afghanistan, and Pakistan (22 countries)
Sub-Saharan Africa (44 countries)

There can be seen that the 39 countries classified as advanced economies are not evenly split between the euro area (19) and the G7 states. Three double counts (France, Germany and Italy) are also present. Therefore, it can also be seen that the remaining 16 countries have no separate classification than advanced economies because they are part of another global location or group (e.g. Australia, Denmark, Korea, New Zealand, Sweden and Switzerland to name a few) (IMF, 2016).

Previously mentioned, the master's thesis is organized into different parts. To make the analysis meaningful it is the authors' goal to apply problem-solving and analytical methodologies. For this reason, qualitative and quantitative methods will be applied.

In the qualitative part of the paper, the author will address the current state of scientific papers with the intention to display the issue in an appropriate manner. As previously mentioned, a central point for the investigation is the subdivision of the different exchange rate regimes into fixed and flexible exchange rate arrangements.

With the help of statistical tools provided by Microsoft Excel, Gretl and SPSS, statistical tests and regressions will be simulated and analyzed within the quantitative part of the master's thesis. Further description of the estimation methodology and assumptions of the conducting statistical approach will be explained in chapter *2. Statistical Methodology*.

1.5 Delimitations

The empirical study is limited to regression models based on two groups of countries: advanced economies and emerging market and developing economies. This means that single regression analyses for single countries will not be conducted due to limited sample size which would lead to unrepresentative results. As the data quality of emerging market and developing countries are not sufficient compared to advanced economies, various countries were neglected. In the appendix 8.1 and 8.2 there can be found the selected and covered countries for each independent analysis in detail.

2 Statistical Methodology

In statistics, the classical linear regression model (CLRM) expresses a linear relationship between the dependent variable and the independent variable. According to missing population parameters and therefore an unknown population regression function (PRF), the population parameter has to be estimated by taking a random sample from the population. As a consequence, the data are not regressed by the CLRM, but by using the sample linear regression model (SMRF). The goal is to establish a model that explains the variability in the dependent variable. An SMRF is generally written as follows (Newbold, Carlson, & Thorne, 2013, p. 477):

$$\hat{y}_i = b_o + b_1 x_{1i} + b_2 x_{2i} + b_3 x_{3i} + \ldots + b_k x_{ki}$$

where $b_o, b_1, \ldots, b_k$ are estimators of parameters $\beta_1, \beta_2, \ldots, \beta_k$

Before modeling the data, it is necessary to identify the most suitable data type for this master's thesis. In theory, four different types can be distinguished: Cross-sectional data, Panel data, Time-series data and Pooled cross-sectional data. The data will be investigated with individual cross-sectional regressions and different meaningful measures such as the F-statistic or the (adjusted) coefficient of determination (Bachmann, 2015d, pp. 5–8). It is possible that differences concerning the test results, either the size or the level of significance will be visible among the different groups of advanced and emerging market / developing countries.

2.1 Sample Linear Regression Model with OLS

Theoretically, different estimation methods can be used to investigate statistics and quantitative analyses. Nevertheless, in the following master's thesis, the data are regressed by using Ordinary Least Squares (OLS). This estimation methodology is the most popular approach and estimates the best linear approximation by minimizing the sum of squared errors (SSE) (Bachmann, 2015d, pp. 6–12).

2.2 Assumptions of OLS

Five assumptions determine the validity of OLS estimations, meaning that for OLS estimations to be reliable, these assumptions cannot be violated. In the case of violation, the data evaluation is of limited use and correctness. The five assumptions are as follows:

1. Linearity in parameters
2. Mean independence
3. No perfect multicollinearity
4. Homoscedasticity
5. No autocorrelation

Generally, these assumptions are necessary to determine whether the OLS estimation produces eligible estimator of the parameters. If there is a full satisfaction of the five assumptions, three properties are fulfilled: non-bias, efficiency and consistency. The latter means that the errors are exogenous and uncorrelated, and no multicollinearity is given (Bachmann, 2015e, pp. 1–4).

In the following sub-chapters, each prerequisite of the relevant OLS estimation will be further exemplified to gain a full understanding of the conducted tests. The corresponding test for each assumption will be briefly highlighted in order to prove the result.

2.2.1 Linearity in Parameters

The CLRM requires the first assumption: linearity in parameters. This does not necessarily imply linearity in variables. The relationship between the dependent variable and some of the independent variables can be nonlinear. So, even though there is a nonlinear relationship in variables present, the assumption 1 is not automatically violated.

Nevertheless, to ensure that the first assumption is given, the author will consider single regression models to follow up the results by plotting them in a graph. The aim of this analysis is to identify a linear function between the dependent variable and each independent variable. If the linearity in the two parameters can graphically be assumed, the unstandardized residuals should be randomly distributed. This type of scatterplots can be created by using statistical tools like SPSS or Gretl (Blanchard et al., 2013, pp. 514–519).

2.2.2 Man Independence

In order to specify the classical linear regression model, the selection of the independent variables is one of the most important and decisive steps. The problem behind the selection could be that either too few or too many independent variables are included in the model. As assumption two implies that the expectation of the error term is zero and independent, one might test if the model is well specified or not. This is necessary as of one or more relevant independent variables are omitted from the CLRM, the omitted variable is then considered of the error term and therefore violates assumption 2. A common methodology uses to test the model specification is the “Ramsey’s regression specification error test” (RESET). RESET is used to detect issues related to omitted variables and can determine whether the null hypothesis, which is defined as all alphas are insignificant, can be rejected or not. The aim is to prove that the null hypothesis cannot be rejected, which means that the misspecification will not be a problem. If this aim is not fulfilled, the model has a specification bias and that issue has to be solved. Such tests can be assessed by using the p-value. Statistical tools like Gretl or SPSS can both deliver the corresponding results. It is essential to interpret the output correctly, otherwise wrong conclusions may be drawn. If the p-value is inferior to 0.05, the null hypothesis can be rejected at the 95%

confidence level. Given that the aim is not to reject the null hypothesis generally, the p-value should be superior to 0.05 to become a positive result of the test (Bachmann, 2015f, pp. 2–20).

2.2.3 No Perfect Multicollinearity

The collinearity issue describes the relationship between the independent variables. No perfect multicollinearity means that the variables are linearly independent. A correlation can be present, but not perfectly. In theory, there are three different degrees of collinearity, which are listed in the table 4:

Table 4: Degrees of Collinearity (Bachmann, 2015e, p. 2)

Multicollinearity:	two or more correlated independent variables (positive or negative and close) (r = pos. or neg. close to 0)
High multicollinearity:	Highly correlated independent variables (r = close to 1 or -1)
Perfect multicollinearity:	Perfectly correlated independent variables (1 = 1 or r = -1)

Based on the above table, it can be concluded that the correlation between two variables it not an issue as long as the correlation coefficient is not too high. More generally and theoretically, if a correlation coefficient between two variables is present in the interval from -0.8 and 0.8, there will not be an issue (Bachmann, 2015e, p. 16).

In order to convey the idea that multicollinearity is not given, there are various methods to investigate whether two or more variables have very similar distributions or not. The first method that can be employed is the Variance Inflation Factors (VIF) test in Gretl. The second possible method is the analysis of the correlation matrix. The equation of the VIF test is defined as follows:

$$\mathrm{VIF} = \frac{1}{1 - \mathrm{R}^2}$$

As can be seen in the formula, the coefficient of determination has to be firstly calculated and then inserted into the equation. Based on the literature about statistical techniques in business and economics, the test result should not exceed the value of ten, otherwise the independent variable is not suitable for the model and should be neglected (Lind, Marchal, & Wathen, 2015, p. 497).

2.2.4 Homoscedasticity

Homoscedasticity explains the existence of constant variance in error terms. Heteroscedasticity is therefore given when the variance of error terms is not constant. And if the variance is not constant, assumption four is violated consequently. The problem of heteroscedasticity is well known in linear regression analysis, especially when using cross-sectional data (Newbold et al., 2013, p. 577).

Heteroscedasticity can be detected by visual inspection or statistical tests. This visualization approach using residual graphs is of limited use as these graphs do not provide evidence of that issue. It is therefore necessary to introduce a further statistical test in this context. Usually, a common measurement of heteroscedasticity is the White test, which can be tested by using the statistical tool Gretl. By applying the White test, nearly any pattern of heteroscedasticity can be identified (Bachmann, 2015c, p. 18).

As a consequence of the identification of heteroscedasticity, the biased standard errors are likely to distort confidence intervals and p-values, which ultimately lead to invalid hypotheses tests. In order to ensure unbiased standard errors, the estimation procedure has to be modified and two common solutions are possible: "White-corrected (robust) Standard Errors" or "Weighted Least Squares" (WLS). Due to the fact that the WLS approach will not be used in this study, further explanations will be neglected. Nevertheless, the white-corrected standard errors have been used permanent, which is very popular in regression analysis to make the standard errors robust. This test can be implemented in the econometric software Gretl, by activating the "HC1" button (Bachmann, 2015c, pp. 28–34). Worth mentioning is the fact that "HC1" is just activated if there are given signs of heteroscedasticity.

2.2.5 No Autocorrelation

The last assumption of the OLS estimations aims to describe whether the error terms are correlated or not. In a similar manner to the multicollinearity section, the (auto)correlation can also be positive or negative. Different statistical tests like Run test, Durbin-Watson test (DW) or Breusch-Godfrey test, are possible procedures for the detection. But as the autocorrelation issue only occurs in CLRM with time series data - meaning that the order of observations is relevant - it does not come up when using cross-sectional data and therefore it is not further relevant in this context (Bachmann, 2015a, pp. 2–4).

2.3 F-Test

Another important and well known test in statistics is the test on all coefficients, called the "F-test". This test is conducted in order to conclude whether the combination of all independent

variables is useful to predict the dependent variable. For illustrative purposes, the null and alternative hypothesis has the following structure and has to be tested for:

$$H_0: \beta_1 = \beta_2 = \cdots = \beta_K = 0$$

$$H_1: \text{at least one } \beta_i \neq 0, \qquad (i = 1,2, \ldots K)$$

On the one hand, the interpretation of the null hypothesis states that all coefficients are equal to zero. Accepting the null hypothesis (therefore H_0 not reject) would mean that none of the coefficients are statistically significant. Due to the fact that the predictor variables do not provide any useful information, the model specification has to be revised. In this case, in order to avoid the model misspecification, new and other variables have to be included. On the other hand, the rejection of the null hypothesis defines that at least one significant predictor variable were identified in the model (Newbold et al., 2013, p. 505). The equation of the "F-test" for the overall significance of the parameters is defined as follows:

$$f = \frac{SSR/K}{SSE/(n-K-1)}$$

Given that the aim to reject the general hypothesis, this formula is employed as long as the test statistic is bigger than the computed random variable from the F distribution ("$F_{K,n-K-1}$") with *K* numerator degrees of freedom K and *(n – K – 1)* denominator degrees of freedom (Newbold et al., 2013, p. 505).

2.4 Coefficient of Determination

Another important statistical measure used in this master's thesis for analyzing and justifying the models and results is the coefficient of determination (also known as R-squared). Based on Newbold et. al. (2013), *the R-squared provides a descriptive measure of the proportion, or per cent, of the total variability that is explained by the regression model* (p. 433). This means that the figure explains the extent to which the variation in "y" can be described by the independent variables. As stated above, the result is quoted in per cent and ranges therefore between 0 and 100%. A coefficient of determination of zero per cent implies no explanatory power by the variation of the regression model, whereas 100% indicates full model explanation. The equation is defined as illustrated bellow with the corresponding definitions in table 5 (Newbold et al., 2013, p. 435):

$$R^2 = \frac{SSR}{SST} = 1 - \frac{SSE}{SST}$$

Table 5: Definitions of R-squared Parameters (Bachmann, 2015b, pp. 4–5)

SSR	Sum of Squares Regression	Difference between the predicted value of dependent variable ($\hat{y}_i$) and the average value of depend variable ($\bar{y}_i$).
SSE	Sum of Squares Errors	Difference between the observed value of dependent variable (y_i) and the predicted value of the dependent variable ($\hat{y}_i$).
SST	Sum of Squares Total	Difference between the observed value of dependent variable (y_i) and the average value of dependent variable ($\bar{y}_i$).

Based on the equation, it can be concluded that the higher the R-squared, the better the model fits the collected data and the closer the data points around the regression line are. The measurement can also be interpreted as the quality of the linear regression model.

3 Fundamentals

The following chapter provides the relevant theoretical macroeconomic knowledge and the different classifications of the arrangements in order to secure the reader's understanding of the topic. To achieve this, course materials from the MSc in Banking and Finance based on Blanchard et al., (2013) will be consulted in combination with additional macroeconomic literature based on Mankiw (2016) and Blanchard & Illings (2014) among others.

3.1 Macroeconomic Theories

In order to understand the interdependencies between the flexible / fixed exchange rates and their influence of the development of a country, different theories should be explored. As a prerequisite, the determination and expressiveness of the nominal and real exchange rate is essential for further study. As long as the nominal exchange rate explains fluctuations in the relative price of two countries, the real exchange rate quotes even more details. Swiss tourists not only want to know how many euros they will receive in exchange for their Swiss francs, but also how many foreign goods they might be able to buy with their Swiss francs. This means that the construction of the real exchange rate must show the price of Swiss goods in terms of euro area goods and looks as follows (Blanchard et al., 2013, p. 113):

$$\varepsilon = \frac{EP}{P^*}$$

This equation can be interpreted as follows: The multiplication of the nominal exchange rate, E, by the domestic price level, P, and the subsequent division by the foreign price level, P*, leads to the real exchange rate. Based on the following formula and under flexible exchange rate arrangements, the nominal exchange rate, E, fluctuates without restrictions, whereas under fixed exchange rate arrangements, the value of the exchange rate will be bundled, $\mathrm{E} = \bar{E}$.

Generally, there are several factors that have an influence on exchange rate changes, but the most important factors that stimulate movements in the exchange rates are the rate of inflation, the balance of payments (surplus or deficit) and the interest rates (Kessler, 2015, p. 22). The latter is particularly relevant, as a common theory in explaining macroeconomic fluctuations of exchange rates is based on the interest rate parity. For illustrative purposes, the equation has the following structure:

$$(1 + i_t) = (1 + i_t^*) \left(\frac{E_t}{E_{t+1}^e} \right)$$

Where i_t is the domestic interest rate, i_t^* is the foreign interest rate, E_t is the current exchange rate and E_{t+1}^e is the future expected exchange rate. The main perception of the interest rate parity theory is that the decision whether to invest abroad or in the domestic financial market not

only depends on the difference of the interest rate, but also on the expectations of the nominal exchange rate. The theory implies that financial investors take such investments (bonds) with the highest rate of returns under the assumptions of identical risk, no transactional cost and capital mobility (Blanchard et al., 2013, p. 120; Kessler, 2015, p. 33). If an investor holds a domestic bond and a foreign bond at the same time, both investments must have the same expected rate of return, which means that the relation of the interest rate parity must hold. The connection between interest rates and exchange rates implied by the interest rate parity tries to show that an appreciation e.g. a higher domestic interest rate leads to a higher exchange rate.

Before focusing on the different effects of fixed and flexible exchange rates in an open economy, one further relation should be mentioned. In the previous theory, the relationship between the interest rates and the exchange rates was discussed without determining the interest rate. An equation should therefore be introduced in order to determine how the interest rate of a country is settled. The corresponding information can be obtained by analyzing the derivation of the LM curve. The interest rate is general defined by the parity of the supply of money and the demand for money:

$$\frac{M}{\mathrm{P}} = YL(i)$$

The following formula shows that the real money supply (left side of the equation) be equal to the real money demand (right side of the equation), which depends on real income (Y) and the interest rate (i) (Blanchard et al., 2013, p. 87). The derivation of the LM curve is straight forward, but the relationship between output and interest rate must be understood at first. Figure 1 explains this link graphically.

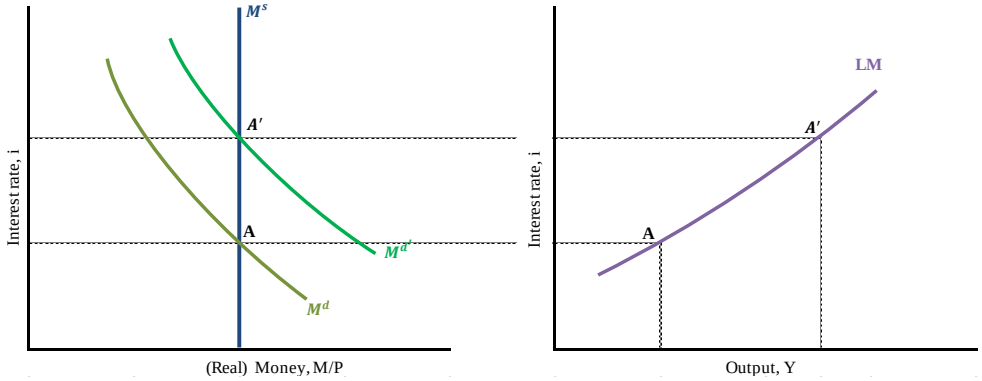

Figure 1: Derivation of the LM curve (Blanchard et al., 2013, p. 88)

The above figure shows that, for any level of real income, Y, the money demand is a downward-sloping curve. This means that the demand for money will increase as long as the interest rate lowers. It is clear that an increase in income leads directly to an increase in the money demand, at a given interest rate. Due to the stable money supply (horizontal line), an increase in the demand for money will lead to a higher equilibrium in the interest rate (shift to the right from A to

A', at a given money stock). It can therefore be said, that the interest rate is an increasing function of the level of income and this relation can be seen by the upward-sloping LM curve. In other words, the equilibrium in financial markets implies that a higher output, Y, leads to higher interest rate, i (Blanchard et al., 2013, p. 88).

With these theories in mind, the author intends to further explore the topic and show the effects of a country's decision to fix or float their exchange rates in an open economy.

3.1.1 Flexible Exchange Rates – The Short Run

Under flexible exchange rates, the national bank of each country sets the money supply and allows the exchange rate to fluctuate freely. This means that the countries do not have explicit exchange rate targets. Figure 2 shows goods and financial markets together in an open economy and the graphs present the ongoing process of exchange rate adjustments according to the interest parity relation. Due to the fact that the IS curve (implication of the goods market equilibrium) has not been introduced before this point, the equation has been added below figure 2.

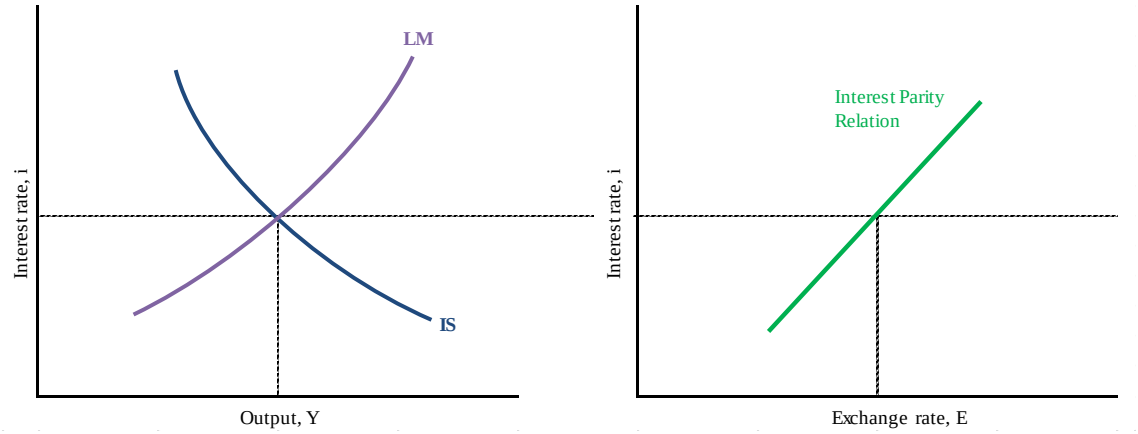

Figure 2: IS-LM Model in an open economy (Blanchard et al., 2013, p. 132)

$$Y = C(Y - T) + I(Y, i) + G + NX(Y, Y^*, \frac{1+i}{1+i^*}\bar{E}^e)$$

The IS curve shows that the output, Y, depends on different factors due to the circumstances of an open economy and also from the interest rate and the exchange rate. A possible increase in the interest rate has two effects, both of which have an influence on the output. Firstly, a higher interest rate leads to lower investments, a decreased demand for domestic goods and a smaller output, Y, as a result. Secondly, an increase in the domestic interest rate also affects the exchange rate due to appreciation. As a result, domestic goods are relatively expensive compared to foreign goods, which means that the demand for domestic goods and the net exports will decrease. It can therefore be concluded that this example shows the reason for the downward sloping IS curve: an increase in the interest rate leads directly and indirectly through the exchange rate to lower output (Blanchard et al., 2013, p. 131).

The interaction of the IS-LM Model, which represents a short run perspective in connection with the interest rate parity condition, can be easily seen in the previous figure. In a market with a flexible exchange rate, the equilibrium in the goods and financial markets and the equilibrium value of the exchange rate will be steadily adjusted. Dynamics under flexible exchange rate can be witnessed if the effects relating to fiscal or monetary policy have been modeled.

An expansionary fiscal policy decision employed by the government to boost the economy with an increase in government spending will have changes in output, interest rate and exchange rate. Based on this decision to increase the government spending, a series of actions will follow:

(1) An increase in government spending increases the output, at a given interest rate
(2) IS curve shifts is shifting to the right whereas the LM curve is not affected
(3) There is a new equilibrium with higher output and higher interest rate (demand for money increases with higher output)
(4) An increase in interest rate leads to appreciation (increase in the exchange rate)

With the mechanism of fiscal policy, the government of a country can influence and interact with the market by employing different instruments. The same happens by taking monetary policy into consideration. Monetary contraction, another favorable policy mechanism, aims to achieve the same goal as before. A decrease in the money stock leads to an increase in the interest rate as the LM curve shits up without affecting the IS curve. An increase in the interest rate leads to adjustments in the exchange rate – in this case also appreciation.

These examples show that national banks employing a floating exchange rate policy are autonomous in terms of monetary policy decisions and may not only intent to influence the macroeconomic development of their country through the financial market. Beside these instruments of the business cycle policy (consisting of fiscal and monetary policy), a national bank has further mechanism to support the countries development by, for example, considering the growth policy. The regulation of the labor market can be used in order to increase the structural output and steer the macroeconomic development without interfering with the financial market.

3.1.2 Fixed Exchange Rates – The Short Run

In reality, many countries and national banks follow clear exchange rate targets and use monetary policies to achieve them. These targets could be specific values, bands or ranges. As already mentioned in the introduction, the IMF describes different exchange rate arrangements, which will be explained in the next chapter. If a country decides to peg their currency, this does not mean that the exchange rate in this country never changes. Adjustments do still occur, but are more of a rarity. Mostly, various countries peg their currency to the U.S. dollar, the euro or even to a basket of foreign currencies (Blanchard et al., 2013, p. 153). In this chapter, the author

will highlight the most significant changes in monetary and fiscal policy decisions initiated by the government, concerning a fixed exchange rate. The examples will be discussed from the short run perspective. The author will then address adaptions in the medium term.

It is crucial that the interest rate parity condition holds in both a floating or fixed economy. If the equation from the interest rate parity holds and the country pegs the exchange rate ($E_t = \bar{E}$), the future expected exchange rate must be equal ($\mathrm{E}^e_{t+1} = \bar{E}$) which leads to the following relation:

$$(1 + i_t) = (1 + i_t^*) \rightarrow \ i_t = i_t^*$$

Investors will ask for identical interest rates in both countries if they believe that the financial investors and foreign exchange markets are holding their position on the market. As well as the interest rate, the equilibrium condition of the supply of and demand for money is also an important factor to consider in this context. Due to the same requested interest rate (domestic and foreign), the following condition has to be adopted:

$$\frac{M}{\mathrm{P}} = YL(i_t^*)$$

The above mentioned context can also be used in the following example. Under flexible exchange rates, the central bank was able to increase the interest rate and take the appreciation without influencing on the money supply. In this case, the central bank must protect the stable exchange rate in order to ensure the desired conditions. This means that the central bank has to adjust the nominal money (increase money supply) by the same amount as the demand for money due to the higher output. Without considering this modification, the domestic interest rate would exceed the foreign interest rate, which in turn would lead to an appreciation and violate the interest rate parity condition (Blanchard et al., 2013, pp. 154–155).

A country that decides to peg their exchange rate must also consider and eventually discount other inefficient monetary policies. For this reason, the author will also address the fiscal policy under fixed exchange rates to clearly identify the different possibilities. Previously, while conducting the interplay in the IS-LM model, steady movements in the equilibrium and adjustments in the interest rates and exchange rates are the expected results under flexible exchange rates. As has already been discussed, a central bank must not allow the currency to appreciate or depreciate under fixed exchange rate. Again, a possible fiscal expansion such as the increase of the output through government spending will cause the corresponding IS curve to the right. In order to avoid higher interest rates, the central bank must counteract this increased demand for money by raising the money supply. The latter action affects the LM curve and therefore there is a downward shift in the new equilibrium with the same level of interest rate as before, but with an

even higher output. With this in mind, the theory shows clearly that the fiscal policy is more powerful under fixed exchange rates than under flexible exchange rates.

Taking everything from chapter three into consideration and comparing the different developments under the flexible or fixed exchange rates, one might ask the reason for which a country should fix their currency. Different aspects argue against fixed exchange rates and can be summarized as follows:

(1) Running out of instruments in order to boost the economy (only fiscal policy is effective)
(2) Implementation of fiscal policy leads to higher trade deficit (monetary policy not possible)
(3) Loss of effective tools to adjust trade imbalances
(4) Loss of control of interest rate in conjunction with matching foreign interest rate movements

Based on the short-term perspective, it seems that the choice of fixed exchange rate arrangement makes less sense and is associated with a multitude of disadvantages. Nevertheless, by comparing the different countries and their exchange rate selection, it is clear that that many countries continue to employ a fixed exchange rate arrangement. The fact that countries are still employing this system indicates that there are indeed advantages to pegging a currency, but on a longer timescale. Therefore, the author will also consider the medium run in an open economy to illustrate how the differences between the two arrangements disappear.

3.1.3 The Medium Run

The previous chapter examined how the flexible exchange rate regimes dominate fixed exchange rate regimes. A country that operates under fixed exchange rates and perfect capital mobility sets the monetary policy aside, why should that approach be taken? Taking the medium perspective into consideration could reveal an obvious answer. Using the equation of the real exchange rate relationship, is seems that adjustments are possible in the medium run even if the nominal exchange rate is fixed. These adjustments can be done by changing the domestic price level using the equation below:

$$\varepsilon = \frac{\bar{E}P}{P^*}$$

This theory proves that regardless of the exchange rate regime, the economy achieves the same real exchange rate and output in the medium run. The above equation shows a real appreciation will occur if the domestic price level, P, shows a reaction and will appreciate as long as the foreign price level, P*, is given. This sort of increase in the price level affects the aggregated demand because domestic goods are more expensive than foreign goods, which leads to a decrease in output. This situation describes the initial position as the short run equilibrium in the AS-AD

model. In order to understand the process of adjustments, the current output has been compared to the natural level of output. The natural level of output defines the determined output in the medium run, which means that the aggregated demand or the aggregated supply will move back to this point over time. As long as the output is below the natural level of output, the expected price level will be higher than the price level. The aggregated supply curve therefore shifts downwards over time, which means that the price level will decrease until it has returned to the natural level. As well as the decreasing price level, there is also a steady depreciation, which leads to an increase in the output. In order to illustrate this behavior in a mathematical way, the following equation shows the definition of the aggregated supply:

$$P = P^e(1-\mu)(1-\frac{Y}{L}, z)$$

The aggregate supply shows in the above equation states that the price level, P, depends on the expected price level, P^e, and also on the level of output, Y. An important property of this equation is that an increase in output leads to an increase in the price level and can be explained as follows (Blanchard et al., 2013, p. 190):

(1) Higher output supports the employment market, which leads to a decrease in the unemployment rate.
(2) As a consequence, nominal wages will increase, which has also a positive effect on the price setting power by firms and therefore an increase in the price level is given.

