Do financial systems converge? A Comprehensive panel data approach and new evidence from a dataset for 102 countries

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Do financial systems converge?
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by

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Abstract

This paper is to investigate the existence of β- convergence and σ- convergence for financial institutional characteristics for the dataset of 102 countries from 1980 to 2009. The research is based on panel data econometric models and 10 financial depth indicators. The partial effects of corruption and financial openness are also to be estimated. The main conclusion is that the world exhibits steady financial development as well as β-convergence of financial depth indicators, the middle income countries converging relatively faster. Nevertheless the speed of convergence is not sufficient for the developing world to catch up. This results in the absence of σ-convergence. Similarly financial heterogeneity decreases only during financial crises due to financial degradation or lack of development and steadily increasing financial heterogeneity is observed for all groups of countries. Financial openness facilitates financial development and convergence. Higher transparence (lower corruption) is associated with lower banking sector growth rates. This may simply indicate that banking sector is more important in developing countries. Also there is some limited evidence that although recourses are being redirected from the developing countries in the developed countries, the situation is likely to change.

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[1] This is merely a draft working paper, if you have any ideas to discuss or remarks to make please do not hesitate to contact me. My e-mail is snakers4@mail.ru
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1. Introduction

The world has witnessed the unprecedented process of financial liberalization and globalization since 1980[4]. In the era of global economy and drastically developing financial sector, financial deregulation and rapid technological advances financial systems all over the world are likely to be transformed. According to conventional wisdom nowadays financial systems tend to be of more uniform nature i.e. they are supposed to experience certain kind of convergence, which shapes contemporary policy. But can this common presumption be not true? And what underlying factors affect this process? Also the traditional bank-based vs. financial-market-based dichotomy is to be challenged. Financial depth (FD) indicators (deposit money bank assets to GDP ratio for example) are an adequate instrument of describing institutional characteristics of financial systems. A certain amount of questions about global financial imbalances can be answered speaking in terms of financial convergence. For example, if bank deposit to bank credit ratio does not converge in the long run and bank deposit to GDP ratio does, it might imply that the developing countries provide financial recourses to the developed ones in a certain way[5]. Anyway knowing whether countries are on the convergence path or not may cause certain implications for macroeconomic policy as it is no secret that in the long term financial "deepening" fosters economic growth and innovation[6]. The absence or presence of financial convergence may also be a certain kind of indicator whether the developing world is catching up or not.

The investigation of financial convergence is done empirically, and a vast variety of methods can be applied. In this paper a comprehensive "all in" approach is used. First of all the concepts of β- σ-convergence will be applied. In a nutshell, β-convergence means that more economically (or financially) disadvantaged countries are to experience higher growth rates. Σ-convergence implies that financial heterogeneity decreases (for all or certain groups of FD indictors or countries). It is usually measured by means of standard deviation, conditional or not. Also we will mention one new promising panel convergence methodology developed by Philips and Sul (2007). This paper relies mainly on the use of vast dataset for 102 countries for a time period from 1980 to 2009, embracing 10 FD indicators characterizing the following aspects of financial system:

- Banking sector (4 FD indicators, almost balanced panel data);
- Insurance sector (2 FD indicators, data is quite scarce for all countries but the economies with High Income[7]);
- Stock exchange and private bond market (the same as previous);
- Financial Openness indicators (2 indicators, abundant data for one of them).

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[4] At least it is claimed by authoritative researchers like Rajan and Zingales.

[5] Stolbov M. Finansovyi rinok i economichesky rost: konturi problemi. - M.: Naychnaya kniga, 2008.- 201.

[6] Amvrosov, Veysov, Stolbov et al. – MGIMO-University, 2010. ()

[7] According to World Bank classification. It is quite straightforward but in certain countries there might be no data simply due to inexistence of certain financial institutions

To keep it short, these indicators will be characterized in detail later. It is obvious that financial convergence is a long-run concept. That is why we consider the use of long time series extremely beneficial in this respect. To be short, the key features of this paper are:

- Vast database for 102 countries, from 1980 to 2009[8];
- A variety of FD indicators (10);
- Estimation of partial effects of corruption and financial openness indicators (Corruptions Perceptions Index and KAOPEN[9]);
- Extensive use of panel data models;
- Review of existing empiric literature and convergence testing methods.

This paper is divided into 5 sections. After the introduction Section 2 briefly summarizes the existing literature this paper is based on, the statistical methods and econometrical methods. Section 3 describes the dataset and explains briefly how and whether the omitted data was inserted. Section 4 is dedicated mainly to econometric results but you will also find certain other issues covered. Section 5 concludes.

2. Mathematical methodology and review of the literature

This section focuses primarily on existing literature on financial convergence and underlying statistical and mathematical methods. Then panel data econometric models are briefly reviewed, showing the benefits of such approach. Also much emphasis is made on the new panel convergence methodology introduced by Phillips and Sul (2007). This approach was adopted by Antzoulatos, Panopoulo and Tsoumas (2011) to produce results which are in a seeming controversy with the results of this paper. That is why the results of these researchers will be thoroughly compared with the results hereof to produce clarity. This is also possible as the same data source was used and the datasets are therefore easily comparable.

2.1 Review of literature

The literature on this subject is quite scarce as few working papers deal with the subject directly. Or to be precise, the literature on financial convergence of institutional characteristics (FD indicators) is scarce. However, the convergence of EU-member economies is a well covered issue. In general financial convergence can be investigated in certain number of ways using a variety of indicators. The main types of indicators are[10]:

- Price-based measures. This approach aims to test the validity of law of one price or whether the differences of yields of financial instruments are caused by different origin;
- News-based measures. They analyze the impact of common factors, such as the availability of new public information;
- Quantity-based measures. Adopted indicators can differ, but we focus primarily on FD indicators.

