M.A. ECONOMICS OF INTERNATIONAL TRADE AND EUROPEAN INTEGRATION

2010 – 2011

Master dissertation

Relation between Globalisation and the Real Convergence:

Does convergence of globalisation influence convergence of real GDP per capita?

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Acknowledgements

I would like to thank to my supervisor, Prof. José Villaverde Castro, for all his guidance and insights. Thanks also to my family for their support and patience during my studies.

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List of used abbreviations

CU	Customs Union
EIA	Economic Integration Agreement
EU	European Union
FDI	Foreign direct investments
FTA	Free trade area
GATT	General Agreement on Trade and Tariffs
GDP	Gross domestic product
IMF	International Monetary Fund
KFP	A.T. Kearney/Foreign Policy Globalisation Index
MNC	Multinational corporation
PS	Partial Scope Agreement[1]
RTA	Regional trade area
UN	United Nations
UNCTAD	United Nation Conference on Trade and Development
WTO	World Trade Organisation
WW1	First World War
WW2	Second World War

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[1] Covers only certain products (WTO)

Abstract

This dissertation poses the question of whether there is a relationship between the speed of convergence of globalisation and the speed of convergence of GDP per capita. Firstly, the concepts of globalisation and real convergence and their relationship are thoroughly explained from both the theoretical and empirical point of view. And secondly, the answer to the question comes in the form of beta and sigma convergence analysis of this relationship. Thirdly, the analysis splits the countries into two groups (developed and developing countries) and finds interesting but ambiguous results in their comparison. Finally, in order to correctly interpret the results of absolute and conditional beta and sigma convergence, their theoretical and empirical overview is discussed in depth. The dissertation concludes by providing some answers to the initial question for every particular analysis. Namely, it shows that this relationship is indeed very ambiguous.

Introduction

"We see globalisation everywhere ... by contrast, we do not see convergence everywhere."

Dowrick and DeLong (2001)

As Dowrick and DeLong point out globalisation can be indeed seen everywhere. From the end of the last century till the present, there is literally a boom of globalisation which penetrates to our everyday lives. By the expanding globalisation there are numerous opportunities and challenges as well as risks brought into being. It is a world spread process which is most likely impossible to reverse.

By convergence we understand diminishing of disparities among the regions. Many researchers claim that the two phenomena go hand in hand (Lutz 2001). But studying this relationship using different econometric approaches leads economists to various, even antagonist results. While most of them agree that the result depends much on a sample chosen, few provide a really robust empirical analysis to support their particular claim (Villaverde and Maza, 2011). No one has to prove that globalization occurs in the contemporary world. But does real convergence occur, too? Or even convergence of globalization patterns? And are these phenomena interconnected?

This work intends to sketch the phenomenon of globalisation and means of its measurement, the logics of estimating the rate of convergence in both, the globalisation levels and national incomes (real GDP per capita) alike, and finally finding a relationship between the two. The main objective is to answer a question:

„Is there a relationship between the rate of convergence in globalisation and the rate of real convergence among countries?" or rather *„If globalisation levels (indices) of countries converge more rapidly in a certain period, does it cause more rapid real convergence across these countries in the same period?"*

The paper is organised as follows. First, the theoretical part discusses the phenomena of globalisation concentrating on its definitions, historical development, causes, and main features. Since globalisation is a phenomenon of heterogeneous character, there are various approaches to the issues concerning it, which are sketched in the last part of the globalisation chapter. The second part of the theory is devoted to the description of convergence, and what models have been presented to measure it most precisely. In contrast to globalisation, convergence can be defined quite simply; however, there are many debates on the proper way of measuring it. Still, there are some generally accepted models on which I will focus in this part.

Thirdly, the empirical part focuses on the question I have posed and attempts to describe the relationship between globalisation and real convergence, particularly, if the speed of convergence of real GDP per capita can be explained by the rate of convergence of globalisation. In order to study this relationship I measure the absolute and conditional beta convergence and compare the rates of convergence. In addition to beta convergence analysis, there is also a short look at the sigma convergence. Finally, the paper present the main conclusions.

1   Globalisation

The first part of this thesis analyses the globalisation phenomena in detail. The starting point is the definition of the term; subsequently, it shortly presents its historical evolution, and finally, it analyses some of the causes and most important features of globalisation with focus on economic globalisation.

1.1   The definition of the term

Globalisation is a term we are all familiar with, a term we all use on daily basis or at least understand its meaning and application. As Fischer (2003) indicated, the debate over globalisation is very heated as the term is more frequently mentioned and referred to over the last decades. However, there is no precise definition of the term. Beerkens (2006) composed a list of definitions of globalisation, where one can find dozens of various explanations of the term. The globalisation processes penetrate many areas and fields of human activity, which is acknowledged by Giddens (1999) saying that "globalisation is political, technical and cultural, as well as economic." In addition to that, it also covers environmental issues concerning sustainable development. This feature is one of the reasons that make the definition of globalisation complicated and difficult to be expressed in a short sentence. In very general terms the process of globalisation can be defined as Fisher (2003) suggests: "Globalization – the ongoing process of greater interdependence among countries and their citizens – is complex and multifaceted." This idea is also supported by Held et al. (1999) who see globalisation, "in its simplest sense, as referring to the widening, deepening and speeding up of global interconnectedness."

To conclude, globalisation is a process leading to the perfection of the global (world) system characterised by free effective allocation and usage of all resources, minimisation of the cost due to strong competition, integration of all the subjects on the market and deep interdependence of governments, organisations, trade and people, built on the accelerating information flows contributing to maximal effectiveness (Chrastinová, 2009).

1.2   The evolution of globalisation

It might look like processes of globalisation appeared only recently, but this is not the case. Globalisation is a part of our history for a number of centuries. Yet, stating the exact origin of globalisation processes is questionable and uncertain. The evolution of globalisation can be divided into numerous cycles or waves. The number of historical periods is varying from one author to another. Sweden economist Therborn (2000) specifies in his historical hypothesis six or even seven major historical waves, first dating back to the beginning of the Christian era. In his division, at the beginning, the main drivers of globalisation were religion and culture, and then it was especially political power, trade and economic objectives. Jeníček (2001) in his work mentions the theory of economic cycles of Russian economist Kondratiev who divides the evolution of globalisation into five periods of approximately 50 years. The Kondratiev cycles differ in the specific structural changes, technological progress and innovations influencing the whole cycle. According to Williamson (2002) there are four epochs of globalisation. He suggests that the first signs of globalisation can be traced back to the 15th century when great discoveries have been made and when the world trade in

commodities and factors of production has begun. He considers the second epoch (1820-1913) as the first global century, and the last epoch (1950-up to now) as the second global century – the periods of great globalisation. Preda (2000) emphasises the connection between globalisation and World-States System by which emergence, at the end of WW2, the European-States System ceased to exist, but he quickly adds that this was "the last act of a long process, that slowly crossed the whole eighteen century."

Figure 1.1   Three waves of globalisation
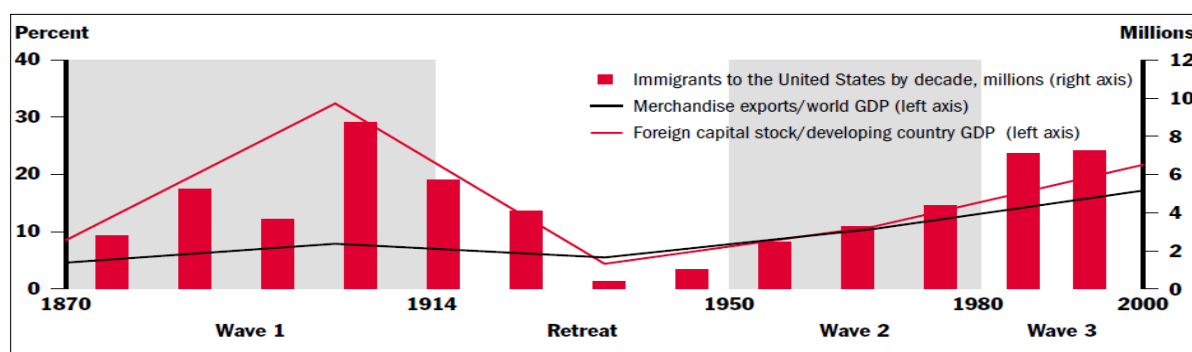
Source: A World Bank Policy Research Report: Globalization, Growth, and Poverty. Oxford University Press. 2002

Despite all the differences in timing, number and character of globalisation periods, all the authors depict two most significant periods. The first globalisation era is prior to the WW1, characterised by the technological progress in industry, transportation, and communication, reduction in trade barriers and transport costs, what enabled people to travel, expand, invest and trade. The second globalisation era emerged after the end of WW2 (around 1950). At the beginning of the period there was enhanced cooperation of the most developed nations – as Eichler (2006) indicates, world institutions such as UN, IMF and GATT agreement were established. Later, after 1980, many developing countries entered the world markets[2] and international economy was starting to gain features of the global one (see the figure1.1). Another very important feature of this last period, which is strengthening globalisation, is the prevailing economic and political model – capitalism and liberalism, as stated by Eichler (2006).[3] Figure 1.1 depicts the waves of globalisation and some factors driving economic integration which, according to The World Bank Policy Research Report (2002), are mainly trade, migration, and capital flows.

The waves of globalisation can be in some way compared to business cycles because, although they last longer, they are similar in nature. The end of globalisation waves arrive with the arrival of deep recessions and crises. In the starting phase economies gradually open to the world markets and lower trade barriers. As the trade is becoming promising and the economic growth increases the interconnection rises as well. The competition intensifies, countries start to specialise, what contributes to mutual interdependence. Due to accelerating technological progress globalisation deepens with arrival of every new wave which, in turn, makes the cycles shorter (Chrastinová, 2009). That consequently makes current cycle the most globalised.

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[2] A World Bank Policy Research Report (2002)
[3] Capitalism and liberalism dominated world systems especially after the end of the cold war and the fall of iron curtain, when eastern economies commenced the transition to market economy.

1.3   The causes and main features of globalisation

Jeníček (2001) recognizes two main causes of globalisation (focusing on economic globalisation). The most obvious one is the existence of numerous and especially small economies. At this point, Jeníček (2001) adds that it is not just the size and lack of resources, but particularly increased flow of information regarding technological progress, which makes countries willing to keep up with the rest of the world and join the global market to maintain the sufficient standards and stuck to actual trends. Giddens (1999) assumes that globalisation is triggered by "massive increase in financial foreign exchange transactions", and he similarly supports the notion that dramatic improvement in communication technology facilitates the process.

