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147

Heikki Lehkonen

Essays on Emerging Financial Markets, Political Institutions and Development Differences

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ABSTRACT

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This thesis studies the emerging financial markets, their institutional environment and the effects development differences between emerging and developed markets. It comprises of four empirical research articles preceded by introductory chapter that describes background of the emerging economies and their investing environment as well as the main results of the thesis.

The first study (Ch. 2) considers the integration of local stock market to global markets and crisis periods by studying the integration dynamics during the major financial crisis periods, the effects of integration on the crisis and the integration determinants. Results indicate that integration decreased during the global financial crisis for developed market but increased slightly for emerging markets and that the integration affected to the wideness of the crisis but not to its depth. Also several factors are found to affect to integration.

The second study (Ch. 3) examines the political regimes of the emerging markets by studying if the country's democracy level affects stock returns directly or indirectly via parabolic relationship with political risk. The results indicate quite consistently that countries with higher level of democracy also produce higher returns and, a bit counter intuitively, lower political risk affects positively to returns.

The third study (Ch. 4) utilizes wavelet decomposition and dynamic conditional correlation to examine timescale-dependent, time-varying correlations between emerging and developed markets and thus contributes to portfolio diversification literature. With these methods it is possible to study whether comovement has changed during the sample period and detect the differences between correlations of different timescales, development levels and geographic regions.

The fourth study (Ch. 5) concentrates studying whether the China's stock markets were characterized by rational speculative bubbles and can they, in terms of bubbles, be compared to more developed markets of Hong Kong. Used method, duration dependence test, provides mixed results and thus can be considered sensitive to sample selection. However, it also provides evidence that while bubbles can be found from Mainland China, they are rarer in Hong Kong and thus the markets cannot be considered similar.

Keywords: emerging financial markets, institutions, development, correlation, integration

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Jyväskylä, March 2014
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CONTENTS

CHAPTER 1

INTRODUCTION

1 BACKGROUND

This dissertation consists of an introductory chapter and four research articles which aim to provide new perspectives to emerging financial markets and especially to the effects of development and the political institutional environment in which they operate. None of the articles aims to provide straightforward investing guidelines, but instead the objective is to provide important insights into macroeconomic factors that affect market behavior. Although all of the studies can be laid under the umbrella of emerging markets institutions and development, the themes, data sets and methods vary between the articles, ranging from the determinants of market integration and the effects of democracy and political environment to scale varying dynamic correlation of the BRIC markets and to the tests of China's stock market bubbles.

This first chapter aims to provide framework for the essays that follow it by introducing the emerging financial market environment and some previous results related to them. Section 1.1 introduces the emerging markets, their recent macroeconomic development and significance to global economic growth while section 1.2 concentrates more on the investing side and describes briefly the general behavior of the emerging stock markets. As this thesis concentrates partly on the political institutions, section 1.3 provides a rough picture on the political risks related to emerging economies and compares them to more developed countries while section 1.4 presents the research gaps and questions which this dissertation deals with. Section 2 goes through emerging financial markets, their development and the effects of institutions via previous studies. The themes range from the stock market returns and volatility (subsection 2.1.1); diversification benefits (subsection 2.1.2); crises and contagion (subsection 2.1.3); to stock market liberalization and integration (subsection 2.2.1); capital flows (subsection 2.2.2); and emerging market specific risks (section 2.3). Section 3.1 summarizes the four essays and their relationship to each other while sections 3.2 and 3.3 conclude the contributions of the thesis and discuss some possible future research topics, respectively. The essays follow in Chapters 2, 3, 4 and 5.