When it comes to empirical contributions the results might be quite controversial as researchers use different statistical methods for different time periods. But it is worth mentioning that the research is focused primarily on convergence within European

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[8] This database is constructed using mainly World Bank sources, i.e. World Bank Financial Structure Database. Thortsen Beck and Asli Demirgüç-Kunt, "Financial Institutions and Markets Across Countries and over Time: Data and Analysis", World Bank Policy Research Working Paper No. 4943, May 2009

[9] For full description and references refer to Section 2

[10] Do financial systems converge? New evidence from household financial assets in selected OECD countries. Giuseppe Bruno and Riccardo De Bonis, IFC Bulletin No 31

economies. Bruno and De Bonis (2009) claim that *mixed results and often no convergence* are found for nine OECD member economies for time period since 1980. Stolbov (2008) *found β- and σ-convergence* for stock market capitalization to GDP ratio and bank and other financial institutions deposits to GDP ratio for 16 developing and 17 developed economies for time period from 1980 to 2005. But this research embraced a cross-section data structure making use only of data for 1980 and 2005. In this respect such an approach might be quite biased due to the fact that FD indicators might not only increase but also decrease, especially in case of developing countries. Bianco, Magda, Gerali and Riccardo Massaro (1997) found that convergence across financial systems of the countries of the EU is still *limited* and major changes are under way in one of the countries considered only. At the same time Di Giacinto and Esposito (2006), using a panel data model *found convergence* for indicators of financial development of 13 European countries from 1995 to 2003, but not for banking products. You may see that the empiric literature is highly controversial. And this paper provides possible explanation of that. Schmidt, Tyrell and Hackethal (1999) pointed out that the financial systems of the major EU economies are *unlikely to be converging*. Hartmann, Maddaloni and Manganelli (2003) documented the *progress towards integration* of the major euro area financial segments, namely money markets, bond markets, equity markets and banking. Murinde, Agung and Mullineux (2004) *found convergence* of the EU financial systems on a variant of the Anglo-Saxon model (7 countries, 1972-1996). When it comes to financial system dichotomy, it is worth mentioning that traditional assumption that financial systems move along the one-dimensional space of bank-based vs capital-market-based financial systems does not hold and such classifications is only roughly applicable (for details see Block (2002) or Antzoulatos, Thanopoulos and Tsoumas (2004))[11]. It is far from possible to make a reasonable conclusion from this massive of controversial results (consider words in italics which support this idea implicitly).

As mentioned above, Antzoulatos, Panopoulo and Tsoumas (2011) applied a new panel convergence methodology developed by Phillips and Sul (2007) and discovered the absence of convergence of any kind for any indicators in general and for any country clubs. They employed a dataset encompassing data for 38 developed and developing countries over the period 1990-2005. It is worth mentioning that their main instrument is panel convergence test, which is in a nutshell analogous to conditional σ-convergence. It measures whether so called heterogeneous time-varying idiosyncratic components converge over time to a constant, after controlling for common growth component across the cross sectional units. In other words it tests the existence of sigma convergence provided that global trend within cross sectional units are eliminated. Researchers found no such convergence and notice that convergent clubs differ across the FD indicators. What is more important is that there are no convergent clubs where all the FD indicators converge. In other word no set of countries exhibits convergence of all indicators, which leads to certain international policy implications. Differences across clubs are substantial and do not decrease over time. The distance between the "leaders" and the "followers" is large and even increases over time. Remarkably, the "leaders" consist mainly of developed economies and the "followers" consist mainly of developing economies. Obviously, the less developed financially are *not catching up* with their relatively more financially developed financial peers or the developed countries. It might be quite controversial or misleading but these results *by no means are in contradiction* with the results obtained by us. In fact we found also found no σ-convergence (in our case unconditional[12]) at all (except for the periods of financial instability which are characterized by decreasing financial sophistication and financial degradation). It is difficult to state whether conditional

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[11] Reasonable ways to classify financial systems are to employ cluster analysis or composite index calculation via PCA

[12] The obvious extension of this paper might be to apply the aforementioned approach to our version of dataset. Apparently, this should show no σ-convergence.

or unconditional σ-convergence is weaker assertion, but it is likely that absence of conditional σ-convergence is to be somehow related with the absence if unconditional one. We also found the existence of β-convergence, which is too weak to ensure the existence of σ-convergence, which corresponds with the aforementioned results, obtained Antzoulatos et. al.. by To sum up, Antzoulatos, Panopoulo and Tsoumas conclude that country-specific factors exert a much stronger influence on financial system structure than the common global forces; differences in financial systems are increasing. Also convergent clubs transcend the distinction of developed vs. developing countries.

2.2 Statistical methodology

The intuitive meaning of the term convergence is easy to understand. This paper embraces the β- and σ-convergence approaches. They imply that the average growth rate may depend on its initial level. Or similarly there is negative relation between the growth rate of the FD indicator and its initial level. To a certain extent this might be called "the effect of the low start" meaning that economically disadvantaged countries with lower FD and GDP volumes may exhibit outpacing behaviour. In other words β-convergence implies that poor and disadvantaged economies may grow faster that their richer counterparts. This can under certain conditions lead to a decrease in variation between FD indicators, which is the essence of σ-convergence. It is worth mentioning that β-convergence is necessary but not sufficient condition for σ-convergence. Initially this approach was developed in the growth literature and introduced by Baumol (1986),

All things considered, bearing panel data structure in mind the basic model is the following:

$$\frac{1}{T} \ln\left(\frac{FD_{i,t+T}}{FD_{i,T}} \right) = \beta_0 + \beta_1 \ln(FD_{i,T}) + \xi_{i,t} \ ^{13} \tag{1}$$

In this equation FD is the measure of financial sophistication, T is the period for which the average annual logarithmic growth rate is computed, $\xi_{i,t}$ is the Gauss-Markov error.

According to this specification, β-convergence can be observed if β<0. If β<0, poor and disadvantaged economies tend to grow faster than the developed ones, therefore contributing to convergence.

On the other hand, if differences between FD of a number of countries smoothen with time, the dispersion is likely to decrease. Mathematically speaking: $\sigma_{t+T} < \sigma_t$, where σ_t is the standard deviation of FD. These concepts are quite closely related but countries may exhibit β-convergence without of σ-convergence. B-convergence is merely a necessary condition for σ-convergence. The lower the beta, the faster all FD indicators get asymptotically to a steady level. As later it will be discussed in this paper countries (the whole dataset and different groups) are not likely to exhibit σ-convergence while β-convergence is quite common.