The possible adjustments of the price level in the medium run suggest that the exchange rate regime a country is set does not limit their actions entirely. However in the short run, it does. Nevertheless, fixed exchange rates have also a higher sensitivity to crises, as the author will discuss in the next chapter. One of the main arguments against flexible exchange rates is the difficulties it presents when a country is confronted with high exchange rate fluctuations. These fluctuations could be difficult to control with a monetary policy (Blanchard et al., 2013, p. 277).

3.1.4 Exchange Rate Crises

The protection of fixed exchange rates can result in an inflexible economy because central banks consciously abandon two macroeconomic instruments: interest rate and exchange rate. It is consequently more difficult to react to shocks which could in turn lead to exchange rate crises. Furthermore, there is also a risk of possible interest rate adjustments on the part of foreign countries. As a result, the affected country is forced to adapt and could face devastating consequences. The argument behind this phenomenon is the interest rate parity theory in which the country could face potential economic downturn (Oliver Blanchard & Illing, 2014, p. 607).

In that respect and in order to support the outlined theory, a practical example will illustrate and emphasize the pressure put on countries under a regime of fixed exchange rates. The EMS, which was briefly explained in the introduction, was a system in which a single country could not adjust interest rates individually if the other countries did not also change their interest rates. Due to this divergence of macroeconomic goals, the central bank of Germany was forced to increase their interest rates due to strong growth (rise in demand) and possible overheating of the economy. Whilst Germany was suffering from strong growth and possible overheating, the other countries were also forced to make less attractive adjustments due to the increased interest rates. Subsequently, a strong decrease in demand and production occurred, due to the high nominal and real exchange rates in order to fight against the parity. Different countries were confronted with a distinct weakening of the economy and two exchange rate crises 1992 and 1993 respectively, were the expected consequences (Blanchard & Illing, 2014, p. 608).

In a country with a fixed exchange rate, the domestic currency may become overvalued in which case the country could face a real depreciation. As a result, financial investors may consider adjusting the exchange rate. As mentioned in the previous chapter, this can be accomplished in the medium run without targeted adjustments. But it is possible, and acknowledged by financial investors, that the government may use a more pragmatic method to solve the economic situation. Overvaluation occurs when the nominal exchange rate of a country is pegged to the currency of a country with a lower inflation, because domestic goods become more expensive than foreign goods as a result. Time is a crucial factor in this economic context (Blanchard & Illing, 2014, p. 626).

However, if the central bank and the government want to maintain an overvalued exchange rate, they have to convince investors and markets that they do not intend to devalue. They use public mass media in order to communicate clearly and emphatically, that they are committed to the existing parity. It is important to consider that this line of defense is often difficult because such pledges are just words without actions and therefore worthless to investors. If the strategy fails to make the value of the currency publically credible, there is a high risk of currency crises. In this case, the government is faced with two aims that must be fulfilled: The central bank must not only raise the interest rate to maintain parity, but must also fulfil the expectations of the market and the devaluation. Maintaining the parity can become very costly based on the high interest level, which could have a significant negative impact on demand and production and a possible economic recession (Blanchard & Illing, 2014, p. 626).

3.1.5 Conclusion

Based on the covered theory, it can be concluded that from a macroeconomic perspective, the flexible exchange rate regimes dominate the fixed exchange rate regimes. Whilst this conclusion

appears to support economists' theories, there are two clear exceptions: On the one hand, a country with a regime under fixed exchange rates might be better off when working with a group of countries that are already well integrated and that have similar economic conditions. In these circumstances, the necessity of a combined monetary policy may not lead to considerable restrictions. On the other hand, if a countries' central bank does not manage the monetary policy correctly, the country could end up with a misleading credibility rate. In the latter case, a stronger form of fixed exchange rates, e.g. currency board or dollarization could be interesting alternatives.

3.2 Choice of the Exchange Rate Arrangements

As already mentioned in the first chapter, for the statistical analyses in this master thesis the author distinguishes between two different exchange rate arrangements: fixed and flexible. Nevertheless, as the classification of the IMF is structured into different types and categories, the author intends to briefly address these different arrangements. The idea behind the IMF's methodology is to provide consistency of exchange rate classifications across countries. They also aim to improve transparency of the IMF surveillance in this area.

Table 6: Detailed Classification of Exchange Rate Arrangements (IMF, 2016, pp. 46–48)

Hard pegs	
Exchange arrangements with no separate legal tender	A country can officially use another one's currency and further gives away its capacity of using monetary policies. As stated by the IMF, "the currency of another country circulates as the sole legal tender (formal dollarization)" (2016, p. 46).
Currency board arrangement	The domestic currency is exchanged for a specific foreign currency at a fixed exchange rate. The traditional central bank functions such as monetary control are eliminated (IMF, 2016, p. 47).
Soft pegs	
Conventional peg / Pegged exchange rate within horizontal bands	A country pegs its currency at a fixed rate to another currency. There is no commitment to irrevocably keep the parity, but the formal arrangement must be confirmed empirically: A fluctuation within a range of ±1% around the central rate or the max. / min. value of the spot market exchange rate must be within a margin of 2% for at least six months. The authorities are responsible for complying the regulations, otherwise they might intervene directly (with sale or purchase of foreign exchange in the market). (IMF, 2016, p. 47)
Stabilized arrangement	This system contains a spot market exchange rate that fluctuates within a range of 2% for six months or more and it should not float. It is allowed to make some adjustments without breaking the required terms (IMF, 2016, p. 47).
Crawling peg / Crawl-like arrangement	Exchange rate with a fixed bandwidth but no official target rate. The IMF states, "The currency is adjusted in small amounts at a fixed rate or in response to changes in selected quantitative indicators" (2016, p. 17). The adjustments take place regularly according to political decisions.

Floating regimes	
Floating	Floating exchange rates are market determined, without influencing the path of the rate. Just some interventions in order to prevent excessive fluctuations in the exchange rate are allowed (IMF, 2016, p. 48)
Free floating	"A floating exchange rate can be classified as free floating if intervention occurs only exceptionally and aims to address disorderly market conditions" (IMF, 2016, p. 48).
Residual	
Other managed arrangement	This category is a residual and is only used when the exchange rate arrangement does not fit with any other mentioned systems.

Table 6 shows two extreme systems as well as arrangements with various degrees of commitment to an exchange rate target. These types of hybrid form exchange rate regime typically make sense for countries with higher domestic inflation rates than their trade partners. Pegging their nominal exchange rate against the currencies of their trade partners would lead to a continuous real appreciation (scenario as discussed in the chapter *3.1.3 The Medium Run*). The consequences would be that these countries would lose their competitiveness. In order to avoid this situation, countries choose the system crawling peg.

3.2.1 Impossible Trinity

The decision of whether to fix or to float the exchange rates has further implications and is mostly dependent on the exchange rate policy of a country. The country must accept any restrictions when implementing their exchange rate arrangement. According to the "Impossible Trinity", a country cannot have an independent monetary policy, an open capital account and a fixed exchange rate at the same time (Rickards, 2015). The properties of the "Impossible Trinity" can be applied to a typical trade-off situation where the country follows two of the three conditions. It is therefore, referred to as a 'trilemma' as it describes the impossibility to simultaneously achieve the features all at the same time. With this in mind, countries have to make a decision about which conditions they will focus on in their implementation of the exchange rate strategy. The following figure 3 shows the different policy goals and choices. A country has to sacrifice one goal in order to attain the others.

Generally, in order to find the most appropriate policy, Mankiw (2016) recommends that nations should deal with the following thoughts (2016, p. 394):

(1) Uncertainty in exchange rate fluctuations and volatility

(2) Waiving monetary policy in order to ensure domestic stability

(3) Isolation from the outside world in terms of financial markets and capital flows

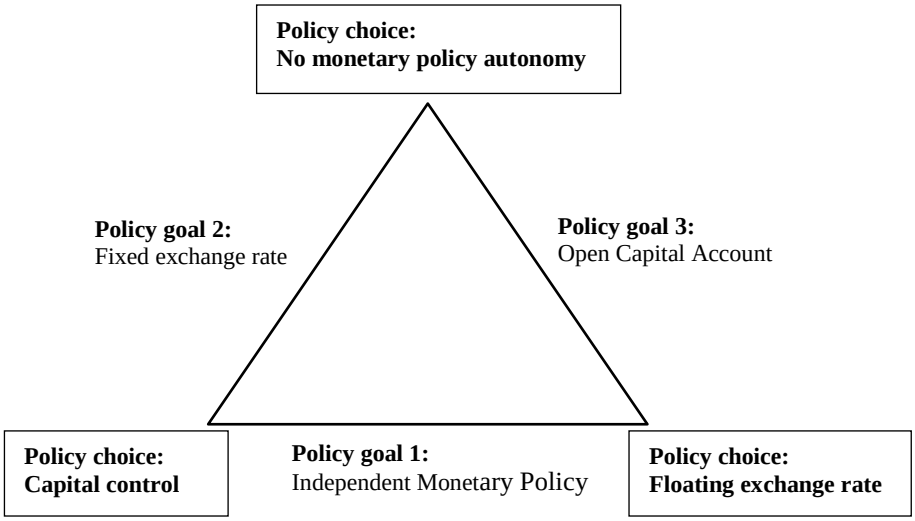

Figure 3: Impossible Trinity (Mankiw, 2016, p. 393)

The first implication of this theory is the condition of an independent monetary policy. In other words, a central bank can act freely and independently without the consent of other countries. If they want to boost the economy, they may decide to decrease the interest rates independently, even though other countries want to prevent price increases. The second implication of the "Impossible Trinity" is the fixed exchange rate, which implies that the value of a currency is pegged against another currency. The last implication of this theory is the open capital account. It examines the capability of investors to make money, stock, bonds or direct foreign transactions with other countries as easily as possible, avoiding harsh restrictions. The possibility of having full access to foreign markets, transactions, and converting money back to the domestic currency at any time is the main idea behind an open capital account. But if a central bank tries to control the capital, the foreign market is not open for investors and therefore, the central bank retains control of the money (Rickards, 2015). Based on figure three there are three possible policy choices given: The first choice of a floating exchange rate, as the USA has followed in past, can be reached by an independent monetary policy in combination with the open capital account. This means that it is impossible to hold the exchange rate fixed. The second choice of no monetary policy autonomy is the interaction between fixed exchange rate and free flows of capital. With this in mind, a country such as Hong Kong is consequently dependent on the other country's monetary policy due to their peg. The third choice of capital control of a nation allows a fixed exchange rate and an independent monetary policy. An example of such restrictions in the international flow of capital can be found in China. In this case, a country acts nearly in a closed economy and due to their demarcation they are able to change the domestic interest rates independently of the world interest rate (Mankiw, 2016, p. 394).

4 Empirical Analysis of Exchange Rate Arrangements

After the theoretical background of the different exchange rate arrangements, this chapter contains an empirical study with the aims to identify on the one hand how the science of the exchange rate arrangements can be distinguished, and on the other hand which exchange rate system is appropriate in a given context. Based on the research question and the corresponding subquestions, the focus of this chapter lies firstly on the link between exchange rate arrangements and macroeconomic growth during normal market conditions. In this chapter, the author also identify differences between the two groups of countries as defined in the introduction as developing / emerging markets and advanced countries. It might be possible that empirical evidence shows that one group of countries is better off with a specific exchange rate arrangement. In a further study the author also takes special market situations, meaning financial crises or macroeconomic vulnerability, into account. This additional study will be carried out in order to identify any evidence suggesting that a specific exchange rate arrangement is more appropriate in difficult market circumstances to boost the economy faster or to absorb financial turbulences in a more effective manner. It is important to note the large number of current economic theories, academic literature and scientific papers. With this in mind, the author only examines subjects that are relevant and interesting regards the title of the master's thesis.

4.1 Determinants of the Choice of Exchange Rate Regimes

The overall development of countries in an open economy is dependent on various economic determinants, but one of the most important factors is the price of exchange rates. Not only do these prices affect the flow of capital, services and goods within each country, they exercise also pressure on the balance of payments, inflation and several other macroeconomic variables. It is therefore necessary to choose the correct exchange rate regime in order to ensure competitiveness, stability and growth (Yagci, 2001, p. 1).

By focusing on the selection process, it is important to acknowledge the different dependent criteria in this context. As a basic adjustment, the regime has to be suitable and well balanced with a countries economic purpose, goals and interests. In order to support countries in their decision, the following factors should be a founding part of the process (Yagci, 2001, p. 1):

(1) Specific country circumstances (such as size and openness to trade and financial flows; structure of production and exports; financial development; history of inflation)
(2) Policymakers‘ preferences
(3) Political conditions
(4) Credibility of its policy makers and institutions

The choice of a suitable exchange rate regime for countries, whether in advanced or emerging market / developing countries, is based on a variety of factors, as well as the importance of these factors. The selection of an appropriate arrangement is therefore a common theme not only in the macroeconomic context, but also in international finance. Generally speaking, it can be said that there is no 'golden rule' to determine the perfect exchange rate regime and more importantly there is no single exchange rate arrangements that fits all countries (Yagci, 2001, p. 1). Frankel (1999) also addresses this consensus and points out that even the circumstances for a given country are subject to change and with this transformation, also the regime (Frankel, 1999, p. 2).

The second point mentioned in the above list, policymakers' preferences, is related to trade-offs among the policy goals. Like every part of the decision making process, each possibility has to be proved carefully because behind each regime there are opportunities, risks and costs but also benefits. With the corresponding table 7, the dependencies of various factors are listed:

Table 7: Trade-Offs in Selection an Exchange Rate Regime (Yagci, 2001, p. 8)

	Floating (independent floating, lightly managed float)	**Intermediate** (managed float, crawling broad band)	**Soft Peg** (crawling narrow band, crawling peg, pegged within bands, fixed peg)	**Hard Peg** (currency board, currency union / dollarization)
Stability	- -	+ -	+ +	+ +
Misalignment	+ -	+ +	+ -	+ +
Vulnerability to Currency Crisis	+ +	+ +	- -	+ +
Vulnerability to Shocks	+ +	+ -	- -	- -
Independence of Monetary Policy	+ +	+ -	- -	- -

The first group of floating regimes has three distinct advantages. First of all, under floating exchange rates a country is resilient to currency crisis and shocks, and the central bank has the ability to follow an autonomous monetary policy. These benefits are linked to the instability of the exchange rates due to high volatility in the short and medium run, as well as the possible fluctuations according to the misalignment. Both disadvantages are associated with costs and uncertainty. On the other hand, there is the classical hard peg regime, which provides full stability and credibility for a monetary policy associated with low transaction costs. Nevertheless, countries under hard peg will suffer from the loss of independent monetary policy. The hybrid forms in the center of table seven have their individual advantages and disadvantages. In particular, worth noting is the vulnerability issue to currency crisis under a soft peg, because countries that are open to international capital flows are prone to crisis due to their inability to secure stability. Moving to a greater flexibility regime, such as intermediate, might be more appropri-

ate in this case in order to absorb the risk of possible currency crisis (Yagci, 2001, p. 8). This issue will be discussed in more detail in a later chapter.

Besides these factors in table 7, other issues such as policy activism, discipline and credibility, are also important in the selection of an exchange rate arrangement. In general, the degree of policy activity under floating regimes is greater than in all other variations. As already mentioned in the theory section, the market determines the real and nominal exchange rates based on supply and demand, because they are endogenous variables. In other words, the government and the central bank do not take an active role in the price determination at all. Occasionally there are some small interventions but these are generally not intended to defend a certain level of the exchange rate. These interventions may take place in order to calm and stabilize the financial markets. Yagci makes a comparison to explain these small interventions, using the expression *"leaning against the wind"* (2001, p. 9). Conversely, under a pegged exchange rate, the value generally does not vary and if it does varies, it will only be within marginal levels. The fixation of the central bank is additionally a strong commitment intended to maintain the parity. In this case, the government must know the appropriate value of the real exchange rate regime to maintain a stable economy (Yagci, 2001, p. 9).

4.2 Linkage between Exchange Rate Regime and Macroeconomic Growth

The aim of this section is to present arguments for the linkage between the exchange rate regime and macroeconomic growth, due to the fact that the economic theory does not examine how the choice of an exchange rate regime and notably how the exchange rate peg influences growth in great detail. This might be more an empirical question, but the topic is one of the most contested themes in macroeconomic policy. Theoretically and as seen in the fundamental part of the thesis, the choice of exchange rate arrangements may not influence the economic growth in the medium run. This can be seen directly, through the effects on adjustments to shocks, and indirectly, through influences on other variables which determines performance such as investments or international trades (Bailliu, Lafrance, & Perrault, 2002, p. 1). In their study, Levy-Yeyati and Sturzenegger (2003) argue that even if a correlation between exchange rate regimes and growth has been implied by the literature, this does not guarantee indisputable indications (Levy-Yeyati & Sturzenegger, 2003, p. 1173).

Only a few scientists have investigated the link between exchange rate regime and macroeconomic growth in a cross-country context. Based on Ghosh, Gulde, Ostry and Wolf (1997), they identified in their study "Does the Nominal Exchange Rate Regime Matter?" only a weak link between exchange rate regime and output growth by covering 140 countries over a time period of thirty years (Ghosh, Gulde, Ostry, & Wolf, 1997, p. 4). The scientists conducted a mean and standard deviation comparison across the selected countries according to their methodology.

Further examination of the results of the descriptive analyses showed that the choice of the exchange rate systems has just a slight impact on economic growth. More precisely, this means that under flexible exchange rates, there was a marginal higher GDP growth detectable (A. Ghosh et al., 1997, p. 24). Several other empirical studies have been previously conducted by other researchers, all with contradictory results. In order to establish a solid foundation for this study, the author reviewed the current state of research concerning the effect of exchange rate regimes to the connected growth.

Baxter and Stockman (1989) with their empirical study about the exchange rate regime effect on growth compared 49 countries from 1946 to 1984. The descriptive analyses showed no visible effect, proving that there is no relationship between real aggregates and exchange rate system (Baxter & Stockman, 1989, p. 28-29). Despite the fact that theories and relevant models indicate that different macroeconomic measures and figures are influenced by the exchange rate system, the author detected weak evidence in their study: they were not able to confirm that the exchange rate system is an significant factor for growth (Baxter & Stockman, 1989, p. 29).

Mundell (1995) also made a comparison between the average growth rates between two periods based on United States data. The first was the time of fixed exchange rate system (1947-67 gold dollar) and the second was the time of exchange rate under the generalized floating (1968-93 paper dollar). He discovered that all visible variables (real GDP growth, productivity, inflation rate, unemployment rate a.s.o.) performed stronger under the exchange rate system of the pegged currency (Mundell, 1995, p. 31).

Moreno (2000), another economic scientist, also investigated how the regime affects GDP growth. He published two different studies in 2000 and 2001, respectively, where he focused firstly on East Asia countries and secondly on developing countries from 1974 to 1999. Moreno examined whether economies perform better under a fixed exchange rate regime. Pegging the currency within this observation period was worthwhile in both group countries as the results support the view of Moreno. Real growth was higher by 1.1 and 3 percentage points respectively. Nevertheless, he claims that independent of the test statistics and the existing correlation, the results deliver insufficient confirmation about an existing causality effect (Moreno, 2000, pp. 48–63, 2001, pp. 17–29).

All of the empirical studies analysed up to this point in the literature review have used descriptive analysis to obtain an appropriate result. At the turn of the millennium, different scientists, including Levy-Yeyati and Sturzenegger (2003), Edwards and Levy-Yeyati (2003), Husain, Mody & Rogoff (2004), Garofalo (2005), and Dubas et. al. (2005), took other approaches into account, namely pooled and single regression models by using OLS, in order to assess the relationship between exchange rate regimes and growth. It is worth noting to present the findings of other authors which show evidence of a linkage. These authors observed other group of coun-

tries over different time periods which could account for the disparity. But a more likely explanation of the different findings is the individually defined exchange rate arrangement classification of the featured countries.

Levy-Yeyati and Sturzenegger (2003) present interesting results in their study "To Float or to Fix: Evidence on the Impact of Exchange Rate Regimes on growth", which investigated the effect of hard pegs on growth. As previously addressed, how the authors defined the exchange rate regime classifications is of high importance. In their paper, they lean towards a de facto classification of exchange rate arrangements based on a technique defined as cluster analyses. The goal of this methodology is to form groups of countries according to their observable behavior based on factors with a close relation to the exchange rate policy, namely: exchange rate volatility, volatility of exchange rate changes and volatility of reserves (Levy, p. 1175). They modeled the subject with a sample, composed of 183 countries in the post-Breton-Woods era (1974-2000) and discovered on the one hand that a connection exists between the two factors and on the other hand that the results has to be distinguished between the group of developing countries and industrial countries. The test result of the latter group of countries states that there is no statistical evidence that the arrangements have any significant impact on growth. Despite the fact that no empirical relationship is detectable within this group, the researchers found out that a negative linkage between exchange rate arrangements and economic growth is evident when considering nonindustrial countries. In other words, this means that developing countries have slower growth under an arrangement with less floating exchange rates and that these findings does not hold for industrial countries (Levy-Yeyati & Sturzenegger, 2003, p. 1174).

Edwards and Levy-Yeyati (2003) results echoed those of Levy-Yeyati and Sturzenegger (2003), concluding that: "(…), countries with a fixed exchange rate regime have had a lower rate of growth of GDP per capita ranging between 0.66 and 0.85 percentage point per year, than countries with a flexible regime" (Edwards & Levy-Yeyati, 2003, p. 14). A possible explanation for their similar findings could be that they used the same specifications and the same country sample but with a one year longer time frame as in Levy-Yeyati and Sturzenegger (2003) in order to analyze the same scientific question. A further and comparable study, published by Husain, Mody & Rogoff (2004), must be addressed in this context, as they also used the same specifications but with another observation period and another exchange rate regime classification. The researchers tried to find statistical evidence for the relationship between pegs or floating and economic growth for two different groups of countries, based on 158-country sample with consideration in using de-jure exchange rate arrangement classifications over a period of 1970-1999. Due to the fact that the results were mostly statistically insignificant, a well-founded conclusion cannot be drawn. Nevertheless, based on their analyses they identified some favorable

potential to holding the exchange rate regimes flexible in advanced economies (Husain, Mody, & Rogoff, 2004, p. 25).

By considering the covered scientific studies so far, it is difficult to find the most appropriate arrangement due to the macroeconomic variables which influence a country's choice. Huang and Malhotra (2004) also began some analyses in this area, focusing on the choice of regime and economic growth rate for developing Asian and advanced European countries. In this context, a special focus lies on the effects of the level of development of the selected countries. For this reason, they used de facto classification for 12 developing economies from Asia and 18 developed (advanced) countries from Europe from 1976 to 2001 (Huang & Malhotra, 2004, p. 8). The selection of the corresponding countries is based on the level of attention paid to the level of macroeconomic development. They were able to detect a dependency between the significance of the choice of the exchange rate arrangement for economic performance and the level of development of an economy. Based on the investigated Asian economies, it is impossible to determine an appropriate regime, as both fixed and managed float disclose the highest growth rates. Nevertheless, the authors argue that developing and emerging markets (in this case Asia) should consider other factors, such as level of development, capital market development and capital account, when choosing a regime (Huang & Malhotra, 2004, pp. 12–16). By focusing on the other observation group, defined as advanced European countries, there is statistical evidence that no relationship is given and therefore the choice of arrangements has no influence on the target group. In fact, they identified a possible positive relationship between more floating exchange rate arrangements and economic growth, but the statistical significance does not support this idea, instead presenting very low R-squared. Due to a weak check of the robustness of the models, it could be difficult to give a definite answer (Huang & Malhotra, 2004, pp. 17–21).

It has been noted that a specific conclusion of the reviewed empirical studies is not possible, due to the existence of different groups of studies. While a certain group of qualified scientists found that arrangements under flexible exchange stimulate growth, whereas pegging a currency has no influence at all, and others conclude that pegging is more appropriate for the stimulation. Hence, a further group is not able to make a clear statement about the linkage between the choice of exchange rate regime and growth. It is therefore not possible to reach a conclusion due to unambiguous results. Reasons can be found in relation to errors in the classification of the exchange rate arrangements (Levy-Yeyati & Sturzenegger, 2003). The next section will place more emphasis on the two groups of countries as defined in the introduction, in order to identify empirically relevant perceptions about which exchange rate regime might be the most appropriate. Here, it should be noted that due to the use of two groups of countries, the findings are just generalizations.

4.2.1 Emerging Market / Developing Countries

The classification of a country as well developed or not can be defined according to different determinants. But the most common indicators for the evaluation are GDP per capita, per capita income, level of industrialization, infrastructure and general standard of living. Generally, emerging market and developing nations is a broad term that includes countries that are less industrialized and have a low per capital income level. Additionally, they tend to be in the process of industrialization and have limited to technological capacity. In general, the development of an emergent market country requires consistency. In other words, volatile exchange rates have some negative aspects because it creates uncertainty, which is not conducive for the growth strategy. Beside the uncertainty issue, high fluctuations can also influence transaction costs, interest rates, inhibit international trade and investment. With this in mind, it seems that a suitable exchange rate arrangement for emerging market / developing countries can be found more on the right side of the spectrum as listed in table 7. Yagci argues in his study about "Choice of Exchange Rate for Developing Countries" that soft pegs deliver the best fit for such countries (2001, p. 7) . The scientist's assertion is supported by various facts but the most accurate argument can be found in the openness of a country; countries with limited access to international capital markets and less diversified production and exports perform better with less flexible arrangements. This argument is supported in the findings of Husain, Mody & Rogoff (2004). They constitute those countries that do not have full access to international capital market and that are under a peg exchange rate arrangement show not only low inflation rates, but also high exchange rate arrangement durability. The authors were surprised by the good performance in this environment, but it seems that such countries acted as a result of resilience (Husain et al., 2004, p. 1).

On the basis of various fixed exchange rate regimes that collapsed in the 1990s, the question about an appropriate exchange rate arrangement for developing and emerging market countries is highly debated. Given that previous academics had recommended a move towards pegging a currency, Bailliu, Lafrance & Perrault (2001) did some further research that dealt with the unanswered question of which extreme regime fits best. In their study, they tested different hypotheses about the link between exchange rate regimes and growth by using a specific sample consisting of 25 developing and emerging market countries over a period of 15 years. The findings can be summarized as follows: in countries that have no restrictions on capital movements, the authors found statistical evidence of a positive linkage between flexible exchange rates and growth. Similar results appear if the financial markets of these countries are also well-developed, although the positive effect of higher growth rates under floating exchange rates is not as strong (Bailliu et al., 2002, p. 2).

Nevertheless, despite the fact that Yagci (2001) and Bailliu et. al. (2001) came up with different findings: both studies have a decisive point in common. They both argue that their results are associated with access to international capital markets. If there is no limitation given (high degree of involvement with international capital markets), flexible exchange rates seem to have a positive impact on economic growth. Otherwise, with respect to limited access to international capital markets, a fixed exchange rate regime could be a profitable alternative due to relatively low inflation and higher durability in the exchange rate policy.

Nonetheless, the current literature and scientific approach has displayed a variety of opinions of exchange rate regimes. Some favorable suggestions for emerging market and developing countries have been identified: On the one hand, pegging the exchange rate arrangement will generate a beneficial anchor for this group of countries, and this is associated with lower inflation in comparison to other regimes without cutting growth performance. On the other hand, a floating exchange rate arrangement is related to lower vulnerability to crisis and a central bank is able to react quickly and efficiently to external adjustments.