1.1 Emerging markets

The World Bank classifies countries on the basis of their Gross National Income per capita into low, middle and high income economies. Using these definitions, emerging market economies can be classified as countries with low (<$1,036, 2012) to middle ($1,036 - $12,615, 2012) per capita income. The term refers to a situation in which economy emerges from a lower income per capita level to higher level i.e. from developing to developed economy. It should be noted that the definition of the emerging market does not necessary mean that the country is small or poor. For example such economic giants as China and Russia are classified as emerging as well as several OECD member countries (for example Czech Republic, Hungary and Mexico). Table 1 presents some figures of the emerging and developed markets as well as for the BRIC markets (Brazil, Russia, India and China) and the major industrialized economies. Often the emerging market economies are characterized with rapid growth and they do contribute a large part of the world economic growth which comes clear from the first column of Table 1. While between years 2000-2011, the average GDP growth rate of the emerging economies was almost 6%, it was less than 2% for the developed countries. During the same time emerging economies' GDP share of the global GDP increased from 18.2% to 33.6%. China's share of this increase was especially large as it almost tripled from 3.7% to 10.5%. Partly based on these figures, it has been argued, that at least for some countries, the term emerging market economy is outdated and it should be replaced with growth markets, which describes better their characteristic of the fast growth and significance to the global economic performance in the near decades[1]. Together with growth, the inflation in emerging markets was also higher than in developed markets reflecting the growth as well as the uncertainty in their macroeconomic environment. Other distinctive characteristic of the emerging markets is their size. They cover almost 74% of the total land area and almost 87% of the population and thus any changes and developments in their economic, financial and political environment have effects on a significant share of global population. The last two columns in Table 1 are dedicated for financial market development and present the market capitalizations of the markets in 2000 and 2011. Emerging markets, and especially BRIC countries, have approximately quadrupled their market shares between 2000 and 2011 passing even some of the major industrialized economies while the market capitalization of the developed countries has decreased substantially. This shows clearly that the importance of the emerging economies in global finance has increased significantly and they have become major players in the international financial markets.

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1 http://www.goldmansachs.com/our-thinking/global-economic-outlook/intro-growth-markets/index.html

TABLE 1 Development of the emerging economies

Country/Area	Growth rate	GDP		Inflation	Population [% of total]	Land area [% of total]	Market Cap	
		(2000)	(2011)				(2000)	(2011)
Emerging markets	5.98	18.2	33.6	5.67	83.7	73.8	6.1	22.1
Developed markets	1.79	81.8	66.6	2.47	16.3	26.2	93.9	77.9
Brazil	3.62	2.0	3.5	6.71	2.8	6.5	0.7	2.6
Russia	5.29	0.8	2.7	12.92	2.0	12.6	0.1	1.7
India	7.13	1.5	2.6	6.38	17.8	2.3	0.5	2.2
China	10.22	3.7	10.5	2.26	19.3	7.2	1.8	7.2
The U.S.	1.80	30.6	21.4	2.54	4.5	7.1	46.9	33.4
The U.K.	1.91	4.6	3.5	2.19	0.9	0.2	8.0	6.2
Japan	0.78	14.6	8.4	-0.30	1.8	0.3	9.8	7.6
Germany	1.35	5.8	5.1	1.61	1.2	0.3	3.9	2.5

Notes: Growth rate is the percentage average growth between years 2000-2011. The GDP ratios are based on the US$ denominated GDPs. Inflation is the average inflation of 2000-2011 measured with percentage changes in consumer price indices. Population and land area are measured as a percentage of the total world population and land area in 2011, respectively. Market cap is the market capitalization of the local listed companies as a ratio of the world market capitalization. Source: World Bank World Development Indicators.

Emerging markets are defined as the capital markets in emerging market economies but in this dissertation these two are used as synonyms. Often the term emerging markets refers, but is not limited, to the countries which opened their financial markets during late 1980s and early 1990s providing access for foreign investors to domestic markets as well as allowing domestic investors to trade in international markets. These developments in capital markets occurred often together with reforms on macroeconomic and trade environment leading to significant increases in the size and compositions of the capital flows as foreign portfolio flows and direct investments replaced commercial bank debt as the dominant source of foreign capital (Bekaert and Harvey, 2003). Buckberg (1995); Kim and Singal (2000); Henry (2000); and Bekaert, Harvey and Lundblad (2003) provide estimates of the market liberalization dates for several emerging markets of South America, Asia, Europe and Africa and study the effects of liberalization and the capital flows for both real economy and financial markets. As the identification of the liberalization date creates a natural experiment for capital markets, it raises a bunch of interesting questions from the perspectives of both, the liberalizing markets and of the investors. Mainly, what are the effects, both positive and negative, of the increased capital flows for the recipient countries, what are the investment risks and how large and persistent are the expected diversification benefits for foreign investors? The first decade of emerging market research concentrated mostly on studying the effects of market liberalization and the integration of the emerging markets to global

financial markets (Bekaert and Harvey (2003) provide a comprehensive review of this research) and while these themes are still alive, the trend has started to turn towards the special characteristics of the emerging markets and their comparison with developed markets.