Increasing trade and financial flows, facilitated by proceeding liberalisation, scientific and technological progress, leads to narrow regional specialisation followed by growing interdependence. Equally, Angell cited in Stopford (2000) emphasizes that "interdependence is driven by science, technology and economics - the forces of modernity." Jeníček (2006) implies that ongoing globalisation makes the world smaller in space and time. The revolution in transportation, the pace of information flows and the availability of information all contribute to the process. Liberalisation is done on the multilateral level by the means of supranational organisations, as well as on the regional level.[4] Figure 1.2 depicts the increase in the formation of RTAs in the world. According to the records of WTO, there are 216 RTAs (mostly FTAs, some CUs, EIAs, and PSs[5]) in force in the present time and 37 RTAs are under negotiation or already signed (but not in force yet).[6]

Figure 1.2   Number or RTAs in force
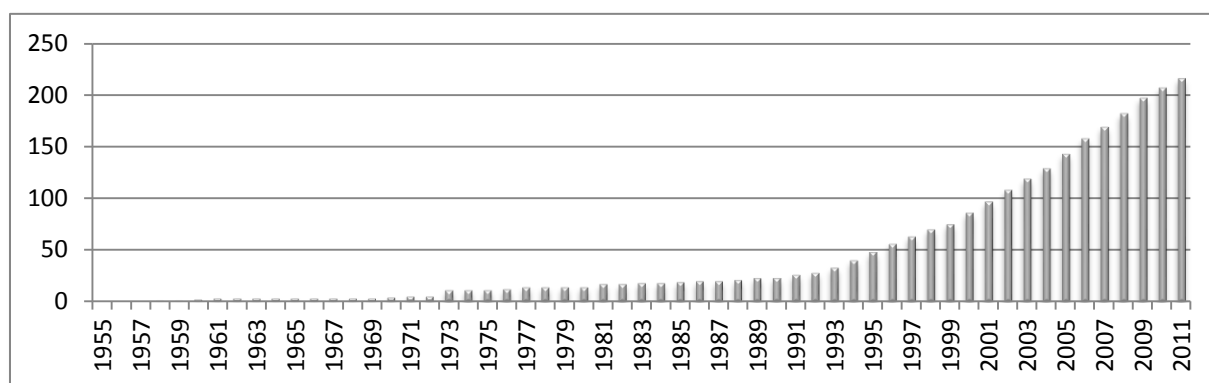
Source: Own calculations based on the List of RTAs, WTO

Figure 1.3 shows the evolution of financial flows by receiving economic groups. Despite the total financial flow fluctuations, due to the crises and the recessions,[7] the fraction of FDI received by developed economies has reduced almost by half since the recent downturn, while in developing economies FDI income decreased only slightly after the crisis in 2008, and in 2009 it began to grow more rapidly – claiming 52% of the total FDI flows in 2010.

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[4] Chrastinová ,2009

[5] See the List of used abbreviations at the beginning of this paper for the explanation of these abbreviations.

[6] As Chrastinová (2009) notes the main reasons for rapid creation of RTAs in recent years are prolonging negotiations of WTO on the multilateral level. By creating RTAs countries liberalise trade routes they most favour, however, this mass RTA creation makes the system less transparent.

[7] Outrata et al. (2006) suggest that decrease in FDI inflows can be triggered not only by crises but also by low economic growth in some counties causing a long term fixation of the capital in one place.

The flows of investment from developed to developing economies are caused by growing openness of developing economies, reduction of trade barriers, comparable lower costs of factors of production and generally easier penetration to these markets that aim to attract foreign investors. This advantage has been quickly taken by MNCs relocating their production to the most profitable regions. Jeníček (2006) considers a firm being one of the most important components of the economy. Of course no one would dispute that MNCs are slightly different from regular low scale firms. During the last century they grew rapidly, and as Marfleet (1998) observes, MNCs now dominate the world economy, unlike in the previous period, when national states and state capital were in that position.

Figure 1.3 **FDI inflows, global and by group of economies in billions of dollars**
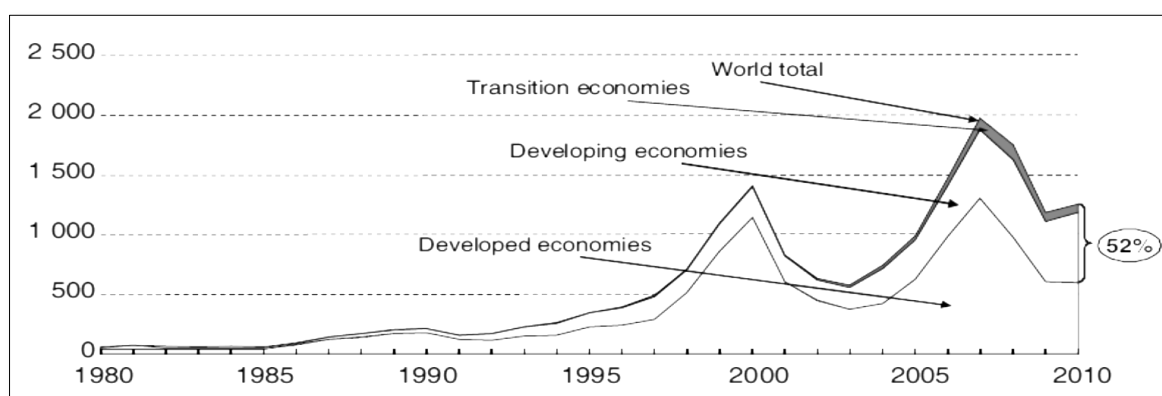
Source: UNCTAD: World Investment Report 2011

Apart from economic globalisation, there are also signs of political, cultural, and environmental one. However, economic integration (globalisation) is more advanced since it is not so personal, sovereignty suppressing matter.[8] It appears that migration and mixing of cultures is still a very sensitive issue and to some extend it is limited by many countries. Fisher (2003) finds out that "with respect to migration and labour flows the modern system is less globalised than it was a century ago." Nevertheless, he continues in support for globalisation in migration, by indicating increased speed of migration from developing to developed economies, which, however, might include brain-drain aspect. Political globalisation is an issue all nations are carefully avoiding; nevertheless, by integrating with the aid of various supranational organisations, they are willing to relinquish part of their sovereignty for greater good.[9] Environment, natural protection, and sustainable development are subjects of heated debates, and even though they affect us all equally, and no matter how much attention is paid to them, still, the successful solutions are missing since the global community is not flexible enough.[10] "Consensus about the strength and direction of action in each dimension has yet to emerge," claims Wheeler (2010). He goes on saying that the "debate is no longer about science" but concerns mostly economy and technology, and political matters.

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[8] MNCs seem to be the only factor suppressing, to greater extend, national authorities independence since they often dictate rules and state conditions (usually under the threat of withdrawing investments from the country and relocating the production).
[9] The example can be the common policies of the EU
[10] For example, United States and China, as the world biggest polluting nations, are still not on the list of signers of the Kyoto Protocol.

1.4 The debate over globalisation

"For some, globalisation is a way of being happy; for others, it is a cause of unhappiness. But for all, it is an irrevocable destiny of the world, an irreversible flow of events and a process influencing every one of us in the same way and extend." Bauman (1999)

The more this topic is discussed the more mixed opinions are offered. It is not much of a surprise since the issue of globalisation is so broad and heterogeneous. Many, like Carnoy (2001), refer to deterioration of state sovereignty as a negative aspect of globalisation. Geyer and Bright (1995) point to "a relation of domination and subordination among all regions of the world."

Marfleet (1998) argues that even though according to the globalisation theory, everyone should benefit from these changes, economic indicators imply otherwise, as along with worsened living conditions of people living in developing economies. In support of the previous argument, Fisher (2003) finds out a similar story, saying that in the world of deepening globalisation developing countries on average improved their conditions; however, it is not the case of all countries. Considering the disparities and poverty gaps, one might point to globalisation as the root of all evil, while Stiglitz (2002) recommends not abandoning globalisation, which is "neither feasible nor desirable", but finding a proper way of managing it since globalisation is not a problem. A chairman of numerous prosperous corporations, Niall FitzGerald (1997), is in favour of globalisation, claiming that nowadays era of globalisation is just a part of evolutionary process of the world economy. It is obvious that those who take advantage of the current conditions would not contradict their actions and wait for a change worsening their position.

Up to now, the world is not fully globalised, and the only way to complete globalisation, as Snowdon (2007) notes, would be a single market with no political borders. In reaction to a world single market, Gray (1998) fiercely disputes the idea by saying that only utopians can anticipate such a future.

,,Almost everyone recognizes that the world could be a better place, and that there is much work to be done to improve it. Why then is so much of the debate about whether the world is getting better or worse, rather than about what can be done to make it a better place?" Fisher (2003)

2   Convergence

Many economists ask themselves whether there is any sign of convergence between the economies, specifically, whether weaker economies grow faster than strong ones and consequently meet at the same level. Although there is a number of indicators and indices measuring convergence, some countries may converge in some areas and diverge in others. Similarly, there is no optimal way of measuring and modelling convergence. There are, though, numerous theories capturing the idea of measuring convergence. I will in short present three most prevalent approaches, namely, standard neoclassical growth model, new endogenous growth theory growth model, and new economic geography. [11]

The standard neoclassical growth model (Solow-Swan model, also known as exogenous growth theory) was worked out by Solow[12] and Swan[13] in 1956.[14] The model is based on the relationship of production function and the capital stock movements, and, as amended by Swan, it also considers exogenously given technical progress.[15] The theory presumes higher capital concentration in rich economies and higher labour concentration in poor economies, which consequently generates decreasing returns according to factor intensity. By liberalising economies, capital and labour are free to move and therefore the productivity gap decreases, which contributes to mutual convergence. Circulation of new innovative technology might cause convergence even in the case of positive returns to scale, since adoption of innovations by poorer economies is less costly than their creation.[16]

In contrast to the exogenous neoclassical Solow – Swan theory, there is an endogenous growth theory proposed by Romer (1986). His model counts on positive returns to capital that generates even greater disparities among the economies, and consequently causes divergence. Romer, in his theory, incorporates human capital, and resource and development expenditures as a part of capital. However, this may not presume decreasing returns to capital in a capital intensive economy, as was the case in the neoclassical growth model, which may even lead to divergence between the regions.[17]

The new economic geography model, framed up by Krugman (1999), considers as sources of convergence location, imitation of technology, and trade and FDI flows which it refers to as channels for technology spillovers. This theory highlights the importance of location and proximity of an economic region, since it supposes that poor regions are likely to converge to rich ones if they are close to each other.[18]

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[11] Orlik, 2003

[12] Solow, 1957

[13] Swan, 1956

[14] Solow and Swan were not the first attemting to measure convergence. In 1928, Ramsey created an endogenous growth model which considered individual's preferences for consumption and saving, and later, in 1965, the original Ramsey endogenous growth model was adjusted by Cass and Koopmans (Ferrara and Guerrini, 2009) .

[15] As Ferrara and Guerrini (2009) observe, increasing capital intensity is distinguished from technological progress in this model.

[16] Paas et al., 2007

[17] Paas et al., 2007

[18] Paas et al., 2007

2.1 Types of convergence

On the base of prevalent empirical studies on convergence, two most used types of empirical methodologies for testing convergence are distinguished, in particular, sigma and beta convergence.

Sigma convergence works with the coefficient of variation which is calculated for number of observing regions in specified time. Observing regions are considered convergent if the coefficient of variation decreases over time. The coefficient of variation is computed in the following way:

$$cv_t = \frac{\sigma_t}{a} = \frac{\sqrt{\frac{\sum_{i=1}^{n}\left(a_{it} - a_t\right)^2}{n}}}{a_t}$$

Where σ_t stands for a standard deviation of the sample, a is a custom indicator by which convergence is calculated (very often and also in the case of this dissertation - GDP per capita), and n is a number of observations in the sample.[19] Sigma convergence is a very useful tool for measuring convergence, however, the result does not provide any information on the development of a particular observant – an economic region, since, as Pentecost (2010) implies, "the measure is of absolute, unconditional convergence."

In the case of beta convergence, conditional and absolute (unconditional) beta convergence is distinguished. In order to measure absolute beta convergence it is necessary to run an estimation regressing time-period adjusted regressant growth over the period on the suggested regressor, as Barro and Sala-i-Matin (1995) show:

$$\frac{1}{T} \log\left(\frac{y_{iT}}{y_{i0}}\right) = c + \beta \log(y_{i0}) + \mu_i$$

Where y indicates per capita income (or possibly any other variable being analysed for convergence) y_{iT} refers to income at the end of the period and y_{i0} stands for initial income (at the beginning of the observed period) for country i, T indicates number of periods, and μ is an error term.
Quite reasonably, in order to suggest a positive convergence pattern, a negative coefficient (β) on the initial value of an explanatory variable must be obtained from the estimation, meaning that countries with lower initial independent variable (income) will on average tend to grow faster than the initially higher-value countries.

