The role of financial development in the exchange rate regime choice

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Abstract

This paper studies the relationship between the degree of exchange rate flexibility and the growth rate of output per worker of a country. The interaction effect between the degree of exchange rate flexibility and the level of financial development is used to compare financially developed and financially undeveloped countries. A comparison is made between this relationship in the periods 1960-1999 and 1960-2022. The results of 2 step system GMM estimations show that due to the increase in financial development in the late 20th and early 21st century the effect of the exchange rate regime of a country becomes smaller when we look at the growth rate of output per worker.

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1. Introduction

Throughout the last 150 years, the world has seen a great variety of visions when it comes to exchange rate regimes. Ever since the fall of the first gold standard due to the first world war we have seen that the largest share of countries tends to switch between exchange rate regimes every few decades. The most well-known and wide spread global exchange rate regime periods were the original gold standard up to the first world war, the interwar gold standard, the Bretton woods agreement and the period of more floating exchange regimes after the fall of the Bretton woods agreement. Sometimes the choice of an exchange rate regime is presented as a choice between completely pegging your currency to another currency or letting the forces of supply and demand fully decide the exchange rate. The bipolar view that some policymakers have that there are only these 2 forms of exchange rates is incorrect. The classification of exchange rate regimes is a wide variety of structures that lie between fixed and free floating exchange rates. There is also not one single classification system that is used by all academic papers, most papers use different classification systems by different academicians. In the paper by Ilzetski et al (2017) a sophisticated classification of exchange rates is presented that gives a clearer view of the exchange rate policy of a country.

Choosing an exchange rate regime has always been a politically influenced choice. In the work by Rodrik (2000) it is argued that there is a political trilemma when it comes to monetary policy and forms of government. A country can choose between national sovereignty, a strong increase in globalization and democratic policies but can never have all 3. The fact that there is such a trade-off presents a large social relevance to research into exchange rate policies since it might influence topics such as democracy and national sovereignty.

The economic choice of which exchange rate is optimal has also been a much debated topic. In the work by Ghosh et al (2002) some of the most important economic questions and trade-offs are highlighted such as the connection between a fixed exchange rate and lower inflation or the more frequent occurrence of crisis, and what is the connection between a flexible exchange rate and output growth? As these works show there seems to be a connection between exchange rate regimes and economic growth however

there is not much consensus on in which direction this connection moves and under which conditions it holds. The fact that there might be a connection between choosing an exchange rate regime and certain macro-economic variables such as economic growth or inflation presents a strong economic relevance to this area of research. Further research such as this one should try to give more insight into the economic consequences of deciding to fix or float the exchange rate of a country.

The paper by Aghion et al (2009) presents a new model that tries to answer the question of the optimal exchange rate regime. This paper connects the optimal exchange rate regime for economic growth to the extent of the financial development of a country. The empirical analyses that use panel data on 83 countries show that there is a significant effect between exchange rate regimes and economic development but that this effect is the strongest when it comes to countries that have a low degree of financial development. The main argument that the paper gives for this effect is that due to the poor financial system that these countries have there are more severe credit constraints for companies that want to lend in times of economic downfall. The theory for this will be explained in detail in the theoretical framework. This work has led to the main question of this paper which is: What is the relation between the growth rate of output per worker and the degree of exchange rate flexibility? In this paper, I will try to replicate the results that were found by Aghion et al (2009) and test the external validity of these results when it comes to more recent data. The results that were found by Aghion et al have led to the main hypothesis of this paper which is:

"Having a fixed exchange rate has a positive effect on the growth rate of output per worker, this effect is stronger for countries with a low degree of financial development"

However, the development of capital markets in the period after the end of their data which is 1999 may have had a large impact on the way that companies can acquire credit and to the extent of which capital constraints still exist in the 21st century. Further clarification of these developments in the capital markets will be provided in the theoretical framework. The developments of the capital markets, the possible implications for the optimal exchange rate regime and the external validity of the results found before 1999 have led to the following hypothesis