Then country specific variables might be introduced into the equation **(1)** to hold for certain factors hampering of facilitating convergence. In this paper partial effects of the following factors will be tested: corruption, financial openness. In this case the model is modified:

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[13] Logarithms are used for econometric purposes, but nevertheless it is useful to keep this in mind

$$\ln \frac{FD_{i,t+T}}{FD_{i,t}} \approx \frac{FD_{i,t+T} - FD_{i,t}}{FD_{i,t}} \text{ for small } \Delta FD$$

$$\frac{1}{T}\ln\left(\frac{FD_{i,t+T}}{FD_{i,T}}\right)=\beta_0 +\beta_1 \ln(FD_{i,T})+\vec{\gamma}\vec{X}_{i,t}+\xi_{i,t} \qquad (2)$$

In this equation X is the vector of the variables specific to a particular country. Although it might be quite straightforward or even obvious, in this paper we would like to introduce a simple way to measure of averaged level of financial sophistication for the whole world or its regions. That is:

$$\overline{FD}_t =\sum_{i=1}^{N} FD_{it}\omega_{it} \; , \qquad \omega_t =\frac{GDP_{it}}{\sum_{i=1}^{N} GDP_{it}} \qquad (3)$$

In this formula FD is financial depth indicator, N is the number of countries, and GDP is annual PPP GDP in 2000 US dollars. So FD indicators are simply statistically weighted and the weight is PPP GDP in constant prices in USD.

2.3 Panel data model review

This section is to describe briefly the merits of panel data approach, slight differences from panel data approach applied in the above papers and some particular things about panel data estimators.

First of all, we consider it irrational to dwell on purely cross sectional or time series structure of data as cross sectional data structure (in this case indicators might be taken, for example, for 1980 and 2009 to form a cross section of countries) does not catch global tendencies, decreases the amount of observations (and thus statistical inference suffers) and does not use all the data available. Time series approach requires computing too many regressions and statistical inference might also leave much to be desired with N around 30[14]. Panel data models help to resolve all this problems. The common panel data approaches are the following[15] [16]:

1. Pooled OLS estimator (not using longitudinal data structure);
2. LSDV estimator (Least Squares Dummy Variables);
3. Within estimator or Fixed Effect (FE) estimator;
4. Random effect estimator.

Pooled OLS simply ignores panel data structure and considers all countries to be homogeneous, which is a weak assumption. But from computational standpoint this one is the easiest. LSDV estimator and FE-estimator assume all countries to be unique, and it is recommended to use such and approach when dealing with big regions, countries or big firms. In case unobservable country effects are correlated with other explanatory variables RE-estimator is introduced. It also worth mentioning that LSDV estimator and FE-estimator provide exactly the same coefficients and standard deviations, but in case of LSDV computation of R^2 might be quite misleading (as inclusion of 102 dummies can increase R^2 significantly telling us nothing about goodness of fit). That is why we will report the so called R^2 within, which is a measure of correlation between fitted value and actual value.

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[14] Although this number of observations is usually considered sufficient for time series models

[15] Magnus, Katishev, Peresetsky Introductory Econometrics — 373-375

[16] Jeffrey Wooldridge Introductory Econometrics: A Modern Approach - Michigan State University ISBN-10: 0324581629 ISBN-13: 9780324581621, chapter 14

In fact in panel data empiric papers there are usually two ways of producing results, either to produce all estimations or to choose the most appropriate method. It might be sensible to perform a robustness check using all the estimators, but taking into consideration the amount of variables it might be quite bulky. The FE-estimator was chosen for the most of regressions computed according to the following criteria:

1. F-test that all the country specific dummies are zero;
2. Common sense;
3. Hausman test[17] (testing the null of correlation among the unobserved individual effects and the explanatory variables).

Also note that due to vast data omissions of certain variables data is not cut into N/5 small periods as it was performed by Bruno and De Bonis (2009) but the method applied is more like moving average, which provides flexibility when dealing with vast unbalanced datasets. Bearing all that in mind let us proceed to the main part.

3. The dataset[18]

Perhaps the main merit of this paper is an extensive dataset for 102 countries for time period from 1980 to 2009, the number of observations being 3060. The World Bank Financial Structure Database[19] is a flexible instrument for analyzing institutional characteristics of the whole world, which reports data in a very useful way. This is the main source of data used in this paper. Certain alterations were made to the data presented there which will be described later. The following FD indicators and other variables were included into the dataset from this Database (indicators divided into groups characterizing banking sector, insurance sector, stock market and bond market and financial openness) consists of the following indicators :

1. Deposit money bank assets/GDP[20] (**dbagdp**);
2. Private credit by deposit money banks/GDP (**pcrdbgdp**);
3. Private credit by deposit money banks and other financial institutions/GDP (**pcrdbofgdp**);
4. Bank deposits/GDP (**bdgdp**);

5. Life insurance premium volume/GDP (**inslife**);
6. Non-life Life insurance premium volume/GDP (**insnonlife**);

7. Stock market capitalization/GDP (**stmktcap**);
8. Private bond market capitalization/GDP (**prbond**);

9. Loans from non-residents banks (net)/GDP (**intldebtnet**);
10. Remittance inflows/GDP (**remit**);

It is worth making a few remarks about the completeness of the dataset. Banking data is the most full and comprehensive. Several interpolation and extrapolation methods were used in

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[17] Econometric Analysis of Cross Section and Panel Data Jeffrey M. Wooldridge The MIT Press Cambridge, Massachusetts London, England, page 251
[18] The size of the dataset prevents me from including it to the appendix, so the dataset is available upon request
[19] Thortsen Beck and Asli Demirgüç-Kunt, "Financial Institutions and Markets Across Countries and over Time: Data and Analysis", World Bank Policy Research Working Paper No. 4943, May 2009
[20] Full methodology of calculating this indicators is given in the Database downloadable from the internet site of the World Bank

order to make banking panel data almost completely balanced (i.e. there are only a few pieces of data omitted[21]). Then remittance statistics is quite full. Other FD indicators are scarcely represented. As it is anticipated the fullest data are provided for countries with high income[22]. There are also variables responsible for region and income group. To give a better idea of the coverage of the dataset the following tables containing descriptive statistics are presented.