In this context, it is also important to remember that the right choice of an exchange rate arrangement can support the macroeconomic goals of a country. But it should be noted that the exchange rate issue is just one of various aspects within an overall macroeconomic policy. In order to visualize the development of the exchange rate regime, different trends and changes in the distribution over the past few years will be addressed and exemplified in the following figure:

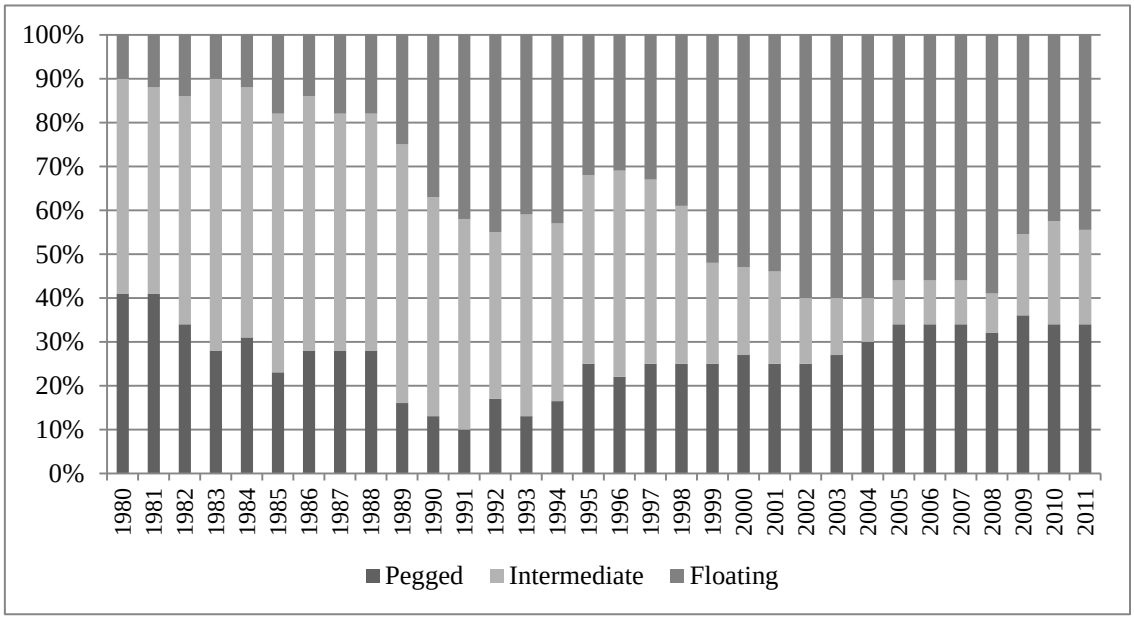

Figure 4: Distribution of Emerging Markets de facto Classification (IMF, 2017)

Figure 4 shows the development of the de facto classification of Emerging Market Countries based on the IMF staff calculations. At the beginning of the 1990s numerous developing and

emerging market countries pegged their exchange rate to a strong currency, in particular to the dollar and to the deutsche mark, in order to stabilize their economies (A. R. Ghosh & Ostry, 2009, p. 38). This can be seen in the distribution of the share of pegged exchange rate regimes had doubled within 5 years. The substantial increase in hard peg regimes would suggest that, since 2000, they have been once again considered a favorable regime. Another mentionable recognition is that countries have decided either to fix or to float their currency since the end of the 1990s. That development is consistent with the empirical awareness as scientists recommended that emerging market countries should choose one of the two extreme regimes.

4.2.2 Advanced Countries

Advanced or developed nations are countries that are more industrialized and have a higher per capita income. In addition to having high per capita income and stable population growth rate, developed nations are also characterized by a highly developed economy with state-of-the-art standards in technological infrastructure in comparison with less developed nations. For this reason, the use of human and natural resources by the population is also an adequate indicator. According to the definition of advanced nations, however, they are already well integrated and mostly globally linked. In this case, the question arises if flexible exchange rate might be the most appropriate method for advanced economies due to their openness in trade and capital markets.

Ghosh and Ostry (2009) believe that an intermediate exchange rate regime would support economic growth mostly effective. Intermediates are generally characterized by their relatively inflexible nature, somewhere between fix and free float. Under both extremes, there are advantages and disadvantages. Despite the fact that a pegged regime leads to lower inflation, lower nominal and real exchange rate volatility and greater trade openness, these regimes are more fragile to exchange rate overvaluation, which affects a country's competitiveness and therefore weakens economic growth. However, flexible exchange rates do mean a country is less susceptible to overvaluation but reaches their limit to provide low inflation, reduced volatility, or better trade integration (2009, p. 39). In their study, the same authors reported two main findings: Firstly, there is a link between intermediate exchange rate regime and faster growth performance given. Secondly, under a pegged currency, a country will likely enjoy better growth performance than under flexible regimes. The latter point will help the country to avoid overvaluation, but only if the country does not have competitive advantage.

In contrast to Ghosh and Ostry, Yagci (2001) experienced that flexible exchange rate regimes are particularly important for medium and highly industrialized countries as well as some emerging market economies. These countries are characterized usually by having an import and export sector which is small compared to the GDP. Furthermore, their integration into the global

capital markets is sophisticated and they expulse diversification in production and trade (Yagci, 2001, p. 7). In addition to these factors, they have also an expanded financial sector and the authority is able to execute an independent monetary policy based on their individual local targets and conditions (Yagci, 2001, p. 13). This is very important, especially for advanced economies, because it is the main instrument to manage and coordinate macroeconomic performance. Husain, Mody & Rogoff have also found evidence that advanced economies should orient themselves towards flexible exchange rates on the one hand because they become richer and on the other hand because they are financially more developed (Husain et al., 2004, p. 1).

Generally, after reviewing various academic research papers, the studies did not provide a clear statement about the most appropriate exchange rate regime for advanced economies. Levy-Yeyati and Sturzenegger (2003) even discovered that a strong link between arrangements and macroeconomic growth had not been established (Levy-Yeyati & Sturzenegger, 2003, p. 1174).

The following table shows the development of the exchange rate arrangements over the last thirty years:

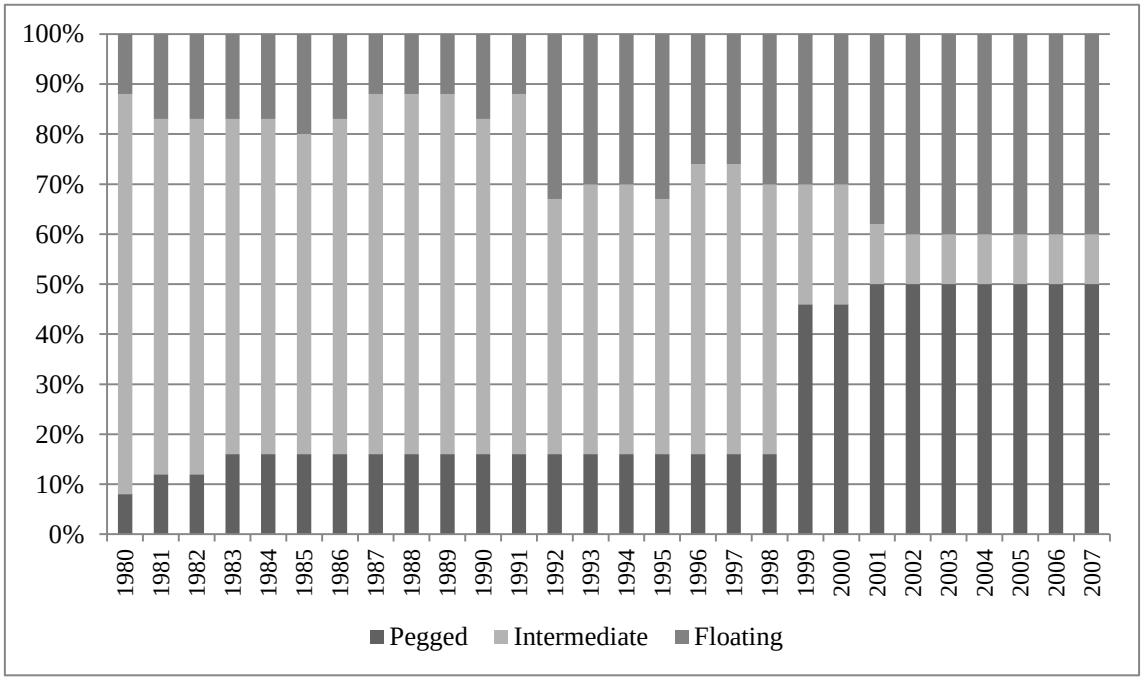

Figure 5: Distribution of Advanced Economies de facto Classification (IMF, 2017)

In figure 5, one occurrence stands out. In 1999, the common currency (euro) was introduced and various countries adopted the euro. Since its introduction, these member states were classified as having a hard peg, although the euro fluctuates freely against other currencies. Since 1999, the proportion of the exchange rate regimes has remained stable in all countries using the common currency. By looking at the time period from 1980 to 1998, it is worthwhile noting that the majority of advanced countries chose an intermediate regime. This trend is consistent with the

results of Ghosh and Ostry (2009) who stated that under an intermediate regime, a country has significant advantages concerning growth performance.

4.2.3 Comparison between Groups of Countries

Taking everything into consideration, the main conclusion still stands that no single exchange rate regime is the perfect option for all countries, given their different circumstances. The member states still have freedom of action in their choice of the optimal exchange regime, which forces countries to pay attention to their individual needs, and take into account the fact that the chosen regime must be credibly supported by policy measures and therefore has to be consistent with their choice. The question of which exchange rate regimes and which policies depends on the individual conditions of the specific country, particularly whether it is a developing country or an advanced nation. Although the increasing mobility of capital has prompted an increasing numbers of countries to make a clear decision of one of the two extreme solutions: fixing or free floating. However, it can also be seen that several of the empirical studies support other views.

The selection of an exchange rate arrangement is also highly dependent on the size and level of integration of the corresponding country. The evaluation about what kind of factors may be essential for a sustainable development of a country must be carried out with special focus on current circumstances.

Past distribution of the exchange rate regimes in the corresponding groups of countries has shown a continual switch of advanced economies from fixed and floating regimes since 1999. Interferences occurred due to the introduction of the euro in 1999 as different countries decided to join the union and peg their exchange rate. Only a few groups of countries decided to follow an intermediate regime, which can be seen in both observation groups. That was not always the case as the proportion of intermediate exchange rate regimes was significantly higher between 1980 and 1998. This is also in line with both observation groups. A clear distinction can be made by focusing on the development of emerging market countries. Despite the fact that floating exchange rate regimes are more prone to exchange rate crisis, there has been a clear shift towards more flexible exchange rate arrangements since 1999. As the proportion of floating regimes remains as stable as advanced economies in previous years, there is a slight decrease in flexible arrangements of intermediate regimes.

4.3 Exchange Rate Regimes in Financial Crisis

As mentioned in the previous section, an important factor in the selection process is how vulnerable the regime is to currency attacks and crises. The theoretical point of view states clearly that under a peg, it is difficult to react in case of a crisis due to the missing flexibility. In this section, it is the authors' goal to detect which exchange rate regime is most likely to absorb

financial instabilities. Is it the flexible approach that allows an independent fiscal and monetary policy to exist in order to absorb financial instabilities? Or does the government pursue fixed exchange rates under the acceptance of dispatching autonomous monetary policy? Divergence can also be found in the field of scientific studies. The following section explains an objective and varying comparison of the current literature.

A statement often used in the conducted studies of the connection between the vulnerability to financial crisis is that the susceptibility is much higher if a policy of fixed exchange rates is pursued. Yagci (2001), Bubula & Otker-Robe (2003), Ghosh (2009), Ghosh and Ostry (2009), and Gosh et. al. (2014) agree that the vulnerability to financial crisis is higher under less flexible exchange rate regimes compared to floating arrangements, and that this applies above all developing countries. This academic evidence confirms that there is a higher probability of a sharp fall in economic growth under pegged regimes. Researchers from the IMF has ascertained that not only approximately 75 percent of the crisis between 1990 to 2001 appeared under hard and soft regimes, but also that the frequency under pegged regimes is higher than under floating (Bubula & Otker-Robe, 2003, p. 11).

Clarifications for such an unambiguous statement are based on various findings and can be summarized as follows: The first supporting argument focuses on the trade-off based on the impossible trinity issue. On the basis of the loss of the exchange rate as a monetary policy instrument under fixed exchange rates, a country will face higher difficulties in order to fight against external imbalances. This loss of the right to intervene on the market may lead to an overvaluation of the real exchange rate and therefore higher imbalances, which in turn may cause a currency crisis. The second argument addresses the possible occurrence of deflationary pressure on the domestic economy because a country is interested in not losing the competitiveness against foreign countries, but must reach its goal without a flexible nominal exchange rate. The third point is approaching the issue of the interest rate parity. If a country is missing the equality of the theory there might be more advantageous foreign interest rates, which can encourage domestic banks and institutions to take up more foreign loans. More capital inflow results from that action and it has even more pressure on the national currency (A. R. Ghosh, Ostry, & Qureshi, 2014, p. 8). Besides these factors, another important issue about the vulnerability to crisis has to be stated in this context and is already discussed in the theoretical part, namely the problem of arising doubts about the credibility of the peg (Yagci, 2001, p. 11). Credibility can only be ensured by vehement defense from the government. If the government does not fully support the regime, there could be devastating consequences for the corresponding country. As a first reaction, inflows of capital stop immediately and the demand for international reserves increases. This sort of reaction could have a significant impact on defending the peg as it is cost-intensive (Yagci, 2001, p. 11).

Contrary to the other researchers mentioned in this section, Yagci's study also documented that a mixed form of arrangements (intermediate regimes) can diminish the risk of currency attacks significantly if the such regimes are properly managed (Yagci, 2001, p. 13). Soft pegs are characterized by their band system, and the central bank is forced to take action if the exchange rate moves outside of the required band. This situation enables financial speculators bet against the valuation of the exchange rate. It is possible that the assessed band is determined incorrectly and is therefore not credible or defensible. Such critical situations have to be avoided in order to reduce the risk of currency attacks. Yagci, is addressing issue recommended that the regime should not be implemented too strictly, but also not without full commitment. It should be acceptable to temporarily fluctuate outside of the barriers to keep the speculators away (Yagci, 2001, p. 13). As this example shows, this situation occurs only if a band system has been announced and the authorities have their obligation to fulfill their promises.

However, Bubula and Otker-Robe (2003) rebut this argument by referring to their statistical analyses of crisis frequency. Their results showed that countries under intermediate regimes had a significantly higher incidence of crisis than both extreme regimes. The authors are, however, also aware of the correct interpretation of the test results and they do not persist purely on their statistical findings. Consequently, they mentioned in their concluding remarks that beside the prevailing exchange rate regime they are various other influencing factors that determine the likelihood of currency crisis (Bubula & Otker-Robe, 2003, p. 19). On this point they do face also the issue of the durability of rigid regimes and they argue that: *"Differences between the durability of various rigid regimes can in general be attributed to the nature of the accompanying monetary system and consistency between exchange rate policy and other macroeconomic policies"* (2003, p. 19). In this case, if any inconsistencies are present, a country is more fragile to speculative attacks. Eichengreen, Rose, & Wyplosz (1994) analyzed this sort of specific speculative attacks across 22 countries within an observation period from 1967 to 1992 and observed that intermediate regimes are more prone to banking crises (Eichengreen et al., 1994). In addition to these insights, Angkinand, Willett, & Colleges (2006) also see a higher probability of financial crises under soft pegs and other intermediate regimes, but do not believe that exchange rate regimes are not the main direct driver of crises. These authors believe that exchange rate regimes instead have an indirect influence on banks' excessive lending and borrowing because an exchange rate regime with determined bands encourages banks to take more risk as the government guarantees to hold the exchange rate stable (Angkinand et al., 2006, p. 19).

In contrast to Bubula and Otker-Rober, Ghosh and Ostry i.a., who all supported the view that pegged economies are most prone to growth collapse, Domac and Martinez Peria (2003) argues the opposite. In their study "Banking Crises and Exchange Rate Regimes: Is There a Link?" they were interested in whether the probability, cost and durability of possible crises are influ-

enced by the choice of exchange rate regimes. For their descriptive analysis, the authors examined data containing advanced and developing countries and they found some particularly interesting evidence, especially for developing countries. The main point that can be drawn from the analyses is that the likelihood of occurring banking crises in developing countries can be decreased by adapting a fixed exchange rate regime. They address the existing trade-off between credibility and flexibility in order to justify their results and recommend that credibility, in addition to fixed exchange rates, might support stability in financial troubles. Their findings also showed that as soon as a crisis erupts, there are much higher combined costs under fixed exchange rates. In this context, the costs are measured in terms of GDP growth (Domac & Martinez Peria, 2003, pp. 25–28).

A practical example for the above explanations can be found by considering Argentina's economic situation under President Carlos Menem in 1989. Macroeconomic figures such as inflation and output growth were out of control and the government - in association with the central bank - consequently decided in 1991 to fix the peso to the dollar with a hard peg, namely a currency board. The government pursued the objective to convince the financial markets and other participants to take their crucial role of making the fixed exchange rate more credible seriously. In order to reach their goal and also reduce the risk of a foreign exchange crisis, the use of a symbolic exchange rate, in this case dollar was purposely chosen. Following the initial introduction of the currency board, the economy recovered very well as a result of the rigid implementation of the hard peg. However, due to the fact that the dollar appreciated steadily against other currencies, the peso consequently also appreciated and made Argentina less competitive. More specifically, the demand for domestic goods decreased, which led to an overall lower output and furthermore the trade deficit increased at the end of 1990s. Consequently, Argentina found itself in a recession. The hard peg was not responsible for the recession, but the currency board made it difficult to fight against the macroeconomic pressure because lower interest rates and depreciation was not an option under fixed exchange rates. As the economic crisis developed into a financial and exchange rate crisis in Argentina, and due to their domestic macroeconomic instabilities (high amount of government debt, fear of debt default, demand of high interest rates, steadily increasing fiscal deficit), the likelihood of giving up the currency board increased, as did worries of devaluation. As soon as the credibility of the government was gone, the defense of the peg became very costly for the government due to very high interest rates and the peg was no longer acceptable. However, this is also what actually happened in 2002, as the government defaulted on part of its debt and allowed the peso float again (Frank, 2005).

Divergent representatives of the ideal exchange rate arrangement have been covered in order to show which regime would most likely lead to an exchange rate crisis. As there is a predominant negative attitude to pegged regimes and soft / intermediate regimes, respectively, the author of

this master's thesis again focus on the occasional aspects of floating exchange rate regime advocates. Ghosh et. al. (2014) examined the bipolar prescription for regime choice, which means that emerging market economies may adopt either fixed, or flexible arrangements, but neglect intermediate regimes due to their higher likelihood of crises. The empirical results showed consistency with the prescription, especially for floating arrangements as they have the smallest probability of vulnerability to crisis (A. R. Ghosh et al., 2014, p. 21).

Ghosh and Ostry argued that: *"Greater crisis susceptibility is a cost of more rigid exchange rate regimes. But countries with floating regimes are not entirely immune"* (2009, p. 40). With this statement the authors aim to highlight that even less fixed exchange rate regimes reach their limits and can, of course, not prevent crises. Despite the fact that different studies confirming that in particular developing and emerging market countries with more openness in capital accounts have a greater vulnerability to crisis such as debt crisis or banking crisis, Ghosh and Ostry also highlight that crises which arises from credit booms are just as susceptible as flexible exchange rate regimes (A. R. Ghosh & Ostry, 2009, p. 40). One of the most prominent examples is indeed the global economic and financial crisis, which began in 2008. This crisis shows that floating exchange rates are not fully immune, as plenty of involved countries pursue this sort of regimes. Furthermore and to conclude the empirical review, the current studies do not see a link between the risk of growth crisis, which could be a dramatic fall in growth, and exchange rate regimes. But one can assume generally that a fragile financial sector is highly associated with the disruption of the domestic currency (A. R. Ghosh & Ostry, 2009).

4.4 Conclusion

As defined in the introduction, this master's thesis has focused on three different sub-questions in order to follow a clear structure. Before starting with the statistical analysis, the author would first like to conclude the findings of the theoretical and empirical analyses by answering the leading questions without taking the results from the descriptive part into account.

(1) Which exchange rate regime has a significant impact on the countries' performance and is a correlation detectable?

In general there is no uniform and optimal exchange range regime for every country at any time. The selection of an appropriate exchange rate regime, whether fixed or flexible, is dependent on various factors, especially level of integration, openness of capital markets and the size of a country. The choice of a regime is a macroeconomic decision that should be in line with the overall objective and targets of a country as set by the government in cooperation with the central bank, given that they are responsible for a rigid implementation. The determination of an exchange rate regime is therefore not an off-off decision but rather an ongoing process in order to ensure a sustainable development with special considerations to the prevailing conditions.

(2) Can differences be observed between the two groups (advanced and emerging market / developing countries) regarding the choice of exchange rate regime?

The separation into two observation groups concerning the choice of exchange rate regimes would appear to make sense, given that the empirical analysis often distinguishes in the same way. On the whole, there are some obvious differences between the groups, in particular considering emerging market and developing countries. From a macroeconomic point of view, the best solution for these countries could be to take an arrangement with less flexible exchange rates due to the stability issue and required consistency in order to grow. However, there is a general trend that countries with a higher degree of openness and global interconnectedness are moving towards more flexible exchange rates.

The same trend can be seen in advanced countries, albeit to a lesser extent. Through and since the introduction of the Euro, which is linked to the countries' adjustment by pegging their domestic currency to the Euro, the allocation of the arrangements has been balanced between fix and floating.

(3) In the case of financial instabilities or economic crises, which exchange rate regime can better absorb financial instabilities?

In general, the vulnerability of an exchange rate regime to crises is highly discussed and the opinions on the topic also vary. Overall, it can be said that academics and scientists generally agreed that less flexible exchange rate arrangements are more prone to crises compared to floating regimes. A plausible explanation can be found in the theory of impossible trinity, as under fixed exchange rates, a country gives up their autonomous monetary policy and therefore they lose their flexibility in order to react to distress signals, shocks and similar situations. Nevertheless, different studies have also shown evidence that other regimes could be more appropriate in certain situations, but one of the most important points in this topic is the fact that every exchange rate regime reaches their limitations. The fact that a country falls into a crisis is based on multiple factors, but the regime alone cannot absorb every problem. The financial crisis that began in 2008 and resulted in the collapse of financial systems, independent of the set regime acts as one of the best supporting examples of the above claim.

5 Statistical Analysis of Exchange Rate Arrangements

In the second part of the master thesis the author intends to statistically investigate the dependencies between the choice of the exchange rate regime and macroeconomic growth. In order to reach an appropriate result, the corresponding analyses will be conducted using multiple regression models with a dummy variable for the exchange rate regime, indicating 1 as a fixed regime and 0 as a flexible regime, respectively. Despite the fact that additional variables are considered in the model, the main focus lies on the interpretation of and interaction between the following variable: the choice of the exchange rate regime and yearly changes in real GDP per capita growth. In combination with other variables, the author aims to test the extent to which degree the exchange rate arrangements may have a positive or negative impact on the macroeconomic development. In the following chapters, and before examine the model analyses, different issues such as the data, observation periods and analysis of utilised factors will be covered.

5.1 Data and Observation Period

In order to provide the reader with a comprehensive understanding of the conducted analyses in the statistical part of the thesis, various factors should be addressed. Generally - with exceptions of some variables -, the data is collected from the World Bank national accounts data, and OECD National Accounts data files between 1980 and 2015. More specifically, the listed variables all have the same origin and were calculated in USD on a yearly basis:

- Real GDP per capita (constant 2010)
- Final consumption expenditure (constant 2010)
- Gross capital formation (constant 2010)
- Gross savings (current)
- Total population (amount)

The additional variables were collected from the International Monetary Fund, International Financial Statistics and data files:

- Exchange rate arrangement (AREAER)
- Current account balance (BoP Statistics Yearbook and data files, % of GDP)
- Inflation, consumer prices (annual %)
- Consumer price index (CPI; 2010 = index 100%)

Overall it can be seen that the macroeconomic figures used for the analysis show constant values with the determination date 2010. This was chosen consciously due to an assumed better fit of the model. However, two figures (gross savings and current account balance) are only available in current USD figures. This means that they are calculated on the actual price level and

known as nominal values. Additionally, the remaining factors are stated either as indices, absolute values or in percentage of the GDP. According to the different basis of calculations at this stage, the values in this form are inappropriate to model and do not allow for adequate comparisons. In order to draw valid and meaningful conclusions of the descriptive analyses, the data should be modified to obtain a consistency. In order to achieve this, the author carried out some standardizations and adjustments.

Firstly, due to the chosen dependent variable, which is defined as the real GDP per capita, the determinants of the model are also calculated on a 'per capita' basis. With this generalization, a proper comparison can be reached. The variables final consumption expenditure, gross capital formation and gross savings were therefore divided by the total population. Furthermore, as already mentioned, the conducted analysis examines macroeconomic development, which can be evaluated based on the GDP growth rate. With this in mind, these mentioned independent variables must also take growth rates into consideration. The remaining proposed variables of the model, which disclose their value as an indices or percentage is simplified by applying the simple difference. With these adjustments, all variables show the same data structure with the exception of gross savings and current account balance. Given that gross savings values are nominal growth rates and due to the effect that the current account balance is in percentage of the GDP, the difference between t and t-1 is not consistent with the other variables and could lead to an unfitted model compilation. Furthermore, during the process of data procurement, the author selected two different figures to identify price changes of consumer goods: the classical inflation rate and the CPI. These particular figures were chosen in order to determine whether the inflation rate or the changes in the CPI leads to a more suitable model.

The data collection was carried out systematically in order to prove whether the data quality is good enough for further investigations. Due to two different groups of countries, both datasets were provided separately. The first main goal was to obtain a general overview of the data quality and availability. According to the different reporting quality standards of each country, there are huge discrepancies in the data procurement, especially in the group with emerging market and developing countries. As a result, some data is unavailable and therefore data from only 86 of the 151 countries analysed over the 35 years can be used. As a consequence, and in order to investigate the collected data more precisely, the author defined three different observation periods. With this decision, the time period of each observation period becomes shorter but more countries were included. The following overview in table 8 should give a clear understanding of the different observation groups, time period and amount of covered countries:

Table 8: Overview of different Observation Groups (own illustration, 2017)

Observation group	Observation period / number of observed years	Amount of covered countries
Emerging market / developing countries	1980 – 2015 / 35 years	65 out of 151
Emerging market / developing countries	1992 – 2015 / 23 years	91 out of 151
Emerging market / developing countries	2000 – 2015 / 15 years	115 out of 151
Advanced countries	1980 – 2015 / 35 years	34 out of 38
Advanced countries	1992 – 2015 / 23 years	34 out of 38
Advanced countries	2000 – 2015 / 15 years	36 out of 38

Table 8 shows that the number of selected countries within the different observation groups could be significantly increased by choosing shorter observation times. This is particularly relevant to emerging market and developing countries. The entire list of countries used for the corresponding groups can be found in the appendix chapter 8.1 and 8.2. At this stage, it should be mentioned that the selection and elimination process is based on the data quality and availability. The countries not included in the data collection carry less important information with regard to macroeconomic development, for example countries such as Ethiopia, Iraq, Libya, Myanmar, Palau, Samoa, São Tomé and Príncipe. These countries are, however, still on a very low stage of their development.

Based on the adjustments of the different observation periods for each observation group, the original datasets can be divided into three samples. With this optimization, the data quality of each observation group could be enhanced considerably, but it is inevitable that some values in isolated cases will still be missing. However, based on the sample size, the statistical results will not be distorted. By applying the mentioned adaptations, six different samples (in each case three) can be used to conduct multiple regressions in order to analyse the statistical relationship between the choice of an exchange rate regime and macroeconomic growth. The distribution of the observation period not only allows separate analyses and interpretation of the results, but also enables a comparison based on the determined observation period to be made.

Before analysing the composition of the regression model and outlining the used factors for the conducted analyses in more detail, the distribution of the exchange rate arrangement, whether fixed or flexible, for each observation group should be discussed.