Emerging countries have received plenty of interest during the last few decades, largely because the economic performance of the BRIC countries has strongly exceeded the economic growth of industrialized countries as Table 1 shows. BRICs are the biggest, the most influential and the most important emerging markets. They have been recognized as the global growth motors with enormous natural resources as well as skilled and cheap labor force and thus are also subject of a large part of the emerging market research. The abbreviation BRIC (introduced by Goldman Sachs's report by Wilson and Purushothaman (2003) and the follow-up paper by O'Neill, Wilson, Purushothaman and Stupnytska (2005)) has become an everyday term among finance professionals, and it is expected that the importance of these countries will grow in equity portfolios. It is expected that under favorable economic growth conditions, the combined economies of the BRICs could grow larger than the combined economies of the G7 nations (the U.S., Japan, Germany, France, Italy, Canada and the United Kingdom) in the U.S. dollar terms by 2032 (O'Neill and Stupnytska, 2009).

Emerging markets can be further divided into several intersecting subsets based on their history, development phase and size. One of these subsets is the transition economies, which comprises of the economies which have changed or are changing from centrally planned economy to a free market based economy. These include for example China, Russia, Czech Republic, Poland and several other East European economies. Another subset is the frontier markets, which refers to economies that are, even in emerging market standards, relative small and less accessible but still investable countries in the developing world. These markets are often pursued by investors seeking high returns and especially good diversification benefits as they are found to be only weakly integrated to the global market (Berger, Pukthuanthong and Yang, 2011). Several African, Middle Eastern and East European countries are typically classified as frontier markets. In this dissertation, the frontier markets are not treated separately from other emerging markets.

The strict categorization of the countries between developed and emerging varies slightly depending on the source. For example FTSE classified in 2011 25 markets as Developed, 10 as Advanced Emerging, 12 as Secondary Emerging and 26 markets as Frontier markets based on their market and regulatory environment while the MSCI classified markets to 24 Developed, 21 Emerging and 26 Frontier Markets countries. However, these lists live according to markets' performance and regulations. In general, for each region the following are often counted as emerging market economies: South America: Argentina, Brazil, Chile, Colombia, Mexico, Peru; Europe: Bulgaria, Czech Republic, Estonia, Hungary, Poland, Romania, Russia; Asia: China, India, Indonesia, Malaysia, Pakistan, Philippines, South Korea, Sri Lanka, Taiwan,

Thailand, Turkey, Vietnam; and Africa and Middle East: Bahrain, Côte d'Ivoire, Egypt, Kenya, Morocco, Nigeria, Oman, Qatar, South Africa, Tunisia and UAE.

1.2 Characteristics and special features of the emerging financial markets

The reason why emerging markets have gained popularity among both, academics and practitioners, is clarified by Table 2 which provides some descriptive statistics of the emerging markets and compares them with some of the most developed markets (G7 + Hong Kong). While Bekaert and Harvey (2003) provide several implications of the stock market liberalization to the financial markets behavior, capital flows and political risk, Table 2 concentrates mostly on the period after the liberalization and presents the average of annualized 12-month continuously compounded excess returns (over the U.S. one month Treasury bill rate) between years 1988 (or for the year when the data is first available) and 2011, the volatility of the excess returns (measured with 12-month standard deviation), Sharpe ratios and their volatility as well as correlation with the MSCI World index for several gross indices, number of emerging markets and the most important developed markets from America, Europe, Asia, Middle East and Africa. In addition, the last column of the table shows the ratio between the amount the stock market has experienced a decrease of 20% from its previous month's price level (Mishkin and White (2002) use this same threshold to identify a stock market crisis in the U.S. market) and the amount of observation months (scaled with a multiply of 100) i.e. the percentage of decreases of 20% during the sample period. This figure aims roughly to capture the instability of the stock markets. The stock market indices are measured as MSCI total return indices denominated in the U.S. dollars.