Table 1
Dataset Coverage

Code	WB INCOME GROUP	Number of Countries	Share of number of countries, %	Cumulative GDP share averaged for 1980-2009, %
1	Low Income	17	16.67	0.54
2	Lower Middle Income	27	26.47	10.71
3	Upper Middle Income	25	24.51	10.54
4	High Income	33	32.35	**78.75**
Total		**102**	100	100.54[23]

Note that GDP share is for PPP GDP in 2000 US dollars. While countries with lower middle, upper middle and high income are almost equally represented, the share of the GDP differs drastically. This means that high income states will influence the level of average financial development heavily. In the Appendix you will find the full list of countries in the table **A1**.

Table 2
Dataset Coverage

Code	WB REGION	Number of Countries	Share of number of countries, %	Cumulative GDP share averaged for 1980-2009, %
1	Middle East & North Africa	6	5.88	3.07
2	Biggest Economies	33	32.35	**78.75**
3	South Asia	5	4.90	5.38
4	Latin America & Caribbean	22	21.57	5.95
5	Sub-Saharan Africa	24	23.53	2.32
6	East Asia & Pacific	11	10.78	3.45
7	Europe & Central Asia[24]	1	0.98	1.61
Total		**102**	100	100.54

As mentioned above PPP GPD in 2000 USD was also included into the database and used in statistical weighting procedures. Also the measure of financial openness, namely KAOPEN[25] index, is included into the dataset to measure its partial effects in the framework of conditional convergence model. According to its creator, KAOPEN is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. These variables indicate the presence of multiple exchange rates, restrictions on current account transactions, restrictions on capital account transactions and the requirement of the surrender of export proceeds. These indicators are transformed into an index using statistical procedures and PCA. The author also claims his index to be highly correlated with

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[21] Only data for 2008 and 2009 were left untouched and not used for interpolation. The total amount of inserted pieces of data is negligible in comparison with the number of observations.

[22] According to World Bank classification

[23] This is larger than 100% due to data omissions.

[24] Only Turkey is in this category as the majority of European states are in the group of biggest economies, which coincides fully with high income states

[25] Chinn: Robert M. La Follette School of Public Affairs; and Department of Economics, University of Wisconsin, 1180 Observatory Drive, Madison, WI 53706.

the previously used measures of financial openness. It is time to state a number of hypotheses to test:

Hypothesis 1: In the long run different FD indicators of certain groups of countries are to exhibit certain types of convergence, conditional or not

Hypothesis 2: In the long run financial openness is to facilitate financial convergence and financial development

Also a measure of corruption is included into the dataset. We must notice that the CPI[26] (Corruption Perceptions Index) was calculated inconsistently, i.e. the list of countries varies every year. The data is abundant since sometime around 2005. According to its authors, the Corruption Perceptions Index is an aggregate indicator that brings together data from sources that cover the past two years. For the CPI 2010, this includes surveys published between January 2009 and September 2010. The CPI 2010 is calculated using data from 13 sources by 10 independent institutions. All sources measure the overall extent of corruption (frequency and/or size of bribes) in the public and political sectors, and all sources provide a ranking of countries, i.e. include an assessment of multiple countries.

Hypothesis 3: In the long run the level of corruption is to hinder financial convergence and financial development

4 The Results

The subsection 4.1 deals with long run global tendencies, the subsection 4.2 deals with σ-convergence analysis and the subsection 4.3 deals with β-convergence analysis.

4.1 Long run trends

I will start with defining whether different groups of countries developed financially from 1980 to 2009. Several graphs and simple regressions are useful instruments in this case. This will also show why β-convergence can exist without σ-convergence. Figure 1 depicts the deposit money bank assets to GDP ratio (left scale) for countries with high income. We can see that there is a clear upward time trend (which may be even clearer if we hold for country specific effects). On the right scale we can see a path of standard deviation of **dbagdp**. Assuming that there is β-convergence (and in fact there is), we can see on this figure that when there is a clear upward trend, β-convergence does not always imply σ-convergence. There are periods when standard deviation decreases with time, but the overall trend is clear upward.

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[26] For a more detailed explanation of the CPI method please visit www.transparency.org/cpi

Figure 1
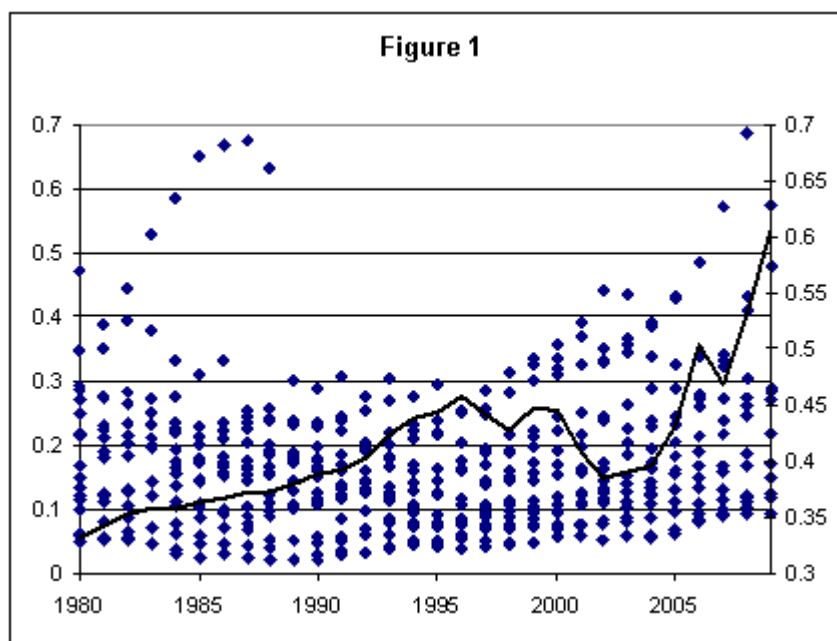
The best compressed illustration for trends of financial development (or degradation) would be a table containing coefficients of the following regression model, estimated using FE-estimator[27]:

$$\ln(FD) = \beta_0 + \beta_1 year + \xi_{i,t} \qquad \qquad (4)$$

If correctly interpreted, this regression provides us annual growth rates of FD holding for country-specific dummies. The difference between these growth rates and ordinary averaged growth rated is that these ones are computed taking country specific effects into consideration.