"The more developed global capital markets after 1999 have eased the credit constraint on companies and have made the choice off a certain exchange rate regimes less relevant"

2. Theoretical framework

2.1 Credit constraints

As stated in the introduction the main argument for countries to choose a fixed exchange rate according to Aghion et al (2009) is due to the credit constraints that arise from having an underdeveloped capital market. The financial development of a country will be measured by dividing its private domestic credit level by the GDP. The theory of credit constraints is based on the fact that companies in a country with flexible exchange rates will face shocks when it comes to the revenue they are generating. These shocks are caused by fluctuations in the exchange rate of a country's currency. These fluctuations in profits are mainly due to the international competitiveness of this country which will face international competition from other regions. The country will become less competitive due to an appreciation of the exchange rate and will not be able to have the same profit margins as before. This decrease in profit margins will in turn lead to a decrease in investments which is the most severe in countries without a developed financial system and proper access to loans. The main reason for this can be found in the paper by Gertler and Gilchrist (1994). In this paper, a relation is made between companies that are credit constrained either by their balance sheet or by relying heavily on external funding and the importance of monetary policy. This monetary policy is important for their credit needs in times of big exchange rate fluctuations that will force companies to look for external credit. Due to their decreasing profits we will see a difference between financially developed countries that have cheaper credits and thus fewer credit constraints and financially undeveloped countries that will face more severe credit constraints. The high costs that external finance brings in these regions will lead to lower investments which in turn will hinder economic growth in the long run.

Another theory by Aghion et al (2010) provides evidence for the relation between being relatively credit constraint as a country and a lower economic growth level. In this paper the relation between investments and the cycles of the economy is discussed both without credit constraints and with credit constraints. The paper shows that the amount of long-term investments turn into a procyclical component due to credit constraints instead of a countercyclical component in the absence of credit constraints. The paper shows that this inversion of the relationship between long-term investments and the business cycle is

harmful to economic growth and causes more volatility in the economy. A solution for this according to the papers discussed above would be to implement a fixed exchange rate to decrease uncertainty and the effect of business cycles.

These theories show that when a country is capital constrained this may have serious repercussions on its economic growth level. This effect is the strongest in times of big exchange rate fluctuations. The papers discussed above show that having a fixed exchange rate takes away most of the shocks when it comes to exchange-rate based profit fluctuations. This will ease the problems that arise from a credit constraint in financially undeveloped countries due to a smaller need for external funding.

2.2 exchange rate regime classifications

The IMF provides a list of de facto exchange rate regimes as they classify the monetary policy of a country. The field of exchange rate classifications is a highly debated field in which there seems to be a lack of consensus on which is the best classification. There however seems to be a consensus on the inability of the IMF database to give a good depiction of the actual situation of exchange rate regimes. The paper by Tavlas, Dellas and Stockman (2008) provides an extensive literature review on the shortcomings of the IMF classification and the alternative exchange rate classifications that are being used around the world for monetary policy evaluation.

The exchange rate regime classification that will be used in the methodology part which is also one of the classifications that is discussed in the paper by Tavlas, Dellas and Stockman (2008) comes from the paper "Exchange rate arrangements entering the 21st century: which anchor will hold?" (Ilzetski et al, 2017) This classification divides countries into 6 subcategories with different extents of exchange rate flexibility. The higher the classification for the exchange rate of a country the more flexible the exchange rate is. The reason that this classification is chosen is that it provides a wide range of options for a large set of countries. The use of dummy variables to describe the exchange rate regimes created by Ilzetski et al also makes it easier to do statistical analyses on our data. The choice of an exchange rate regime is sometimes depicted as a choice between fixed, flexible or partially floating but this does not include the many semi options that central banks have when

choosing an exchange rate regime. By using the classification by Ilzetski et al, I hope to give a more insightful conclusion about the optimal exchange rate regime for different types of countries.