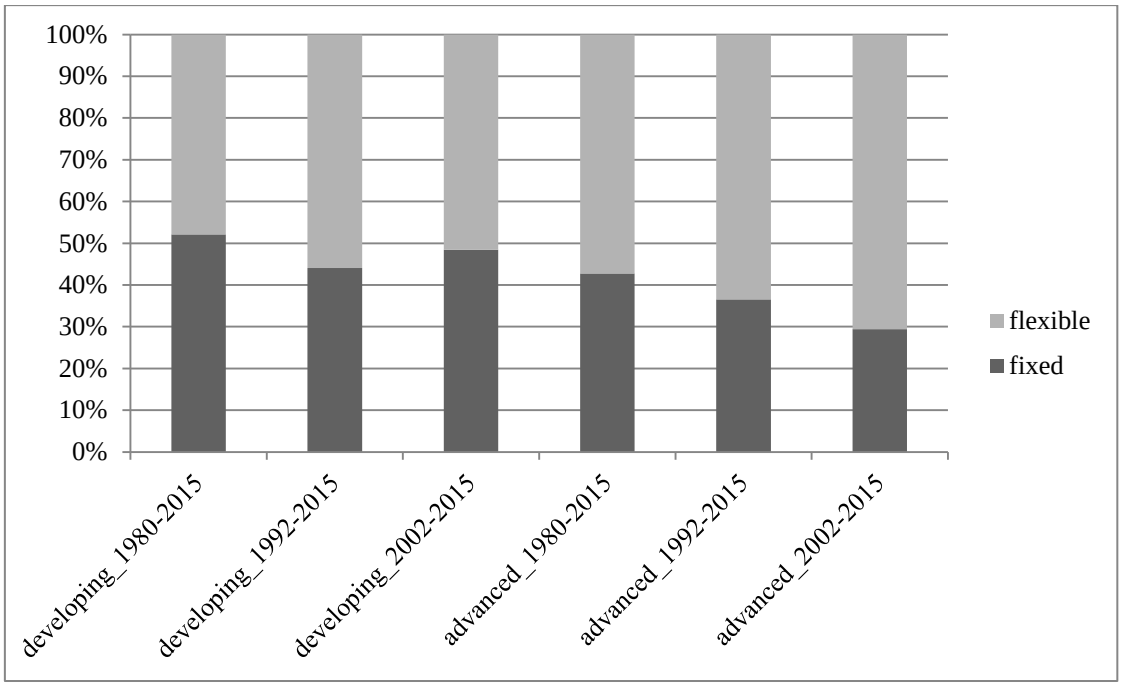

Figure 6: Frequency Distribution of Exchange Rate Regimes (IMF, 2017, own Analyses)

Figure 6 summarizes the distribution of the exchange rate regimes according to the specific observation group and corresponding observation period. Based solely on the above graph and without taking real percentage points into accounts, it is clear that more countries have been introduced with a flexible exchange rate regime over the las 35 years, regardless of the country's classification. Nevertheless, it is clear that the allocation within emerging market and developing countries is generally closer to 50% compared to the group of advanced countries. More precisely, these emerging market and developing countries lie within a range of 44.09% to 52.10%. This leads to the conclusion that countries persuaded a flexible exchange rate arrangement with a frequency ranges between 47.9% and 55.91%. By focusing on the classified advanced countries, a clear tendency towards more flexible exchange rate agreements can be observed. Given that the number of countries considered within the observation group with advanced countries was almost constant, it is clear that with a shorter observation period, more countries changed their arrangement to flexible one. As a result, it is visible that the group with the shortest time period discloses that 70.56% of the countries implemented a flexible exchange rate strategy. One of the most significant impacts on this development is obviously the introduction of the EUR in the corresponding countries. Based on the AREAER, members of the European Union introduced the EUR in 2002. As previously mentioned, most of the countries that changed their currency to the EUR were classified as hard peg (no separate legal tender) at first, despite the fact that the euro fluctuates freely and might be assumed to be classified as free floating. The reclassification of the arrangement from fixed to flexible took place mostly in 2007, which is evident by the significant drop in figures 10 to 12.

As discussed previously, there are various possible exchange rate arrangements which were applied by the involved countries at different stages. Nevertheless, in order to answer the research question more precisely, each arrangement should be classified as either flexible or fixed. The following figures 7, 8 and 9 show the distribution of fixed and flexible exchange rates of emerging market and developing countries according to the three different time periods 1980 – 2015, 1992 – 2015 and 2000 – 2015, respectively. The following regimes belong to flexible arrangements: Floating, Free Floating and other Managed Arrangement, whereas fixed arrangements are determined by No Separate Legal Tender, Currency Board, Conventional Peg, Pegged with Horizontal Bands, Stabilized Arrangement and Crawling Peg / Crawl-like Arrangement.

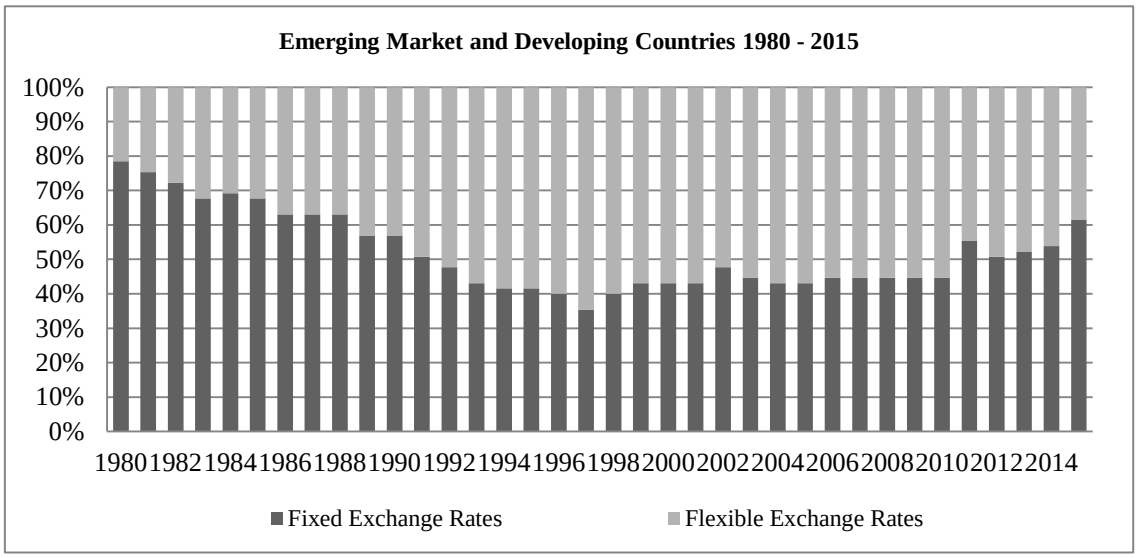

Figure 7: Distribution of Exchange Rate Arrangements from 1980 to 2015 (World Bank, 2017, own Analysis)

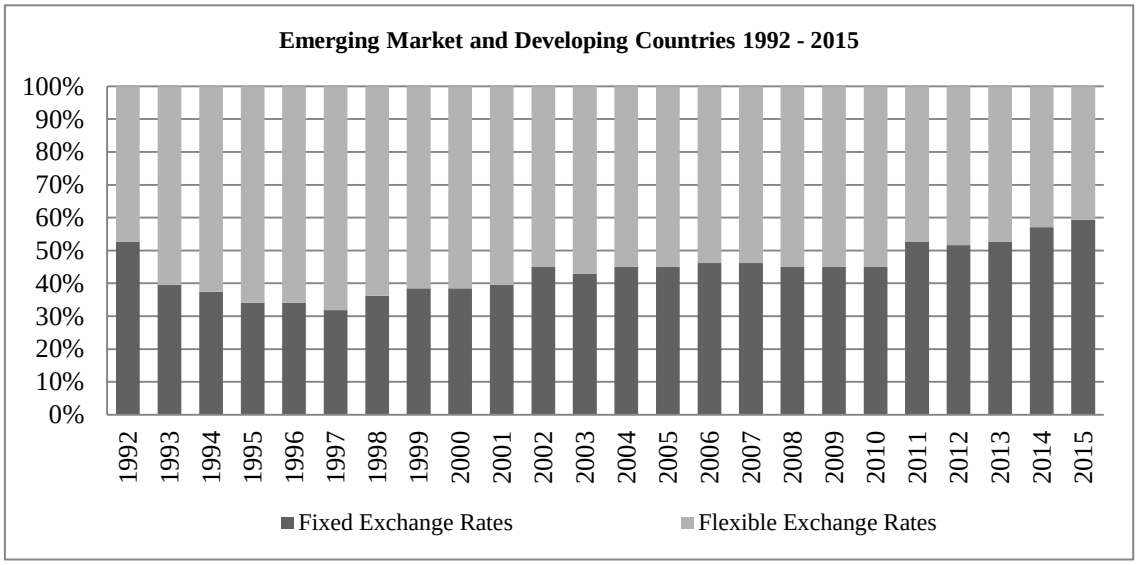

Figure 8: Distribution of Exchange Rate Arrangements form 1992 – 2015 (World Bank, 2017, own Analysis)

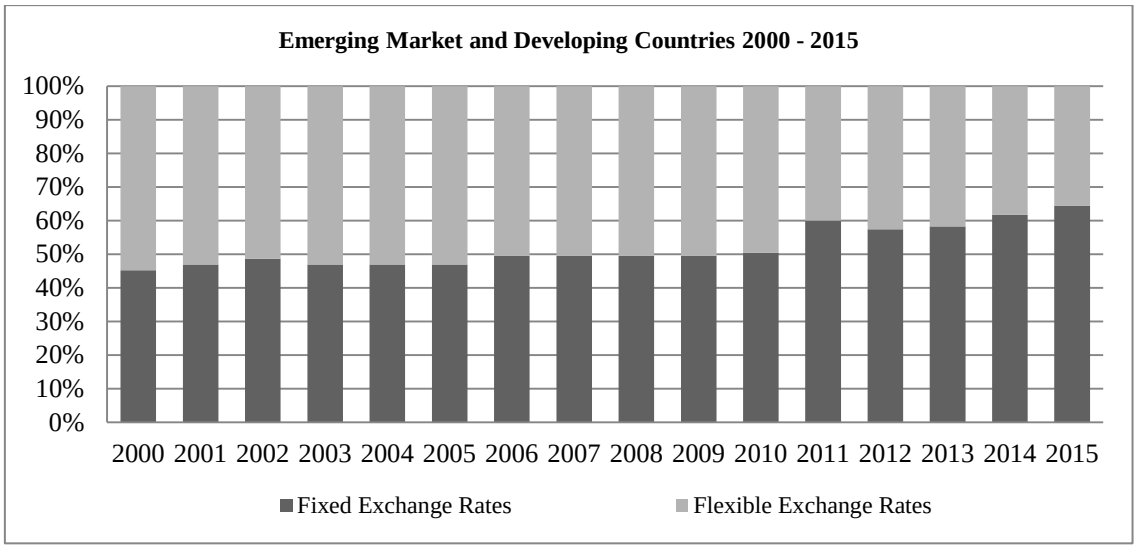

Figure 9: Distribution of Exchange Rate Arrangements from 2000 – 2015 (World Bank, 2017, own Analysis)

Figure 7 shows the development in the broadest time scale over the past 35 years. In particular, the clear growth trend of flexible exchange rate arrangements observed from 1980 to 1997 should be noted. The downward sloping trend of fixed exchange rate arrangements stopped in 1997 and consequently moved to a constant level of around 45%. A possible reason for this slight change of direction could be the financial crises in Asia (1997/1998), Russia (1998/1999), Brazil (1999) and Argentina (2000) due to changes in the nations' respective monetary policies. At the end of 2010, the number of fixed exchange rate regimes increased continuously over the next few years and reached a level of 60% at the end of the observation period. Despite the fact that more countries are included, figure 8 and 9 show a similar distribution and it can also be observed that these figures are well balanced between fixed and flexible exchange rate arrangement, which is also a positive awareness in relation to the subsequent statistical analysis.

Aside from the structural changes addressed with regard to the exchange rate arrangements, additional information must be provided regarding the growth development of each group of countries and time period. Some relevant numerical information can be summarized as follows:

Table 9: Descriptive Statistics Emerging Markets / Developing Countries

Descriptive Statistics	developing_1980-2015	developing_1992-2015	developing_2000-2015
Minimum	-0.4772	-0.4772	-0.3134
25th Percentile	-0.0028	0.0048	0.0062
Median	0.0194	0.0250	0.0274
75th Percentile	0.0393	0.0466	0.0490
Maximum	0.3713	1.4164	6.5346
Mean	0.0162	0.0254	0.0389
Standard Deviation	0.0457	0.0603	0.2449
Sample Size	2270	2088	1713
Nr. of Countries	65	91	115

The information provided in table 9 shows that the measures of central tendency and measure of variation vary strongly according to the corresponding observation period. One of the reasons for these test results is the fact that the number of covered countries increases substantially with shorter time periods. As previously mentioned, more countries could be included in the observation group due to higher data quality. Overall, these results should be interpreted carefully, as statistical outliers are also included in the analyses. Nevertheless, a more positive development of the macroeconomic performance between 1992-2015 and 2000-2015 compared to 1980-2015 can be seen by considering the 25th percentile and the median. More specifically, at least 25% of the values covered in the observation group developing_1980-2015 show a negative GDP growth, whereas the remaining groups reveal higher growth rates. This development of the GDP is supported by the sample mean of the different groups. In this context, it is particularly interesting to note that the mean almost doubled over just a 15 year period. Another implication used to judge the distortion of the data is the interquartile distance (IQS). This is a measure of dispersion which allows conclusions about the distribution of the data. The mathematical explanation of the interquartile distance is simply the difference between the third and the first quantile. The IQS of the corresponding groups lie between 0.0365 and 0.0428. Higher IQS means that there are higher distortions in the data, which therefore means that consistency is not guaranteed. In this case, with a value of 0.0428, there is a significant difference between both the points and the corresponding median.

In this context, it is also worthwhile mentioning the high standard deviation of the data within the time period 2000 to 2015 with a value of 0.2449 compared to 0.0457 and 0.0606, respectively. The explanation can be found in the very high range of 6.2212, which provides information about the difference between the maximum and the minimum value. Nevertheless, due to the high sample size this information carries a less meaningful statistical statement.

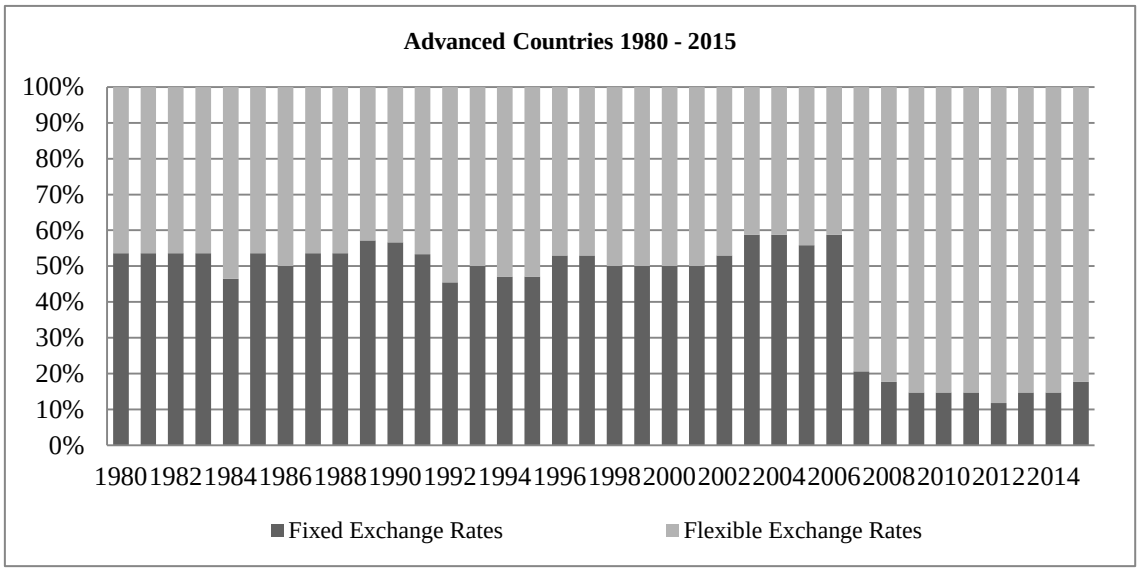

Figure 10: Distribution of Exchange Rate Arrangements from 1980 – 2015 (World Bank, 2017, own Analysis)

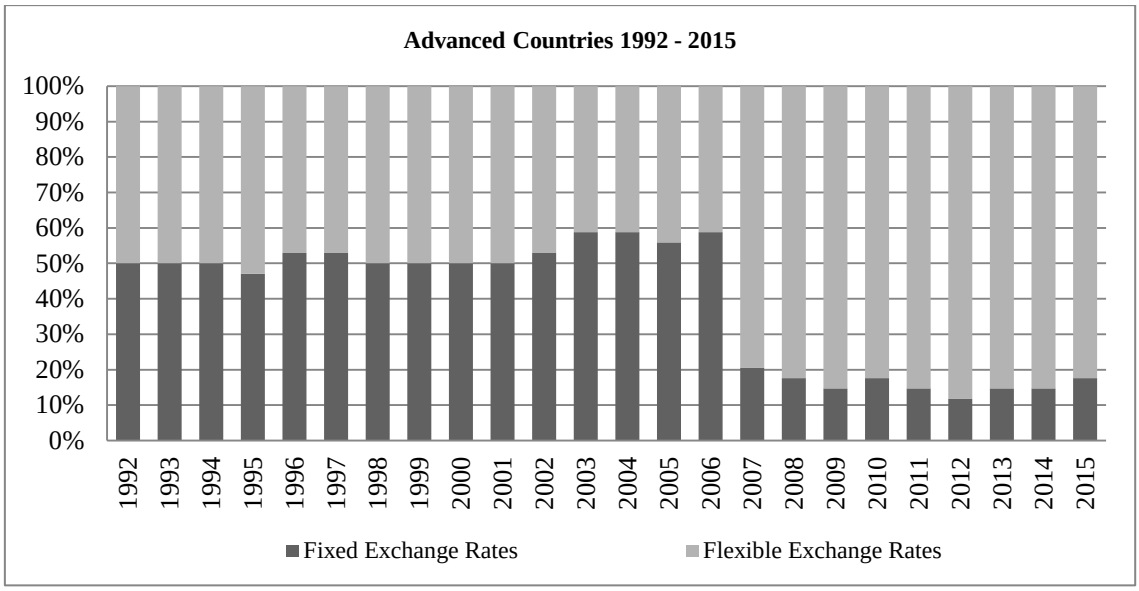

Figure 11: Distribution of Exchange Rate Arrangements from 1992 – 2015 (World Bank, 2017, own Analysis)

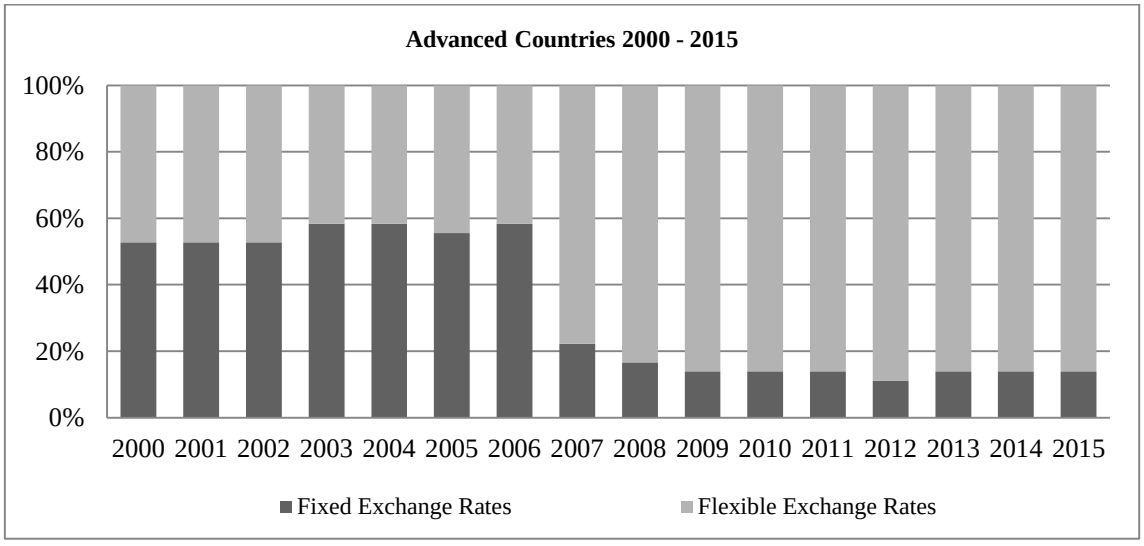

Figure 12: Distribution of Exchange Rate Arrangements from 2000 – 2015 (World Bank, 2017, own Analysis)

Figures 10 to 12, on the other hand, focus on advanced countries within the same time scales. It should be noted that within this group, the number of covered countries is limited due to a generally lower number of advanced countries. Nevertheless, it is clear that the distribution of the regimes is well balanced from 1980 to 2006. As previously mentioned, in all three figures there is a significant drop in 2007 by around 30% of the proportion in fixed exchange rates. During this time, various nations moved the arrangement to a more flexible approach. This adjustment is based on the participation and adoption of countries in the currency union of the EU. Various members introduced the EUR in 2002, however most of them were classified as exchange arrangements with no separate legal tender at first. Based on the general definition, this is still classified as a fixed exchange rate. The individual conversation rate of each nation and currency was fixed to the euro and despite the fact that the EUR fluctuates independently, the ECB was still privileged to influence and intervene in the market in order to smooth out movements in the

exchange rate. In 2007, the reclassification of flexible exchange rates took place and therefore, this discrepancy is mostly in accordance with the introduction and adoption of the euro.

Table 10 provides the information necessary in order to analyse the value distribution within these three groups:

Table 10: Descriptive Statistics Advanced Countries

Descriptive Statistics	advanced_1980-2015	advanced_1992-2015	advanced_2000-2015
Minimum	-0.1456	-0.1456	-0.2166
25th Percentile	0.0062	0.0055	0.0022
Median	0.0212	0.0202	0.0167
75th Percentile	0.0368	0.0361	0.0311
Maximum	0.2564	0.2564	0.2564
Mean	0.0221	0.0212	0.0175
Standard Deviation	0.0322	0.0333	0.0402
Sample Size	1122	781	538
Nr. of Countries	34	34	36

It is evident that the values are much more constant and balanced without significant outliers in terms of minimum or maximum values. As the number of covered countries is more or less the same, the sample size decreased significantly. There is a clear difference between this group and the other observation group covering emerging market and developing countries, as there are much more new countries included within a shorter time period. Despite this, the development of the GDP growth in advanced countries was mostly positive. In particular, within the time scale from 1980 to 2015, the 25^{th} percentile with 0.0062 is already positive and less than 25% of the values show a negative development. Based on table 10 the calculation of the IQS ranges from 0.0289 to 0.0306. This means that the data are not only closer to each other, but also closer to the median when compared with the group of emerging market and developing countries. It can therefore be concluded that there is a higher consistency of the data assumed in comparison to the previous analyses, as there is less dispersion given.

5.2 Factor Analysis

In order to compute a suitable regression model for general analysis, a common approach that can be applied in this context is the Factor Analysis (FA). As long as the explanatory variables of the dependent variable can be assumed or whenever there are known, the FA approach can be used. According to the theoretical background and the covered relevant empirical studies, various drivers for macroeconomic growth can be assumed as independent variables for the regression model. With this in mind, FA method is used for the computation of the model (Zöller, 2012).

First of all, one of the most appropriate indicators of the macroeconomic performance of a country is the GDP per capita. According to the various empirical analyses conducted by scientists and macroeconomic theories, the GDP per capita stands out as the dependent variable of this study.

According to the literature and macroeconomic theories, which outline various drivers for macroeconomic growth, this study conducts a factor analysis. Besides the fact that the author aims to analyse the influence of the choice of exchange rate arrangements, it is also important to consider other factors which may drive the GDP growth. There are different components: household consumption expenditure, gross capital formation, government expenditure and net exports. Due to the fact that all these factors determine the GDP, they can be classed as economic drivers, more specifically, control variables. Furthermore, it can be assumed that explanatory factors such as the consumer price index (CPI) and the population might have also an impact on the development of a nation. In general, each of these listed independent variables draw upon prior studies in this field of research and it is therefore appropriate to add such control variables to the model.

In order to define whether a factor might fit the model, a test can be carried out by deriving single regression models with all the corresponding independent variables. By applying this methodology, the first OLS requirement, which states for linearity in parameters, can be examined. The results of the single regression can be plotted in order to make a graphical assessment. If there is linearity in two variables given or whenever it can be assumed, the unstandardized residuals should be randomly distributed. In the following chapters, the plots will be analyzed and interpreted. For this purpose, the collected yearly data has been used during a time horizon of 35 years, from 1990 to 2015. The data style used in this analysis is either the simple difference on a yearly basis or the yearly growth rate, depending on the pulled data.

5.2.1 Consumption Expenditure

Firstly, the first control variable that should be considered in the model is consumption expenditure. Previously, the influence of household consumption and government expenditure on GDP growth had been regarded separately. Nevertheless, in order to hold the model to a greater and lesser extent slim, the two variables can be summarized under the term “consumption expenditure or total consumption expenditure”. All the values of this variable describe therefore the sum of private consumption and general government consumption. The single regression analysis between the GDP and consumption expenditure shows a coefficient of determination of 0.3257. This means that the variation in GDP growth rate of the group of countries might be statistically explained by 32.57%.

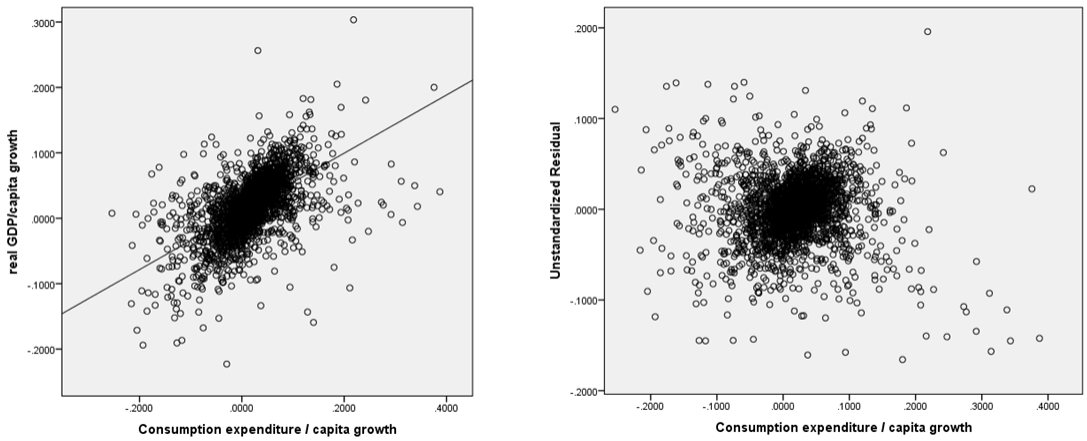

Figure 13: Graphical Linearity Test – Consumption Expenditure (World Bank, 2017, own SPSS Analysis)

Taking a closer look at the figure 13 and the corresponding scatterplot of the dependent and independent variable, a linear relationship between real GDP growth and consumption expenditure is clearly visible. Furthermore, by focusing on the unstandardized residual plot, a random distribution can be assumes. This is a good sign as linearity of this variable is given.