Table 3				
Development or degradation? Annual growth rates, %				
Indicator	Low Income	Lower Middle Income	Upper Middle Income	High Income
dbagdp	0.92	1.73	1.30	**2.99**
pcrdbgdp	1.55	2.12	1.09	**3.35**
pcrdbofgdp	0.94	2.02	1.10	**2.84**
bdgdp	2.12	2.43	1.47	**2.49**
inslife	-[28]	3.69	2.21	**5.68**
insnonlife	-	-0.03	**1.70**	1.01
stmktcap	-	**10.94**	8.19	9.05
prbond	-	**8.20**	2.77	4.79
intldebtnet	-	**8.20**	2.77	4.79
remit	**5.01**	4.60	1.76	-0.11

It is clear that the banking sector of developed countries outpaces the banking sector of the developing. But when it comes to deposits they are quite close. Life insurance grows at the

[27] There will be no statistical tests provided for this table, but later it is clearly visible that FE-estimator is preferable
[28] There is no data or the number of obs. is not sufficient

fastest rate in the developed world but the developing world growth at good rates to. When it comes to stock market, bond market and non-life insurance developing countries outpace the developed.

We will proceed with illustrating how the average FD of the world has changed since 1980. The most efficient way to do this is to depict several figures.

Figure 2
Averaged financial depth in retrospective, banking sector

Figure 3
Averaged financial depth in retrospective, banking sector

Figure 4
Averaged financial depth in retrospective, insurance sector

Figure 5
Averaged financial depth in retrospective, stock and bonds
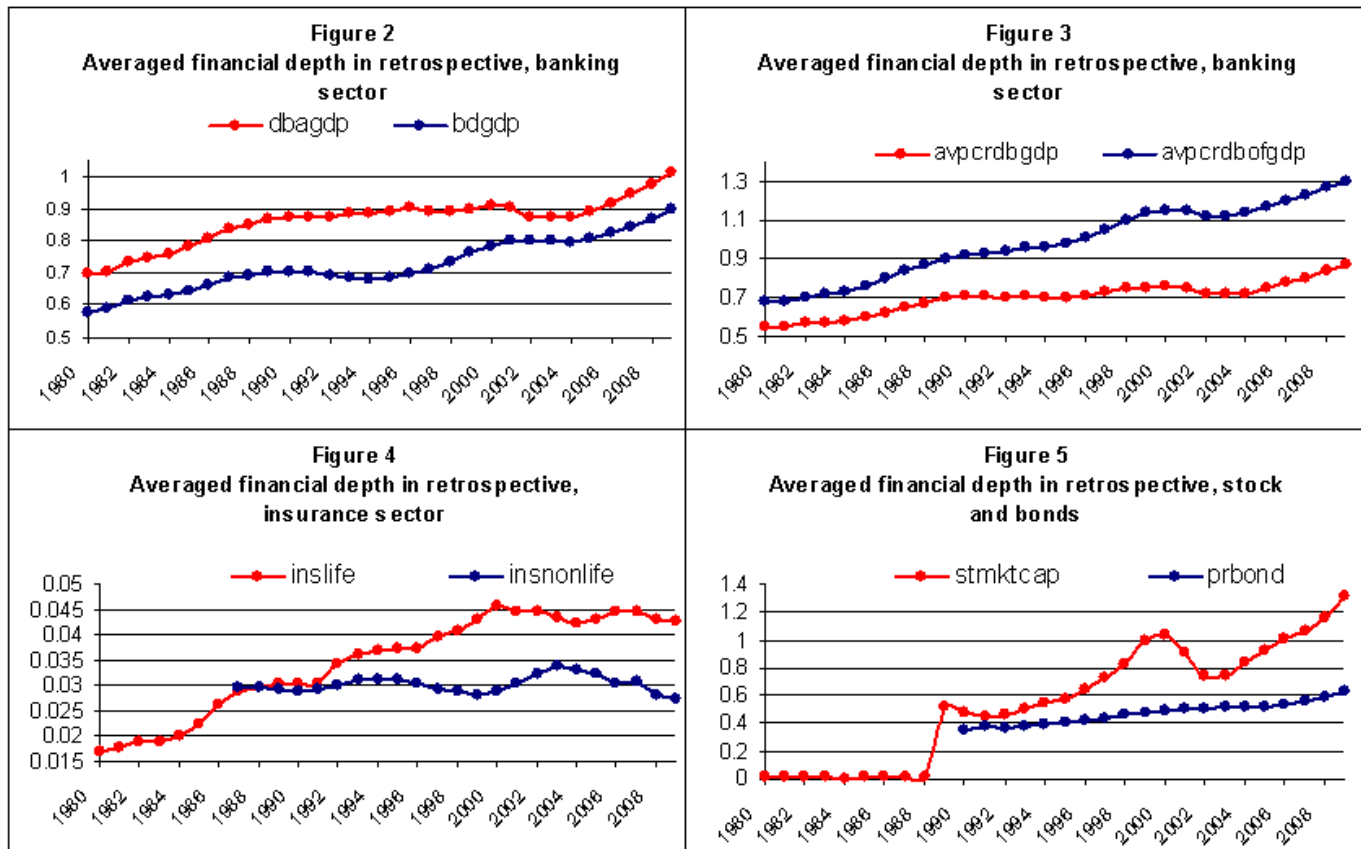
4.2 σ-convergence

As a matter of fact, for no country group absolute σ-convergence can be observed[29], i.e. there might be some backward movements but usually standard deviation is rising. There are two periods, when standard deviation showed downward movement almost for all FD indicators and for all country groups: at the end of the 1980s and at the end of 1990s.