2.3 capital market developments in the 20th and 21st century

The period that is used in the paper by Aghion et all is known to be one for many new innovations. Many of the countries that are in the dataset used to be highly underdeveloped counties in terms of economic development. From the period 1960 until the most recent data available we can see that some of these countries experience an economic boom in production and financial development. This economic progress is not of the same magnitude for every country but for the world as a whole we see serious progress in terms of financial development. There are multiple papers that show that there is a strong growth in financial development in countries with an initial low degree of financial development and the relation that this has to economic growth. Examples of this are the paper by Obreja Brasoveanu et al (2008) in which the capital developments of Romania are discussed and the relation this has to economic growth, these results are then compared to other ex-communist states.

To show that the average level of financial development has increased in the world I have collected data on the degree of financial development which is computed by dividing the private domestic credit by GDP. As can be seen in table 1 there is a significant positive coefficient when you regress the degree of financial development on the year variable which indicates the year we are in. This is done in table 1 for the period in which the data is collected in the original paper by Aghion et al (2009) which is 1960 until 1999 for a set of 83 countries. The coefficient of this regression will thus give us the growth per year of the average degree of financial development in the world. The coefficient of 0.63 indicates that every year the average degree of financial development in the world grows with 0.63. In table 2 we regress the degree of financial development on the year variable for the total period of my dataset which is 1960 until 2022. In this table, we see that there is an even stronger positive relationship which indicates that the growth rate of average financial development in the world is only getting stronger in the 21st century. These results

strengthen the relevance of this paper by showing that indeed the average degree of financial development in the world is increasing over time. This could indicate that the results that were found by Aghion et al have very little external validity in the 21st century due to the higher degree of world financial development.

Finance	Coefficient (Standard error)
Year	0.63*** (0.04
Constant	-1230.50*** (80.84)

Table 1: growth of financial development in the period 1960-1999

***** means significance at 1%, ** means significance at 5% and * means significance at 10%**

Finance	Coefficient (Standard error)
Year	0.80*** (0.03)
Constant	-1549.04*** (60.01)

Table 2: growth of financial development in the period 1960-2022

***** means significance at 1%, ** means significance at 5% and * means significance at 10%**

As stated before the importance of choosing a fixed exchange rate is highly related to the degree of financial development. The global rise of financial development levels will thus mean that according to the above-stated relation between the optimal exchange rate

regime and financial development we will expect to see a weaker relationship between economic growth and the exchange rate regime. This would mean that the relevance of choosing a fixed exchange rate for the lower half of the financial developed countries has decreased. A full statistical analysis to test whether this statement is true will be done in the methodology chapter.

Another factor in the development of capital and financial markets that may take away the importance of exchange rate regimes is the dominant role of the dollar after the second world war. In the paper by Blinder (1996) the rise of the dollar after the second world war and the role of the dollar in the modern-day world is described. By becoming the reserve currency of the world the dollar has been chosen to be the main trading mechanism in many sectors such as oil and other raw materials. The trading in these sectors does often not include any other currencies since dollar invoicing is the main way to pay for these commodities. By taking away home currencies out of the transactions for raw materials you also take away some of the importance of the exchange rate for these trade flows. A lot of developing countries with an underdeveloped financial system rely heavily on the export of raw materials (examples of this are oil exporting countries such as Russia and Venezuela). By invoicing these exports in dollars the role of their home currency declines and the shocks due to exchange rate fluctuations will be less than in the situation without the dominant role of the dollar. This development in the financial market is expected to have an effect on the exchange rate regimes around the world. However, the focus of this paper will not be on the role of dollar invoicing and the effects this has on the importance of exchange rate regimes. A suggestion for further research would be to do an empirical analysis of the development of dollar invoicing.

3. Data

For the empirical section in which I will try to statistically find evidence concerning my hypothesis. I have collected data on multiple variables for a section of 83 countries. The dataset will consist of panel data that is on the period from 1960 until the most recent available data. The dataset is based on the variables that have been used by Aghion et al (2009). For the collection of the data, the attempt has been made to gather the data in the same way as the authors in the original paper. Most of the data come from datasets that were used as described in the appendix of the paper by Aghion et al (2009). For some variables, the origin in the original paper was unclear in which case we used mainly world bank data. The exact sources can be found in appendix B and the excel file containing the data.