TABLE 2 Descriptive statistics of emerging and developed stock markets

Index	First year	Average returns	Volatility	Sharpe ratio	Sharpe ratio volatility	Correlation	Crises [%]
World	1988	2.88	14.28	0.45	1.20	1.000	0.35
G7	1988	2.50	14.17	0.41	1.17	0.997	0.35
EM	1988	8.03	22.36	0.60	1.54	0.740	0.69
BRIC	1995	5.44	27.76	0.50	1.63	0.740	1.96
Frontier	2003	6.15	18.44	0.77	2.07	0.625	1.85
Developed markets							
the U.S.	1988	5.40	13.62	0.72	1.43	0.890	0.00
Canada	1988	5.72	18.17	0.55	1.36	0.792	0.69
the U.K.	1988	3.67	15.75	0.46	1.26	0.860	0.35
Germany	1988	4.07	22.09	0.41	1.12	0.804	1.04

France	1988	4.44	19.91	0.45	1.10	0.824	0.35
Italy	1988	0.05	23.28	0.18	1.18	0.700	0.69
Japan	1988	-4.23	20.19	-0.14	1.24	0.713	0.35
Hong Kong	1988	7.32	24.14	0.51	1.32	0.631	0.69
Emerging markets							
America							
Argentina	1988	11.23	44.02	0.30	1.24	0.298	7.29
Brazil	1988	14.03	46.54	0.59	1.28	0.468	5.56
Chile	1988	13.26	22.97	0.67	1.42	0.462	1.04
Columbia	1993	12.83	29.91	0.59	1.30	0.379	2.19
Mexico	1988	14.92	30.18	0.71	1.20	0.565	2.08
Peru	1993	13.73	31.06	0.64	1.22	0.485	2.19
Europe							
Czech Republic	1995	9.17	28.12	0.60	1.38	0.544	1.47
Hungary	1995	7.23	37.57	0.46	1.42	0.695	3.92
Poland	1993	9.19	41.09	0.28	1.22	0.578	4.82
Russia	1995	10.14	48.52	0.52	1.25	0.531	7.84
Turkey	1988	5.80	51.69	0.17	1.43	0.384	7.29
Asia							
China	1993	-4.20	32.79	0.12	1.43	0.493	3.95
India	1993	5.00	29.05	0.25	1.39	0.502	1.32
Indonesia	1988	8.04	41.08	0.40	1.45	0.368	4.51
Malaysia	1988	4.81	24.16	0.52	1.45	0.456	1.74
Pakistan	1993	1.85	35.15	0.31	1.25	0.130	3.51
Philippines	1988	3.30	28.76	0.18	1.51	0.446	1.74
Sri Lanka	1993	3.49	32.03	-0.01	1.45	0.252	2.63
Taiwan	1988	1.85	33.07	0.06	1.16	0.424	3.47
Thailand	1988	4.17	33.97	0.45	1.57	0.506	4.86
Middle East and Africa							
Egypt	1995	10.05	29.04	0.37	1.79	0.426	0.98
Jordan	1988	-0.61	16.48	-0.07	1.66	0.236	0.69
Morocco	1995	7.90	17.84	0.54	1.44	0.235	0.00
South Africa	1993	8.41	26.75	0.44	1.20	0.663	1.32

Notes: Return is continuously compounded local market monthly total return in the U.S. dollars excess of the U.S. one-month Treasury bill rate presented as a mean of annualized 12-month averages. Volatility is the annualized 12-month standard deviation of excess returns. Sharpe ratio is the average ratio between annualized 12-month excess returns and annualized 12-month standard deviations. Sharpe ratio volatility is the standard deviation of the annual Sharpe ratios. Correlation is the correlation between the index and MSCI World index. Crises is the ratio between the months when the index has decreased for more than 20% during a month and the total amount of months multiplied with 100.

Although, the figures in Table 2 are only very rough descriptive statistics and a more rigorous analysis is needed for more reliable conclusions, several observations can still be done based on them.