Apart from discovering whether the sample is converging or diverging, the rate of convergence can be calculated in following way:[20]

$$rate\ of\ convergence = -\frac{\ln(1 + T\beta)}{T}$$

Conditional beta convergence follows a similar logic as absolute beta convergence, but it is assumed by the neoclassical growth theory when the determinants of the steady state of income per capita -

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[19] Pentecost, 2010
[20] Villaverde and Maza, 2011

technology progress, saving rate in the country, capital depreciation rate and population growth rate are not identical across countries. Therefore, with absolute convergence, countries tend to have steady state with the same income per capita, while in conditional convergence, countries move to their own steady state, based on its determinants. Even with conditional convergence, some countries tend to converge to the same steady state. Such a group of countries are said to belong to the same convergence club.[21]

2.2 Globalisation and convergence

"Globalization of the economy does not necessarily imply global convergence"[22]. This dissertation is studying the relationship of the two described phenomena: globalisation and convergence. This relationship is far from being straightforward and many researchers accentuate its different aspects.

According to Lutz (2001), the current consensus states that "greater integration into the world economy is beneficial for poor countries" and that they benefit from the process of economic globalisation. In his 2001 paper he discusses the long debated question, whether openness (and by implication globalisation) is beneficial for poor countries in the terms of economic growth. By extending endogenous growth models onto open-economy settings he suggests a long run convergence in productivities with an assumption that "technical progress comes in the form of general technologies and knowledge that are diffused costlessly at a global level". However, there is also a number of possibilities of divergence based on the assumption about the origins of technological progress. Even though the endogenous growth models are used as a final proof of the poor countries' benefits from openness, Lutz (2001) states that there is not enough empirical evidence on the general validity of these models. Based on the empirical analyses produced about the issue, he adds that there is also very little empirical evidence on convergence in income per capita between rich and poor countries. Moreover, the accelerating divergence occurred ever since the 1980s. Lutz (2001) concludes that "potential benefits of greater openness and, by implication, increased globalization for developing countries have been significantly overstated". However, there is no evidence that restricting trade and financial flows would be beneficial for poor countries either.[23]

Alternatively, Dowrick and DeLong (2001) suggest that even though globalisation is strongly evident ever since as soon as the 19th century, convergence has occurred rather rarely[24], usually geographically confined and limited in time. By dividing the countries by the strength of forces generating convergence into a convergence club and others, they analyse the pattern of world economic growth. Based on this Baumol and Wolff's (1988) insight, they describe "the correlation between measures of globalisation and the power of forces making for convergence"[25]. They conclude by dividing the relationship of convergence to globalisation into four theses. Firstly, trading staples across the narrow northern Atlantic ocean in Williamson's (2002) second epoch of globalisation made ground for "spreading the possibility of convergence", which made possible industrial development and resulting successful economic growth. Secondly, despite the great

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[21] Villaverde, 2006
[22] Dowrick and Delong, 2001
[23] As Lutz (2001) concludes.
[24] As Dowrick and Nguyen (1989) and Williamson (1996) show, it certainly does appear in the group of OECD countries.
[25] Dowrick and Delong, 2001

structural change, mass migration of workers and economic integration the coffee bean brought to Brazil, the tea plant to Ceylon or the rubber plant to Malaya, it did not bring convergence. On the contrary, both the gaps in industrial structure and income and productivity widened. Thirdly, during the period between the World Wars, the convergence club (countries mentioned in the first thesis) appeared to be enlarged by several countries of coastal Africa, Latin America and the Soviet Union. Lastly, the post-war period has registered an expansion of the convergence club, but also a shift in its geographical location. On the one hand, the OECD countries have showed significant signs of convergence, being followed by (as Dowrick and DeLong (2001) phrase it) the "east Asian miracle" and an "escalator to modernity"[26] for China and India in the last 30 years. On the other hand, though, an occurrence of a very unfavourable development in post-colonial Africa, Latin America and the Soviet Union meant a ticket out of the convergence club for a great many countries, too. Dowrick and DeLong conclude, that the divergence situation continues to be reality (and even accelerating) for the vast majority of the world's countries outside the convergence club since 1980's. As Lewis (1978) states, it is not only the fault of the countries imposing high barriers to trade and capital flow. As Dowrick and DeLong add, opening an economy does not necessarily "guarantee a place at the high table". On the contrary, the poor countries, being unable to afford the investment to keep up with the development pace of the rich countries, continue to fall behind at an increasing rate[27].

Nevertheless, Jones (2001) based on an empirical analysis in his "Comment on Dorwick and Delong "Globalisation and Convergence"" speculates that it might be possible, that the "divergence between the charmed circle and the poor periphery would have been even greater in the absence of globalization".

Baddeley (2006) says that based on his empirical study, there is a linkage between the convergence and globalisation development, albeit on an international level it is a negative one. Surely, trade and financial flows as well as informational flows have increased. Even though the increase in the latter seems to be positively influencing convergence, the increase in the former is associated with an increase in the international income inequality. Increasing the volume of exports of primary commodities from developing countries has served in this capacity. In order to decrease income inequality (and in this way support convergence tendencies), Baddeley (2006) suggests encouraging the development of export industries also by supporting micro-finance schemes and providing incentives for developing infrastructure. He concludes by stating that in order to "ensure that globalization does not limit the potential for growth and development in poorer countries, specific policies should be developed to moderate the inequality potentially generated by globalization". Among these policies, he accentuates monitoring and regulation of international financial systems.

Williamson, in his 1996 paper "Globalization, Convergence and history" claims the contrary to what the previously discussed papers conclude. Namely, he says that there were epochs of fast growth in history when globalisation and convergence flourished. Then, there was an inter-war epoch of deglobalisation, divergence and overall slow growth. Williamson (1996) further elaborates on particular development in Europe and North America and supports his claims with plentiful evidence on historical development, GDP per worker, real wage dispersion and school enrolment data. However, his research only considers OECD countries, which as previously mentioned, in the terms of

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[26] Summers et al., (1991) claim China and India to be solidly on its way towards favourable development.
[27] According to Dowrick and Delong (2001).

globalisation and convergence at any time in the modern history developed differently than the rest of the world. Thus, his results cannot be applied internationally, but they do provoke a thought, that the relationship between globalisation and convergence is by no means simple or straightforward.

While the discussed researchers did a very difficult and important work by trying to find the connection between patterns of globalization and development in the convergence in the per capita income, Villaverde and Maza (2011) took a slightly different approach – the consideration of the convergence of globalization levels themselves worldwide. Firstly, they show the worldwide increase in globalisation and study and show the convergence in the globalisation levels as measured by the KOF globalisation index[28] by the means of sigma and beta convergence. Secondly, they use this wide-range globalisation measure (not only economic-related as many other researchers do[29]) to estimate, whether globalisation has improved income convergence globally, and find that it has. This point of view on establishing a functional relationship between the globalization and convergence in per capita incomes is the one that inspired this dissertation. Namely, the empirical part of this dissertation ultimately analyses the relationship between the measure of the convergence speed of both globalisation levels and incomes per capita.

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[28] As desrcibed in the methodology part.
[29] Villaverde and Maza, 2011

3   Methodology and data

In order to answer the question posed in the introduction,

„Is there a relationship between the rate of convergence in globalisation and the rate of real convergence of national incomes among countries?" or rather „If globalisation levels (indices) of countries converge more rapidly in certain period, does it cause more rapid convergence of the national incomes of the countries in the same period?"

I need to produce some results for myself – namely sets of globalisation indices convergence rates and national incomes convergence rates. To do that I am using the methodology that Barro and Sala-i- Martin (1991, 1992) described that measures beta convergence for the time periods for the set of countries. Firstly, I run a beta convergence estimation in order to find out the rate of convergence in globalisation indices Secondly, I run another beta convergence estimation, this time in order to find the rate of convergence of national incomes in a similar way. For this I am using the data available for the sample countries for the time period of 39 years (1970-2008). I run a convergence regression for every two consecutive years. In such fashion I obtain 38 regression results from which I calculate 38 speeds of convergence.

With these data I am then able to run the ultimate regression estimating the relation between the rate of convergence of globalisation and the rate of real convergence of national incomes and thus come to the final result and answer my question.

In addition to that I intend to plot sigma convergence and consequently compare real GDP per capita to the coefficient of variation of globalisation indices.

Data

For measuring globalisation I have chosen the KOF index, since it is the best available source providing measurements of the levels of globalisation in various aspects (regarding also social and political aspects not only economic one). Although, KOF index of globalisation evaluates indices for about 200 countries, in the analysis I use only 109, which have the globalisation index composed of all three components to contribute to the robustness of the analysis.[30] The KOF globalisation index ranges from 0 to 100, where 0 values indicate a completely closed country and a 100 is the most globalised one. In general, countries range from 9.56 (Myanmar in 1987) to 92.89 (Switzerland in 2000).

Apart from KOF globalisation index there are also other indices measuring globalisation. For example, as Snowdon (2007) promotes, there is A.T. Kearney/Foreign Policy Globalisation Index (KFP). This index measures 4 concepts of globalisation – economic integration, technological connectivity, personal contact, and political engagement. Even though, the KFP index includes other then economic aspects it focuses on the small sample of countries with respect to world proportion of GDP. [31] Another complication with KFP index is that A.T. Kearney started the Globalization Index

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[30] Note: KOF computes globalisation index for 208 countries, but not all have the final globalisation index composed of all three parts – economic, political, and social.
[31] In 2007, it ranked only 72 countries making 97% of world GDP that year. (Globalization index data, 2007)

research in 2003, what is a short period to study. In addition to that Lockwood (2001) argues that KFP index is not constructed perfectly with respect to the measurement, weighting, and choosing the variables. G-index created by World Markets Research Centre in 2001 was one of the first indices measuring globalisation, however this one focuses mostly on the economic aspect of globalization.[32] Other indices measuring globalisation might be composed of non-economic aspects but they are not published regularly, so their evolution cannot be studied.

To measure national income I am using data present in the UNCTADSTAT database processed by UNCTAD. In my work I use real GDP per capita in the given period of time measured in USD. Another reason for using only 109 countries for my estimation observations is also that some countries do not provide data on GDP per capita for the entire period - especially countries established after the beginning of the studied period.

UNCTADSTAT database is mostly a trade and economy oriented database. But in order to add control variables for the measure of conditional beta convergence I also need statistics on population and demographic issues and hence I use data available at The World Bank website. There is a dataset of about 298 featured indicators and the data are provided for 209 countries spanning from 1960 to 2010, yet the availability of many indicators is limited due to the difficulty of gathering source data for further evaluation.[33]

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[32] Dreher et al., 2009
[33] The World Bank website

4 Analysis of the relation between globalisation and real convergence

This thesis tries to find any relationship between the speed of convergence of GDP and globalisation and uses beta convergence as a mean for calculating a rate of convergence. This section is devoted to the empirical study of the relationship of globalisation and real GDP per capita[34]. At first, it calculates absolute beta convergence and the speed of convergence of the indicators. Second part enlarges the model by other variables to measure conditional beta convergence. By dividing world countries into developed and developing ones, it focuses on measuring beta convergence of characteristically similar regions. The last part plots sigma convergence and consequently compares real GDP per capita to the coefficient of variation of globalisation indices, and provides both theoretical and empirical comparison of the two convergence concepts.

4.1 Absolute Beta convergence

As I have already mentioned the sample of countries is restricted due to the unavailability of data for all the countries. The main reason is that the analysis covers a period of almost 40 years during which the status of many countries has changed as well as the area structure of many of them. Therefore I was able to focus only on those stable ones providing data for the whole period, making a sample of 109 observations.

Firstly, I run the beta convergence regressions for every two consecutive years. Then, using the beta coefficient I calculate the speed of convergence among the sample countries between those two years. Doing this, I obtained 38 subsequent convergence speeds[35] (one for every consecutive year pair from 1970 to 2008). I studied these speeds of convergence of both globalisation and GDP[36].

Using the rates of convergence of globalisation and the rates of convergence of GDP in the given period I tried to explain the relationship between the two. I run a regression to explain dependence of the GDP convergence rate on the globalisation convergence rate.[37]

The diagnostic tests of this model are supporting a statistically acceptable model since we do not have enough evidence to reject H_0 of no autocorrelation of the error term, linear functional form, normal distribution of residuals and homoscedasticity.