The list of countries that have been used is noted in appendix A and includes both countries that are in the highest tier of financial development and countries that rank relatively low on financial development. The main variable that is used to measure economic development is the growth rate of output per worker. This variable is used to measure the economic development of a country because it is not impacted by inflation or other nominal variables. The other important variables that are used in the statistical analysis are:

- the degree of exchange rate flexibility which is measured by the classification given in the paper by Ilzetski et al (2017)
- the degree of financial development which is measured by dividing the private domestic credit by the GDP
- The initial output per worker
- The interaction effect between the financial development and the exchange rate flexibility

the paper also uses control variables to enhance the internal validity of the findings. The control variables that will be used are:

- Education which is measured in the percentage of secondary education enrolment, in logs.

- Trade openness which is measured by dividing the trade volume by the GDP of a country, in logs.
- Government burden which is measured by dividing government consumption by GDP, in logs.
- Inflation which is measured by taking the inflation rate, in logs.
- A crisis dummy that indicates whether a country was impacted by a currency or banking crisis

The reason I have chosen these countries and variables is that in order to test if there is a significant difference between the findings in the 21st century and the earlier data points it is important to follow the same direction as the original paper by Aghion et al (2009). By doing this we can be sure that my adaptions are the ones that changed the outcome of the statistical analysis and no other external factors.

4. Methodology

In this part of the paper, the statistical methods that will be used to evaluate the existence of a relation between the growth rate of output per worker and the chosen exchange rate regime will be evaluated. As stated before the statistical methods that I will use are based on the choices of the paper by Aghion et al (2009) to replicate their results and test the external validity of this research in the 21st century. The statistical method that will be used in the main regression of this paper will be a 2 step system general method of moments estimation. Because of the relatively small sample size of this research, the Windmeijer adjustment will be used that Windmeijer created in one of his papers, Windmeijer (2005). In his paper, Windmeijer states that one of the problems that two-step system GMM has is that panel data samples are frequently quite small. Research has shown that in such a small panel sample we might experience problems when it comes to the estimation of the error term. The error term might be severely downward biased. This bias might cause problems when evaluating the significance level of coefficients. By using the adjustment that was created by Windmeijer we are able to reduce this bias and calculate a more precise standard error.

Generalized method of moments has been chosen because the dataset that is used in this paper consists of panel data on multiple different variables for a set of 83 countries. The use of panel data can cause endogeneity issues, for example through autocorrelation within the panel. This means that the variables that we use can be correlated with themselves via the lagged version of this variable. If this is the case then by using a standard OLS estimation there might be a correlation between the independent variables and the error term which would cause endogeneity and thus internal validity issues.

The type of GMM that will be used is system GMM. This method has been developed by Arellano & Bover (1995) and Blundell and bond (1998). Characteristics of this method are that the variables are transformed in a way that they do no longer correlate with the fixed effects that may exist in panel data and that an average of all the future values of a variable is subtracted from the current value instead of using the lagged variable which is done in normal difference GMM. This is especially useful for my dataset since there are quite some missing values which would in the case of difference GMM seriously reduce the number of data points that are usable.

The specific type of system GMM that will be used is 2 step system GMM. The reason we use this version of GMM is that it can even better than one step system GMM deal with internal validity problems such as autocorrelation and heteroscedasticity. Further clarification on the assumptions and limitations of 2 step system generalized method of moments can be found in the paper by Roodman (2009). The instruments that will be used for the 2 step system GMM estimation will include both lagged variables and control variables.