The attractiveness of emerging markets for investments comes clear when the excess returns are studied. For all of the composite indices, emerging markets, BRICs and frontier markets, the returns are clearly higher than for G7 countries and the world index. Also, almost without an exception, annualized monthly average returns are higher in emerging markets than in developed markets. However, to reflect the higher risk, higher return -relationship, also the volatility is higher in emerging markets and thus it is justified to report the risk-return relationships also in the form of Sharpe ratios, higher number indicating better relationship between return and risk. When measured with Sharpe ratio, although with the gross indices emerging markets, BRICs and especially frontier markets produce higher risk corrected returns, individual developed markets fare well in comparison with emerging markets and the U.S. even has the highest ratio. However, the volatility of the Sharpe ratio is generally higher in emerging markets implying that the return-risk relationship varies more in less developed countries.

In addition, seventh column of Table 2 presents the unconditional market correlations with the world portfolio. Almost without exceptions, the correlations are smaller for the emerging than for the developing countries indicating that the emerging markets are less interdependent with the world stock markets than developed markets. With large positive returns and low correlation with developed markets, the emerging markets provide theoretically an ideal environment for international portfolio diversification.

However, the last column of Table 2 also reveals that, the emerging markets do not suffer only from higher volatility, but they have also experienced a larger amount of sudden stock market declines than the developed markets. While the highest percentage amount of crisis among developed countries is Germany with 1.04%, only few of the emerging markets have smaller ratio and Russia, Argentina and Turkey even experienced large market declines for more than 7% of their sample period. During 1990s the emerging markets became infamous for a several large financial crisis periods which spread from one country to another leading to the questioning of the benefits of financial liberation and increased capital flows and eventually created a new financial term, contagion. Especially Mexican crises in 1994, the Asian financial crisis in 1997 and Russian financial crisis in 1998 shocked both, the developed and emerging markets. The crises are further studied in subsection 2.1.3.

1.3 Emerging market institutions and development

What makes emerging markets especially interesting is their diversity in all, financial, economic, political, social and cultural environment. Institutional structure and its development are strongly related to all of these. In this disser-

tation, the institutions are studied at a macro level and often no difference is made between formal (e.g. justice system, political regime and financial institutions) and informal (e.g. culture, habits and customs) institutions but they are studied as a single entity. Thus the concept of institutions is understood quite widely and it comprises of everything from the existence of property rights, political structures, corruption, legal system to the stability of governance, conflicts as well as to external and internal threats. The impact of these has been recognized as an important part of the countries long term macroeconomic development (see for example Knack and Keefer (1995); Hall and Jones (1999); Acemoglu, Johnson and Robinson (2001, 2002); Acemoglu, Johnson, Robinson and Thaicharoen (2003); and Acemoglu and Johnson (2005)) but their influence can also be extended to financial environment. For example, Lothian (2006) argues that good policies, such as price stability, fewer direct interventions, property rights protection and sound institutional structures are associated with higher capital flows while bad policies, weak institutions and political risks such as wars, internal conflicts and unexpected changes in the government structure affect negatively to the preferences of foreign investors to invest in a country. Alfaro, Kalemli-Ozcan and Volosovych (2008) support this view by concluding that institutional quality is the leading causal variable explaining the differences in global capital flows.

For stock markets, previous studies have found that the political risk, which often proxies institutions, is a priced factor for emerging countries while is effect is not significant for developed markets (see e.g. Erb, Harvey and Viskanta (1996); Diamonte, Liew and Stevens (1996); Bekaert, Erb, Harvey and Viskanta (1997); Perotti and van Oijen (2001); and Bilson, Brailsford and Hooper (2002)). In addition, Bekaert, Harvey, Lundblad and Siegel (2011) argue that institutional structure is one of the factors that segments local markets from global markets. These results imply that institutional shortcomings can be considered as one of the main reasons why standard financial models fail for emerging markets who suffer from weaker institutional environment. Regardless of their importance for the market behavior, the institutional structure has often been overlooked in the financial literature. This dissertation aims to tackle this issue as one of its main themes is to examine the effects of institutions to stock market behavior, especially in emerging markets.