5.2.2 Gross Capital Formation

The yearly growth rate of the gross capital formation is also considered as a control variable. These types of values represent gross domestic investment. The World Bank national account data and OECD National Accounts data files, define gross capital formation as follows:

> Gross capital formation consists and outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress". (World Bank, 2017)

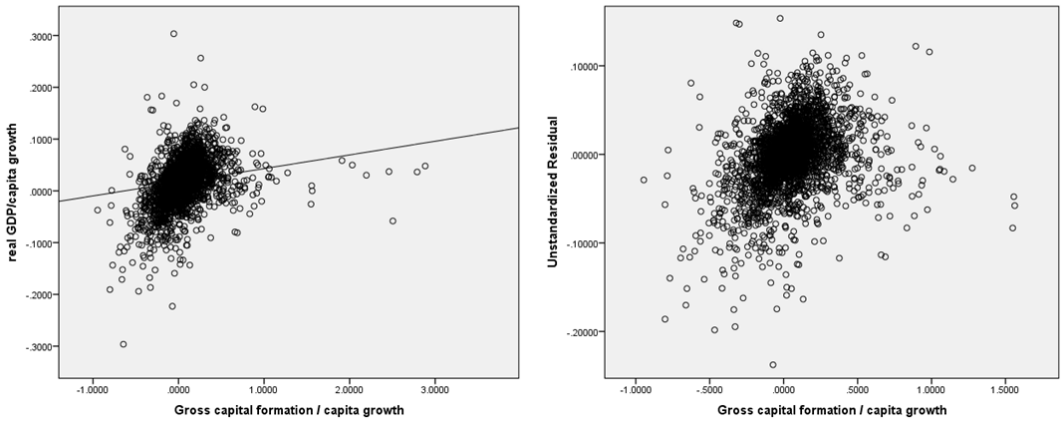

Figure 14: Graphical Linearity Test – Gross Capital Formation (World Bank, 2017, own SPSS Analysis)

Figure 14 also shows a linear relationship between the GDP growth and the gross capital formation. At this point, it should be noted that the distributions of these points are well clustered around zero. As a result, there is not always a clear dependency. Nevertheless, as long as the unstandardized residuals have random patterns, linearity can be assumed and should fit to the model. This could be also the case by considering the second graph of figure 14. According to the coefficient of determination, a low value of 0.0507 can be repatriated to the cluster effect and their narrow distribution. This statistical parameter is, however, only an indicator and the meaning should not be overvalued.

5.2.3 Current Account Balance

The last variable of the GDP composition is defined as net exports. According to data quality issues, the author was exerted to take a similar variable into account which is based on the net exports. Therefore, the values of the current account have been chosen as an additional determinant and will be added to the model. The current account considers beside the net exports of goods and services also the net income.

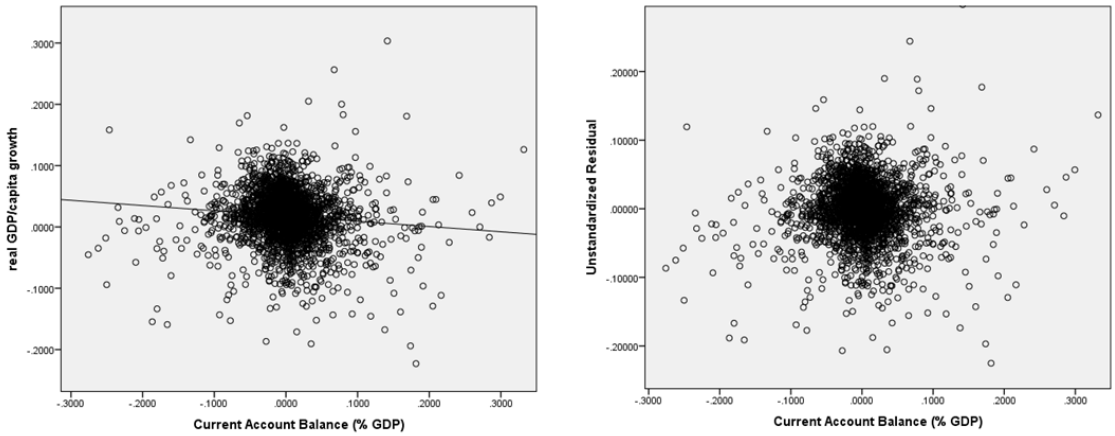

Figure 15: Graphical Linearity Test – Current Account Balance (World Bank, 2017, own SPSS Analysis)

The graphical linearity tests conducted in figure 15 both show a very similar pattern. The points in the plots are narrowly clustered around zero. This leads to a less visual linear connection, however, the residuals are still randomly distributed. In the above graphs, the same problems identified in the previous tests are evident here. Most of the points are tight together. But there is also a slight negative connection between the two variables with a correlation of 0.097 and therefore a coefficient of determination with 0.93%, which is extremely low. In this case, this means that almost no linear relationship between the two variables exists. Nevertheless, the inclusion of a control variable in the single regression model makes it highly significant as a whole and it should therefore also be included in the model.

5.2.4 Consumer Price Index (CPI)

The yearly change in the consumer price index is also considered as an explanatory variable in order to determine to what extent the changes have an influence on GDP growth rates. Alternatively, the changes of the inflation rate could also have been added to the multiple regression models. But as the figure 19 in the appendix indicates, the distribution is statistically not suitable for the conducted analyses. Instead, the CPI - defined as: "Consumer price index reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly" (2017) - is used for the further studies.

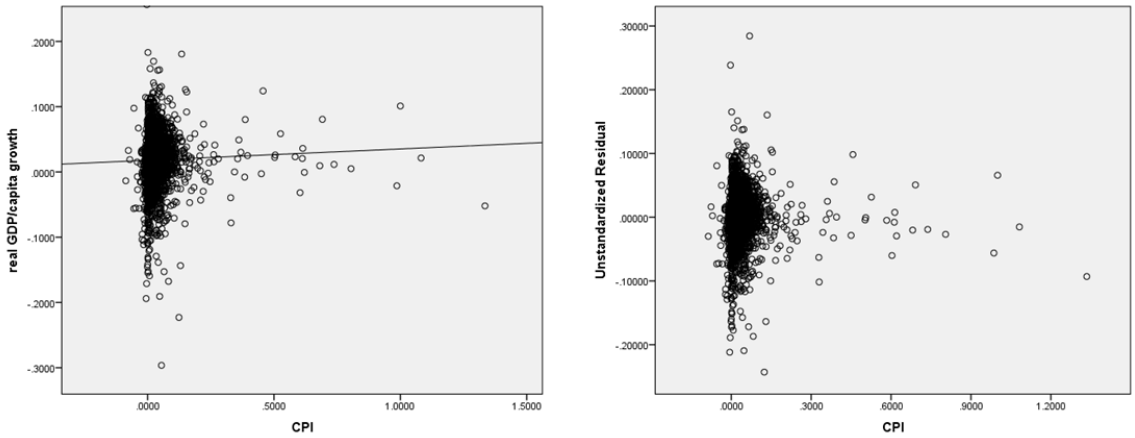

Figure 16: Graphical Linearity Test – Consumer Price Index (World Bank, 2017, own SPSS Analysis)

The scatterplot in figure 16 displays a typical pattern of a cluster around zero values. Despite the fact that some outliers make the graph look wide, the concentration of the CPI changes are mostly between 0.00 and 0.25. This leads to a less visual linear connection. The distribution cannot be supported by the coefficient of determination because there is almost no correlation at all. By taking the unstandardized residual plot into consideration, a nonlinear relationship could be present. Another possible explanation for such a structure of the plotted residuals could be the sign of heteroscedasticity, which can occur commonly in cross-sectional data.

5.2.5 Population

The last variable that is considered a determinant of the depending variable is population growth. It could be assumed that population growth has a positive correlation with the macroeconomic performance of a country to some extent. From an economic point of view, however, more human capital forces the production of products and services which leads to more output. It is widely believed that the aggregated supply curve shifts upwards.

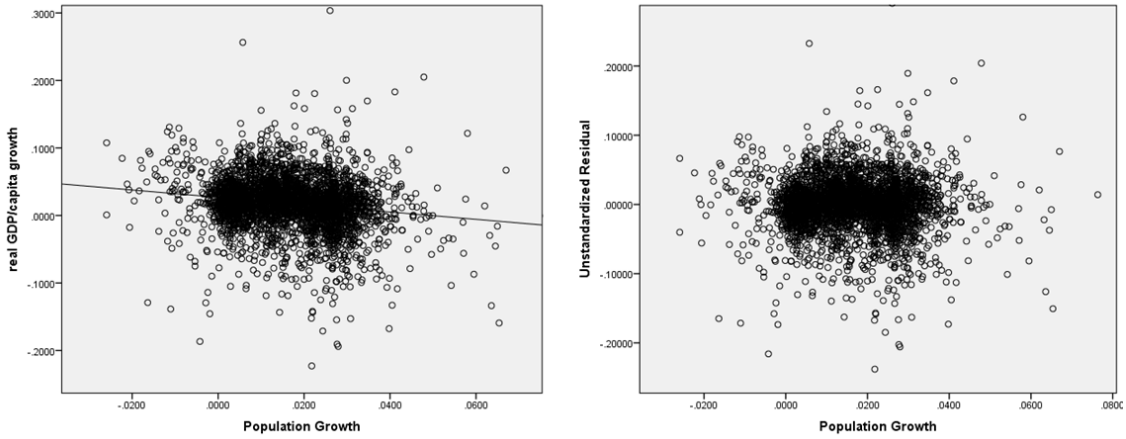

Figure 17: Graphical Linearity Test – Population (World Bank, 2017, own SPSS Analysis)

Keeping in mind that the data structure is calculated on a per capita basis, higher population growth at time t directly affects the GDP per capita calculation at the same time. In other words, this means that a negative linearity may occur as illustrated in figure 17. This downward sloping trend can also be explained economically, especially in case of emerging market and developing countries. These nations may not have the full capacity, production sites or more generally the required infrastructure in order to produce higher output rates.

Compared to the plots described previously, the linearity between the two variables in this case is clearer. Despite the fact that the coefficient of determination with 2.4% is still without strong power of explanation, the unstandardized residuals are distributed randomly and can be used as an additional variable for the model.

5.2.6 Gross Savings

Gross saving as an additional and potential independent variable has also been collected in order to test whether this variable might fit to the model. According to the analyzed statistical tests, which were negative, and the graphical observation of the scatterplots (in appendix 8.4.1, figure 18), the author decided to neglect this variable for the corresponding analyses.

5.2.7 Specification Test

According to table 11, test results concerning heteroscedasticity and specification issues of the considered independent variables are summarized as follows:

Table 11: Specification Test Single Regression Analysis (World Bank, 2017, own Gretl Tests)

Dependent Variable	R^2 single regression	Adjusted R^2	RESET (p-value)	White test (p-value)
Consumption expenditure	0.3257	0.3256	0.0000	0.0000
Gross capital Formation	0.0507	0.0504	0.0000	0.0000
Current Account Balance	0.0093	0.0090	0.0000	0.0000
CPI	0.0019	0.0016	0.1020	0.8519
Population growth	0.0247	0.0244	0.0000	0.0000

In these cases, the null hypothesis of the RESET test can mostly be rejected at the 99% confidence level, which can be assumed under these circumstances because the corresponding p-value is inferior to 0.01. In other words, the misspecification occurs in most cases. One reason is that just one independent variable has been modelled without considering the remaining factors. Therefore, this type of result should be expected. Furthermore, the modelled single regression analysis shows also that the null hypothesis of the White test, which is defined as heteroscedasticity is not present, has mostly been rejected. As the goal is not to reject the null hypothesis on the whole, this means that the variance of the error terms is not constant and therefore heteroscedasticity is mostly given. In general, heteroscedasticity can lead to distortions in hypothesis tests and confidence intervals due to higher or lower standard errors. As a preventative measure, the standard errors should be made robust in the corresponding statistic software. As long as the single regression model is highly significant at the 99 percent confidence level in general, the selected independent variable should be included in the multiple regression models. The common literature and scientific papers also support this theory, due to their considerations in their statistical analyses.

5.3 Model Analysis

Focusing particularly on the research question and the formulation of the corresponding objectives within this master's thesis, the determination of possible dependencies and correlations between the choice of an exchange rate arrangement and the macroeconomic development of the defined group of countries is of key importance. Statistical connections can be represented through the use of multiple regression analyses. This chapter covers the statistical model as well as the interpretation of the test results and connections. Based on the conducted analyses, it is the goal to prove the previous results of the research and to make possible recommendation for further actions.

Based on chapter 5.2 and the perceptions gained so far, the following six-factor model has been constructed:

$$\hat{y}_i = b_o + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6$$

Where:

$\hat{y}_i$ = yearly changes in real GDP / capita growth

x_1 = dummy variable Exchange Rate Regime; 1 = fixed; 0 = flexible

x_2 = yearly changes in final consumption / capita growth

x_3 = yearly changes in gross capital formation / capital growth

x_4 = yearly changes in current account balance

x_5 = yearly changes in CPI

x_6 = yearly changes in Population growth

The six-factor model illustrated above will be identical for each observation group and the corresponding regression analyses in order to compare the findings. All regressions were conducted by using OLS. As previously mentioned, the consideration of robust standard errors has been discussed in order to avoid heteroscedasticity. As the analyses have shown that the constructed six-factor model is free of heteroscedasticity, the regressions were performed without the activation of the HC1 and used for the interpretation of the results. Nevertheless, the regressions were also modelled with robust standard errors and they are all attached in the appendix. Generally, regression analyses for individual countries were not performed due to statistical uncertainties and possible distortions because of the limited sampling. As previously mentioned, the list of selected countries for each observation group can be found in the appendix 8.1 and 8.2. Different statistical tests were also conducted in order to test both the OLS assumptions and to prove the model as a whole. These tests were conducted by applying the statistical tool Gretl. Multicollinearity issues were tested using two methods outlined at the beginning of the master's thesis: visualization of correlation matrix and execution of the VIF test. Both approaches produced identical results, stating that multicollinearity does not exist for all observations groups as the correlation matrix shows values between -0.80 and 0.80. Additionally, the VIF test reached values below the critical value of 10 and therefore no further investigations were necessary.

In the following chapters, the individual outputs of the regression models will be exemplified. The beta factors were tested on their significance in the model. Significant values at 99 percent, 95 percent and 90 percent confidence level are characterized with (***), (**) and (*), respectively. Special attention should be paid to the dummy variable, which describes the influence on GDP growth rate. In each analysis, the dummy x_1 is defined as fixed exchange rate arrangements. In other words, as long as a country acts under a regime that is classified as fixed, the variable x_1 in the regression model applies the value 1, otherwise 0. In addition to the beta factors analyses, various statistical parameters such as the coefficient of determination, adjusted coefficient of determination, "F-Test" and "RESET" test have been applied and will be explained simultaneously.

5.3.1 Emerging Market / Developing Countries

According to table 12, the first output of the analyses shows the outcome of the regression model with covered countries of 65 from 1980 to 2015. At first glance, it is clear that all variables have a significant beta, in particular the factors such as consumption expenditure, gross capital formation and current account balance at the 99 percent level. The dummy variable and the CPI are significant at a confidence level of 95 percent, whereas the factor population growth corresponds to statistical significance at 10 percent as the p-value is superior of 0.05. Two of the variables have a negative sign, which means that changes in population growth for example has

a negative impact on the GDP growth. The negative relationship between these two variables was also observable within the single regression analyses, previously. It can be assumed that this beta factor remains negative for the further regression models. The most important recognition of these analyses is, of course, the dummy variable, which delivers the most effective answer to the research question. The dummy variable has a negative sign, meaning that fixed exchange rate arrangements negatively influence the growth rate, even to a small extent. In other words, evidence exists to prove that flexible exchange rate arrangements were more appropriate in macroeconomic performance during the whole observation period of the past 35 years. In statistical terms, due to the significance of the exchange rate regime variable at the 95 percent level there does a clear link between the independent dummy variable and the GDP per capita exist. The corresponding coefficient with a value of -0.0037 states that the GDP per capita grew more slowly on average under fixed arrangements, with only -0.37%.

Table 12: Beta Factors of Developing Countries 1980 – 2015 Regression (World Bank, 2017, own Gretl Analysis)

Developing Countries 1980 - 2015	Coefficient	P-Value	
Constant	0.0146	0.0026	***
Dummy-Fixed	-0.0037	0.0118	**
Consumption Expenditure	0.3467	0.0000	***
Gross Capital Formation	0.0519	0.0000	***
Current Account Balance	0.1156	0.0000	***
CPI	0.0419	0.0160	***
Population growth	-0.3305	0.0686	***

A p-value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% levels.

Furthermore, the interpretation of the following model must be considered carefully according to appearance of survivorship and selection bias. It would be interesting to observe the upcoming results by considering a shorter time scale, which is also part of the further studies. Nevertheless, as the main focus lies on the dummy variable, such biases should not be overvalued in this context and the issue about biases is addressed in the end of the thesis under criticism & further research.

The next regression output in table 13 with the identical control variables shows results similar to those expressed in table 12. The same independent variables have a negative sign, and they are all still significant at a confidence level of at least 95 percent, except for the dummy variable, which is insignificant. In the conducted analyses they were 91 countries covered and the data was collected over the past 23 years. It is evident that two control variables influence highly the macroeconomic performance of the emerging market and developing countries in a positive manner, namely consumption expenditure and current account balance. From an economical point of view, the results show that private and government consumption directly affects the development of a country and also the current account balance including net export, which also

influences growth potential. It is difficult to determine the effect of the choice of an exchange rate arrangement due to the weak beta value of -0.0026. With flexible exchange rates arrangements, a country would have been better off, but only marginally. Furthermore, due to the fact that the dummy variable is statistically not significant, a linear relationship cannot be approved.

Table 13: Beta Factors of Developing Countries 1992 – 2015 Regression (World Bank, 2017, own Gretl Analysis)

Developing Countries 1992 - 2015	Coefficient	P-Value	
Constant	0.0184	0.0000	***
Dummy-Fixed	-0.0026	0.2772	
Consumption Expenditure	0.3814	0.0000	***
Gross Capital Formation	0.0073	0.0000	***
Current Account Balance	0.2940	0.0000	***
CPI	0.0248	0.0285	**
Population growth	-0.1874	0.0451	**

A p-value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% levels.

Comparing the regressed beta factors in table 13 with the previous results, beside some punctual changes of the significance level, the explanatory power of the variable population growth has nearly halved from -0.3305 to -0.1874. Another noticeable recognition is the fact that the factor current account balance tripled nearby. Such strong variations in coefficients might be the case due to the acceptance of various new countries, where the values of the collected data have big differences and that might lead to such distortions.

Table 14: Beta Factors of Developing Countries 2000 – 2015 Regression (World Bank, 2017, own Gretl Analysis)

Developing Countries 2000 - 2015	Coefficient	P-Value	
Constant	0.0336	0.0000	***
Dummy-Fixed	-0.0078	0.0000	***
Consumption Expenditure	0.0776	0.0000	***
Gross Capital Formation	0.0446	0.0000	***
Current Account Balance	0.0369	0.0116	**
CPI	-0.0047	0.5571	
Population growth	-0.5975	0.0000	***

A p-value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% levels.

Table 14 summarizes the results of the final analysis about emerging market and developing countries, over a limited time period of the past 15 years. Overall, it is evident that the selected variables are for the most part highly significant, except the beta 6 (CPI) which is insignificant due to the changed prefix. According to the high p-value of 0.5571, the CPI as a variable has no significant influence on the dependent variable.

Focusing particularly on the dummy-variable, it is interesting to note that the beta factor is highly significant at the 99 percent confidence level. In this context, this is a good sign given that the statistical influence on the GDP growth rate is verified. Again, the prefix is still negative, mean-

ing that under fixed exchange rate arrangements the countries once again had lower growth rates. During each of these time periods, the dummy variable showed constant results and proved that more flexible exchange rate arrangements would have been more effective in terms of the macroeconomic performance. The impact of the choice of an exchange rate arrangement in the last analyses shows the biggest effect with -0.0078. From an economical point of view, countries would have performed better by 0.78% on average between 2000 and 2015 under flexible exchange rate regimes.

The various statistical parameters executed for each regression analysis show that the average coefficient of determination, also named R-squared, amounts to 0.3089 within an interval of 0.2471 to 0.3787. The figure provides information about the proportion of variability of a dependent variable. The first regression model shows that 37.67% of the variation of the regression model can be explained by all the independent variables. Generally, the higher the R-squared "R^2", the better. Additionally, the adjusted "R^2" gives similar information to the regression model and on the whole, the values are in agreement with the other observations. The main difference between the two indicators is the fact that the adjusted R-squared is the modified type of the R-squared for the number of independent variables in the regression model. Therefore, in most cases the adjusted "R^2" shows a slight smaller result compared to the "R^2". Based on the conducted analyses, the adjusted R-square are almost identical with minimal variation. The validity of the model is supported in all three observation groups not only at the 95, but also at the 99 percent confidence level due to the fact that the "F-Test" exceeds both critical values. Furthermore, by proving the model for specification biases, two out of three models are well specified as the null hypothesis cannot be rejected at the 95% confidence level. This means that the misspecification does not seem to be a problem as long as the p-value is superior to 0.05. The RESET test of the observation group 1992 – 2015 shows that the null hypothesis can be rejected at the 95%, but not at the 99% confidence level.

Table 15: Model Indicators of Developing Countries Regressions (World Bank, 2017, own Gretl Analysis)

Observation Group	N	R^2	Adjusted R^2	F-Test	F-Test 95% Critical Value	F-Test 99% Critical Value	RESET P-Value	RESET min. P-Value	VIF
1980-2015	1873	0.3787	0.3767	56.0222	2.696	3.984	0.0755	0.05	< 10
1992-2015	1651	0.3009	0.2984	117.9341	2.696	3.984	0.0186	0.05	< 10
2000-2015	1465	0.2471	0.2440	79.2504	2.696	3.984	0.0633	0.05	< 10

In addition to the previous statistical parameters, the conducted VIF test regarding multicollinearity is also summarized in table 15. As previously mentioned, a value under 10 indicates that no collinearity is given. The results of the parameters generally lead to the conclusion that the model is appropriate and statistically valid.

5.3.2 Advanced Countries

After presenting the results of the regression analyses concerning groups of emerging market and developing countries, this chapter will focus on the outputs of the observation groups consisting of advanced countries. Again, three analyses were conducted with the same defined observation periods. The statistical interpretation and discussion of the test results will be assessed and evaluated in this chapter, without the intention to make a comparison between the two groups of countries. The latter point will be discussed in the next chapter.

Table 16: Beta Factors of Advanced Countries 1980 – 2015 Regression (World Bank, 2017, own Gretl Analysis)

Advanced Countries 1980 - 2015	Coefficient	P-Value	
Constant	0.0031	0.0009	***
Dummy-Fixed	0.0009	0.3903	
Consumption Expenditure	0.6640	0.0000	***
Gross Capital Formation	0.1631	0.0000	***
Current Account Balance	0.3803	0.0000	***
CPI	-0.0124	0.2617	
Population growth	0.0415	0.5869	

A p-value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% levels.

Table 16 shows the beta factors of the six-factor model with the same independent variables as previously used. The mapped coefficients and corresponding p-values show on the one hand, that the majority of the explanatory variable is significant at the confidence level of 99%. This result can also be verified from an economical point of view as these factors are direct drivers of the macroeconomic performance of a country. For this reason, they are defined as control variables. On the other hand, it can also be observed that the remaining variables are statistically insignificant throughout. Therefore, there is no statistical evidence that the choice of an exchange rate arrangement of advanced countries have an influence on the GDP growth over the last 35 years, even though the beta factor is slightly positive with a value of 0.09%. With this in mind, it can be said that the impact on the macroeconomic performance of a country that followed a fixed exchange rate arrangement was slightly higher, compared to flexible arrangements. In this context, it may also be claimed that the model is statistically not appropriate corresponding the missing significant variables. Furthermore, it can be seen that two control variables, namely consumption expenditure and current account balance, have the highest impact on performance with values of 0.664 and 0.3803, respectively. Beta five, which indicates still changes in the CPI, is the only negative coefficient in the model. In the section where single regressions were modelled, the downward sloping trend was evident. Nevertheless, this negative relationship is not only present by concentrating on advanced countries. From an economical point of view, this effect could be noteworthy due to the advantages of more human capital.

Advanced countries have capacities, better infrastructure, innovative strength and flexibility in order to take benefit out of such circumstances.

Table 17: Beta Factors of Advanced Countries 1992 – 2015 Regression (World Bank, 2017, own Gretl Analysis)

Advanced Countries 1992 - 2015	Coefficient	P-Value	
Constant	0.0034	0.0062	***
Dummy-Fixed	0.0016	0.2446	
Consumption Expenditure	0.6521	0.0000	***
Gross Capital Formation	0.1659	0.0000	***
Current Account Balance	0.3615	0.0000	***
CPI	-0.0073	0.8861	
Population growth	0.0093	0.9167	

A p-value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% levels.

The summarizing table 17 shows almost identical values to table 16. The reason for this is that the same 34 countries are included in the data set. Therefore, only the observation period was shortened and isolated. It is clear that the beta factors express almost constant values with respect to the previous coefficients illustrated in table 16. This can also be applied to the prefixes, as the CPI is the only one with a negative value. Nevertheless, as the dummy variable has the highest priority according to the following analyses, it is stated that the influence of fixed exchange rate arrangements increased slightly but without having a significant impact on the countries development. Due to their insignificance, a clear linear relationship is not apparent. Consequently, without referring to the model indicators it could still be argued that the model could be better specified.

Finally, the last regression model consisting of 36 countries with collected yearly data between 2000 and 2015 come up with the results as follows:

Table 18: Beta Factors of Advanced Countries 2000 – 2015 Regression (World Bank, 2017, own Gretl Analysis)

Advanced Countries 2000 - 2015	Coefficient	P-Value	
Constant	0.0015	0.4117	
Dummy-Fixed	-0.0012	0.5015	
Consumption Expenditure	0.7608	0.0000	***
Gross Capital Formation	0.1836	0.0000	***
Current Account Balance	0.4915	0.0000	***
CPI	-0.0205	0.8199	
Population growth	0.0784	0.6158	

A p-value of below 5% or 1% corresponds respectively to statistical significance at 5% or 1% levels.

Table 18 again comprises the beta factors with the corresponding p-value in order to determine whether the coefficients are significant. It seems that the model has weakened again compared to the previous two regression models with advanced countries and it may create the impression of a distortion. This perception can be supported by various reasons: First of all, the same con-

trol variables are still highly significant at the 99% confidence level. Two variables such as consumption expenditure and current account balance have afforded a much higher impact on the GDP growth rate. It confirms that these variables are important to explain the macroeconomic development of a nation. However, the p-values of the remaining independent variables are still extremely high which is statistically negative. As a consequence, a clear statement cannot be made about the right choice of an exchange rate regime within this group of countries. Of course, it is clear that the dummy variable now has different effects on the defined observation period from 2000 to 2015. However, as long as the beta value of the dummy variable is around zero and insignificant, it is difficult to draw a clear conclusion

Table 19: Model Indicators of Advanced Countries Regressions (World Bank, 2017, own Gretl Analysis)

Observation Group	N	R^2	Adjusted R^2	F-Test	F-Test 95% Critical Value	F-Test 99% Critical Value	RESET P-Value	RESET min. P-Value	VIF
1980-2015	895	0.7787	0.7772	224.2165	2.696	3.984	0.1900	0.05	< 10
1992-2015	700	0.7703	0.7683	197.1958	2.696	3.984	0.2240	0.05	< 10
2000-2015	517	0.7059	0.7025	143.4300	2.696	3.984	0.1100	0.05	< 10

At first glance, by considering the model indicators at table 19 of the regressed models consisting of advanced countries, it is evident that the test results support quantitative analysis of the tests. In other words this means that the "F-Test" statistics exceeds the critical values of 95% and 99% by far, which states that the model is statistically valid and suitable for all groups of countries. Furthermore, there is not only no multicollinearity issue present, but also no specification bias given that the RESET p-values are all above 0.05. In this context, the high "R^2" and adjusted "R^2" who range from 0.7025 to 0.7772 and 0.7025 to 0.7772, respectively, should be noted.

5.3.3 Comparison among Group of Countries

After the individual examination of the regression outputs without comparisons between the different observations groups, several key differences should be highlighted in this section. In order to highlight these differences, the outputs of the same observation periods should be compared in order to ensure the same time scale.

Table 20: Overview of Comparison between Observation Groups

Emerging Market / Developing Countries	Advanced Countries
1980 – 2015	**1980 – 2015**
1992 – 2015	**1992 – 2015**
2000 – 2015	**2000 – 2015**

Before identifying any major differences, it should be noted that the dataset of advanced countries is much smaller than the one with emerging market and developing countries. Furthermore,

due to the introduction of the currency EUR in the beginning of 2002 and its domination in this the group of advanced countries, the data set overall is prone to distortions.