The final form of the 2 step system GMM estimation as it will be depicted in the regressions of tables 3 and 4 in the results chapter is:

"Growth rate of output per worker $_t$=constant+ β1* exchange rate flexibility $_i$+ β2*financial development $_t$+ β3*initial output per worker $_t$+ β4*interaction effect $_t$+ β5*Education $_t$+ β6*Trade openness $_t$+ β7*Government burden $_t$+ β8*Inflation $_t$+ β9*crisis $_i$"

5. Results

In this section, the results of my two-step system GMM will be given. The results will consist of two parts: The first part in which I replicate the paper by Aghion et al (2009) to see if the data that I have collected on my variables (in particular the degree of exchange rate flexibility) for the period of 1960 until 1999 indeed show a significant relation to the growth rate of output per worker of a country. In my main hypothesis, the claim is made that there is also a difference between financially developed countries and financially undeveloped countries. Financially undeveloped countries should benefit more from having a less flexible exchange rate. To show that there is indeed a difference between financially developed countries and financially undeveloped countries we also should see a significant positive interaction effect between the degree of exchange rate flexibility and the level of financial development of a country. To prove my hypothesis the main variables of interest are thus the degree of exchange rate flexibility and the interaction effect between the level of financial development of a country and the degree of exchange rate flexibility. The exchange rate coefficient should be negative and the interaction term should be positive. If this is the case then we show that a country indeed benefits from having a more fixed exchange rate and that this positive effect is stronger when a country has a relatively low level of financial development. The second part of the results will consist of another two-step system GMM in which I will include the additional years of data to see if my hypothesis:

"The more developed global capital markets after 1999 have eased the credit constraint and have made exchange rate regimes less relevant" Is rejected or not.

As stated above my first two-step system general method of moments estimation will be on the period of 1960 until 1999 to test whether the results that were found in the paper by Aghion et al (2009) also hold for the data that I have found. The results of this two-step system GMM can be found in table 3. To prove my hypothesis we will be most interested in the sign and significance of 2 variables. The first of these variables is the degree of exchange rate flexibility which is noted as exchange rate flexibility in table 3. The second variable of interest is the interaction effect between the degree of exchange rate flexibility and the degree of financial development which is noted as interaction effect in table 3. First, we will look at the exchange variable. As table 3 shows the coefficient of the exchange rate regime is -3.7 and is significant at a 5% significance level. The degree of exchange rate flexibility is a

variable that can have a value between 1 and 6 where a higher number indicates a more flexible exchange rate. The value of the coefficient thus means that when the degree of exchange rate flexibility rises by 1, the growth rate of output per worker will decrease by 3.7 percent. Looking at the significance level, we can see that this outcome is highly significant. This outcome would support my hypothesis that having a fixed exchange rate is beneficial for economic growth. The second variable of interest is the interaction effect between the degree of financial development and the level of exchange rate flexibility which is called interaction effect in table 3. As can be seen in table 3 the coefficient of this variable is 0.085 with a p value of 0.056 which makes it significant at a 10% significance level. These results show that there is indeed an interaction effect between the degree of exchange rate flexibility and financial development but that this effect is quite small and not highly significant. This would mean that there is not an enormous difference when it comes to the effects of choosing a fixed exchange rate regime between financially developed and undeveloped countries. Nevertheless, table 3 shows that the interaction effect is indeed positive as thought before which makes it relevant to run a second two-step system GMM estimation on the period 1960 until 2022. The reason for this is that we know that in this period the degree of financial development has increased a lot.

Growth rate of Output per worker	Coefficient (Standard error)
Exchange rate Flexibility	-3.67** (1.48)
Financial Development	-0.31** (0.16)
Initial output per Worker	0.0009 (0.0006)
Interaction effect	0.085* (0.044)
Education	-3.76 (6.58)
Trade openess	4.00 (3.56)
Government Burden	-9.61** (4.84)
Inflation	-0.39 (2.70)
Crisis	-0.98 (0.88)
Constant	18.12** (8.86)

Table 3:regression on the growth rate of output per worker for the period 1960-1999