To provide a general picture of the emerging markets institutions and their development relative to the developed markets in a global context, a measure for international political risk is developed using the political risk component from the International Country Risk Guide (ICRG). ICRG is often used to measure the level of institutions and it divides the political risk into 12 subcomponents (maximum points in parenthesis, total 100, higher number denoting lower risk level): government stability (12); socioeconomic conditions (12); investment profile (12); internal conflict (12); external conflict (12); corruption (6); military in politics (6); religious tensions (6); law and order (6); ethnic tensions (6); democratic accountability (6); and bureaucracy quality (4). The GDP weighted cross-country sum of these components is used as a measure of

international political risk. In addition to international political risk, the risk levels for developed and emerging economies are presented separately. Figure 1 shows the international political risk dynamics for all of these for the time period from 1984 to 2011 and to further illustrate the differences between developed and emerging markets; Figure 2 shows the political risk difference between developed and emerging markets.

In general, it can be seen that, during the last three decades, the international political risk has fluctuated around its mean, decreasing for the first decade, increasing during the second and again decreasing slightly during the last 10 years of observations. However, what is notable is the trend difference between developed and emerging markets. While the political risk profile of developed countries has been decreasing, the trend is completely opposite for emerging countries. The decrease in the gap between developed and emerging economies' political risks is clearly captured in Figure 2. Institutional development has contributed to this decrease both directly and indirectly: better institutions have both, led to decreases in the general political riskiness of the emerging markets but eventually also led to the economic development of the countries which is shown as larger GDP weights of the emerging markets.

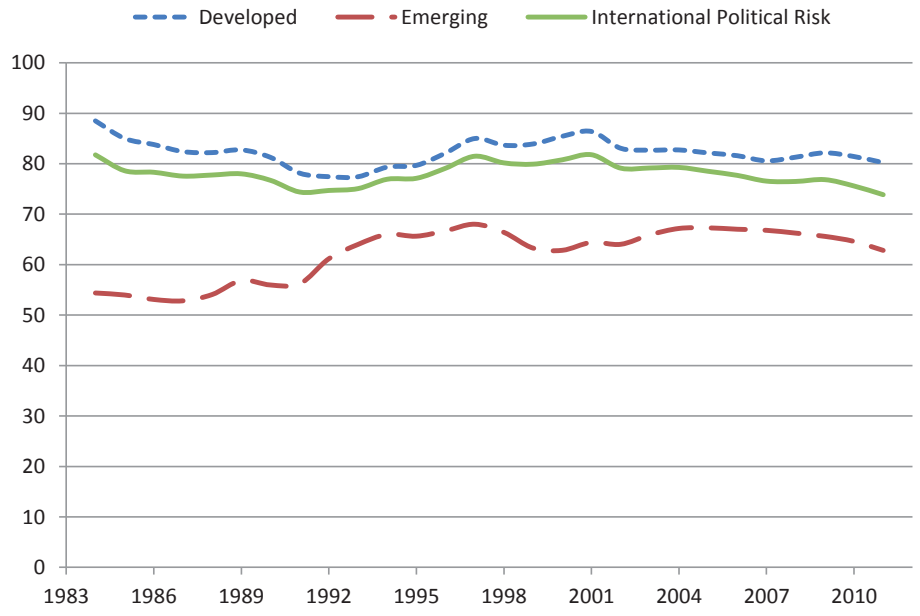

FIGURE 1 International political risk for the world as well as developed and emerging economies

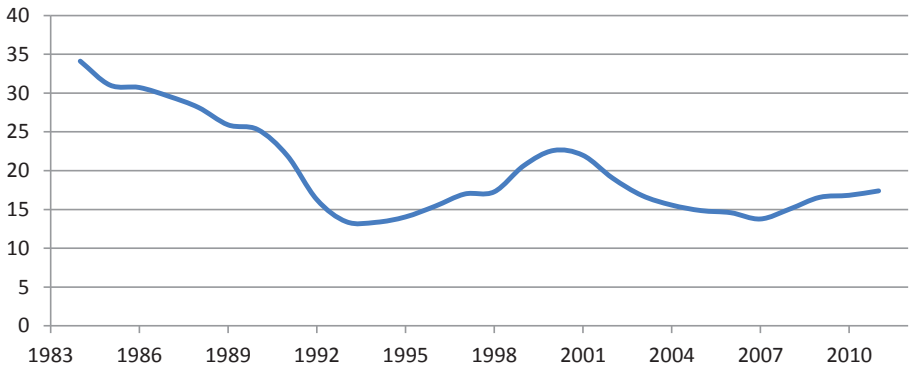

FIGURE 2 Difference between the political risks in developed and emerging economies with a scale from [0, 100]