Although the statistical part of the regression is all right the economic part is not so promising. R-squared – the coefficient of determination, is very low suggesting only 0.14% of variation of the dependent variable (in this case the rate of convergence of GDP) can be explained by the explanatory variable (the rate of convergence of globalisation). What's more, the explanatory variable itself is not statistically significantly different from zero (low t-stat) (Wooldridge).

From the result of the regression it is clear that even if the variable was statistically significantly different from 0 the speed of convergence of globalisation influences the speed of convergence of

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[34] Since the change in this indicator compared among countries measures real convergence
[35] For the result table see App 4.1, Table 4.1 A
[36] In the calculations I used real GDP per capita measured in dollars.
[37] For the result see App.4.1, Table 4.3

GDP only be a minimum positive amount (in fact the gradient of the trend line from Figure 4.1 A is the value of the beta coefficient = 0.009).

Figure 4.1 A Scatter plot of rate of convergence of GDP on rate of convergence of globalisation
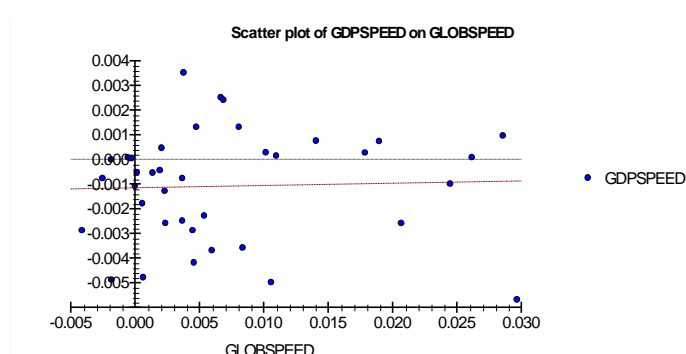
Source: Microfit, based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

The scatter plot of the variables (Fig.4.1 A) confirms that the rate of convergence of GDP is not very much influenced by the rate of convergence of globalisation. The explanation of relatively low overall statistical significance of the model and β coefficient might be relatively low significance of some of the models I used for calculation of the speed of convergence. The result of these regressions can be found in Appendix 4.1 C. In order to improve statistical significance and thus reliability of the model, I amended the model by dummy variables for periods when the rates of convergence resulted from the estimations that suffered from low significance of coefficients or a low significance of statistical diagnostics.[38] The amended model shows slightly better values of R-squared and T-stat, however, according to the results there is an inverse relationship suggesting decrease in the rate of convergence of GDP as the rate of convergence of globalisation increases.[39]

Table 4.1 B   Regression results

Sub-periods of	R - squared		F -value	β coefficient	T – stat	[Prob]
- one year	0.0014	(0.14%)	0.052	0.0094	0.228	[0.821]
- one year amended	0.0179	(1.79%)	0.319	-0.0092	0.048	[0.449]
- three years	0.0703	(7%)	0.832	0.0633	0.912	[0.381]
- four years	0.2303	(23%)	2.394	0.1059	1.547	[0.160]
- five years	0.4898	(49%)	5.761	0.1413	2.400	[0.053]

Source: Own calculations based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

Since I was not able to explain the speed of convergence of GDP by speed of convergence of globalisation to the satisfactory extent in the year by year sub-periods, I tried to work out the same study using sub-periods of three, four, and five years. This way, I run a β convergence regression for every three (four, five) consecutive years' periods. As Villaverde and Maza (2011) suggest, it is vital to use transition periods to control for time-variant heterogeneity. Using time periods indeed improved the economic results of the model while keeping diagnostics in support of statistically good models. Generally, the longer the periods, the better the results (Table 4.1 B). R-squared improved considerably, as well as β coefficients t-stats, however in the case of the explanatory variable there is still not enough evidence for rejecting the hypothesis of its insignificance for the model.[40] Even

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[38] For amended model see App.4.1, Table 4.1.D

[39] In addidition, the diagnostic of the model estimation worsen, however the model remains statistically significant.

[40] The variable is statistically different from 0 only on 20% two tailed significance level in the case of four year periods and on 10% significance level in the case of five years periods (Wooldridge, 2009).

though decreasing number of observations might slightly decrease the robustness of the model, the statistical significance of the models improved greatly.

To improve the result for three years periods I added dummy variables, however the amendment was less ameliorating than in the case of one year periods.[41] As for the more years periods it did not make much sense to add dummy variables, since the number of observations was getting smaller anyway.

Figure 4.1 B   Plot of speeds of convergence of GDP and globalisation
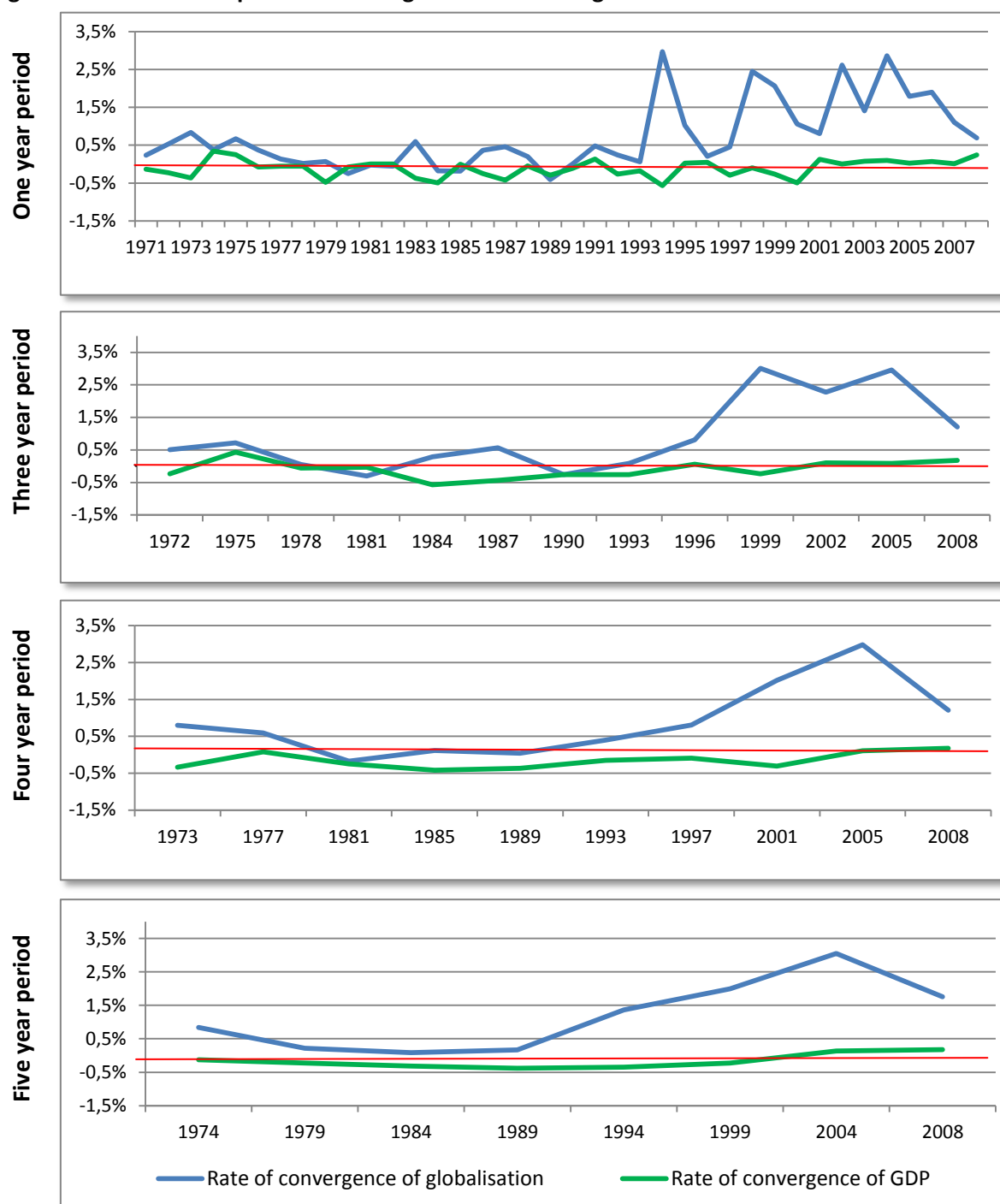
Source: Own calculations by Microfit based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

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[41] For amended model see App. 4.1, Table 4.1 E

My results suggest that the variation in the rate of convergence of GDP can be explained by the variation in the rate of convergence of globalisation in the following way: for the one year transition periods, a 1 increase in the GDP per capita convergence speed, other things being constant, leads on average to a 0.0094 increase in the globalisation convergence speed. For the three year transition periods, a 1 increase in the GDP per capita convergence speed would on average result in a 0.0092 decrease in the globalisation convergence speed. In the three year transition period, such increase in GDP per capita convergence speed would lead on average to an increase in the globalisation convergence speed of 0.0633 (0.1059 in the case of four year transition period and 0.1413 in the case of five year transition period.

Furthermore, the rates of convergence can be plotted. When the values of the rates of convergence are plotted (Figure 4.1 B), we can observe an opposite growth trend, especially in the first plot referring to the one year period calculations. In the case of one year periods, it is clear that the rate of convergence of globalisation is more volatile than GDP convergence rate, but seems to grow faster. By extending the length of periods the curves are getting smoother and less volatile, moreover the trend of globalisation convergence rate seems to be followed by the rate of convergence of GDP curve. From 1990s, the speed of convergence of globalisation grows much faster than the speed of convergence of GDP, however in the few periods there is a hint of slowing down in the case of convergence of globalisation. It is also important to mention that in the case of GDP we can talk about convergence only in the last six years, before, with some exceptions, there is divergence more prevailing, since the curve is below the red-indicated zero line.

4.2   Conditional beta convergence

In the previous analysis the estimation results have improved by adjusting for the time variant heterogeneity or dummy variables, now, I will try to amend the model by adding new variables in attempt for even better estimation results and statistical and economic significance. Therefore, it is vital to calculate conditional beta convergence and then find any relationship of the rates of convergence.

I modified the model adding new explanatory variables:

- ·   Total population
- ·   The aging population as a % of total population
- ·   % of total population living in the urban area
- ·   Fertility rate
- ·   Secondary school enrolment (%)
- ·   Total reserves including gold (in current USD)
- ·   Electric power consumption (kWh per capita)
- ·   Inflation rate

When choosing additional independent variables I focused on those that are not involved in the composition of the KOF index of globalisation[42] to avoid collinearity. Also, I only included indicators that provided data for the whole period (1970-2008). And the most important criterion when choosing these variables was its relevance for the model. In order to run the statistically and economically correct estimation, all logically relevant explanatory variables need to be included on the right hand side of the estimation. In econometric terms – I chose such variables so as to increase

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[42] See App. 4.2, List of indices and variables

the R-squared of the model (i.e. variables that help explain the variation of convergence in GDP per capita). Unfortunately, due to the limited availability of data for some of these control variables, I was forced to reduce the number of countries, and therefore conditional beta convergence was calculated using the sample of 80 observations.