*** means significance at 1%, ** means significance at 5% and * means significance at 10%

The second two-step system GMM that we run is on the period between 1960 and 2022. As stated before the goal of this second regression is to test whether the effect of the exchange rate regime on the growth rate of output per worker has changed due to the growth of the average degree of financial development around the world. In table 4 the results of this two-step system GMM can be found. In table 4 we can find some interesting results. We will start by looking at the most important coefficient in this paper which is the coefficient for the exchange rate regime which is denoted by exchange rate regime in table 4. If we compare this coefficient in table 4 to the results that we have found in table 3 there are 2 important differences that can be seen. The first difference between tables 3 and 4 is the fact that the coefficient for the exchange rate regime has increased from -3.7 to -2.8 this means that in the original situation when we look at the data up to 1999 a change in exchange rate regime to a more flexible regime would decrease the growth rate of output per worker with 3.7 percent. In the new situation in which we include the data up to 2022, we can see that a change in exchange rate regime to a more flexible regime decreases the growth rate of output per worker by -2.8 percent. This change shows that adding the more recent years of data decreases the effect of exchange rate regimes on the growth rate of output per worker. The second difference that can be seen when we compare the coefficient for exchange rate regime between tables 3 and 4 is the significance level. In table 3 the coefficient had a p value of 0.014 and thus was significant at a 5% significance level. When we compare these numbers to table 4 we see that the coefficient has a p value of 0.052 and thus is only significant at a 10% significance level. This difference shows that by adding the data up to 2022 the significance level of the exchange rate coefficient has decreased which means that choosing between a fixed or flexible exchange rate regime has become less relevant in the past decades.

Another difference between tables 3 and 4 that should be discussed is the interaction effect between the degree of exchange rate flexibility and the degree of financial development. In the section about table 3, we saw that there was a positive interaction

effect between the degree of financial development and the degree of exchange rate flexibility that was significant at a 10% significance level. This meant that a country with a low degree of financial development has a bigger advantage when it comes to choosing a fixed exchange rate than a country with a high degree of financial development. If we look at table 4 which adds the data points up to the most recent data available, we see that these results have changed. The interaction coefficient that shows the relation between the level of financial development and the degree of exchange rate flexibility now has a p value of 0.590. This means that the interaction term is no longer significant when we add more recent data. This change between tables 3 and 4 indicates that the relation between the degree of exchange rate flexibility and the level of financial development that existed in the data up to 1999 no longer exists. Where we first saw that choosing a fixed exchange rate regime when your country had a low degree of financial development was more beneficial compared to a country with a high degree of financial development, we now no longer see such a significant relation between these two variables.

Growth rate of Output per worker	Coefficient (Standard error)
Exchange rate Flexibility	-2.79* (1.44)
Financial Development	-0.04 (0.07)
Initial output per Worker	0.001** (0.0004)
Interaction effect	0.013) (0.02)
Education	-4.95 (3.69)
Trade openess	1.99 (3.62)
Government Burden	-12.58*** (4.47)
Inflation	-0.13 (4.33)
Crisis	-0.79 (0.76)
Constant	21.01** (9.47)

Table 4: regression on the growth rate of output per worker for the period 1960-2022

*** means significance at 1%, ** means significance at 5% and * means significance at 10%

6. Conclusion

Scientific research into exchange rates and exchange rate regimes has always been a highly debated topic. The goal of this paper was to provide some more insight into the role of exchange rate regimes on macro-economic variables such as the growth rate of output per worker. The relation between these variables and the rapid changes that the global capital markets have undergone in the past decades were discussed in this paper to try and provide some new ideas about these connections. By using a 2 step system general method of moments estimator an attempt has been made to answer the two hypothesises of this paper. The first and main hypothesis that was based on recreating the original paper and their results by Aghion et al (2009) was:

"Having a fixed exchange rate has a positive effect on the growth rate of output per worker, this effect is stronger for countries with a low degree of financial development"