1.4 Research gaps and motivation

As was, and will be, argued in several of the following sections, emerging economies are characterized by weaker institutions than more developed countries. This is reflected for example in investor protection, accounting standards and investment barriers (both, legal barriers (for example entry and exit regulations) as well as costs (transaction, brokerage, custodial, management and information costs)) that prevent the markets to function effectively. Their influence shows up for example as a lower than excepted capital inflows, higher liquidity costs and lower market integration.

The aim of this dissertation is to further deepen this part of the literature by examining the institutional structure (especially political institutions) as well as the general development of the emerging countries and their effects on the stock market behavior and compare the results with more developed markets. More specifically, the main questions addressed in this dissertation and the motivations behind them are the following:

Global financial crisis of years 2007-2009 caused serious doubts on the benefits of globalization as the crisis propagated quickly to all over the world. However, there has not been yet any formal research on the integration dynamics during the crisis period and how the integration affected the market returns. The first article targets one of the most important issues of emerging markets and studies the global market integration dynamics concentrating especially to financial crisis periods; the consequences of higher integration during crisis; and the determinants of global market integration for developed and emerging markets. Research questions can be formalized as:

How the integration changed during the crisis period and how it affected the returns during crisis? What factors affect the stock market integration and do they diverge between developed and emerging markets? (Chapter 2)

To illustrate the diversity of the political field of the emerging markets, the political systems of emerging economies and their effects on stock market behavior are studied. While most of the developed countries are full democracies, the democracy level among emerging markets varies between the whole autocracy-democracy spectrum from dictatorships and more centrally led systems to full democracies. This leads to wonder if the stock markets are immune to political system or does the democracy level of the country play a role in the stock market performance. As the first contribution, it is examined if country's democracy level affects stock market behavior either directly or indirectly via political risk. In addition, previous research on political risks has found paradoxical evidence on the direct effects of political risk to stock returns: on one hand, political risks are found to be priced risk sources and the investors require compensation for them. On the second hand, decreases in the political riskiness are found to affect positively to returns. In addition, it has been lately claimed that the political risks, while they still exists, can be diversified away. As the second contribution, the study aims to shed light on these issues and examines which results are currently dominating. Third, it is also studied if the democracy and political risks have effects on country's integration level and if there are differences between emerging and developed markets. These research topics can be summarized as:

Do country's democracy and political risk levels contribute to the stock market performance? (Chapters 2 and 3)

The third essay deals with one of the most fundamental international investing issues, international diversification. Portfolio theory states that diversifying portfolios internationally to weakly correlated markets lowers the systematic risk. The contribution of this research is to examine several timescales, taking into account the different investing horizons of the investors. Combining two rather new methods, wavelet multiresolution decomposition and the dynamic conditional correlation, it is possible to decompose the return series into different timescales and examine these separately allowing to study of the timescale and time-varying cross-market correlations. To examine the effects of development and regional factors, the correlations of the most important emerging markets (BRICs) are compared with the developed markets of their regions as well as with the most industrialized economies. The questions of the third study are:

Do development and regional factors affect the cross-market correlations and is this relationship time varying and/or timescale dependent? (Chapter 4)

Previous research has shown that emerging markets are more vulnerable to local market crises than developed markets which might be related to their institutional and development features. As China provides a laboratory environment with its segmented markets and having Hong Kong's more developed markets next to it, the themes of the last article are:

Are there bubbles in China's stock markets and do development factors play any role in their existence? (Chapter 5)

The summaries of these studies can be found from section 3.1 and the contributions and possible further research ideas from sections 3.2 and 3.3. Especially Chapter 3, but also Chapter 2, concentrate on the institutional setting of the markets as the political risks and governance systems are central parts of their explanatory variables set. The development differences between emerging and developed economies are emphasized more in Chapters 2, 4 and 5, as in all of these the results are compared between the emerging and developed economies.