Table 4.2 A   Comparison of 5years periods absolute and conditional beta convergence

Period	β globalisation	T – stat	Rate of conv. of globalisation	β GDP	T - stat	Rate of conv. of GDP
Conditional β convergence (5yera periods)						
1970-74	-0.0085	-2.534	0.0087	-0.0136	-2.809	0.0140
1975-79	-0.0064	-2.105	0.0064	-0.0116	-2.046	0.0119
1980-84	0.0002	0.057	-0.0002	-0.0124	-2.098	0.0128
1985-89	-0.0019	-0.399	0.0019	-0.0167	-3.696	0.0174
1990-94	-0.0142	-2.836	0.0148	-0.0170	-3.268	0.0184
1995-99	-0.0205	-4.688	0.0217	-0.0026	-0.617	0.0026
2000-04	-0.0257	-6.049	0.0275	-0.0074	-1.943	0.0075
2005-08	-0.0126	-3.374	0.0128	-0.0150	-4.282	0.0156
Absolute β convergence result (5year periods)						
1970-74	-0.0082	-2.912	0.0083	0.0013	0.704	-0.0013
1975-79	-0.0022	-0.843	0.0022	0.0023	1.237	-0.0023
1980-84	-0.0009	-0.324	0.0008	0.0031	1.965	-0.0031
1985-89	-0.0016	-0.450	0.0017	0.0039	2.642	-0.0038
1990-94	-0.0132	-3.136	0.0137	0.0035	2.019	-0.0034
1995-99	-0.0190	-5.236	0.0199	0.0023	1.822	-0.0023
2000-04	-0.0283	-8.324	0.0305	-0.0013	-1.226	0.0013
2005-08	-0.0168	-4.875	0.0176	-0.0018	-1.582	0.0018

Source: Own calculations based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

I decided to run regressions of 5 year transition periods in order to achieve the best possible statistical significance of the results. The statistical results varied greatly. In some cases the model was statistically acceptable, however, it suffered from heteroscedasticity, non-normality, or of inadequate functional form quite often. The economic interpretation was also unstable, suggesting low significance of various explanatory variables in different periods, which made it difficult to omit the most statistically insignificant variables for improving the model. Nevertheless, the significance of beta coefficients improved greatly in comparison with the absolute β convergence results. The most obvious difference, compared to absolute β convergence, is the rate of convergence of GDP which is always positive, suggesting convergence for the whole studied period (see Table 4.2 A for specification).

Figure 4.2 A Scatter plot of rate of convergence of GDP on rate of convergence of globalisation
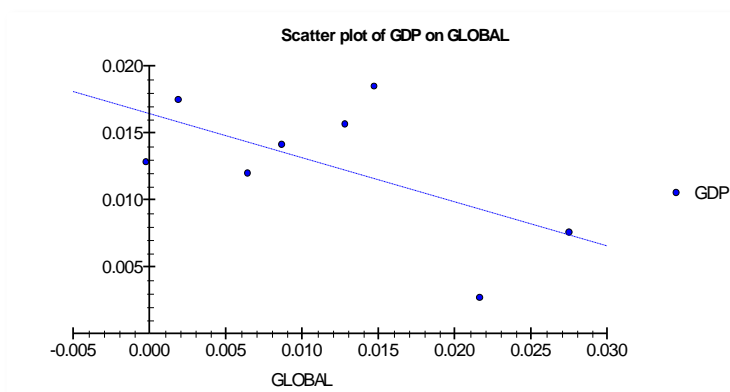
Source: Microfit, based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

When explaining the variation in GDP rate of convergence by the variation in the rate of convergence of globalisation levels the result suggests a negative relationship. An increase in the rate of convergence of globalisation by 1 results on average in the decrease in the rate of globalisation by 0.33. Even though the R-squared of the estimation is 35%, the significance of beta coefficient is very low – statistically not significantly different from zero.[43] The scatter plot confirms the negative relationship between the rate of convergence of globalisation and that of GDP (Figure 4.2 A).

When the rates of convergence are plotted and compared to the absolute beta convergence (Figure 4.2 B), there are visible differences, mainly, as already mentioned, an increasing rate of convergence of GDP. The evolution of the GDP convergence rate has changed dramatically. Apart from its positive values, in the first 30 years it copies the trend of the rate of convergence of globalisation, however, in the last 10 years it proposes an inverse relationship.[44]

Figure 4.2 B   Plot of speeds of convergence of GDP and globalisation
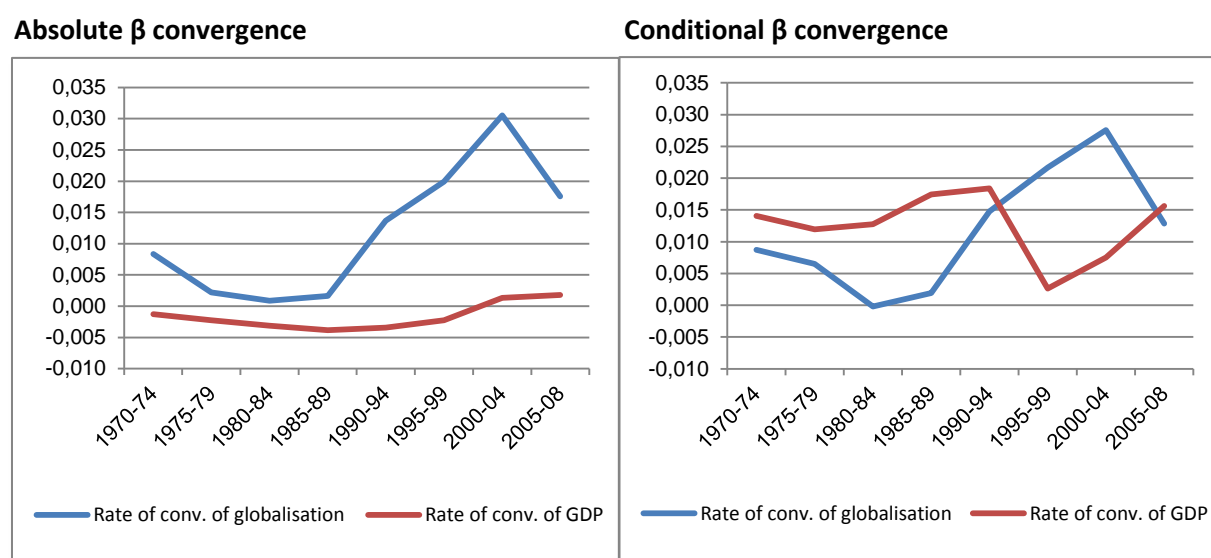
Absolute β convergence   **Conditional β convergence**

Source: Own calculations based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

4.3   Absolute β convergence by groups[45]

Previous parts tried to explain any relationship between the rate of convergence of globalisation and the rate of convergence of GDP using all available data of the countries in the world covering a period of 1970-2008. Now, the question is whether there is any closer relationship in the characteristically similar groups of countries in comparison to the previous part which was not

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[43] See App.4.2 Table 4.2. B for the MicroFit printout
[44] A similar trend could have been observed in the case of one year periods absolute β convergence, where also the last decade suggested inverse relationship, but with a different shape of the curves. (Firstly, it must be noted that the shape of the curves was different due to the shorter transition periods; secondly, in the case of conditional convergence we are dealing with different number of observations, what might also contribute to the unequal result.)
[45] I included this part in order to find out, what the patterns are in different groups of countries. In order to provide a robust analysis, I chose a big sample. However, I was not able to find data in such extent for the conditional beta convergence. I run one such regression of very few samples and it yielded very poor statistical results and it does not make much sense to harness these results in any further calculations.

supporting any significantly positive relationship of the observed indicators. This analysis includes more countries but covers a shorter period, since many countries have been established recently.[46]

It is vital to divide countries into two groups – developed and developing regions according to the United Nation classification.[47]

4.3.1 Developed countries (study period 1970-2008)

In the case of developed countries[48] I analysed separately two periods – first, beginning in 1970; and second, beginning in 1990, when more countries dispose the necessary data for the analysis. For the analysis I chose 4 year transition periods.

When running individual regressions separately, there were still signs of poor diagnostic tests. Especially in the recent years the diagnostics worsened. In the early periods, there was usually a normality problem caused most likely by outliers. This applies equally to both GDP and globalisation convergence indicators.

The economic interpretation is similar to the diagnostics tests – it is varying greatly especially in the case of GDP convergence levels. The significance of indicators is improving for globalization convergence and similarly for GDP convergence in the recent periods, since at the beginning it was of very low significance (Table 4.3.1 A).

Table 4.3.1 A   β coefficients and rates of convergence of developed countries (1970-2008)

| Period	β globalisation	T - stat	Rate of conv. of globalisation	β GDP	T - stat	Rate of conv. of GDP
1970-73	0.0017	0.339	-0.0017	-0.0068	-2.588	0.0069
1974-77	0.0099	1.988	-0.0097	-0.0170	-4.135	0.0176
1978-81	0.0058	1.039	-0.0057	-0.0026	-0.739	0.0026
1982-85	0.0106	2.858	-0.0104	0.0032	1.196	-0.0032
1986-89	0.0059	0.986	-0.0059	0.0018	0.499	-0.0018
1990-93	-0.0181	-1.979	0.0188	0.0175	4.697	-0.0169
1994-97	-0.0402	-5.285	0.0439	0.0001	0.044	-0.0001
1998-01	-0.0399	-6.844	0.0435	-0.0072	-3.293	0.0073
2002-05	-0.0297	-4.518	0.0316	-0.0095	-4.660	0.0097
2006-08	-0.0404	-4.818	0.0431	-0.0130	-6.462	0.0133

Source: Own calculations by Microfit based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

When running a regression explaining the variation in the rate of convergence of GDP by the variation in the rate of convergence of globalisation I got diagnostic result not in support for statistically significant model, however there was no sign of heteroscedasticity or non-normality. The economic part is equally of low quality because the explanatory variable is of low significance, which is also supported by a very low R-squared (of 0.9%).[49] The reason of poor result might be a small number of observations. Nevertheless, we can plot the rates of convergence. As a result, we can see

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[46] This also includes countries that previously suffered from different political regime and did not report the necessary data.

[47] According to the UN - „there is no established convention for the designation of "developed" and "developing" countries or areas in the United Nations system" (Composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other groupings, UN website). However they suggest their own regions division.

Developing regions: Africa, Americas excluding Northern America, Caribbean, Central America, South America, Asia excluding Japan, Oceania excluding Australia and New Zealand

Developed regions: Northern America, Europe, Japan, Australia and New Zealand

[48] See app. 4.3.1 for the list of countries

[49] For the results print out see App. 4.3, Table 4.3.1 B

a similar picture as in the case of conditional β convergence. However, here the two variables seem to have a similar trend only with the exception of a few periods at the beginning and one in the middle.

Figure 4.3.1 A　**The plot of speeds of convergence of GDP and globalisation of developed countries (1970-2008)**
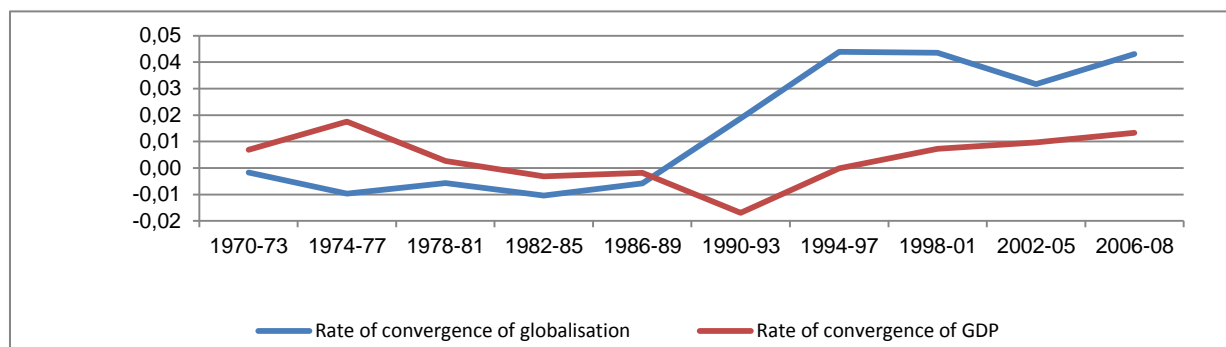
Source: Own calculations by Microfit based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

4.3.2　Developed countries (study period 1990-2008)

For this period I was able to choose many more countries, since, before 1990, some were a part of the Eastern bloc in the environment of a planned economy.[50] As the sample of observations is larger, it has a heterogeneous character. The diagnostic tests are relatively poor as in the case of previous results. Even though the studied period was short the economic interpretations of the models were more feasible. As shown by table 4.3.2 A, the beta coefficients are for the most part statistically significant, especially those on the convergence of globalisation. The speed of convergence is positive in both cases. GDP convergence rate grows from the first period when it was in decline (suggesting divergence). This might be caused by the special position of economies in transition that were in a recession after the structural change (Svejnar, 2002). After the time they started to keep up with the leading developed economies, as suggested by acceleration of the GDP convergence.