The reason for the credit constraints that arise from the low degree of financial development are discussed in the theoretical framework of this paper and show that there indeed seems to be a relation between exchange rate regime-led growth for output per worker and the degree of financial development of a country. In the result chapter of the thesis in which the first two-step system GMM was run which can be seen in table 3, we indeed showed that there is a significant negative relation between the degree of exchange rate flexibility and the growth rate of output per worker in a country. These results align with the results that were found in the paper that was recreated by Aghion et al (2009) which show that constant fluctuations in the exchange rate can bring uncertainty and more severe business cycles which hinder investments and economic growth. The second part of this hypothesis was also discussed after the first GMM estimation. An interaction effect between the degree of financial development and the degree of exchange rate flexibility was included in the regression. This was done to prove that countries with a relatively low level of financial development experience stronger benefits than countries with a relatively high level of financial development. Table 3 showed that there was indeed a significant positive interaction effect between the degree of exchange rate flexibility and the degree of financial development which therefore supports our hypothesis. This effect however was not as strong and as significant as the original paper by Aghion et al. Nevertheless we can state that the strong negative and significant coefficient which we found for the exchange rate regime

variable in combination with the positive interaction effect is supporting evidence for not rejecting our first hypothesis.

To add a new part to the scientific literature a second 2 step system GMM estimation was run. In this second regression which can be found in table 4, around 20 more years of data were added to the original dataset which was a recreation from the paper by Aghion et al (2009). The reason that this extension was chosen was to see if the increasing development in the world capital markets would lower the significance of having a fixed exchange rate regime due to the decrease in credit constraints for countries around the world. From these expectations the second hypothesis was created which is:

"The more developed global capital markets after 1999 have eased the credit constraint on companies and have made the choice off a certain exchange rate regimes less relevant"

As stated above, according to the hypothesis we would expect a weaker relation between the growth rate of output per worker and the degree of exchange rate flexibility. This is due to the strong increase in the degree of financial development over the years which is shown in tables 1 and 2. The results that can be found in table 4 are used to evaluate this hypothesis. The coefficient for the degree of exchange rate flexibility is higher in table 4 than it is in table 3. This indeed indicates that the effect that the degree of exchange rate flexibility has on the growth rate of output per worker has decreased. Having a fixed exchange rate to boost the growth rate of output per worker is no longer as effective as it was in the first 40 years of the dataset. Another thing that was described in the results chapter was the fact that the coefficient for the degree of exchange rate flexibility is no longer significant at a 5% significance level anymore. This indicates that the strong and significant relation that we found between the degree of exchange rate flexibility and the growth rate of output per worker is now weaker than it was in the period 1960 until 1999. Looking at the two arguments that were explained above we can state that there is no reason to reject the hypothesis:

"The more developed global capital markets after 1999 have eased the credit constraint on companies and have made the choice off a certain exchange rate regimes less relevant".

7. Limitations and future research recommendations

7.1 Limitations

This paper had the goal of describing the relationship between the growth rate of output per worker and the degree of exchange rate flexibility in combination with changing levels of the degree of financial development. As stated before in the conclusion we saw now direct reasons to reject the two hypothesises on which the research was based. However, there are some limitations that should be discussed concerning the internal and external validity of this paper which will be followed by recommendations for future research into this topic.

The first discussion point of this chapter is the coefficient that we have found for the interaction effect between the degree of exchange rate flexibility and the level of financial development in a country. In table 3 a positive effect was found that was significant at a 10% significance level. Both the significance level and the coefficient are lower than expected. We were not able to prove a very strong significant effect of the interaction term on the growth rate of output per worker. The height of the coefficient also indicates that this interaction term does not have an enormous impact on the growth rate of output per worker. This means that the finding that the degree of exchange rate flexibility has become less relevant for the growth rate of output per worker probably also has other reasons apart from the interaction effect with the level of financial development. The second discussion point concerning the interaction effect is that if we add the more recent data in table 4 this interaction effect is no longer significant. This means that we cannot assume that in the coming years there is still an interaction effect between the degree of exchange rate flexibility and the level of financial development. This is of course a threat to the external validity of this paper.