Figure 6
Year by year standard deviation for countries with Lower Middle Income (27)

Figure 7
Year by year standard deviation for countries with Upper Middle Income (25)
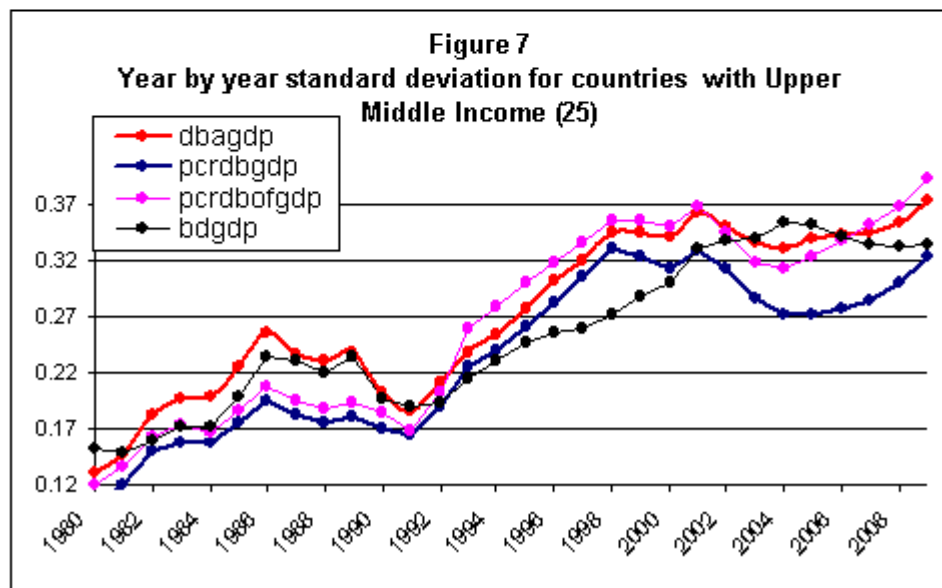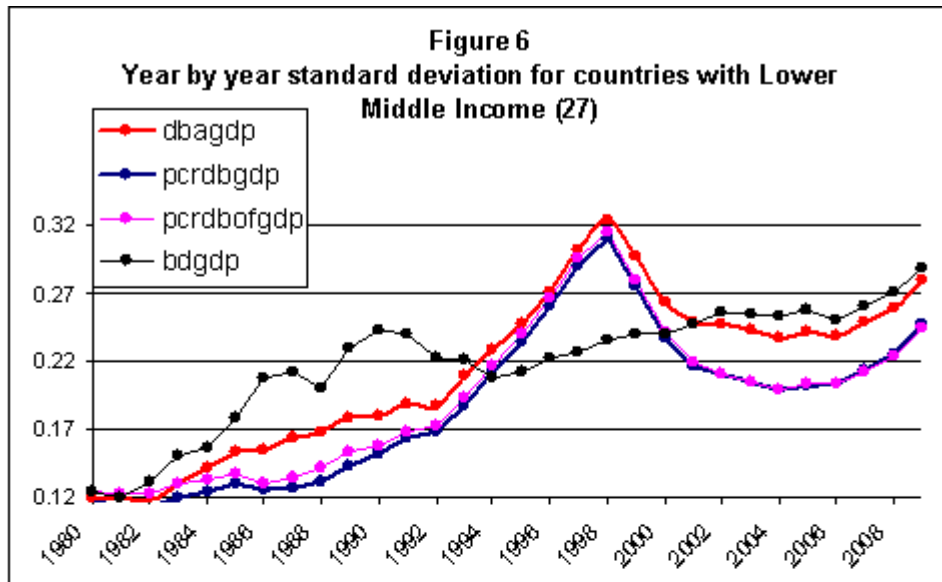
When we take into consideration the fact that the majority of countries with upper middle income in this dataset are from Latin America & Caribbean and that periods of downward mobility of standard deviation coincide with the periods of financial crises, we can make a conclusion that holding other factors equal standard deviation of FD indicators only grew with time from 1980 and 2009. Its downward mobility was only due to financial crises. This is true also for developed countries or countries with high income, but they "suffered" mostly from dotcom failure.

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[29] Bear in mind that this dataset is heterogeneous by its nature. Papers which find σ-convergence base in smaller databases of more homogenous countries. Computing regressions using σ as the dependent variable might be a possible extension of this paper. Also computing weighted standard deviations might be an issue. As mentioned above it conforms to the results obtained by Antzoulatos et. al..

The main conclusion is that during financial crises disproportions of financial development smoothen but only due to degradation of financial systems of leaders. The other is that even if countries exhibit β-convergence (which means that outsiders are more likely to catch up) the speed of their growth is not enough to do it quick in order to reduce standard deviation.

4.3 β-convergence

The dataset confirms the existence of β-convergence among the whole dataset of 102 countries as well as among countries grouped by their income. Note that the reported probability is for t-test of null that beta equals zero. F-test probability is for test of null that there are no fixed effects (all dummies equal zero). Hausman test tests the null that there are random effects. So FE-estimator is preferable in all cases.

The convergence is observed for all indicators. Stock market and bond market FD indicators converge faster that banking sector ones.

Table 4							
Simple unconditional convergence results							
Group	Indicator	Beta	R^2 within	Prob.	F-test prob.	Hausman test prob.	Total panel observations
Banking	DBAGDP	-0.094	0.24	0.000	0.000	0.000	2528
	PCRDBGDP	-0.102	0.30	0.000	0.000	0.000	2527.00
	PCRDBOFGDP	**-0.108**	0.33	0.000	0.000	0.000	2527.00
	BDGDP	-0.085	0.25	0.000	0.000	0.000	2530.00
Insurance	INSLIFE	-0.072	0.27	0.000	0.000	0.000	1218.00
	INSNONLIFE	**-0.160**	0.47	0.000	0.000	0.000	911.00
Stock market and bonds	STMKTCAP	-0.101	0.35	0.000	0.000	0.000	1068.00
	PRBOND	**-0.141**	0.30	0.000	0.000	0.000	488.00
Openness	INTLDEBTNET	**-0.202**	0.57	0.000	0.000	0.000	233.00
	REMIT	-0.089	0.22	0.000	0.000	0.000	2016.00

Table 5				
Beta convergence by groups of countries[30]				
Indicator	Low Income	Lower Middle Income	Upper Middle Income	High Income
dbagdp	-0.106	-0.102	-0.110	-0.059
pcrdbgdp	-0.090	-0.120	-0.115	-0.066
pcrdbofgdp	-0.104	-0.124	-0.109	-0.075
bdgdp	-0.086	-0.081	-0.102	-0.077
inslife	-	-0.076	-0.111	-0.058
insnonlife	-	-0.213	-0.108	-0.161
stmktcap	-	-0.089	-0.100	-0.111
prbond	-	-0.202	-0.172	-0.112
intldebtnet	-	-0.171	-0.242	-0.190
remit	-0.083	-0.072	-0.115	-0.099

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[30] All coefficients are statistically significant at all conventional confidence levels

Analyzing the table dedicated to group convergence[31], you may notice that middle income countries on average are leaders when it comes to banking sector convergence, stock market or bond market convergence. It is also interesting that average deposit growth rate is higher than credit growth rate for developing economies. The situation is vice versa for the developed countries. Credit ratios levels in developing economies converge faster that deposit ratios. In developed world deposit ratios converge faster that credit ratios. It means that now developing countries save more than they give away in the form of credits and the developed countries credit more than they save. But it is good news that credit ratios converge faster that deposit ratios in developing countries as it means that recourses are being redirected in their own economies reducing global imbalances.