Table 4.3.2 A　**β coefficients and rates of convergence of developed countries (1990-2008)**

Period	β globalisation	T - stat	Rate of conv. of globalisation	β GDP	T - stat	Rate of conv. of GDP
1990-93	-0.030	-3.612	0.032	0.009	2.504	-0.009
1994-97	-0.051	-6.193	0.057	-0.006	-1.353	0.007
1998-01	-0.042	-7.592	0.046	-0.004	-2.442	0.004
2002-05	-0.032	-4.529	0.034	-0.013	-8.516	0.014
2006-08	-0.037	-4.715	0.039	-0.010	-4.560	0.011

Source: Own calculations by Microfit based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

When the rates of convergence for this particular period are plotted we can observe the similar trends as in the previous analysis (with focus on the last two decades) with the only difference of the rate of convergence of GDP which is slowing down in the last period.[51]

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[50] See App. 4.3.2 for the List of countries
[51] See App. 4.3.2, Figure A, for the plotted rates of convergence

4.3.3 Developing countries (study period 1970-2008)

In this part I focused on developing countries[52] which also form a heterogeneous group, yet they have more in common as compared to developed economies. As to the diagnostic tests the models usually suffered from non-normality, from time to time from heteroscedasticity, and they rarely suggested a different structural form. The Table 4.3.3 A reveals results of the economic part of the regressions. In general, R-squared was low as well as significance of beta coefficients. The value of beta coefficients suggested mostly (one exception in the late 80's) convergence of globalisation, and on the contrary, GDP was mostly diverging. It must be definitely noted that the t-value was very low – implying low significance of the coefficients.

Table 4.3.3 A   β coefficients and rates of convergence of developing countries (1970-2008)

Period	β globalisation	T - stat	Rate of conv. of globalisation	β GDP	T - stat	Rate of conv. of GDP
1970-73	-0.0093	-2.213	0.0095	0.0008	0.243	-0.0008
1974-77	-0.0135	-3.401	0.0139	-0.0015	-0.541	0.0015
1978-81	-0.0032	-0.601	0.0032	0.0005	0.131	-0.0005
1982-85	-0.0056	-1.188	0.0057	-0.0006	-0.169	0.0006
1986-89	0.0009	0.121	-0.0009	0.0011	0.421	-0.0011
1990-93	-0.0012	-0.154	0.0012	0.0077	2.568	-0.0076
1994-97	-0.0066	-0.832	0.0067	0.0015	0.554	-0.0015
1998-01	-0.0199	-3.242	0.0207	0.0007	0.419	-0.0007
2002-05	-0.0350	-5.608	0.0377	0.0027	1.399	-0.0027
2006-08	-0.0207	-2.839	0.0214	0.0017	0.986	-0.0017

Source: Own calculations by Microfit based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

Running the regression explaining the variation in the rate of convergence of GDP by the variation in the rate of convergence of globalisation was statistically questionable since the significance of the beta coefficient was very small. The value of the coefficient itself was small suggesting only 0.03 change in GDP speed of convergence as the globalisation speed changes by one. In this case there is again a negative relationship implying a decrease in GDP rate of convergence as the rate of convergence of globalisation increases. R-squared was also small – only 0.9%. In this case the diagnostic tests were in support of statistically good estimation (see App. 4.3.3, Table 4.3.3 B for the econometric printout).

When comparing the plot of the rates of convergence of developed and developing countries it is obvious that they differ slightly. The scale of the movement of the rates is greater for developed economies, where especially convergence of globalisation accelerated greatly after 1990. Although, the same acceleration is recognisable in developing economies, it came ten years later and dropped rapidly in the last period.[53] The same drop can be observed in developed economies with the same time shift. The curve of the speed of convergence of GDP in developing countries is much more stable, more often indicating divergence, than that of developed countries.

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[52] See App. 4.3.3 for the List of countries
[53] The possible reason might be that the last period is for a year shorter.

Figure 4.3.3 A

The plot of speeds of convergence of GDP and globalisation of developing countries (1970-2008)	The plot of speeds of convergence of GDP and globalisation of developed countries (1970-2008)
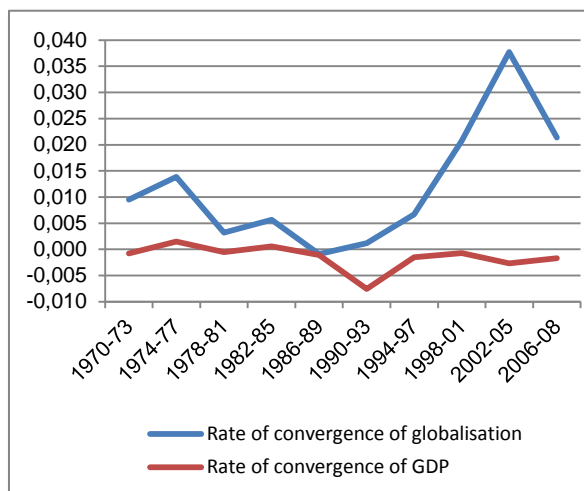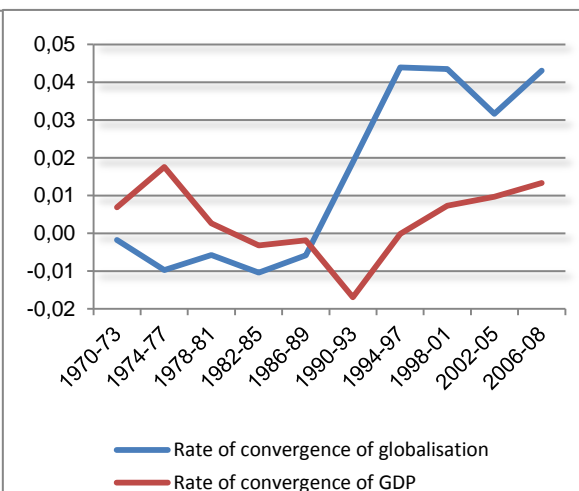
Source: Own calculations by Microfit based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

In general, the division of the countries does not help to better define the relationship of the rates of convergence of globalisation and GDP. In the case of developing countries divergence in GDP is most prevailing, however, the speed of convergence of globalisation levels is positive and increasing in the last 20 years. According to the estimations explaining the relationship, the result for developing countries is opposite to that of developed. The estimation explaining the variation in the rate of convergence of GDP by the variation in the rate of convergence of globalisation finds negative relationship for developing countries, while there is positive for developed. From this finding it is difficult to define any uniform relationship between the observed indicators, since there is not even similar evolution in the two subgroups.

4.4   Sigma convergence

Sigma convergence measures and compares the values of the variation coefficient over time. The first figure in Figure 4.4 A shows the plotted values of the coefficient of variation of GDP and globalisation of all countries disposing available data. We can observe that convergence is obvious in globalisation which tends to converge more rapidly in the last 15 years. The evolution of GDP is completely different. There were signs of rapid convergence in early 70's, however, from that period there is no progress; moreover, there are periods of divergence of GDP. It must be also noted that even though there are some trends of evolution of studied indicators the magnitude dispersion is much larger in the case of GDP than globalisation indices.

When we plot the data for groups of countries[54] we see that the trend and even the value of globalisation indices are almost equal for both developed and developing economies. This is not the case for the GDP variance which differs greatly in developed and developing regions. Developed regions seem to have converged slightly in terms of GDP in 70's, but from that time there is no visible

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[54] There is applied the same division as in the beta convergence analysis

progress. In developing economies there was strong convergence of GDP in the 70's and early 80's when the variance dropped from 3.3 in 1970 to the value of 1.4 in 1982. Then it stayed stable for couple of years and at the begging of 90's it diverged to 1.7 and then kept its value of around 1.6 till the present.

Figure 4.4 A   Sigma convergence
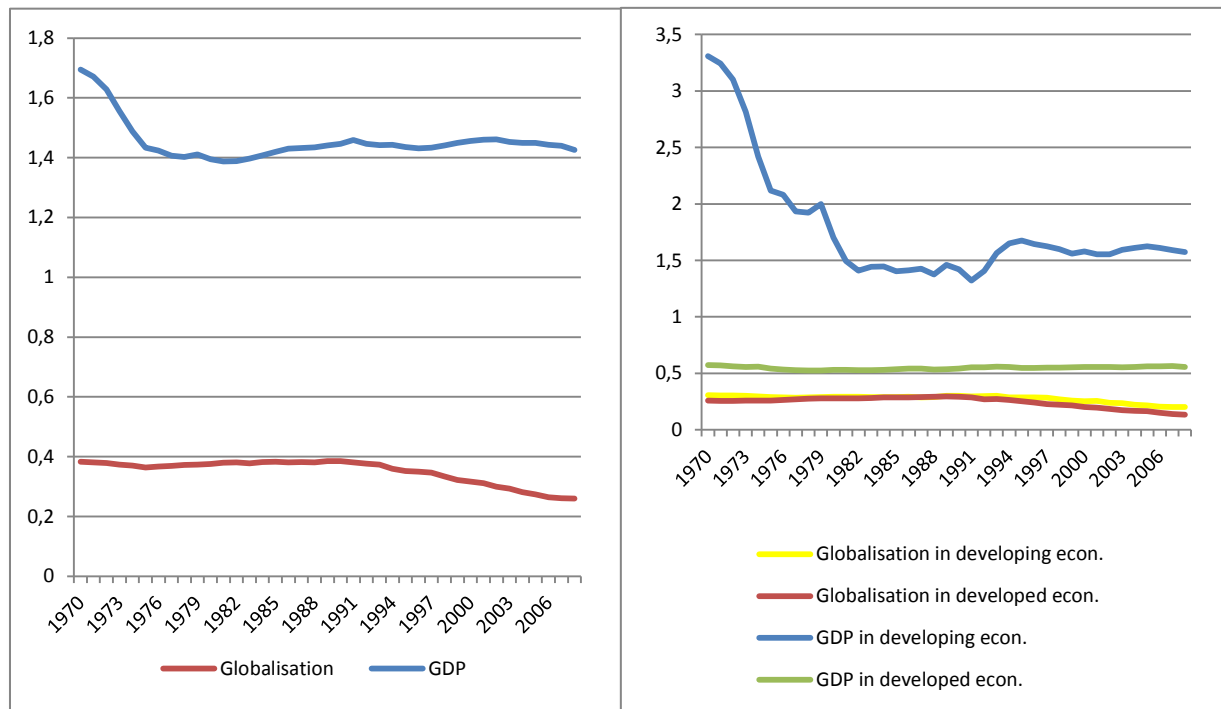
Source: Own calculations by Microfit based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

From the sigma convergence of groups we can conclude that the reason for high variation coefficient of the world GDP are developing regions where the dispersion of GDP is extremely large in comparison to developed regions. There are no evident signs of sigma convergence of GDP in neither region in the last 30 years, albeit there is convergence in globalisation.

4.4.1   Sigma and beta convergence

The main difference between beta and sigma convergence is in the way they are measured. Sigma convergence focuses on the dispersion of the indicator whose convergence is measured based on its coefficient of variation over time. It is obvious that when the dispersion decreases the observed countries are converging. When measuring beta convergence it is necessary to run a regression estimating the growth of a measured indicator for a particular time period on its initial level. When there is an inverse relationship between a growth rates and initial levels the countries are converging (suggesting faster growth of countries with lower initial levels).