Focusing on the longest observed period from 1980 to 2015, it is clear that the dummy variable behave differently between emerging market / developing countries and advanced countries. According to the insignificant variable on part of advanced countries, the result in this case is not statistically proven. Nevertheless, it is evident that countries which followed flexible exchange rate arrangements over the past 35 year developed on average better in terms of GDP rate than countries under fixed arrangements, especially emerging market / developing countries. Another implication of the test results based on the longest time period is the fact that the same two control variables, namely consumption expenditure and current account balance, are always highly significant at 99% level and show the largest impact on GDP growth. The last observation that can be made by comparing the outputs is the different influence of the CPI and population growth on the GDP growth rate. As the development of a country is positively affected by the changes in the CPI and negatively by population growth within emerging market and developing countries, it is the complete opposite in advanced countries. Despite the fact that these variables are not statistically significant within advanced countries, it is difficult to identify a clear tendency.

According to analyses with a shorter time scale from 1992 to 2015, all beta factors of the regression model are mostly constant in terms of prefixes, values and level of significance compared to the longest time period. One of the biggest differences is the fact that both dummy variables of each regression model are not at all significant. This means that there is no statistical evidence that the choice of an exchange rate arrangement has an influence on the GDP growth rate.

The analysis with the shortest period (2000 – 2015) again shows similar patterns. The dummy variable in the six-factor model of emerging market and developing countries shows again highly significance, which is effective in order to explain the linear relationship and therefore the impact on the development of a country.

With regard to the research question, "How do Exchange Rate Regimes influence Countries' Development and is a significant pattern detectable?", it can be concluded that statistical evidence shows that emerging market and developing countries act better under flexible exchange rate arrangements in terms of GDP growth rate than under fixed regimes. For advanced countries this is not consistent due to insignificant dummies and values around zero. In the latter case, it can be said that based on the collected data of advanced economies, throughout all observation periods, the choice of an exchange rate regime does not have a significant impact in the development of a country. Nevertheless, in some cases a weak correlation between the choice of an exchange rate regime and the development of a country is clear. The statistical

findings of the observation group consisting of advanced countries show that various variables were purely insignificant and consequently not allow such results to be interpreted in an effective manner. The dummy variables are particularly insignificant and the values highlight a weak influence on a countries development. These findings were surprising because the data analyses of the other observation group showed constant and better results.

One of the explanations of the unsatisfied findings of the group with advanced countries may be found in the limited members of countries and also due to the domination of the EUR as already previously addressed. The majority of the covered countries in this group adopted this currency within the observation period. At an early stage, the regime was classified as a hard peg and after reclassifications, the regime changed to free floating. Due to the high number of countries that changed their currency against EUR, this sort of reclassification has a major impact also in the statistics. Therefore, from a statistical point of view this sort of shift influences the interpretation of the statistics according to the EUR dominance. With this in mind, a model optimization is taken into account in the next chapter in order to identify clear patterns and correlations corresponding the exchange rate arrangements.

5.4 Model Optimization

As briefly mentioned in the previous chapter, as a result of unsatisfying test results of the observation group advanced countries, the author intends to optimize the model in order to evaluate the findings and to present more conclusive results. The outputs of the three regression models of advanced countries have shown that there are various insignificant factors, which have a minimal impact on the dependent variable. Furthermore, throughout the whole analyses, different variables with uneven data structure were identified. As every control variable was calculated on a per capita basis, beta four, which is the current account balance, has been in percent of the GDP. In order to guarantee identical variables with the same data structure, the affected variable must also be disregarded. With this in mind, the initial model will be reduced to a classical three-factor model. In other words, the two insignificant factors such as beta five and beta six, as well as the factor current account balance will be neglected for further studies, resulting in the following model structure:

$$\hat{y}_i = b_o + b_1 x_1 + b_2 x_2 + b_3 x_3$$

Where:

$\hat{y}_i$ = yearly changes in real GDP / capita growth

x_1 = dummy variable Exchange Rate Regime; 1 = fixed; 0 = flexible

x_2 = yearly changes in final consumption / capita growth

x_3 = yearly changes in gross capital formation / capital growth

Based on the restructured model, it is evident that that the structure of the betas are identical, which in turn means that all variables are calculated on a per capita basis. For the purpose of comparison, this might be more appropriate. Nevertheless, the most important factor refers still to beta one, which indicates again the dummy variable. The main goal of the model optimization is to therefore investigate the results taking the choice of an exchange rate regime into account, including it is association with the level of significance, by making the model statistically robust.

Table 21: Beta Factors / Indicators of Optimized Regression Model 1980 – 2015 (World Bank, 2017, own Gretl Analysis)

Advanced Countries 1980 - 2015	Coefficient	P-Value	
Constant	0.0063	0.0000	***
Dummy-Fixed	0.0028	0.3903	**
Consumption Expenditure	0.5730	0.0000	***
Gross Capital Formation	0.1265	0.0000	***

Observation Group	N	R^2	Adjusted R^2	F-Test	F-Test 95% Critical Value	F-Test 99% Critical Value	RESET P-Value	RESET min. P-Value	VIF
1980-2015	1067	0.6992	0.6984	376.8753	2.696	3.984	0.0000	0.05	< 10

Table 22: Beta Factors / Indicators of Optimized Regression Model 1992 – 2015 (World Bank, 2017, own Gretl Analysis)

Advanced Countries 1992 - 2015	Coefficient	P-Value	
Constant	0.0053	0.0000	***
Dummy-Fixed	0.0045	0.0013	***
Consumption Expenditure	0.5662	0.0000	***
Gross Capital Formation	0.1288	0.0000	***

Observation Group	N	R^2	Adjusted R^2	F-Test	F-Test 95% Critical Value	F-Test 99% Critical Value	RESET P-Value	RESET min. P-Value	VIF
1992-2015	766	0.7069	0.7058	323.8108	2.696	3.984	0.0020	0.05	< 10

By comparing the beta factors of the optimized three-factor model in table 21 and 22 with those of table 16 and 17, it is particularly evident that the beta values are much higher and therefore the dependencies are more detectable. The fact that all values achieve now reach at least at the 99% confidence level, apart from the dummy variable of the longest observation period at 95%, is even more significant. At first glance, it seems that the model optimization has fulfilled the purpose of identifying a linear relationship between the choice of an exchange rate arrangements and the macroeconomic performance not only by considering the changes in regimes over the past 35 years, but also by taking a shorter time period into account. In order to determine whether the data quality suffers from the adjustments, the corresponding statistical parameters should be considered.

Due to the implemented optimization it could be that the data quality deteriorates or enhances. Therefore, the results of the statistical indicators of the table 21 and 22 must be compared with the initial six-factor model on table 19. First of all, the coefficient of determination and the adjusted coefficient of determination of the optimized model are both slightly different. Due to the reduction of variables, it can be expected that the "R^{2}" and adjusted "R^{2}" will have smaller values. Nevertheless, they are still very high compared to the coefficients of determination of the other group of countries. It is, however, important that these high values are not overvalued because the correlation coefficient between the dependent and independent variables is quite strong. According to the conducted "F-test", the results at the 95 and 99 percent confidence level are reliable. The results are even better for the two groups of countries from 1980 – 2015 and 1992 – 2015, respectively. It can therefore be concluded that the model is appropriate and statistically still valid. The latter statement can also be made independently of the negative RESET test result of the optimized models, as the p-value with 0.0000 and 0.0020 in each case is considerably lower than the defined minimum p-value. Misspecification seems to be a problem, and can be explained by the conscious negligence of the three independent variables. Generally and statistically spoken, it must be stated that the optimized model containing values from advanced countries between 1992 - 2015 is the most reliable model of all groups with advanced countries. The argumentation is based on the highly significant coefficients of the model, which means that statistically, all variables have a significant influence on the dependent variable at the 99% confidence level. Furthermore, the conducted statistical test can mostly be accepted, which in turn means that the model can also be accepted as a whole. The dummy variable, which in this case expresses a value of 0.0045, shows a clear positive correlation between the arrangement and the development of the GDP. This result can be interpreted to mean that advanced countries grow faster under fixed exchange rates. This statement can therefore be statistically proven as long as the p-value is inferior to 0.01. Consequently, based on the conducted optimized analyses about advanced countries, it can be summarized that the choice of an exchange rate arrangement has a higher effect and impact on the GDP growth rate.

The last output of the optimized model addresses the results regarding the shortest time period from 2000 – 2015.

Table 23: Beta Factors Optimized Regression Model 2000 – 2015 (World Bank, 2017, own Gretl Analysis)

Advanced Countries 2000 - 2015	Coefficient	P-Value	
Constant	0.0039	0.0053	***
Dummy-Fixed	0.0015	0.5348	
Consumption Expenditure	0.6931	0.0000	***
Gross Capital Formation	0.1237	0.0000	***

Observation Group	N	R^2	Adjusted R^2	F-Test	F-Test 95% Critical Value	F-Test 99% Critical Value	RESET P-Value	RESET min. P-Value	VIF
2000-2015	532	0.6147	0.6125	264.1000	2.696	3.984	0.2230	0.05	< 10

Table 23 once again shows that the dummy variable is not significant and is therefore not useful in reaching a clear conclusion. Nevertheless, due to the positive dummy variable, the consistency in terms of the positive impact of fixed exchange rates arrangements on the GDP growth rate is still given. In comparison with the previous optimized models, the coefficient of the dummy in table 23 decreased considerably. This can be explained by the various reclassifications of the arrangements following the currency EUR, but the statistical parameter also looks reliable. To be more precise, the overall model is statistically valid and there is no specification bias given. The coefficient of determination with 61.47% and 61.25%, respectively, also express high variation of the dependent variables. These additional analyses could be used as evidence that the choice of an exchange rate arrangement within the last 15 years was irrelevant in terms of GDP growth for advanced countries. As previously mentioned, the issue with the adaption of the EUR may of course also influence the statistics.

5.5 Comparison of Statistical Findings with Empirical Studies

In this section of the thesis, the author intends to compare the results of the statistical analyses with the covered empirical studies. Based on the historical course of the development of fixed, intermediate and flexible exchange rate arrangements, there was a clear tendency towards more flexible exchange rate regimes, especially in emerging market and developing countries. The outbreak of various crises in the nineties was a possible trigger for this switch to less pegged arrangements as national banks became more flexible to intervene in the market.

In general, the results of the statistical analyses in this thesis confirm some trends and findings of the existing empirical studies. The consistency is given not only by focusing on emerging market and developing countries, but also by taking only the advanced countries into account, even if the latter analysis is less conclusive.

The results of the different regression analyses of emerging market and developing countries are consistent with the results of Levy-Yeyati and Sturzenegger (2003) and Edwards and Levy-Yeyati (2003) during their analysis of the dependency between the choice of an exchange rate arrangement and the macroeconomic performance of a country. Their results vary greatly depending on the stage of development of the countries. They found a clear correlation between the choice of an exchange rate arrangement and the development of a country does exist and this holds true for non-industrial countries. On the contrary, based on their analyses, monetary policy decisions of industrial nations are not essential for the success of the development. On their basis of research it can be stated that in developing countries, acting under more fixed exchange rate arrangements is connected with lower growth and higher output volatility (Levy-Yeyati & Sturzenegger, 2003, p. 1173). Compared to the results of the statistical analyses conducted in this master thesis, the findings are in accordance with the above scientific findings. This applies

not only to the group of countries with emerging market and developing countries, but also to the group of developed / advanced countries. The results of the regression analyses of emerging market and developing countries show a significant correlation between the choice of an exchange rate arrangement, either fixed or flexible, and the countries' performance for the observation period 1980 – 2015 and 2000 – 2015, respectively. There is evidence that a difference in economic growth of emerging market and developing countries between fixed and flexible exchange rate regimes does exist. It shows that countries under flexible regimes generate higher growth compared to rigid regimes. Furthermore, by considering the results of the regression analyses of advanced countries before the optimization, it is clear that a correlation does not exist and the impact of the choice of an arrangement is limited due to very low coefficients. The latter is also supported by Huang & Malhotra (2004), who focused on advanced European countries and found no correlation or possible influence of an arrangement. As the p-values of the independent variables do not fulfill the level of significance at all, and in combination with the low betas, there is evidence that the exchange rate arrangement does not impact the development of an advanced country.

As the results of the observation group covering advanced countries show that a clear tendency is difficult to derive due to insignificant dummy variables and very low coefficients. Therefore, the findings of Yagci (2001), which found that flexible exchange rate regimes are more important for advanced countries with a highly expanded financial sector, cannot be confirmed by the conducted regression analyses. Husain et al. (2001) also support the findings of Yagci with similar arguments, stating that industrialized countries are better off with flexible exchange rates due to openness in trade and capital markets. However, these also contradict the findings as shown in the conducted study, before applying the optimization approach.

Given that the results of the optimization lead to the conclusion that the dummy variables become significant with considerable changes in beta values, there is statistical evidence of a relationship between the exchange rate regime and macroeconomic performance. According to the significant values of the dummy coefficient, the impact on performance is mostly not particularly high. Nevertheless, these findings are consistent with the results of Ghosh and Ostry (2009), who believe that pegging a currency helps a country to evade overvaluation. Independent of this comparison, it is worth noting that the optimization measures may not be considered as conclusive due to simple negligence of variables.

6 Conclusion

According to the mentioned objectives and scientific issues explained in the introduction of the master thesis, the focus lies in particular on the choice of an exchange rate arrangement and the related consequences regards the macroeconomic development of emerging market / developing countries and advanced / developed countries. To be more precise, aside from the outlined research question which is defined as "How do Exchange Rate Regimes influence Countries' Development and is a significant pattern detectable?", three additional leading questions have formulated. In this section, all questions will be answered by analyzing the conducted empirical and descriptive analyses. The initial findings are based on the results discussed in the short conclusion of the first part and consequently supplemented with the findings from the statistical results.

(1) Which exchange rate regime has a significant impact on the countries' performance and is a correlation detectable?

According to the empirical analyses and the review of the current academic literature covered in the first part of the thesis, there is no clear answer to this question possible due to the fact that no uniform exchange rate arrangement fits for every country. Various factors and considerations must be taken into account in order to choose the right regime and this decision is also associated with the overall objectives of a country. Generally spoken, and with regard to previous academic works it can be concluded that a correlation between the exchange rate arrangement and the macroeconomic performance exists, but variation does occur and is dependent on the observation period and observation group. With this in mind, this question can be answered more precisely by taking the results of the statistical analyses into consideration. These findings deliver a more suitable answer and can be summarized as follows: First of all, the statistics have shown that the introduced dummy variable in the six-factor regression model disclose mostly significant coefficients. This means that the exchange rate regime has a significant impact on the nations' performance. But differences can be observed according to the group of observations and observation period. Further details can be derived from the next leading question. In addition to these results, a correlation between the two variables is given, even though the choice of an exchange rate arrangement has a weak influence due to low beta-factors.

(2) Can differences be observed between the two groups (advanced and emerging market / developing countries) regarding the choice of exchange rate regime?

The separation into two observation groups concerning the choice of exchange rate regimes seems appropriate, given that the empirical analysis often distinguishes in the same way. Generally, there are some obvious differences between the groups, in particular considering emerging market and developing countries. From a macroeconomic point of view, the best solution for

these countries could be to take an arrangement with less flexible exchange rates due to the stability issue and required consistency in order to grow. However, there is a general trend that countries with a higher degree of openness and global interconnectedness are moving towards more flexible exchange rates. The statistical analyses, applied in the second part of the master's thesis confirm previous conducted analyses. The regressed six-factor models show statistical evidence that countries under flexible exchange rate arrangements performed better compared to those with fixed arrangements, especially within the research periods of 1980 – 2015 and 2000 – 2015. In respect that countries with restricted stage of development are not included in the group of observation (see list of covered countries in the appendix 8.1 and 8.2), combined with the statistical robustness of the data quality, the results are reliable and statistically valid. During the whole analyses covering the emerging market and developing countries, the dummy variable was always negative which indicates that fixed arrangements has a negative impact on the macroeconomic performance, even if the influence is weak. The correlation can also be verified statistically, except the research period 1992 – 2015 expulse unexamined statistical correlation.

The same trend can also be seen, albeit to a lesser extent, by considering the group with advanced countries by just assessing previous scientific studies. Through and since the introduction of the Euro, which is linked to the countries' adjustment by pegging their domestic currency to the Euro, the allocation of the arrangements has been balanced between fix and floating. From a statistical perspective, a weak correlation between the choice of an arrangement and macroeconomic performance is only detectable within this group. It is worth noting that the model is still statistically valid, despite the fact that the coefficient of the dummy variable is insignificant within all observation periods. Due to the missing significance and very low coefficients, it can be summarized that the choice of an exchange rate regime only marginally affects the development of a country. It can therefore be concluded that the dummy variable in an individual review is not essential for the development of an advanced country.

As a further study and in order to analyze the data of advanced countries in more detail, an optimization of the model has been conducted. Insignificant variables have been neglected in order to determine the changes of the regression output. The dummy variable, which still indicates the exchange rate arrangement, has a consequent significant impact on GDP growth, with higher coefficients. Indeed, this means that the choice of a regime now has a statistically proven impact on the development, but again to a limited extent. Nevertheless, these optimizations must be critically analyzed due to simple modifications of the model and also according to missing comparative analysis.

(3) In the case of financial instabilities or economic crises, which exchange rate regime can better absorb financial instabilities?

In general, the vulnerability of an exchange rate regime to crises is highly discussed and the opinions on the topic also vary. Overall, academics and scientists generally agree that less flexible exchange rate arrangements are more prone to crises compared to floating regimes. A plausible explanation can be found in the theory of impossible trinity, as under fixed exchange rates, a country gives up their autonomous monetary policy and therefore they lose their flexibility in order to react to distress signals, shocks and similar situations. Nevertheless, different studies have also shown evidence that other regimes could be more appropriate in certain situations, but one of the most important points in this topic is the fact that every exchange rate regime reaches their limitations. The fact that a country falls into a crisis is based on multiple factors, but the regime alone cannot absorb every problem. The financial crisis that began in 2008 and resulted in the collapse of financial systems, independent of the set regime acts as one of the best supporting examples of the above claim.

Based on the answer of the leading questions, the hypothesis of the master's thesis can therefore be accepted, due to the identification of patterns in the correlation between the choice of an exchange rate arrangement and countries' performance. Despite the fact that the economic literature has controversial meanings of the right choice of an exchange rate arrangement, there is generally a slightly higher acceptance of more flexible exchange rate arrangements compared to fixed arrangements. These results can also be found by evaluating the conducted regression models, especially for emerging market and developing countries. Within this group, a positive correlation between the flexible exchange rate regimes and macroeconomic growth was identified. The analyses also showed that no or a very limited relationship between the choice of an arrangement and performance is present by considering advanced countries that do not take the optimized model into account. But these results are statistically not robust due to insignificant dummy variables, which lead to a limited interpretation of the findings. Generally, this means that the choice of an exchange rate arrangement has a different impact on performance, which is dependent on the nations' stage of development. It can therefore be concluded that more flexible arrangements boost the economy in emerging market and developed countries more effectively than other regimes.

6.1 Recommendations for Action

According to the findings in the master's thesis and the summarized results of the previous chapter, it is difficult to give a precise recommendation for one single country. The focus in this thesis was primarily the comparisons between different groups of countries, without taking specific countries individually into account. In particular, when a country decides whether to fix or

to float their currency, a solid analysis based on macro- and microeconomic thoughts must be taken into consideration. It can therefore be said that due to a variety of conditions (such as openness in capital and financial market, level of dependencies on foreign countries, import and export amongst others) and individual dynamics, opportunities and forces within each single country, it is difficult to make appropriate recommendations. Nevertheless, as the analyses have shown that emerging market and developing countries perform better under flexible arrangements, this might be an indication that flexible arrangements are a better option for these countries. However, the country-specific features and conditions do not give any further information about the proper time for choosing an exchange rate arrangement. In this context, the working paper of Frankel (1999) addresses the same issue, claiming that: "no single currency regime is right for all countries or at all times." This statement could summarize this debate in just one point. The past has shown that countries eventually reach a point, where they wish to follow another regime. Therefore, it may be proposed to consider the determination of an exchange rate regime as an ongoing process in order to ensure a sustainable development with special considerations to the prevailing conditions.

6.2 Criticism & further Research

The identification of the relevant countries of each observation group was simple and transparent as the IMF provides the corresponding information, whereas the data collection has proved more problematic. Numerous emerging market and developing countries did not report relevant data, which leads to various gaps in the data set. More precisely, neither the extraction of the dependent variable, real GDP, nor the identification of the yearly-defined exchange rate arrangement of the countries provided any problems. On the contrary, different values of control variables were incomplete and could not be used for the conducted statistical analyses. Consequently, countries without satisfactory data quality were neglected and eliminated in order to avoid distortions in the results. This type of phenomena describes a typical sample bias in this context, namely the survivorship bias. By considering quantitative analyses, this sort of bias is common due to the tendency to exclude missing values consciously and in the context of this study, countries without limited data has been neglected. In this case, a survivorship bias may distort statistical results as failures are ignored and results may lead to wrong conclusions and opinions. Furthermore, the survivorship bias is closely linked to the selection bias. The second bias describes the selection of groups (in this case observation groups), data or time scale (in this case observation period) in order to conduct an analysis by violating the randomization issue. This leads to the conclusion that the sample is not representative of the population and that the statistical results of the study might not be fully reliable and precise.

Generally, the topic is considered highly complex due to the variety of sources and studies on exchange rate arrangements and the corresponding correlation to the macroeconomic development. It is therefore necessary to do further research in this field of science, especially in the classification of the different exchange rate arrangements. In this master's thesis, the soft pegs (intermediate regimes) were allocated to fixed arrangements. In further work, the fact that various countries have chosen to follow hybrid arrangement could be problematic. The dummy variable must be extended in order to assess the influence of such soft pegs on the development of a country.

Additionally, the decision to group countries according to their stage of development is appropriate. But given that the group size of emerging market and developing countries is quite large, subcategories containing similar countries which perform in similar macro- and microeconomic circumstances could be defined. This would enhance the comparisons as well as the explanatory power of the results.

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8 Appendix

8.1 Selection of Emerging Market and Developing Countries

8.1.1 List of Analysed Countries between 1980 - 2015

Table 24: List of Emerging Market and Developing Countries 1980 – 2015 (IMF, 2017, own Table)

Observation Period 1980 - 2015	
selected (65)	**eliminated (86)**
Algeria	Afghanistan
Argentina	Albania
Bangladesh	Angola
Belize	Antigua and Barbuda
Benin	Armenia
Bolivia	Azerbaijan
Botswana	The Bahamas
Brazil	Bahrain
Burundi	Barbados
Cameroon	Belarus
Chile	Bhutan
China	Bosnia and Herzegovina
Colombia	Brunei Darussalam
Comoros	Bulgaria
Republic of Congo	Burkina Faso
Dominican Republic	Cabo Verde
Ecuador	Cambodia
Egypt	Central African Republic
El Salvador	Chad
Gabon	Costa Rica
The Gambia	Côte d'Ivoire
Ghana	Croatia
Guatemala	Djibouti
Guinea-Bissau	Dominica
Guyana	Equatorial Guinea
Honduras	Eritrea
India	Ethiopia
Indonesia	Fiji
Islamic Republic of Iran	Georgia
Jamaica	Grenada
Jordan	Guinea
Kenya	Haiti
Madagascar	Hungary
Malawi	Iraq

Malaysia	Kazakhstan
Mali	Kiribati
Mauritania	Kosovo
Mauritius	Kuwait
Mexico	Kyrgyz Republic
Morocco	Lao P.D.R.
Nepal	Lebanon
Nicaragua	Lesotho
Niger	Liberia
Nigeria	Libya
Pakistan	FYR Macedonia
Panama	Maldives
Peru	Marshall Islands
Philippines	Micronesia
Rwanda	Moldova
Saudi Arabia	Mongolia
Senegal	Montenegro
Seychelles	Mozambique
Sierra Leone	Myanmar
South Africa	Namibia
Sri Lanka	Oman
Sudan	Palau
Swaziland	Papua New Guinea
Thailand	Paraguay
Togo	Poland
Tonga	Qatar
Tunisia	Romania
Turkey	Russia
Uganda	Samoa
Uruguay	São Tomé and Príncipe
Venezuela	Serbia
	Solomon Islands
	South Sudan
	St. Kitts and Nevis
	St. Lucia
	St. Vincent and the Grenadines
	Suriname
	Syria
	Tajikistan
	Tanzania
	Timor-Leste
	Trinidad and Tobago
	Turkmenistan

	Tuvalu
	Ukraine
	United Arab Emirates
	Uzbekistan
	Vanuatu
	Vietnam
	Yemen
	Zambia
	Zimbabwe

8.1.2 List of Analysed Countries between 1992 - 2015

Table 25: List of Emerging Market and Developing Countries 1992 – 2015 (IMF, 2017, own Table)

Observation Period 1992 - 2015	
selected (91)	**eliminated (60)**
Albania	Afghanistan
Algeria	Antigua and Barbuda
Angola	The Bahamas
Argentina	Bahrain
Armenia	Barbados
Azerbaijan	Bosnia and Herzegovina
Bangladesh	Brunei Darussalam
Belarus	Cabo Verde
Belize	Cambodia
Benin	Central African Republic
Bhutan	Chad
Bolivia	Costa Rica
Botswana	Côte d'Ivoire
Brazil	Croatia
Bulgaria	Djibouti
Burkina Faso	Dominica
Burundi	Eritrea
Cameroon	Ethiopia
Chile	Fiji
China	Grenada
Colombia	Haiti
Comoros	Islamic Republic of Iran
Republic of Congo	Iraq
Dominican Republic	Kiribati
Ecuador	Kosovo
Egypt	Kuwait
El Salvador	Lao P.D.R.