However, the speed of convergence is not very high. The beta coefficient being around -0.1 on average means that if the FD indicator of one country decreases by 1% then the annual growth rate of this FD indicator is to increase by 0.1%. If one country has FD indicator that is 50% lower than the average then this FD indicator annual growth rate is to be 5% higher than the average growth rate. If the handicap is 66% or 75% the results are 6,6% and 7,5% respectively. The speed of convergence is higher for developing countries for bond market but the most vital financial sectors are banking and stock market. The role of banking sector cannot be underestimated for developing countries. It is easy to understand, why such speed of convergence is insufficient by considering the following example:

Table 6

Convergence example for credit depth[32]

	Average group credit depth value	Average beta	Growth rate acceleration, %
Low Income	0.231	-0.108	21.03
Lower Middle Income	0.401	-0.108	14.04
Upper Middle Income	0.588	-0.108	9.42
High Income	1.353	-0.108	0.00

Also simple mathematical modeling showed the following. If the banking depth indicators for the developed countries are around 1.4 and for developing around 0.5 and the average annual growth rate of this indicator is 3%, then the developing countries can catch up within 15 years provided beta is around -0,7. By catching up we mean achieving the level of banking depth around 1.4. These results by no means should be considered accurate but they provide useful insight into understanding why beta being around -0.1 is insufficient.

Table 7

Simple mathematical modeling for credit depth indicators	
Approximate beta	Number of years to achieve target banking depth
-0.7	15
-1.1	10
-1.9	5

[31] All coefficients are valid at all conventional confidence levels and are obtained using FE-estimator
[32] Please note that if economic indicator grows at the rate of 10%, and this rate is subject to 10% growth, then the new growth rate would be 11%.

The last thing to deal with is to test conditional convergence models, using CPI and KAOPEN as regressors. We may simply put KAOPEN or CPI into the regression, i.e. use the following model:

$$\frac{1}{T} \ln\left(\frac{FD_{i,t+T}}{FD_{i,T}} \right) = \beta_0 + \beta_1 \ln(FD_{i,T}) + \beta_2 KAOPEN + \xi_{i,t}$$

(5)

In this case financial openness or absence of capital restrictions can affect the growth rate of the FD indicator. If we want to test whether it fosters or hampers convergence, we should run the following model:

$$\frac{1}{T} \ln\left(\frac{FD_{i,t+T}}{FD_{i,T}} \right) = \beta_0 + \beta_1 \ln(FD_{i,T}) + \beta_2 KAOPEN + \beta_3 \ln(FD_{i,T}) \cdot KAOPEN + \xi_{i,t}$$

(6)

In this case we estimate a ceteris paribus effect of financial openness on financial sophistication and a ceteris paribus effect of financial openness on the speed of convergence. If coefficient $\beta_3 < 0$, then financial openness fosters convergence. Interpretation of β_2 can also be of interest. The same technique can be applied to CPI.

Table 7						
Conditional convergence results[33]						
Group	**Indicator**	**KAOPEN**	**Prob.**	**KAOPEN*ln(FD)**	**Prob.**	**Obs.**
Banking	DBAGDP	**0.010**	0.000	**-0.00310**	0.028	2355
	PCRDBGDP	**0.014**	0.000	-0.00034	0.815	2354
	PCRDBOFGDP	**0.011**	0.000	-0.00202	0.159	2354
	BDGDP	0.003	0.144	**-0.00562**	0.000	2356
Insurance	INSLIFE	**0.022**	0.007	0.00226	0.144	1146
	INSNONLIFE	**-0.063**	0.000	**-0.01477**	0.00	849
Stock market and bonds	STMKTCAP	**0.033**	0.000	0.00221	0.397	992
	PRBOND	-0.004	0.794	**-0.00820**	0.080	454
Openness	INTLDEBTNET	**0.127**	0.067	0.01380	0.160	211
	REMIT	-0.006	0.536	**-0.00362**	0.046	1870

First of all financial openness fosters the convergence of banking assets and deposits ratios. These FD indicators tend to grow faster in economically disadvantaged countries with higher levels of financial openness. It is sensible as lesser restrictions make certain bank operations more profitable. KAOPEN also has a positive effect on growth rates of credit ratios and asset ratios. Greater financial openness also fosters stock market development, insurance sector performance and of course the amount of loans from non-residents. Financial openness also has a positive effect on convergence of bond market ratio and remittance ratio. So we can make a conclusion that financial openness has a positive effect on financial growth and convergence, provided the corresponding coefficients are significant.

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[33] Coefficients significant at conventional confidence levels are in bold

Table 8						
Conditional convergence results[34]						
Group	**Indicator**	**CPI**	**Prob.**	**CPI*ln(FD)**	**Prob.**	**Obs.**
Banking	DBAGDP	**-0.012**	0.002	**0.000**	0.000	804
	PCRDBGDP	-0.00751	0.117	**0.00017**	0.016	803
	PCRDBOFGDP	-0.007	0.176	**0.000**	0.023	803
	BDGDP	**-0.01093**	0.001	**0.00036**	0.000	803
Insurance	INSLIFE	0.000	0.916	**-0.00010**	0.024	486
	INSNONLIFE	**-0.005**	0.012	**-0.00032**	0.00	486
Stock market and bonds	STMKTCAP	0.007	0.470	0.00004	0.663	581
	PRBOND	0.004	0.803	0.00008	0.363	331
Openness	INTLDEBTNET	-0.037	0.099	**-0.00034**	0.000	192
	REMIT	-0.002	0.703	0.00000	0.993	738

This table suggests that greater corruption or lower transparence (there is less corruption or more transparency in a country with higher CPI) is associated with higher growth rates of bank assets, bank deposits and insurance premiums. Or similarly higher transparence is hampers the development of banking sector and insurance sector. It means that banking and insurance sector might be quite non-transparent. It also may mean that more transparent financial systems can be more market based. Remarkably, transparency hampers convergence of all banking indicators. On the other hand it fosters convergence of insurance sector and loans from non-resident ratios.