When deciding which concept is more preferable, Sala-i-Martin (1994) advocated both beta and sigma convergence concepts, since each provides different information. He suggests that while sigma convergence predicts if the aggregate cross sectional variance is falling or rising over time, beta convergence is a more interesting concept capable of providing answers on predicting whether poor countries grow faster than rich countries, the speed of convergence, whether the convergence process is conditional or unconditional and its differences between different groups of countries.

Sala-i-Martin (1996) suggests that it might be important to combine both concepts, since they do not yield the same results and do not substitute each other. The presence of sigma convergence is conditional on beta convergence. However, beta convergence can exist without a presence of sigma convergence. This is easily observable when GDP per capita grows faster in rich countries than in poor countries in relative terms but not in absolute terms. Such development might lead to even greater overall GDP per capita dispersion and might result in a positive beta convergence, but no sigma convergence.[55]

From the empirical point of view based on the results of this dissertation, sigma convergence plots variation coefficients of GDP and globalisation levels for the studied period. Figure 4.4 A clearly suggests convergence of globalisation levels of all the countries, and also for the group of developed and developing countries, especially in the last two decades. Beta convergence finds convergence of globalisation in the last twenty years; however, there were some years of divergence before 1988.[56] Conditional beta convergence finds convergence for all the studied period with the exception of early 80's when there are signs of slight divergence. When measuring beta convergence of globalisation by groups of developed and developing countries, there are signs of convergence only in the last two decades for developed countries, while in the case of developing there was convergence of globalisation levels present for all the study period with the exception of late 80's.

Convergence of the real GDP per capita is not as obvious as convergence of globalisation levels. Sigma convergence implies strong convergence of GDP in early 70's, while afterwards there were changing periods of divergence and convergence. As for the groups, the dispersion of GDP is stable and almost unchanging for developed economies suggesting no convergence or divergence. Developing economies were converging in the terms of GDP rapidly at the beginning of the study period (till 1982), however afterwards there is stable non-volatile development of GDP mostly with the signs of divergence. Absolute beta convergence finds mostly divergence of GDP for all the countries with some tiny exceptions during the studied period and last five years when it suggests convergence. On the contrary, conditional beta convergence finds convergence of the GDP for all of the studied period. When beta convergence studies countries by groups there are signs of both convergence as well as divergence. Developed countries were converging in the terms of GDP at the beginning and at the end of the study period (by contrast, they were diverging between 1982 and 1997, (Table 4.3.1 A)). Developing countries were mostly diverging in the area of GDP with only slight signs of convergence in mid 70's and early 80's (Table 4.3.3 A).

In general, both sigma and beta convergence concepts support convergence of globalisation levels of all the world countries. In the case of GDP there is no clear development as to whether there is prevailing convergence or divergence since the results are unstable and changing in the case of absolute or conditional beta convergence as well as in the case of groups of countries.

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[55] Cofré, 2010

[56] This holds for beta convergence calculated for one, three, and four year transition periods for all the countries (Figure 4.1 B).

Conclusions

The analysis of the relationship between globalisation and real convergence, as the principal objective of this thesis, was based on the comparison and the relationship of the rate of convergence of globalisation and the rate of convergence of real GDP per capita. For the analysis I used conditional and unconditional beta convergence based on the Barro and Sala-i-Martin (1991) paper.

When comparing rates of convergence of globalisation and GDP measured by absolute beta convergence the results are getting better by the expansion of the length of transition periods. As the transition periods are getting longer, a common trend in the rate of convergence of globalisation and the GDP rate of convergence is more visible. On the contrary, when the periods are shorter the trend was mostly of the opposite direction. Also the speed of convergence of GDP explained by the speed of convergence of globalisation was yielding more promising results as the periods were getting longer. Nevertheless, using absolute convergence measures of the rate of convergence of the studied indicators did not help explain much about the relationship between the two, not even to find any similar pattern, suggesting no particular dependence of the speed of convergence of GDP on the speed of convergence of globalisation levels.

The conditional Beta convergence results demonstrate a negative relationship between the rates of convergence of globalisation and GDP. The negative trend of the indicators is most visibly observable in the last ten years of the study period. In comparison with other calculations, only conditional beta convergence yields results suggesting the positive rate of convergence of GDP.

Not even the division of the countries into developed and developing helps explain the relationship more convincingly. In the case of developing countries the divergence in GDP is most prevailing, however, the speed of convergence of globalisation levels is positive and increasing in the last 20 years. The estimation explaining the variation in the rate of convergence of GDP by the variation in the rate of convergence of globalisation finds a negative relationship for developing countries, while there is a positive one for developed. This finding suggests that worldwide we cannot apply the idea of uniform development of the GDP and globalisation, because as the globalisation converges faster there is estimated slower convergence of GDP in developing countries, while developed countries' GDP converges faster.

Sigma convergence findings support differences in GDP convergence of developed and developing countries. The value of dispersion in GDP is 3 times lower than in developed countries. Even though, there is visible convergence in globalisation levels, the GDP convergence does not seem to progress much in neither case.

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Appendices

Appendix 4.1

Table 4.1 A   Ordinary Least Squares Estimation

Ordinary Least Squares Estimation			
Dependent variable is GDPSPEED			
38 observations used for estimation from 1 to 38			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	-.0011621	.4770E-3	-2.4361[.020]
GLOBSPEED	.0094058	.041211	.22824[.821]

R-Squared	.0014449	R-Bar-Squared	-.026293
S.E. of Regression	.0022684	F-stat. F(1. 36)	.052092[.821]
Mean of Dependent Variable	-.0010928	S.D. of Dependent Variable	.0022391
Residual Sum of Squares	.1852E-3	Equation Log-likelihood	178.4781
Akaike Info. Criterion	176.4781	Schwarz Bayesian Criterion	174.8405
DW-statistic	1.7336		

Diagnostic Tests

* Test Statistics *	LM Version *	F Version *
* A:Serial Correlation*CHSQ(1)=	.42001[.517]*F(1. 35)=	.39118[.536]*
* B:Functional Form *CHSQ(1)=	1.8403[.175]*F(1. 35)=	1.7813[.191]*
* C:Normality *CHSQ(2)=	.87458[.646]*	Not applicable *
* D:Heteroscedasticity*CHSQ(1)=	.88730[.346]*F(1. 36)=	.86070[.360]*

Source: Microfit print out based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

Table 4.1 D   Ordinary Least Squares Estimation

Ordinary Least Squares Estimation			
Dependent variable is GDPSPEED			
38 observations used for estimation from 1 to 38			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	-.0014806	.6350E-3	-2.3318[.026]
GLOBSPEED	-.0092450	.048074	-.19231[.849]
DUMMY	.6930E-3	.9048E-3	.76586[.449]

R-Squared	.017903	R-Bar-Squared	-.038216
S.E. of Regression	.0022815	F-stat. F(2. 35)	.31902[.729]
Mean of Dependent Variable	-.0010928	S.D. of Dependent Variable	.0022391
Residual Sum of Squares	.1822E-3	Equation Log-likelihood	178.7939
Akaike Info. Criterion	175.7939	Schwarz Bayesian Criterion	173.3375
DW-statistic	1.8033		

Diagnostic Tests

* Test Statistics *	LM Version *	F Version *
* A:Serial Correlation*CHSQ(1)=	.19487[.659]*F(1. 34)=	.17525[.678]*
* B:Functional Form *CHSQ(1)=	.085713[.770]*F(1. 34)=	.076864[.783]*
* C:Normality *CHSQ(2)=	1.6337[.442]*	Not applicable *
* D:Heteroscedasticity*CHSQ(1)=	2.4310[.119]*F(1. 36)=	2.4605[.125]*

Source: Microfit print out based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

Table 4.1 C   Results of regressions studying convergence in one year periods

Period	Beta coefficient of global.	t-stat	R^2	Convergence Rate of globalisation	Beta ceofficient of GDP	t-stat	R^2	Rate of convergence of GDP
1970 - 71	-0.0023	-0.870	0.007	2.33E-03	0.0013	0.870	0.0070	-0.0013
1971 - 72	-0.0053	-2.250	0.046	0.0054	0.0023	1.280	0.0150	-0.0023
1972 - 73	-0.0083	-1.950	0.034	0.0084	0.0036	1.798	0.0290	-0.0036
1973 - 74	-0.0038	-1.090	0.011	0.0038	-0.0035	-1.770	0.0280	0.0035
1974 - 75	-0.0067	-2.500	0.055	0.0067	-0.0025	-1.267	0.0140	0.0025
1975 - 76	-0.0037	-0.990	0.009	0.0037	7.77E-04	0.490	0.0020	-7.77E-04
1976 - 77	-0.0014	-0.440	0.002	0.0014	5.60E-04	0.390	0.0014	-5.60E-04
1977 - 78	-1.82E-04	-0.450	2.00E-05	1.82E-04	5.49E-04	0.338	0.0010	-5.48E-04
1978 - 79	-6.65E-04	-0.257	0.001	6.65E-04	0.0048	2.480	0.0540	-0.0048
1979 - 80	0.0025	0.570	0.003	-0.0025	7.79E-04	0.430	0.0017	-7.79E-04
1980 - 81	2.54E-04	0.560	0.005	-2.54E-04	-3.31E-05	-0.020	3.92E-06	3.31E-05
1981 - 82	0.0005	0.205	3.94E-04	-5.12E-04	-5.92E-05	-0.037	1.32E-05	5.92E-05
1982 - 83	-0.0059	-2.398	0.051	0.0060	0.0037	2.350	0.0400	-0.0037
1983 - 84	1.81E-03	0.560	0.003	-1.81E-03	0.0050	3.820	0.1200	-0.0049
1984 - 85	1.84E-03	0.450	0.002	-1.84E-03	2.90E-05	0.023	5.10E-06	-2.90E-05
1985 - 86	-0.0037	-1.210	0.013	0.0037	0.0025	1.970	0.0350	-0.0025
1986 - 87	-0.0046	-1.108	0.011	0.0046	0.0042	3.270	0.0910	-0.0042
1987 - 88	-0.0020	-0.280	0.001	1.96E-03	4.55E-04	0.307	0.0009	-4.55E-04
1988 - 89	0.0041	0.780	0.006	-0.0041	0.0029	1.879	0.0320	-0.0029
1989 - 90	-2.08E-05	-0.005	2.19E-07	2.08E-05	0.0011	0.800	0.0050	-0.0011
1990 - 91	-0.0048	-0.700	0.005	0.0048	-0.0013	-0.611	0.0030	0.0013
1991 - 92	-0.0024	-0.407	0.002	0.0024	0.0026	1.290	0.0150	-0.0026
1992 - 93	-6.13E-04	-0.126	1.49E-04	0.0006	0.0018	0.960	0.0080	-0.0018
1993 - 94	-0.0293	-4.200	0.142	0.0297	0.0057	2.700	0.0640	-0.0057
1994 - 95	-0.0102	-1.490	0.020	0.0102	-2.70E-04	-0.200	0.0004	2.70E-04
1995 - 96	-0.0021	-0.320	9.97E-04	0.0021	-4.51E-04	-0.339	0.0011	4.51E-04
1996 - 97	-0.0045	-0.880	0.007	0.0045	0.0029	2.613	0.0600	-0.0029
1997 - 98	-0.0242	-4.310	0.140	0.0245	1.00E-03	0.865	0.0060	-0.0010
1998 - 99	-0.0204	-4.760	0.170	0.0207	0.0026	2.420	0.0522	-0.0026
1999- 00	-0.0106	-2.310	0.047	0.0106	0.0050	5.720	0.2300	-0.0050
2000 - 01	-0.0081	-1.946	0.034	0.0081	-0.0013	-1.390	0.0170	0.0013
2001 - 02	-0.0258	-5.080	0.190	0.0262	-6.95E-05	-0.058	3.18E-05	6.95E-05
2002 - 03	-0.0140	-3.940	0.120	0.0141	-7.38E-04	-0.730	0.0049	7.38E-04
2003 - 04	-0.0282	-4.130	0.140	0.0286	-0.0009	-0.870	0.0061	9.48E-04
2004 - 05	-0.0177	-3.530	0.100	0.0179	-2.53E-04	-3.335	0.0010	2.53E-04
2005 - 06	-0.0189	-3.680	0.110	0.0190	-0.0007	-0.748	0.0050	7.23E-04
2006 - 07	-0.0110	-2.070	0.038	0.0110	-1.36E-04	-0.171	2.75E-04	1.36E-04
2007 - 08	-0.0069	-1.570	0.022	0.0069	-0.0024	-2.640	0.0600	0.0024