Equatorial Guinea	Lesotho
Gabon	Liberia
The Gambia	Libya
Georgia	Maldives
Ghana	Marshall Islands
Guatemala	Micronesia
Guinea	Moldova
Guinea-Bissau	Montenegro
Guyana	Mozambique
Honduras	Myanmar
Hungary	Namibia
India	Oman
Indonesia	Palau
Jamaica	Papua New Guinea
Jordan	Qatar
Kazakhstan	Samoa
Kenya	São Tomé and Príncipe
Kyrgyz Republic	Serbia
Lebanon	Solomon Islands
FYR Macedonia	South Sudan
Madagascar	St. Kitts and Nevis
Malawi	St. Lucia
Malaysia	St. Vincent and the Grenadines
Mali	Syria
Mauritania	Timor-Leste
Mauritius	Trinidad and Tobago
Mexico	Turkmenistan
Mongolia	Tuvalu
Morocco	United Arab Emirates
Nepal	Uzbekistan
Nicaragua	Yemen
Niger	Zambia
Nigeria	Zimbabwe
Pakistan	
Panama	
Paraguay	
Peru	
Philippines	
Poland	
Romania	
Russia	
Rwanda	
Saudi Arabia	

Senegal	
Seychelles	
Sierra Leone	
South Africa	
Sri Lanka	
Sudan	
Suriname	
Swaziland	
Tajikistan	
Tanzania	
Thailand	
Togo	
Tonga	
Tunisia	
Turkey	
Uganda	
Ukraine	
Uruguay	
Vanuatu	
Venezuela	
Vietnam	

8.1.3 List of Analysed Countries between 2002 - 2015

Table 26: List of Emerging Market and Developing Countries 2002 – 2015 (IMF, 2017, own Table)

Observation Period 2002 - 2015	
selected (115)	**eliminated (36)**
Albania	Afghanistan
Algeria	The Bahamas
Angola	Bahrain
Antigua and Barbuda	Barbados
Argentina	Brunei Darussalam
Armenia	Central African Republic
Azerbaijan	Chad
Bangladesh	Costa Rica
Belarus	Djibouti
Belize	Equatorial Guinea
Benin	Eritrea
Bhutan	Ethiopia
Bolivia	Iraq
Bosnia and Herzegovina	Kiribati
Botswana	Kosovo

Brazil	Lao P.D.R.
Bulgaria	Lesotho
Burkina Faso	Libya
Burundi	Maldives
Cabo Verde	Marshall Islands
Cambodia	Micronesia
Cameroon	Myanmar
Chile	Palau
China	Papua New Guinea
Colombia	Samoa
Comoros	São Tomé and Príncipe
Republic of Congo	Solomon Islands
Côte d'Ivoire	South Sudan
Croatia	Syria
Dominica	Timor-Leste
Dominican Republic	Turkmenistan
Ecuador	Tuvalu
Egypt	United Arab Emirates
El Salvador	Uzbekistan
Fiji	Yemen
Gabon	Zambia
The Gambia	
Georgia	
Ghana	
Grenada	
Guatemala	
Guinea	
Guinea-Bissau	
Guyana	
Haiti	
Honduras	
Hungary	
India	
Indonesia	
Islamic Republic of Iran	
Jamaica	
Jordan	
Kazakhstan	
Kenya	
Kuwait	
Kyrgyz Republic	
Lebanon	
Liberia	

FYR Macedonia
Madagascar
Malawi
Malaysia
Mali
Mauritania
Mauritius
Mexico
Moldova
Mongolia
Montenegro
Morocco
Mozambique
Namibia
Nepal
Nicaragua
Niger
Nigeria
Oman
Pakistan
Panama
Paraguay
Peru
Philippines
Poland
Qatar
Romania
Russia
Rwanda
Saudi Arabia
Senegal
Serbia
Seychelles
Sierra Leone
South Africa
Sri Lanka
St. Kitts and Nevis
St. Lucia
St. Vincent and the Grenadines
Sudan
Suriname
Swaziland
Tajikistan

Tanzania	
Thailand	
Togo	
Tonga	
Trinidad and Tobago	
Tunisia	
Turkey	
Uganda	
Ukraine	
Uruguay	
Vanuatu	
Venezuela	
Vietnam	
Zimbabwe	

8.2 Selection of Advanced Countries

8.2.1 List of Analysed Countries between 1980 – 2015 and 1992 - 2015

Table 27: List of Advanced Countries 1980 – 2015 and 1992 – 2015 (IMF, 2017, own Table)

Observation Period 1980 – 2015 and 1992 - 2015	
selected (34)	**eliminated (4)**
Australia	Macao SAR, China
Austria	Malta
Belgium	Puerto Rico
Canada	San Marino
Cyprus	
Czech Republic	
Denmark	
Estonia	
Finland	
France	
Germany	
Greece	
Hong Kong SAR, China	
Iceland	
Ireland	
Israel	
Italy	
Japan	
Korea, Rep.	
Latvia	

Lithuania	
Luxembourg	
Netherlands	
New Zealand	
Norway	
Portugal	
Singapore	
Slovak Republic	
Slovenia	
Spain	
Sweden	
Switzerland	
United Kingdom	
United States	

8.2.2 List of Analysed Countries between 2000 - 2015

Table 28: List of Advanced Countries 2000 – 2015 (IMF, 2017, own Table)

Observation Period 2000 - 2015	
selected (36)	**eliminated (2)**
Australia	Macao SAR, China
Austria	Malta
Belgium	
Canada	
Cyprus	
Czech Republic	
Denmark	
Estonia	
Finland	
France	
Germany	
Greece	
Hong Kong SAR, China	
Iceland	
Ireland	
Israel	
Italy	
Japan	
Korea, Rep.	
Latvia	
Lithuania	
Luxembourg	

Netherlands	
New Zealand	
Norway	
Portugal	
Puerto Rico	
San Marino	
Singapore	
Slovak Republic	
Slovenia	
Spain	
Sweden	
Switzerland	
United Kingdom	
United States	

8.3 Correlation Matrix among Different Group of Countries

8.3.1 Emerging Market and Developing Countries 1980-2015

Table 29: Correlation Matrix Emerging Market and Developing Countries 1980 -2015 (World Bank, 2017, own SPSS Output)

Correlation Matrix (Pearson)		real GDP/capita growth	Consumption expenditure / capita growth	Gross capital formation / capita growth	Gross savings / capita growth	Current Account Balance (% GDP)	Inflation	CPI	Unemploy-ment	Population Growth
real GDP/capita growth	Correlation	1	.546**	.199**	0.041	-.075**	-.052*	.057*	-0.042	-.160**
	Significance		0.000	0.000	0.064	0.001	0.015	0.011	0.138	0.000
	N	2270	2234	2240	2078	2168	2181	1991	1231	2270
Consumption expenditure	Correlation	.546**	1	.164**	-0.032	-.227**	-0.007	0.002	-0.039	-.148**
	Significance	0.000		0.000	0.150	0.000	0.752	0.926	0.173	0.000
	N	2234	2234	2223	2064	2137	2145	1958	1214	2234
Gross capital formation /	Correlation	.199**	.164**	1	.049*	-.143**	-0.007	0.014	0.016	0.013
	Significance	0.000			0.024	0.000	0.758	0.535	0.584	0.530
	N	2240	2223	2240	2078	2144	2156	1968	1215	2240
Gross savings / capita	Correlation	0.041	-0.032	.049*	1	-0.008	0.000	0.038	-0.012	0.002
	Significance	0.064	0.150	0.024		0.728	0.987	0.101	0.680	0.935
	N	2078	2064	2078	2078	2073	2012	1828	1147	2078
Current Account Balance (%	Correlation	-.075**	-.227**	-.143**	-0.008	1	0.006	-0.036	-.072*	-0.010
	Significance	0.001	0.000	0.000	0.728		0.789	0.112	0.014	0.636
	N	2168	2137	2144	2073	2168	2094	1904	1177	2168
Inflation	Correlation	-.052*	-0.007	-0.007	0.000	0.006	1	-0.016	-.085**	0.002
	Significance	0.015	0.752	0.758	0.987	0.789		0.485	0.003	0.925
	N	2181	2145	2156	2012	2094	2181	1980	1223	2181
CPI	Correlation	.057*	0.002	0.014	0.038	-0.036	-0.016	1	-.085**	-.066**
	Significance	0.011	0.926	0.535	0.101	0.112	0.485		0.004	0.003
	N	1991	1958	1968	1828	1904	1980	1991	1142	1991
Unemploy-ment	Correlation	-0.042	-0.039	0.016	-0.012	-.072*	-.085**	-.085**	1	.096**
	Significance	0.138	0.173	0.584	0.680	0.014	0.003	0.004		0.001
	N	1231	1214	1215	1147	1177	1223	1142	1232	1231
Population Growth	Correlation	-.160**	-.148**	0.013	0.002	-0.010	0.002	-.066**	.096**	1
	Significance	0.000	0.000	0.530	0.935	0.636	0.925	0.003	0.001	
	N	2270	2234	2240	2078	2168	2181	1991	1231	2270

**. Correlation is significant at the level of 0.01

*. Correlation is significant at the level of 0.05

8.3.2 Emerging Market and Developing Countries 1992-2015

Table 30: Correlation Matrix Emerging Market and Developing Countries 1992 -2015 (World Bank, 2017, own SPSS Output)

Correlation Matrix (Pearson)		real GDP/capita growth	Consumption expenditure / capita growth	Gross capital formation / capita growth	Gross savings / capita growth	Current Account Balance (% GDP)	Inflation	CPI	Unemploy-ment	Population Growth
real GDP/capita growth	Correlation	1	.406**	.091**	.089**	.187**	-0.01939662	0.01639561	-0.053	-.071**
	Significance		0.000	0.000	0.000	0.000	0.383	0.488	0.118	0.001
	N	2088	2063	2064	1829	1927	2027	1793	865	2086
Consumption expenditure	Correlation	.406**	1	0.030482615	-.091**	-.252**	-.085**	-0.015	.091**	-0.04112901
	Significance	0.000		0.167	0.000	0.000	0.000	0.532	0.007	0.062
	N	2063	2066	2053	1826	1910	2010	1784	860	2064
Gross capital formation /	Correlation	.091**	0.030482615	1	.080**	-.050*	0.020	.081**	0.053	-.045*
	Significance	0.000	0.16738714		0.001	0.030	0.382	0.001	0.121	0.039
	N	2064	2053	2068	1832	1911	2007	1783	859	2066
Gross savings / capita	Correlation	.089**	-.091**	.080**	1	.148**	0.024	0.014	.092*	-0.002
	Significance	0.000	0.000	0.001		0.000	0.316	0.566	0.011	0.933
	N	1829	1826	1832	1832	1794	1805	1614	777	1830
Current Account Balance (%	Correlation	.187**	-.252**	-.050*	.148**	1	.133**	-0.036	-0.06069786	-0.006
	Significance	0.000	0.000	0.030	0.000		0.000	0.139	0.084	0.783
	N	1927	1910	1911	1794	1931	1898	1676	812	1929
Inflation	Correlation	-0.019396618	-.085**	0.020	0.024	.133**	1	-0.003	-0.02126898	0.008
	Significance	0.383	0.000	0.382	0.316	0.000		0.886	0.535	0.704
	N	2027	2010	2007	1805	1898	2032	1786	855	2030
CPI	Correlation	0.016395613	-0.015	.081**	0.014	-0.036	-0.003	1	-0.03467121	-0.01716601
	Significance	0.488	0.532	0.001	0.566	0.139	0.886		0.341	0.467
	N	1793	1784	1783	1614	1676	1786	1798	755	1796
Unemploy-ment	Correlation	-0.053	.091**	0.053	.092*	-0.060697862	-0.02126898	-0.03467121	1	-0.0279655
	Significance	0.118	0.007	0.121	0.011	0.084	0.535	0.341		0.411
	N	865	860	859	777	812	855	755	868	867
Population Growth	Correlation	-.071**	-0.041129007	-.045*	-0.002	-0.006	0.008	-0.01716601	-0.0279655	1
	Significance	0.001	0.062	0.039	0.933	0.783	0.704	0.467	0.411	
	N	2086	2064	2066	1830	1929	2030	1796	867	2091

**. Correlation is significant at the level of 0.01
*. Correlation is significant at the level of 0.05

8.3.3 Emerging Market and Developing Countries 2002-2015

Table 31: Correlation Matrix Emerging Market and Developing Countries 2002 -2015 (World Bank, 2017, own SPSS Output)

Correlation Matrix (Pearson)		real GDP/capita growth	Consumption expenditure / capita growth	Gross capital formation / capita growth	Gross savings / capita growth	Current Account Balance (% GDP)	Inflation	CPI	Unemploy-ment	Population Growth
real GDP/capita growth	Correlation	1	.839**	.189**	.298**	.124**	0.00958336	-.281**	.252**	-.135**
	Significance		0.000	0.000	0.000	0.000	0.695	0.000	0.000	0.000
	N	1716	1674	1689	1443	1604	1678	1605	959	1705
Consumption expenditure	Correlation	.739**	1	.251**	.233**	.068**	-0.004	-.289**	.314**	-.080**
	Significance	0.000		0.000	0.000	0.007	0.876	0.000	0.000	0.001
	N	1674	1676	1674	1432	1566	1644	1574	933	1666
Gross capital formation /	Correlation	.189**	.251**	1	.297**	-.099**	.128**	-0.044	.202**	0.030
	Significance	0.000	1.46804E-25		0.000	0.000	0.000	0.083	0.000	0.220
	N	1689	1674	1691	1445	1581	1653	1582	944	1681
Gross savings / capita	Correlation	.298**	.233**	.297**	1	.261**	-0.011	-.062*	.200**	0.018
	Significance	0.000	0.000	0.000		0.000	0.679	0.023	0.000	0.486
	N	1443	1432	1445	1445	1444	1420	1356	825	1438
Current Account Balance (%	Correlation	.124**	.068**	-.099**	.261**	1	-0.009	-.107**	0.02980985	-0.016
	Significance	0.000	0.007	0.000	0.000		0.713	0.000	0.374	0.511
	N	1604	1566	1581	1444	1606	1573	1499	891	1596
Inflation	Correlation	0.00958336	-0.004	.128**	-0.011	-0.009	1	.214**	-0.01304571	-0.002
	Significance	0.695	0.876	0.000	0.679	0.713		0.000	0.691	0.924
	N	1678	1644	1653	1420	1573	1680	1585	931	1669
CPI	Correlation	-.281**	-.289**	-0.044	-.062*	-.107**	.214**	1	-.128**	-0.00010433
	Significance	0.000	0.000	0.083	0.023	0.000	0.000		0.000	0.997
	N	1605	1574	1582	1356	1499	1585	1607	889	1596
Unemploy-ment	Correlation	.252**	.314**	.202**	.200**	0.029809847	-0.01304571	-.128**	1	0.01386155
	Significance	0.000	0.000	0.000	0.000	0.374	0.691	0.000		0.669
	N	959	933	944	825	891	931	889	960	952
Population Growth	Correlation	-.135**	-.080**	0.030	0.018	-0.016	-0.002	-0.00010433	0.01386155	1
	Significance	0.000	0.001	0.220	0.486	0.511	0.924	0.997	0.669	
	N	1705	1666	1681	1438	1596	1669	1596	952	1707

**. Correlation is significant at the level of 0.01

*. Correlation is significant at the level of 0.05

8.3.4 Advanced Countries 1980-2015

Table 32: Correlation Matrix Advanced Countries 1980 -2015 (World Bank, 2017, own SPSS Output)

Correlation Matrix (Pearson)		real GDP/capita growth	Consumption expenditure / capita growth	Gross capital formation / capita growth	Gross savings / capita growth	Current Account Balance (% GDP)	Inflation	CPI	Unemploy-ment	Population Growth
real GDP/capita growth	Correlation	1	.764**	.724**	.468**	-.249**	-0.01162383	0.01291568	-.614**	-.093**
	Significance		0.000	0.000	0.000	0.000	0.702	0.670	0.000	0.002
	N	1122	1069	1069	911	961	1086	1093	744	1115
Consumption expenditure	Correlation	.764**	1	.593**	.303**	-.445**	-0.018	0.039	-.583**	-.099**
	Significance	0.000		0.000	0.000	0.000	0.566	0.202	0.000	0.001
	N	1069	1069	1067	895	921	1039	1044	732	1065
Gross capital formation /	Correlation	.724**	.593**	1	.429**	-.549**	-0.021	0.015	-.587**	-.081**
	Significance	0.000	2.6403E-102		0.000	0.000	0.499	0.629	0.000	0.008
	N	1069	1067	1069	895	921	1038	1044	733	1065
Gross savings / capita	Correlation	.468**	.303**	.429**	1	.174**	0.015	0.050	-.289**	-0.022
	Significance	0.000	0.000	0.000		0.000	0.650	0.139	0.000	0.518
	N	911	895	895	911	908	888	891	648	908
Current Account Balance (%	Correlation	-.249**	-.445**	-.549**	.174**	1	0.004	-0.018	.422**	-0.026
	Significance	0.000	0.000	0.000	0.000		0.909	0.578	0.000	0.423
	N	961	921	921	908	961	934	938	676	957
Inflation	Correlation	-0.011623833	-0.018	-0.021	0.015	0.004	1	-.108**	-0.02767043	0.056
	Significance	0.702	0.566	0.499	0.650	0.909		0.000	0.454	0.064
	N	1086	1039	1038	888	934	1086	1084	734	1080
CPI	Correlation	0.012915685	0.039	0.015	0.050	-0.018	-.108**	1	0.04914716	-0.04156215
	Significance	0.670	0.202	0.629	0.139	0.578	0.000		0.182	0.171
	N	1093	1044	1044	891	938	1084	1093	738	1087
Unemploy-ment	Correlation	-.614**	-.583**	-.587**	-.289**	.422**	-0.02767043	0.04914716	1	-0.02582482
	Significance	0.000	0.000	0.000	0.000	0.000	0.454	0.182		0.482
	N	744	732	733	648	676	734	738	744	742
Population Growth	Correlation	-.093**	-.099**	-.081**	-0.022	-0.026	0.056	-0.04156215	-0.02582482	1
	Significance	0.002	0.001	0.008	0.518	0.423	0.064	0.171	0.482	
	N	1115	1065	1065	908	957	1080	1087	742	1115

**. Correlation is significant at the level of 0.01

*. Correlation is significant at the level of 0.05

8.3.5 Advanced Countries 1992-2015

Table 33: Correlation Matrix Advanced Countries 1992 -2015 (World Bank, 2017, own SPSS Output)

Correlation Matrix (Pearson)		real GDP/capita growth	Consumption expenditure / capita growth	Gross capital formation / capita growth	Gross savings / capita growth	Current Account Balance (% GDP)	Inflation	CPI	Unemploy-ment	Population Growth
real	Correlation	1	.769**	.737**	.470**	-.287**	0.02814694	.088*	-.613**	-.145**
GDP/capita	Significance		0.000	0.000	0.000	0.000	0.435	0.014	0.000	0.000
growth	N	781	768	768	688	718	773	777	716	778
Consumptio	Correlation	.769**	1	.617**	.266**	-.480**	0.003	.093*	-.591**	-.148**
n	Significance	0.000		0.000	0.000	0.000	0.935	0.010	0.000	0.000
expenditure	N	768	768	766	683	709	762	764	705	765
Gross	Correlation	.737**	.617**	1	.416**	-.565**	.074*	.096**	-.585**	-.094**
capital	Significance	0.000	1.83973E-81		0.000	0.000	0.041	0.008	0.000	0.009
formation /	N	768	766	768	683	709	761	764	706	765
Gross	Correlation	.470**	.266**	.416**	1	.168**	.093*	.138**	-.275**	-0.051
savings /	Significance	0.000	0.000	0.000		0.000	0.015	0.000	0.000	0.186
capita	N	688	683	683	688	686	684	685	628	685
Current	Correlation	-.287**	-.480**	-.565**	.168**	1	-0.035	-0.051	.430**	-0.035
Account	Significance	0.000	0.000	0.000	0.000		0.346	0.177	0.000	0.354
Balance (%	N	718	709	709	686	718	712	714	656	715
Inflation	Correlation	0.028146937	0.003	.074*	.093*	-0.035	1	-.151**	-0.02137152	.178**
	Significance	0.435	0.935	0.041	0.015	0.346		0.000	0.570	0.000
	N	773	762	761	684	712	773	771	709	770
CPI	Correlation	.088*	.093*	.096**	.138**	-0.051	-.151**	1	0.05544868	-.104**
	Significance	0.014	0.010	0.008	0.000	0.177	0.000		0.139	0.004
	N	777	764	764	685	714	771	777	712	774
Unemploy-	Correlation	-.613**	-.591**	-.585**	-.275**	.430**	-0.02137152	0.05544868	1	-0.01887665
ment	Significance	0.000	0.000	0.000	0.000	0.000	0.570	0.139		0.615
	N	716	705	706	628	656	709	712	716	714
Population	Correlation	-.145**	-.148**	-.094**	-0.051	-0.035	.178**	-.104**	-0.01887665	1
Growth	Significance	0.000	0.000	0.009	0.186	0.354	0.000	0.004	0.615	
	N	778	765	765	685	715	770	774	714	778

**. Correlation is significant at the level of 0.01

*. Correlation is significant at the level of 0.05

8.3.6 Advanced Countries 2002-2015

Table 34: Correlation Matrix Advanced Countries 2002 -2015 (World Bank, 2017, own SPSS Output)

Correlation Matrix (Pearson)		real GDP/capita growth	Consumption expenditure / capita growth	Gross capital formation / capita growth	Gross savings / capita growth	Current Account Balance (% GDP)	Inflation	CPI	Unemploy-ment	Population Growth
real GDP/capita growth	Correlation	1	.724**	.669**	.540**	-.161**	.369**	0.06231438	-.635**	-0.08177166
	Significance		0.000	0.000	0.000	0.000	0.000	0.150	0.000	0.059
	N	538	534	534	520	527	536	536	480	536
Consumption expenditure	Correlation	.724**	1	.589**	.314**	-.398**	.259**	.094*	-.674**	-.118**
	Significance	0.000		0.000	0.000	0.000	0.000	0.031	0.000	0.007
	N	534	534	532	518	523	533	532	478	532
Gross capital formation /	Correlation	.669**	.589**	1	.447**	-.563**	.370**	0.056	-.569**	-0.006
	Significance	0.000	4.76675E-51		0.000	0.000	0.000	0.199	0.000	0.890
	N	534	532	534	518	523	532	532	479	532
Gross savings / capita	Correlation	.540**	.314**	.447**	1	.200**	.169**	.170**	-.331**	-0.038
	Significance	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.389
	N	520	518	518	520	518	518	518	465	518
Current Account Balance (%	Correlation	-.161**	-.398**	-.563**	.200**	1	-.270**	-0.044	.393**	-.090*
	Significance	0.000	0.000	0.000	0.000		0.000	0.318	0.000	0.040
	N	527	523	523	518	527	525	525	470	525
Inflation	Correlation	.369**	.259**	.370**	.169**	-.270**	1	.442**	-.406**	0.069
	Significance	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.112
	N	536	533	532	518	525	536	534	478	534
CPI	Correlation	0.062314377	.094*	0.056	.170**	-0.044	.442**	1	-0.08902102	0.0822201
	Significance	0.150	0.031	0.199	0.000	0.318	0.000		0.052	0.058
	N	536	532	532	518	525	534	536	478	534
Unemploy-ment	Correlation	-.635**	-.674**	-.569**	-.331**	.393**	-.406**	-0.08902102	1	0.0083679
	Significance	0.000	0.000	0.000	0.000	0.000	0.000	0.052		0.855
	N	480	478	479	465	470	478	478	480	479
Population Growth	Correlation	-0.081771663	-.118**	-0.006	-0.038	-.090*	0.069	0.0822201	0.0083679	1
	Significance	0.059	0.007	0.890	0.389	0.040	0.112	0.058	0.855	
	N	536	532	532	518	525	534	534	479	536

**. Correlation is significant at the level of 0.01

*. Correlation is significant at the level of 0.05

8.4 Linearity Test

8.4.1 Gross Savings

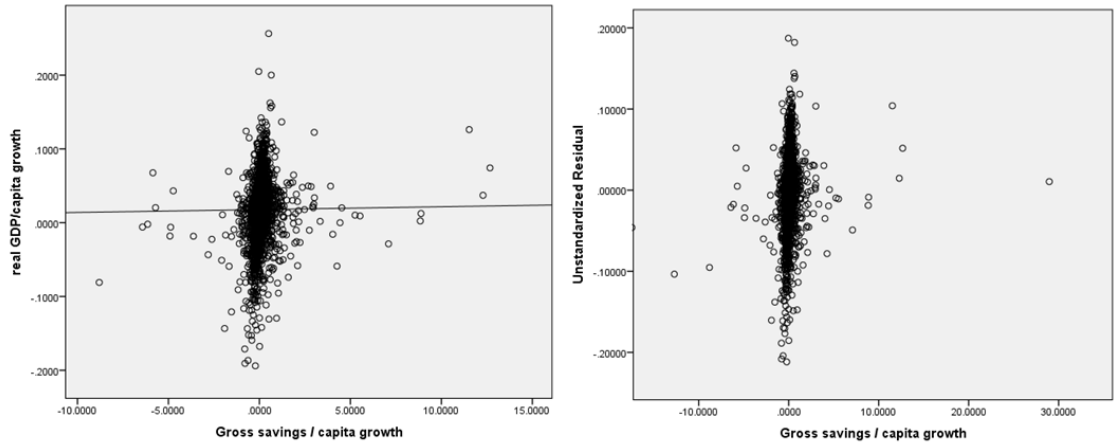

Figure 18: Graphical Linearity Test – Gross Savings (World Bank, 2017, own SPSS Analysis)

8.4.2 Inflation

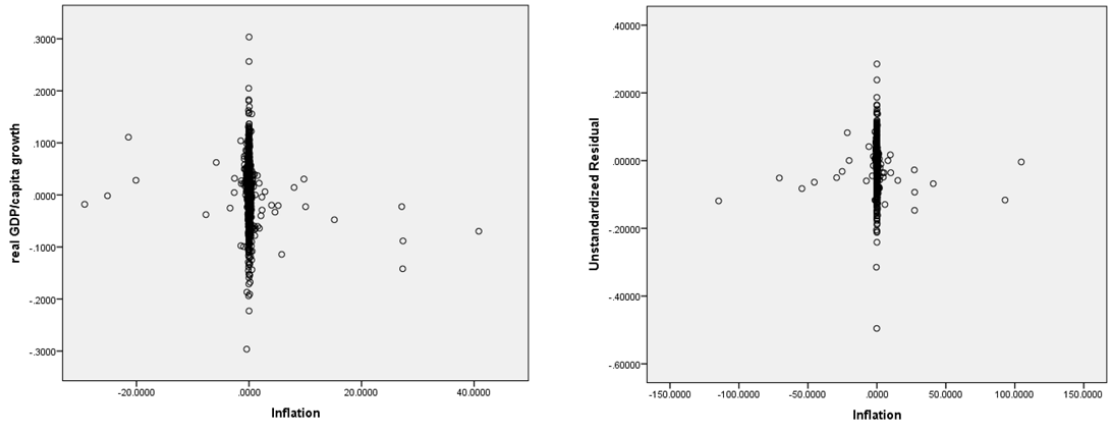

Figure 19: Graphical Linearity Test – Inflation (World Bank, 2017, own SPSS Analysis)

8.4.3 Unemployment

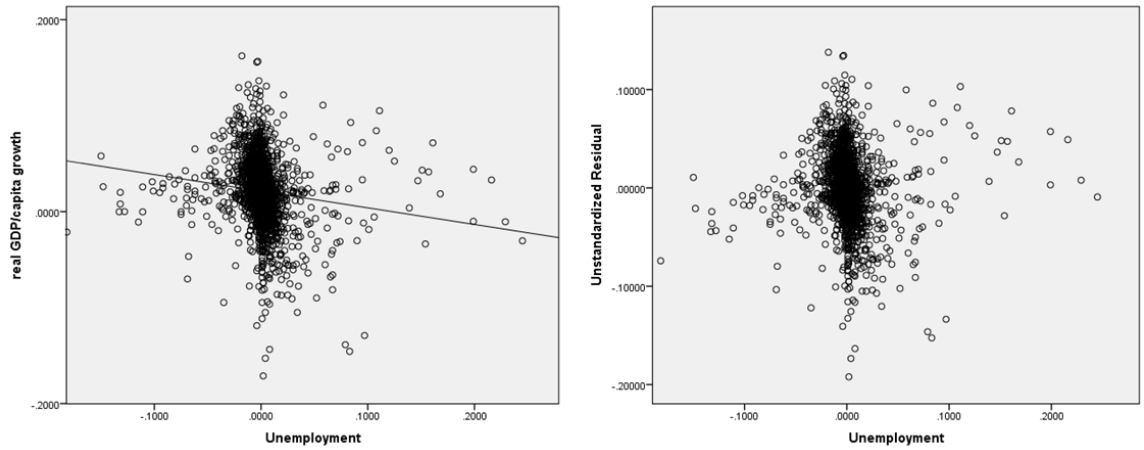

Figure 20: Graphical Linearity Test – Unemployment (World Bank, 2017, own SPSS Analysis)

8.5 Statistical Outputs of Regression Models

8.5.1 Emerging Market and Developing Countries

```
Modell 1: KQ, benutze die Beobachtungen 1-2334 (n = 1873)
Fehlende oder unvollständige Beobachtungen entfernt: 461
Abhängige Variable: realGDPcapitagrowth

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const                0.0145933   0.00201013      7.260    5.66e-013 ***
  DExchangeRateR~_1   -0.00367549  0.00160262     -2.293    0.0219    **
  Consumptionexpen~    0.346685    0.0138362     25.06     1.12e-119 ***
  Grosscapitalform~    0.0518625   0.00310443    16.71     1.70e-058 ***
  CurrentAccountBa~    0.115579    0.0162240      7.124    1.49e-012 ***
  CPI                  0.0419318   0.0103492      4.052    5.29e-05  ***
  PopulationGrowth    -0.330538    0.0760327     -4.347    1.45e-05  ***

Mittel d. abh. Var.     0.016904   Stdabw. d. abh. Var.     0.043129
Summe d. quad. Res.     2.163329   Stdfehler d. Regress.    0.034049
R-Quadrat               0.378736   Korrigiertes R-Quadrat   0.376738
F(6, 1866)              189.5920   P-Wert(F)                8.4e-189
Log-Likelihood          3676.485   Akaike-Kriterium        -7338.970
Schwarz-Kriterium      -7300.223   Hannan-Quinn-Kriterium  -7324.695

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 1864) = 64.59
  mit p-Wert = P(F(2, 1864) > 64.59) = 7.55484e-028

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 900.253
  mit p-Wert = P(Chi-Quadrat(26) > 900.253) = 4.82977e-173
```