The second discussion point of this chapter is about the statistical method that is used in this thesis. For both of the main regressions which can be found in tables 3 and 4, a two-step system general method of moments estimator is used. The reasons for this are endogeneity issues and have been described in detail in the methodology chapter. This method was used because of the goal of first replicating the results found by Aghion et al (2009). More recent papers have started frequently using more modern techniques that are even better in handling endogeneity issues in panel data sets. Using these more advanced statistical

methods could improve the internal validity of this paper but this was beyond the scope of this paper.

7.2 recommendations for further research

the points that were noted in the limitation part create opportunities for further research into this field. As noted before the main limitations of this paper are the lack of impact of the interaction effect before 1999 and the nonexistence of a significant interaction effect if we add the more recent data points. Recommendations for further research are based on the fact that there are probably other effects and variables that have an impact on the importance of countries to choose a certain exchange rate regime which were not included in our regression. This fact becomes most clear if we look at table 4 in which the interaction effect no longer exist in a significant way. To explain the relation between the degree of exchange rate flexibility and the growth rate of output per worker in the 21st-century further research should focus on finding variables that explain the relationship between these two variables in more detail.

The second point that was named in the discussion section of this paper is the one concerning the methodology. In the 13 years that have passed since the publication of the paper by Aghion et al (2009), there has been a wide range of new developments when it comes to statistical analyses. The goal of eliminating endogeneity issues in panel data is one of the fields that has seen many new methods in the past decade. Future research should focus on finding a more suitable modern statistical method. This should enhance the internal validity of this research due to the use of panel data with a relatively small sample size.

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Appendixes

Appendix A: list of the 83 countries included in the dataset

Algeria	Argentina	Australia
Austria	Bangladesh	Belgium
Bolivia	Botswana	Brazil
Burkina Faso	Canada	Chile
China	Colombia	Congo republic
Congo democratic republic	Costa Rica	Cote de Ivoire
Denmark	Dominican republic	Ecuador
Egypt	El Salvador	Finland
France	The Gambia	Germany
Ghana	Greece	Guatemala
Haiti	Honduras	Iceland
India	Indonesia	Iran
Ireland	Israël	Italy
Jamaica	Japan	Jordan
Kenya	Korea	Madagascar
Malawi	Malaysia	Mexico
Morocco	Netherlands	New Zealand
Nicaragua	Niger	Nigeria
Norway	Pakistan	Panama
Papua new guinea	Paraguay	Peru
Philippines	Portugal	Senegal

Sierra Leone	Singapore	South Africa
Spain	Sri Lanka	Sweden
Switzerland	Syria	Thailand
Togo	Trinidad and Tobago	Tunisia
Turkey	Uganda	United kingdom
United states	Uruguay	Venezuela
Zambia	Zimbabwe	

Appendix B: Data sources

Variable name	Description	Source and number of observations
Growth rate of output per worker	Log difference of the output per worker compared to last year	Up to 1999: multiple souces_micro time series_annual.xls After 1999: Ilostat database Number of observations: 3231
Exchange rate flexibility	The degree of exchanger rate flexibility	Exchange rate regime, Reinhart, Rogoff and Ilzetski classification Number of observations: 3240
Financial development	Private domestic credit divided by GDP	world bank Financial Structure Database Number of observations: 3240
Initial output per worker	The output per worker in 1960	see "Growth rate of output per worker Number of observations: 83
Interaction effect	The interaction term between exchange rate flexibility and financial development	Number of observations 3240
Education	Log percentage of secondary school enrolment	Global Development Finance & World Development Indicators_indicators_annual.xls Number of observations 3084
Trade openness	Log Trade volume divided by GDP	World bank trade data Number of observations: 4329
Government burden	Log government consumption divided by GDP	world bank_government consumption_annual.xls Number of observations 3175
Inflation	Log inflation rate per year	https://www.macrotrends.net/countries/WLD/world/inflation-rate-cpi Number of observations: 3488

Crisis	Dummy indicating if there was a banking or currency crisis	Reinhart dataset_crisis data_annual.xlsx Number of observations: 2800