5 Conclusions

To be short the main contributions of this paper are the following:

1. The world experiences steady financial development since 1980;
2. The developed world shows highest banking sector growth rates and the developing world – highest stock, bond and insurance market growth rates;
3. It was proven that 102 countries (together or divided in income groups) do not exhibit σ-convergence, i.e. the world is becoming more heterogeneous in terms of financial development;
4. σ exhibits downward behavior only during financial crises due to financial degradation or lack of development;
5. All types of countries within the dataset exhibit β-convergence, beta coefficient being from around -0.2 to around -0.08 for different FD indicators and different groups of countries;
6. The speed of convergence is not sufficient to secure the fact that developing countries can catch up quickly. Similarly, it is obvious that the presence of β-convergence without σ-convergence means that financial systems are likely to stay unique and the distance between the developed world and the developing is not going to decrease;
7. The fastest rates of convergence are observed within the group of countries with middle income. The least pronounced convergence is within the group of biggest economies;
8. Average deposit growth rate is higher than credit growth rate for developing economies. The situation is vice versa for the developed countries. Credit ratios levels in developing economies converge faster that deposit ratios. In developed world deposit ratios converge

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[34] Coefficients significant at conventional confidence levels are in bold

faster that credit ratios. This means that although recourses are being redirected from the developing countries in the developed countries, the situation is likely to change;

9. Financial openness facilitates financial development and convergence wherever β coefficient is significantly different from zero;

10. Higher transparence (lower corruption) is associated with lower banking sector growth rates. Similarly transparence hampers the development of banking sector. This may simply indicate that banking sector is more important in developing countries;

11. Remarkably, lower corruption (higher transparence) hinders banking sector convergence;

12. By providing ample evidence that the world is becoming more heterogeneous financially we have shown that traditional financial system dichotomy is not applicable.

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Appendix

Table A1

COUNTRY	WB COUNTRY CODE	WB REGION	WB INCOME GROUP
Algeria	DZA	1	3
Australia	AUS	2	4
Austria	AUT	2	4
Bahamas, The	BHS	2	4
Barbados	BRB	2	4
Belgium	BEL	2	4
Bhutan	BTN	3	2
Bolivia	BOL	4	2
Botswana	BWA	5	3
Burkina Faso	BFA	5	1
Burundi	BDI	5	1
Cameroon	CMR	5	2
Canada	CAN	2	4
Chile	CHL	4	3
Colombia	COL	4	3
Costa Rica	CRI	4	3
Côte d'Ivoire	CIV	5	2
Cyprus	CYP	2	4
Denmark	DNK	2	4
Dominica	DMA	4	3
Dominican Republic	DOM	4	3
Ecuador	ECU	4	2
Egypt, Arab Rep.	EGY	1	2
El Salvador	SLV	4	2
Ethiopia	ETH	5	1
Fiji	FJI	6	3
France	FRA	2	4
Gabon	GAB	5	3
Gambia, The	GMB	5	1
Germany	DEU	2	4
Ghana	GHA	5	1
Greece	GRC	2	4
Grenada	GRD	4	3
Guatemala	GTM	4	2
Haiti	HTI	4	1
Honduras	HND	4	2
Hungary	HUN	2	4
Iceland	ISL	2	4
India	IND	3	2
Indonesia	IDN	6	2
Iran, Islamic Rep.	IRN	1	3
Ireland	IRL	2	4
Israel	ISR	2	4
Italy	ITA	2	4
Jamaica	JAM	4	3
Japan	JPN	2	4
Jordan	JOR	1	2
Kenya	KEN	5	1

Korea, Rep.	KOR	2	4
Kuwait	KWT	2	4
Lesotho	LSO	5	2
Luxembourg	LUX	2	4
Madagascar	MDG	5	1
Malawi	MWI	5	1
Malaysia	MYS	6	3
Malta	MLT	2	4
Nepal	NPL	3	1
Netherlands	NLD	2	4
New Zealand	NZL	2	4
Niger	NER	5	1
Nigeria	NGA	5	2
Nepal	NPL	3	1
Netherlands	NLD	2	4
New Zealand	NZL	2	4
Niger	NER	5	1
Nigeria	NGA	5	2
Norway	NOR	2	4
Pakistan	PAK	3	2
Panama	PAN	4	3
Papua New Guinea	PNG	6	2
Paraguay	PRY	4	2
Philippines	PHL	6	2
Portugal	PRT	2	4
Rwanda	RWA	5	1
Samoa	WSM	6	2
Saudi Arabia	SAU	2	4
Senegal	SEN	5	2
Seychelles	SYC	5	3
Sierra Leone	SLE	5	1
Singapore	SGP	2	4
Solomon Islands	SLB	6	1
South Africa	ZAF	5	3
Spain	ESP	2	4
Sri Lanka	LKA	3	2
St. Lucia	LCA	4	3
St. Vincent and the Grenadines	VCT	4	3
Suriname	SUR	4	3
Swaziland	SWZ	5	2
Sweden	SWE	2	4
Switzerland	CHE	2	4
Syrian Arab Republic	SYR	1	2
Thailand	THA	6	2
Togo	TGO	5	1
Tonga	TON	6	2
Trinidad and Tobago	TTO	2	4
Turkey	TUR	7	3
Uganda	UGA	5	1
United Kingdom	GBR	2	4
United States	USA	2	4
Uruguay	URY	4	3
Vanuatu	VUT	6	2
Venezuela, RB	VEN	4	3

Figure A1
Year by year standard deviation for all countries (102)

- dbagdp
- pcrdbgdp
- pcrdbofgdp
- bdgdp

Figure A2
Year by year standard deviation for all countries (102)

- inslife
- insnonlife

Figure A3
Year by year standard deviation for all countries (102)

- stmktcap
- prbond