Figure 21: Output Six Factor Model Developing Countries 1980 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 1: KQ, benutze die Beobachtungen 1-2334 (n = 1873)
Fehlende oder unvollständige Beobachtungen entfernt: 461
Abhängige Variable: realGDPcapitagrowth
Heteroskedastizitäts-robuste Standardfehler, Variante HC1

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const                0.0145933   0.00484706      3.011    0.0026    ***
  DExchangeRateR~_1   -0.00367549  0.00145864     -2.520    0.0118    **
  Consumptionexpen~    0.346685    0.0295813     11.72     1.17e-030 ***
  Grosscapitalform~    0.0518625   0.00768045     6.753    1.93e-011 ***
  CurrentAccountBa~    0.115579    0.0293633      3.936    8.58e-05  ***
  CPI                  0.0419318   0.0173962      2.410    0.0160    **
  PopulationGrowth    -0.330538    0.181434      -1.822    0.0686    *

Mittel d. abh. Var.     0.016904   Stdabw. d. abh. Var.     0.043129
Summe d. quad. Res.     2.163329   Stdfehler d. Regress.    0.034049
R-Quadrat               0.378736   Korrigiertes R-Quadrat   0.376738
F(6, 1866)              56.02222   P-Wert(F)                7.95e-64
Log-Likelihood          3676.485   Akaike-Kriterium        -7338.970
Schwarz-Kriterium      -7300.223   Hannan-Quinn-Kriterium  -7324.695

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 900.253
  mit p-Wert = P(Chi-Quadrat(26) > 900.253) = 4.82977e-173

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 1864) = 64.59
  mit p-Wert = P(F(2, 1864) > 64.59) = 7.55484e-028
```

Figure 22: Output Six Factor Model (HC1, robust errors) Developing Countries 1980 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 2: KQ, benutze die Beobachtungen 1-2184 (n = 1651)
Fehlende oder unvollständige Beobachtungen entfernt: 533
Abhängige Variable: GDPcapitagrowthrateCONSTANT

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const                0.0183777   0.00223506      8.223    4.00e-016 ***
  DExchangeRateR~_2   -0.00259863  0.00239046     -1.087    0.2772
  finalconsumption~    0.381432    0.0161226      23.66     9.75e-107 ***
  grosscapitalform~    0.00726911  0.00139968      5.193    2.32e-07  ***
  CurrentAccountBa~    0.293994    0.0173796      16.92     2.64e-059 ***
  ChangeCPICONSTAN~    0.0247996   0.0113119       2.192    0.0285    **
  PopulationGrowth    -0.187405    0.0934485      -2.005    0.0451    **

Mittel d. abh. Var.      0.025775   Stdabw. d. abh. Var.     0.056330
Summe d. quad. Res.      3.660182   Stdfehler d. Regress.    0.047185
R-Quadrat                0.300903   Korrigiertes R-Quadrat   0.298351
F(6, 1644)               117.9341   P-Wert(F)                5.0e-124
Log-Likelihood           2702.478   Akaike-Kriterium        -5390.955
Schwarz-Kriterium       -5353.092   Hannan-Quinn-Kriterium  -5376.917

Abgesehen von Konstante war p-Wert am höchsten für Variable 12 (DExchangeRateRegime_2)

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 1467.44
  mit p-Wert = P(Chi-Quadrat(26) > 1467.44) = 1.15551e-293

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 1642) = 353.688
  mit p-Wert = P(F(2, 1642) > 353.688) = 1.85879e-128
```

Figure 23: Output Six Factor Model Developing Countries 1992 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 2: KQ, benutze die Beobachtungen 1-2184 (n = 1651)
Fehlende oder unvollständige Beobachtungen entfernt: 533
Abhängige Variable: GDPcapitagrowthrateCONSTANT
Heteroskedastizitäts-robuste Standardfehler, Variante HC1

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const                0.0183777   0.00572178      3.212    0.0013    ***
  DExchangeRateR~_2   -0.00259863  0.00250473     -1.037    0.2997
  finalconsumption~    0.381432    0.0963277       3.960    7.82e-05  ***
  grosscapitalform~    0.00726911  0.00617139      1.178    0.2390
  CurrentAccountBa~    0.293994    0.189006        1.555    0.1200
  ChangeCPICONSTAN~    0.0247996   0.0143513       1.728    0.0842    *
  PopulationGrowth    -0.187405    0.187312       -1.000    0.3172

Mittel d. abh. Var.      0.025775   Stdabw. d. abh. Var.     0.056330
Summe d. quad. Res.      3.660182   Stdfehler d. Regress.    0.047185
R-Quadrat                0.300903   Korrigiertes R-Quadrat   0.298351
F(6, 1644)               9.050096   P-Wert(F)                9.36e-10
Log-Likelihood           2702.478   Akaike-Kriterium        -5390.955
Schwarz-Kriterium       -5353.092   Hannan-Quinn-Kriterium  -5376.917

Abgesehen von Konstante war p-Wert am höchsten für Variable 10 (PopulationGrowth)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 1642) = 353.688
  mit p-Wert = P(F(2, 1642) > 353.688) = 1.85879e-128

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 1467.44
  mit p-Wert = P(Chi-Quadrat(26) > 1467.44) = 1.15551e-293
```

Figure 24: Output Six Factor Model (HC1, robust errors) Developing Countries 1992 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 1: KQ, benutze die Beobachtungen 1-1826 (n = 1456)
Fehlende oder unvollständige Beobachtungen entfernt: 370
Abhängige Variable: GDPcapitagrowthrateCONSTANT

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const                0.0336488   0.00168092    20.02      6.72e-079 ***
  DExchangeRateR~_2   -0.00783807  0.00174764    -4.485     7.87e-06  ***
  finalconsumption~    0.0775910   0.00970123     7.998     2.56e-015 ***
  grosscapitalform~    0.0445777   0.00325386    13.70      2.92e-040 ***
  CurrentAccountBa~    0.0369147   0.0146059      2.527     0.0116    **
  ChangeCPICONSTAN~   -0.00471754  0.00803332    -0.5872    0.5571
  PopulationGrowth    -0.597520    0.0646727     -9.239     8.57e-020 ***

Mittel d. abh. Var.      0.026499   Stdabw. d. abh. Var.     0.038158
Summe d. quad. Res.      1.595073   Stdfehler d. Regress.    0.033178
R-Quadrat                0.247078   Korrigiertes R-Quadrat   0.243960
F(6, 1449)              79.25043    P-Wert(F)                8.23e-86
Log-Likelihood          2896.459    Akaike-Kriterium        -5778.917
Schwarz-Kriterium      -5741.933    Hannan-Quinn-Kriterium  -5765.119

Abgesehen von Konstante war p-Wert am höchsten für Variable 8 (ChangeCPICONSTANT2010)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 1447) = 138.947
  mit p-Wert = P(F(2, 1447) > 138.947) = 6.3281e-056

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 357.857
  mit p-Wert = P(Chi-Quadrat(26) > 357.857) = 4.72261e-060
```

Figure 25: Output Six Factor Model Developing Countries 2000 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 2: KQ, benutze die Beobachtungen 1-1826 (n = 1456)
Fehlende oder unvollständige Beobachtungen entfernt: 370
Abhängige Variable: GDPcapitagrowthrateCONSTANT
Heteroskedastizitäts-robuste Standardfehler, Variante HC1

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const                0.0336488   0.00244704    13.75      1.57e-040 ***
  DExchangeRateR~_2   -0.00783807  0.00181515    -4.318     1.68e-05  ***
  finalconsumption~    0.0775910   0.0265374      2.924     0.0035    ***
  grosscapitalform~    0.0445777   0.00897923     4.965     7.70e-07  ***
  CurrentAccountBa~    0.0369147   0.0262972      1.404     0.1606
  ChangeCPICONSTAN~   -0.00471754  0.0137631     -0.3428    0.7318
  PopulationGrowth    -0.597520    0.0740116     -8.073     1.42e-015 ***

Mittel d. abh. Var.      0.026499   Stdabw. d. abh. Var.     0.038158
Summe d. quad. Res.      1.595073   Stdfehler d. Regress.    0.033178
R-Quadrat                0.247078   Korrigiertes R-Quadrat   0.243960
F(6, 1449)              35.00292    P-Wert(F)                1.11e-39
Log-Likelihood          2896.459    Akaike-Kriterium        -5778.917
Schwarz-Kriterium      -5741.933    Hannan-Quinn-Kriterium  -5765.119

Abgesehen von Konstante war p-Wert am höchsten für Variable 8 (ChangeCPICONSTANT2010)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 1447) = 138.947
  mit p-Wert = P(F(2, 1447) > 138.947) = 6.3281e-056

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 357.857
  mit p-Wert = P(Chi-Quadrat(26) > 357.857) = 4.72261e-060
```

Figure 26: Output Six Factor Model (HC1, robust errors) Developing Countries 2000 – 2015 (World Bank, 2017, own Gretl Output)

8.5.2 Advanced Countries

```
Modell 1: KQ, benutze die Beobachtungen 1-1155 (n = 895)
Fehlende oder unvollständige Beobachtungen entfernt: 260
Abhängige Variable: GDPcapitagrowthrateCONSTANT

                      Koeffizient   Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const                0.00313802   0.000990670    3.168     0.0016    ***
  DExchangeRateR~_1    0.000947988  0.00112469     0.8429    0.3995
  finalconsumption~    0.663982     0.0231188     28.72      8.09e-129 ***
  grosscapitalform~    0.163082     0.00645675    25.26      1.66e-106 ***
  CurrentAccountBa~    0.380289     0.0236931     16.05      4.28e-051 ***
  ChangeCPI           -0.0123699    0.0149809     -0.8257    0.4092
  PopulationGrowth     0.0414895    0.0660528      0.6281    0.5301

Mittel d. abh. Var.     0.021268   Stdabw. d. abh. Var.     0.033069
Summe d. quad. Res.     0.216312   Stdfehler d. Regress.    0.015608
R-Quadrat               0.778744   Korrigiertes R-Quadrat   0.777249
F(6, 888)               520.9091   P-Wert(F)                8.2e-287
Log-Likelihood          2456.767   Akaike-Kriterium        -4899.533
Schwarz-Kriterium      -4865.955   Hannan-Quinn-Kriterium  -4886.703

Abgesehen von Konstante war p-Wert am höchsten für Variable 10 (PopulationGrowth)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 886) = 1.66312
  mit p-Wert = P(F(2, 886) > 1.66312) = 0.190139

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 292.569
  mit p-Wert = P(Chi-Quadrat(26) > 292.569) = 6.43139e-047
```

Figure 27: Output Six Factor Model Advanced Countries 1980 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 2: KQ, benutze die Beobachtungen 1-1155 (n = 895)
Fehlende oder unvollständige Beobachtungen entfernt: 260
Abhängige Variable: GDPcapitagrowthrateCONSTANT
Heteroskedastizitäts-robuste Standardfehler, Variante HC1

                      Koeffizient   Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const                0.00313802   0.000943079    3.327     0.0009    ***
  DExchangeRateR~_1    0.000947988  0.00110298     0.8595    0.3903
  finalconsumption~    0.663982     0.0319029     20.81      1.15e-078 ***
  grosscapitalform~    0.163082     0.0124641     13.08      6.71e-036 ***
  CurrentAccountBa~    0.380289     0.0543276      7.000     5.05e-012 ***
  ChangeCPI           -0.0123699    0.0110133     -1.123     0.2617
  PopulationGrowth     0.0414895    0.0763340      0.5435    0.5869

Mittel d. abh. Var.     0.021268   Stdabw. d. abh. Var.     0.033069
Summe d. quad. Res.     0.216312   Stdfehler d. Regress.    0.015608
R-Quadrat               0.778744   Korrigiertes R-Quadrat   0.777249
F(6, 888)               224.2165   P-Wert(F)                5.3e-174
Log-Likelihood          2456.767   Akaike-Kriterium        -4899.533
Schwarz-Kriterium      -4865.955   Hannan-Quinn-Kriterium  -4886.703

Abgesehen von Konstante war p-Wert am höchsten für Variable 10 (PopulationGrowth)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 886) = 1.66312
  mit p-Wert = P(F(2, 886) > 1.66312) = 0.190139

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 292.569
  mit p-Wert = P(Chi-Quadrat(26) > 292.569) = 6.43139e-047
```

Figure 28: Output Six Factor Model (HC1, robust errors) Advanced Countries 1980 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 1: KQ, benutze die Beobachtungen 1-815 (n = 700)
Fehlende oder unvollständige Beobachtungen entfernt: 115
Abhängige Variable: GDPcapitagrowthrateCONSTANT

                     Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const               0.00337635  0.00124919     2.703     0.0070    ***
  DExchangeRateR~_2   0.00159569  0.00136169     1.172     0.2417
  finalconsumption~   0.652062    0.0277194     23.52      2.14e-090 ***
  grosscapitalform~   0.165883    0.00761679    21.78      1.62e-080 ***
  CurrentAccountBa~   0.361483    0.0273397     13.22      9.45e-036 ***
  ChangeCPI          -0.00733123  0.0346789     -0.2114    0.8326
  PopulationGrowth    0.00930670  0.0758114      0.1228    0.9023

Mittel d. abh. Var.     0.020475   Stdabw. d. abh. Var.     0.033862
Summe d. quad. Res.     0.184093   Stdfehler d. Regress.    0.016299
R-Quadrat               0.770310   Korrigiertes R-Quadrat   0.768321
F(6, 693)               387.3519   P-Wert(F)                1.6e-217
Log-Likelihood          1891.932   Akaike-Kriterium        -3769.863
Schwarz-Kriterium      -3738.005   Hannan-Quinn-Kriterium  -3757.548

Abgesehen von Konstante war p-Wert am höchsten für Variable 10 (PopulationGrowth)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 691) = 1.4972
  mit p-Wert = P(F(2, 691) > 1.4972) = 0.224481

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 256.146
  mit p-Wert = P(Chi-Quadrat(26) > 256.146) = 1.0716e-039
```

Figure 29: Output Six Factor Model Advanced Countries 1992 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 2: KQ, benutze die Beobachtungen 1-815 (n = 700)
Fehlende oder unvollständige Beobachtungen entfernt: 115
Abhängige Variable: GDPcapitagrowthrateCONSTANT
Heteroskedastizitäts-robuste Standardfehler, Variante HC1

                     Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const               0.00337635  0.00122956     2.746     0.0062    ***
  DExchangeRateR~_2   0.00159569  0.00137022     1.165     0.2446
  finalconsumption~   0.652062    0.0383444     17.01      1.84e-054 ***
  grosscapitalform~   0.165883    0.0154436     10.74      5.33e-025 ***
  CurrentAccountBa~   0.361483    0.0655123      5.518     4.85e-08  ***
  ChangeCPI          -0.00733123  0.0511530     -0.1433    0.8861
  PopulationGrowth    0.00930670  0.0889886      0.1046    0.9167

Mittel d. abh. Var.     0.020475   Stdabw. d. abh. Var.     0.033862
Summe d. quad. Res.     0.184093   Stdfehler d. Regress.    0.016299
R-Quadrat               0.770310   Korrigiertes R-Quadrat   0.768321
F(6, 693)               197.1958   P-Wert(F)                3.2e-146
Log-Likelihood          1891.932   Akaike-Kriterium        -3769.863
Schwarz-Kriterium      -3738.005   Hannan-Quinn-Kriterium  -3757.548

Abgesehen von Konstante war p-Wert am höchsten für Variable 10 (PopulationGrowth)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 691) = 1.4972
  mit p-Wert = P(F(2, 691) > 1.4972) = 0.224481

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 256.146
  mit p-Wert = P(Chi-Quadrat(26) > 256.146) = 1.0716e-039
```

Figure 30: Output Six Factor Model (HC1, robust errors) Advanced Countries 1992 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 1: KQ, benutze die Beobachtungen 1-574 (n = 517)
Fehlende oder unvollständige Beobachtungen entfernt: 57
Abhängige Variable: GDPcapitagrowthrate

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const                0.00154038  0.00183408     0.8399    0.4014
  DExchangeRateR~_2   -0.00119505  0.00225187    -0.5307    0.5959
  finalconsumption~    0.760822    0.0427980     17.78      2.25e-055 ***
  grosscapitalform~    0.183563    0.0110132     16.67      4.13e-050 ***
  CurrentAccountBa~    0.491471    0.0387700     12.68      3.33e-032 ***
  ChangeCPI           -0.0205287   0.0551595     -0.3722    0.7099
  PopulationGrowth     0.0784004   0.116550       0.6727    0.5015

Mittel d. abh. Var.      0.017569   Stdabw. d. abh. Var.     0.040466
Summe d. quad. Res.      0.248468   Stdfehler d. Regress.    0.022072
R-Quadrat                0.705930   Korrigiertes R-Quadrat   0.702470
F(6, 510)                204.0470   P-Wert(F)                4.7e-132
Log-Likelihood           1241.473   Akaike-Kriterium        -2468.947
Schwarz-Kriterium       -2439.211   Hannan-Quinn-Kriterium  -2457.295

Abgesehen von Konstante war p-Wert am höchsten für Variable 8 (ChangeCPI)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 508) = 2.21527
  mit p-Wert = P(F(2, 508) > 2.21527) = 0.110178

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 162.362
  mit p-Wert = P(Chi-Quadrat(26) > 162.362) = 1.10942e-021
```

Figure 31: Output Six Factor Model Advanced Countries 2000 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 2: KQ, benutze die Beobachtungen 1-574 (n = 517)
Fehlende oder unvollständige Beobachtungen entfernt: 57
Abhängige Variable: GDPcapitagrowthrate
Heteroskedastizitäts-robuste Standardfehler, Variante HC1

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const                0.00154038  0.00187504     0.8215    0.4117
  DExchangeRateR~_2   -0.00119505  0.00177655    -0.6727    0.5015
  finalconsumption~    0.760822    0.0630042     12.08      1.05e-029 ***
  grosscapitalform~    0.183563    0.0210124      8.736     3.48e-017 ***
  CurrentAccountBa~    0.491471    0.100847       4.873     1.47e-06  ***
  ChangeCPI           -0.0205287   0.0901434     -0.2277    0.8199
  PopulationGrowth     0.0784004   0.156124       0.5022    0.6158

Mittel d. abh. Var.      0.017569   Stdabw. d. abh. Var.     0.040466
Summe d. quad. Res.      0.248468   Stdfehler d. Regress.    0.022072
R-Quadrat                0.705930   Korrigiertes R-Quadrat   0.702470
F(6, 510)                143.4291   P-Wert(F)                4.3e-106
Log-Likelihood           1241.473   Akaike-Kriterium        -2468.947
Schwarz-Kriterium       -2439.211   Hannan-Quinn-Kriterium  -2457.295

Abgesehen von Konstante war p-Wert am höchsten für Variable 8 (ChangeCPI)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 508) = 2.21527
  mit p-Wert = P(F(2, 508) > 2.21527) = 0.110178

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 162.362
  mit p-Wert = P(Chi-Quadrat(26) > 162.362) = 1.10942e-021
```

Figure 32: Output Six Factor Model (HC1, robust errors) Advanced Countries 2000 – 2015 (World Bank, 2017, own Gretl Output)

8.5.3 Model Optimization

```
Modell 2: KQ, benutze die Beobachtungen 1-1155 (n = 1067)
Fehlende oder unvollständige Beobachtungen entfernt: 88
Abhängige Variable: GDPcapitagrowthrateCONSTANT

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const               0.00631484   0.000796191     7.931    5.46e-015 ***
  DExchangeRateR~_1   0.00280070   0.00112094      2.499    0.0126    **
  finalconsumption~   0.573032     0.0235162      24.37     1.49e-104 ***
  grosscapitalform~   0.126546     0.00633430     19.98     1.21e-075 ***

Mittel d. abh. Var.      0.022366   Stdabw. d. abh. Var.     0.032665
Summe d. quad. Res.      0.342098   Stdfehler d. Regress.    0.017939
R-Quadrat                0.699241   Korrigiertes R-Quadrat   0.698392
F(3, 1063)               823.7955   P-Wert(F)                1.0e-276
Log-Likelihood           2778.140   Akaike-Kriterium        -5548.281
Schwarz-Kriterium       -5528.390   Hannan-Quinn-Kriterium  -5540.745

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 1061) = 8.56555
  mit p-Wert = P(F(2, 1061) > 8.56555) = 0.000204053

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 42.1766
  mit p-Wert = P(Chi-Quadrat(8) > 42.1766) = 1.25472e-006
```

Figure 33: Output Optimized Three Factor Model Advanced Countries 1980 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 1: KQ, benutze die Beobachtungen 1-1155 (n = 1067)
Fehlende oder unvollständige Beobachtungen entfernt: 88
Abhängige Variable: GDPcapitagrowthrateCONSTANT
Heteroskedastizitäts-robuste Standardfehler, Variante HC1

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const               0.00631484   0.000896472     7.044    3.35e-012 ***
  DExchangeRateR~_1   0.00280070   0.00111271      2.517    0.0120    **
  finalconsumption~   0.573032     0.0342183      16.75     4.80e-056 ***
  grosscapitalform~   0.126546     0.0101148      12.51     1.33e-033 ***

Mittel d. abh. Var.      0.022366   Stdabw. d. abh. Var.     0.032665
Summe d. quad. Res.      0.342098   Stdfehler d. Regress.    0.017939
R-Quadrat                0.699241   Korrigiertes R-Quadrat   0.698392
F(3, 1063)               376.8753   P-Wert(F)                1.1e-166
Log-Likelihood           2778.140   Akaike-Kriterium        -5548.281
Schwarz-Kriterium       -5528.390   Hannan-Quinn-Kriterium  -5540.745

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 1061) = 8.56555
  mit p-Wert = P(F(2, 1061) > 8.56555) = 0.000204053

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 42.1766
  mit p-Wert = P(Chi-Quadrat(8) > 42.1766) = 1.25472e-006
```

Figure 34: Output Optimized Three Factor Model (HC1, robust errors) Advanced Countries 1980 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 2: KQ, benutze die Beobachtungen 1-815 (n = 766)
Fehlende oder unvollständige Beobachtungen entfernt: 49
Abhängige Variable: GDPcapitagrowthrateCONSTANT

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const               0.00530460   0.000901670     5.883    6.03e-09  ***
  DExchangeRateR~_2   0.00447666   0.00138313      3.237    0.0013    ***
  finalconsumption~   0.566150     0.0290183      19.51     4.56e-069 ***
  grosscapitalform~   0.128761     0.00754673     17.06     1.59e-055 ***

Mittel d. abh. Var.      0.021100   Stdabw. d. abh. Var.     0.033558
Summe d. quad. Res.      0.252484   Stdfehler d. Regress.    0.018203
R-Quadrat                0.706929   Korrigiertes R-Quadrat   0.705776
F(3, 762)                612.6854   P-Wert(F)                1.5e-202
Log-Likelihood           1983.830   Akaike-Kriterium        -3959.660
Schwarz-Kriterium       -3941.095   Hannan-Quinn-Kriterium  -3952.513

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 760) = 6.28111
  mit p-Wert = P(F(2, 760) > 6.28111) = 0.00196991

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 31.3931
  mit p-Wert = P(Chi-Quadrat(8) > 31.3931) = 0.000119574
```

Figure 35: Output Optimized Three Factor Model Advanced Countries 1992 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 1: KQ, benutze die Beobachtungen 1-815 (n = 766)
Fehlende oder unvollständige Beobachtungen entfernt: 49
Abhängige Variable: GDPcapitagrowthrateCONSTANT
Heteroskedastizitäts-robuste Standardfehler, Variante HC1

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const               0.00530460   0.000961101     5.519    4.67e-08  ***
  DExchangeRateR~_2   0.00447666   0.00140640      3.183    0.0015    ***
  finalconsumption~   0.566150     0.0416497      13.59     7.74e-038 ***
  grosscapitalform~   0.128761     0.0128074      10.05     2.05e-022 ***

Mittel d. abh. Var.      0.021100   Stdabw. d. abh. Var.     0.033558
Summe d. quad. Res.      0.252484   Stdfehler d. Regress.    0.018203
R-Quadrat                0.706929   Korrigiertes R-Quadrat   0.705776
F(3, 762)                323.8108   P-Wert(F)                1.7e-135
Log-Likelihood           1983.830   Akaike-Kriterium        -3959.660
Schwarz-Kriterium       -3941.095   Hannan-Quinn-Kriterium  -3952.513

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 760) = 6.28111
  mit p-Wert = P(F(2, 760) > 6.28111) = 0.00196991

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 31.3931
  mit p-Wert = P(Chi-Quadrat(8) > 31.3931) = 0.000119574
```

Figure 36: Output Optimized Three Factor Model (HC1, robust errors) Advanced Countries 1992 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 4: KQ, benutze die Beobachtungen 1-574 (n = 532)
Fehlende oder unvollständige Beobachtungen entfernt: 42
Abhängige Variable: GDPcapitagrowthrate

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const               0.00389712   0.00139277     2.798     0.0053    ***
  DExchangeRateR~_2   0.00149763   0.00241104     0.6212    0.5348
  finalconsumption~   0.693050     0.0474034     14.62      6.85e-041 ***
  grosscapitalform~   0.123710     0.0111416     11.10      6.88e-026 ***

Mittel d. abh. Var.      0.017539   Stdabw. d. abh. Var.     0.040358
Summe d. quad. Res.      0.333223   Stdfehler d. Regress.    0.025122
R-Quadrat                0.614721   Korrigiertes R-Quadrat   0.612532
F(3, 528)                280.8119   P-Wert(F)                6.4e-109
Log-Likelihood           1207.031   Akaike-Kriterium        -2406.061
Schwarz-Kriterium       -2388.955   Hannan-Quinn-Kriterium  -2399.367

Abgesehen von Konstante war p-Wert am höchsten für Variable 12 (DExchangeRateRegime_2)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 526) = 1.50443
  mit p-Wert = P(F(2, 526) > 1.50443) = 0.223099

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 21.8748
  mit p-Wert = P(Chi-Quadrat(8) > 21.8748) = 0.00515312
```

Figure 37: Output Optimized Three Factor Model Advanced Countries 2000 – 2015 (World Bank, 2017, own Gretl Output)

```
Modell 5: KQ, benutze die Beobachtungen 1-574 (n = 532)
Fehlende oder unvollständige Beobachtungen entfernt: 42
Abhängige Variable: GDPcapitagrowthrate
Heteroskedastizitäts-robuste Standardfehler, Variante HC1

                      Koeffizient  Std.-fehler  t-Quotient   p-Wert
  ------------------------------------------------------------------
  const               0.00389712   0.00139131     2.801     0.0053    ***
  DExchangeRateR~_2   0.00149763   0.00212894     0.7035    0.4821
  finalconsumption~   0.693050     0.0574217     12.07      8.61e-030 ***
  grosscapitalform~   0.123710     0.0196872      6.284     6.92e-010 ***

Mittel d. abh. Var.      0.017539   Stdabw. d. abh. Var.     0.040358
Summe d. quad. Res.      0.333223   Stdfehler d. Regress.    0.025122
R-Quadrat                0.614721   Korrigiertes R-Quadrat   0.612532
F(3, 528)                264.1041   P-Wert(F)                1.2e-104
Log-Likelihood           1207.031   Akaike-Kriterium        -2406.061
Schwarz-Kriterium       -2388.955   Hannan-Quinn-Kriterium  -2399.367

Abgesehen von Konstante war p-Wert am höchsten für Variable 12 (DExchangeRateRegime_2)

RESET-Spezifikationstest -
  Nullhypothese: Spezifikation ist angemessen
  Teststatistik: F(2, 526) = 1.50443
  mit p-Wert = P(F(2, 526) > 1.50443) = 0.223099

White's Test für Heteroskedastizität -
  Nullhypothese: Heteroskedastizität nicht vorhanden
  Teststatistik: LM = 21.8748
  mit p-Wert = P(Chi-Quadrat(8) > 21.8748) = 0.00515312
```

Figure 38: Output Optimized Three Factor Model (HC1, robust errors) Advanced Countries 2000 – 2015 (World Bank, 2017, own Gretl Output)