Source: Microfit print out based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

Table 4.1 E   Ordinary Least Squares Estimation

```
                      Ordinary Least Squares Estimation
*******************************************************************************
 Dependent variable is GDPSPEED
 13 observations used for estimation from      1 to     13
*******************************************************************************
 Regressor          Coefficient         Standard Error        T-Ratio[Prob]
 C                  -.0012735            .0016432             -.77501[.456]
 GLOBSPEED           .080803             .082620               .97801[.351]
 DUMMY              -.5829E-3            .0020639             -.28243[.783]
*******************************************************************************
 R-Squared                  .089097    R-Bar-Squared                -.093083
 S.E. of Regression         .0028383   F-stat.    F(  2,  10)   .48906[.627]
 Mean of Dependent Variable -.9434E-3  S.D. of Dependent Variable    .0027147
 Residual Sum of Squares    .8056E-4   Equation Log-likelihood        59.4985
 Akaike Info. Criterion     56.4985    Schwarz Bayesian Criterion     55.6511
 DW-statistic               1.8724
*******************************************************************************
                              Diagnostic Tests
*******************************************************************************
 *    Test Statistics   *       LM Version        *        F Version        *
*******************************************************************************
 * A:Serial Correlation*CHSQ(   1)=  .0049903[.944]*F(   1.    9)= .0034561[.954]*
 * B:Functional Form    *CHSQ(   1)=   2.8923[.089]*F(   1.    9)=  2.5753[.143]*
 * C:Normality          *CHSQ(   2)=   .33760[.845]*     Not applicable       *
 * D:Heteroscedasticity*CHSQ(   1)=   .10107[.751]*F(   1.   11)= .086193[.775]*
```

Source: Microfit print out based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

Appendix 4.2

The list of indices and variables in the composition of 2011 KOF Index of Globalization

Indices and variables	Weights
A. Economic Globalization	**[36%]**
i) Actual Flows	(50%)
Trade (percent of GDP)	(22%)
Foreign Direct Investment. stocks (percent of GDP)	(29%)
Portfolio Investment (percent of GDP)	(22%)
Income Payments to Foreign Nationals (percent of GDP)	(27%)
ii) Restrictions	(50%)
Hidden Import Barriers	(22%)
Mean Tariff Rate	(28%)
Taxes on International Trade (percent of current revenue)	(27%)
Capital Account Restrictions	(23%)
B. Social Globalization	**[38%]**
i) Data on Personal Contact	(33%)
Telephone Traffic	(26%)
Transfers (percent of GDP)	(2%)
International Tourism	(26%)
Foreign Population (percent of total population)	(20%)
International letters (per capita)	(25%)
ii) Data on Information Flows	(36%)
Internet Users (per 1000 people)	(36%)
Television (per 1000 people)	(37%)
Trade in Newspapers (percent of GDP)	(28%)
iii) Data on Cultural Proximity	(31%)
Number of McDonald's Restaurants (per capita)	(43%)
Number of Ikea (per capita)	(44%)
Trade in books (percent of GDP)	(13%)
C. Political Globalization	**[26%]**
Embassies in Country	(25%)
Membership in International Organizations	(28%)
Participation in U.N. Security Council Missions	(22%)
International Treaties	(25%)

Table 4.2 B   Ordinary Least Squares Estimation

```
              Ordinary Least Squares Estimation
************************************************************************
 Dependent variable is GDP
 8 observations used for estimation from    1 to    8
************************************************************************
 Regressor         Coefficient      Standard Error      T-Ratio[Prob]
 C                   .016408            .0026695         6.1464[.001]
 GLOB               -.32921             .18135          -1.8153[.119]
************************************************************************
 R-Squared               .35451    R-Bar-Squared              .24692
 S.E. of Regression    .0045664    F-stat.   F(  1,  6)   3.2952[.119]
 Mean of Dependent Variable  .012549  S.D. of Dependent Variable .0052621
 Residual Sum of Squares .1251E-3  Equation Log-likelihood    32.9114
 Akaike Info. Criterion  30.9114   Schwarz Bayesian Criterion  30.8319
 DW-statistic            2.4389
************************************************************************
                      Diagnostic Tests
************************************************************************
*    Test Statistics  *      LM Version        *       F Version       *
************************************************************************
* A:Serial Correlation*CHSQ(  1)=  .64817[.421]*F(  1,  5)=  .44083[.536]*
* B:Functional Form   *CHSQ(  1)=  1.3421[.247]*F(  1,  5)=  1.0079[.361]*
* C:Normality         *CHSQ(  2)=  .15951[.923]*     Not applicable     *
* D:Heteroscedasticity*CHSQ(  1)=  .90097[.343]*F(  1,  6)=  .76149[.416]*
```

Source: Microfit print out based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

Appendix 4.3.1

List of developed countries (1970-2008)

Albania	Denmark	Japan	Poland
Australia	Finland	Luxembourg	Portugal
Austria	France	Macedonia, FYR	Romania
Belarus	Germany	Malta	Serbia
Belgium	Greece	Moldova	Spain
Bosnia and Herzegovina	Hungary	Montenegro	Sweden
Bulgaria	Iceland	Netherlands	Switzerland
Canada	Ireland	New Zealand	United Kingdom
Cyprus	Italy	Norway	United States

Appendix 4.3.2

List of developed countries (1990-2008)

Albania	Estonia	Lithuania	Romania
Australia	Finland	Luxembourg	Russian Federation
Austria	France	Macedonia, FYR	Serbia
Belarus	Germany	Malta	Slovak Republic
Belgium	Greece	Moldova	Slovenia
Bosnia and Herzegovina	Hungary	Montenegro	Spain
Bulgaria	Iceland	Netherlands	Sweden
Canada	Ireland	New Zealand	Switzerland
Croatia	Italy	Norway	Ukraine
Cyprus	Japan	Poland	United Kingdom
Czech Republic	Latvia	Portugal	United States
Denmark			

Table 4.3.2   Ordinary Least Squares Estimation

```
                    Ordinary Least Squares Estimation
 Dependent variable is RATEGDP
 10 observations used for estimation from    1 to    10
 *****************************************************************
 Regressor          Coefficient        Standard Error        T-Ratio[Prob]
 C                     .0029654           .0039004            .76029[.469]
 RATEKOF               .038953            .14435              .26986[.794]
 *****************************************************************
 R-Squared             .0090210   R-Bar-Squared               -.11485
 S.E. of Regression    .010334    F-stat.   F(  1,   8)  .072825[.794]
 Mean of Dependent Variable .0035400  S.D. of Dependent Variable  .0097877
 Residual Sum of Squares   .8544E-3  Equation Log-likelihood    32.6491
 Akaike Info. Criterion    30.6491   Schwarz Bayesian Criterion 30.3465
 DW-statistic          1.1300
 *****************************************************************
                         Diagnostic Tests
 *****************************************************************
 *    Test Statistics   *     LM Version       *       F Version        *
 *****************************************************************
 * A:Serial Correlation*CHSQ(   1)=   1.9612[.161]*F(   1,   7)=   1.7078[.233]*
 * B:Functional Form    *CHSQ(   1)=   2.3166[.128]*F(   1,   7)=   2.1105[.190]*
 * C:Normality          *CHSQ(   2)=    .66230[.718]*     Not applicable     *
 * D:Heteroscedasticity*CHSQ(   1)=   .083338[.773]*F(   1,   8)=   .067231[.802]*
```

Source: Microfit print out based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

Figure 4.3.2 A   The plot of speeds of convergence of GDP and globalisation of developed countries (1970-2008)

Source: Own calculations by Microfit based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)

Appendix 4.3.3

List of developing countries (1970-2008)

Algeria	Fiji	Malawi	Rwanda
Angola	Ghana	Malaysia	Senegal
Argentina	Guatemala	Mali	Sierra Leone
Bangladesh	Guyana	Mauritania	Singapore
Barbados	Haiti	Mauritius	South Africa
Benin	Honduras	Mexico	Sri Lanka
Bolivia	Chad	Morocco	Swaziland
Botswana	Chile	Mozambique	Syrian Arab Republic
Brazil	China	Namibia	Tanzania
Burkina Faso	India	Nicaragua	Thailand
Burundi	Indonesia	Niger	Togo
Cameroon	Iran	Nigeria	Trinidad and Tobago
Central African Republic	Israel	Occupied Palestinian territory	Tunisia
Colombia	Jamaica	Oman	Turkey
Costa Rica	Jordan	Pakistan	Uganda
Cote d'Ivoire	Kenya	Panama	Uruguay
Dominican Republic	Korea, Rep.	Papua New Guinea	Venezuela, RB
Ecuador	Kuwait	Paraguay	Zambia
Egypt, Arab Rep.	Lesotho	Peru	Zimbabwe
El Salvador	Madagascar	Philippines	

Table 4.3.3 B   Ordinary Least Squares Estimation

```
                  Ordinary Least Squares Estimation
*******************************************************************************

 Dependent variable is GDPSPEED

 10 observations used for estimation from     1 to    10
*******************************************************************************

 Regressor          Coefficient       Standard Error       T-Ratio[Prob]
 C                   .2686E-3             .0012946           .20748[.841]
 GLOBSPEED           -.028668             .10744            -.26684[.796]
*******************************************************************************

 R-Squared               .0088220   R-Bar-Squared               -.11508
 S.E. of Regression      .0036421   F-stat.    F(  1,    8)   .071204[.796]
 Mean of Dependent Variable .1108E-3   S.D. of Dependent Variable   .0034490
 Residual Sum of Squares   .1061E-3   Equation Log-likelihood       43.0784
 Akaike Info. Criterion     41.0784   Schwarz Bayesian Criterion    40.7758
 DW-statistic              1.8921
*******************************************************************************

                         Diagnostic Tests
*******************************************************************************
 *    Test Statistics    *     LM Version       *        F Version         *
*******************************************************************************
 * A:Serial Correlation*CHSQ(   1)=  .063435[.801]*F(   1,   7)=  .044688[.839]*
 * B:Functional Form    *CHSQ(   1)=   .45576[.500]*F(   1,   7)=   .33426[.581]*
 * C:Normality          *CHSQ(   2)=  1.8681[.393]*      Not applicable      *
 * D:Heteroscedasticity*CHSQ(   1)= .0034472[.953]*F(   1,   8)= .0027587[.959]*
```
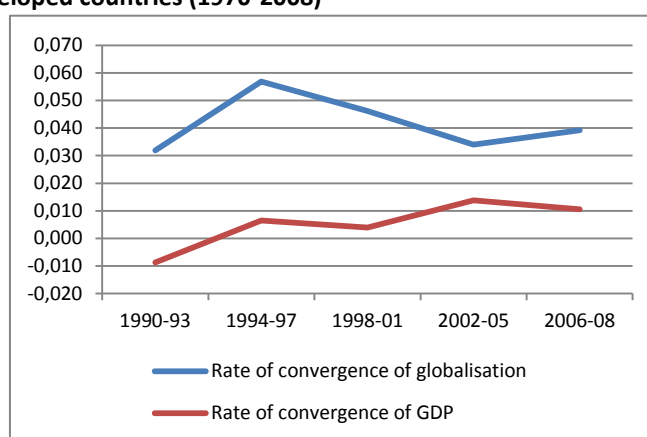
Source: Microfit print out based on KOF globalisation index and GDP per capita (Handbook of statistics, UNCTAD)