2 EMERGING FINANCIAL MARKETS AND THEIR INSTITUTIONAL ENVIRONMENT

The literature on emerging markets has exploded during 2000s. Thus, instead of presenting standard asset pricing models (as they do not always even exist or do not suit well for the emerging markets) the following sections go through some fundamental results of the most important aspects on emerging market finance and institutional environment using previous studies and concentrating on the return behavior and investing benefits; the crises vulnerability; liberalization of the stock markets and their integration to the global markets; the determinants and consequences of capital flows as well as the emerging market specific factors. Aim of these sections is to create a big picture of the emerging financial markets instead of concentrating on country specific issues unless they are considered to be especially interesting for some topic.

2.1 Return behavior, volatility, diversification benefits and crises

The following subsections present some studies related to stock market returns and their volatility as well as evidence on one of the main reasons why the emerging markets have become interesting for foreign investors, diversification benefits. The last subsection also presents research related to emerging market crises and the concept of contagion which has become a current topic again after global financial crisis.

2.1.1 Emerging equity market returns and volatility

This section presents some basic observations related to the emerging market returns and their volatility. More results, for example their relationship with capital inflows and liberalization, are partly intersecting with other topics and hence presented in the following sections.

Table 2 reports some fundamental features of emerging equity markets. As was already reported in the Section 1.2, relative to developing markets, emerging markets have higher returns accompanied with larger volatility (i.e. higher returns which are associated with higher risks) and low correlations with developed countries. In addition, although not reported in Table 2, it has been found that instead of normally distribution, emerging stock market returns are fat-tailed i.e. the large price changes can be expected relatively often. These are all well-known characteristics of emerging stock markets and reported for example in Harvey (1995); Bekaert and Harvey (1997); and De Santis and Imrohorogly (1997). While the higher expected returns and low correlation with developed markets are attracting features for investors, high volatility and the number of stock market crises restrains some of the investment desires. As was noted, when the Sharpe ratios are inspected, the developed countries can be considered almost equal alternatives.

Bekaert (1995) and Harvey (1995) argue that, unlike for the developed markets, standard global asset pricing model, which assumes complete market integration, has only weak explanatory power when applied to emerging markets. This result indicates that emerging markets are only partly integrated to global markets and the pure world CAPM should not be used as a benchmark model for them. Moreover, the efficiency of the emerging markets has been questioned. Harvey (1995) shows that emerging market returns are more predictable than developed market returns and this predictability can be traced to the local information variables which predict more than half of the predictable variance. On the other hand, as the volatility of the emerging markets is relatively high and persistent, De Santis and Imrohorogly (1997) argue that the predicting the excess returns is difficult. Their view is further supported by Kim and Singal (2000) who state that the markets tend to become more efficient after the liberalization. More evidence of this is provided in Bae, Ozoguz, Tan and Wirjanto (2012) who argue that the accessibility of foreign investors to emerging equity markets (investibility) has significant impact on the stock pricing of emerging markets via better ability to process global information. Their results show that the greater investibility reduces the price delay to global information and that the returns of more investible lead those of less investible implying that the financial liberalization and higher investibility yield more efficient stock markets.

Several studies have also examined the cost of capital around the liberalization period. In theory, the demand for local stocks and their prices should increase when the markets are opened (or when the markets expect that the stock market liberalization is about to occur) implying higher excess returns. However, as the cost of capital decreases, the returns should also decrease after some time. Kim and Singal (2000) study the period around capital market openings and argue that the stock returns increase for about 12 months immediately after the liberalization but fall subsequently and reach the pre-liberalization level about 24 months after the liberalization. This decrease in the cost of capital

after liberalization is consistent with the findings of Henry (2000b) and Bekaert and Harvey (2000).

It used to be argued that the arrival of new international investors to the local markets creates excess volatility and thus destabilizes financial systems. Financial theory itself does not provide clear answer to this. On one hand, market may become informationally more efficient leading to higher volatility as prices quickly react to relevant information. On the other hand, in the pre-liberalized market, the large swings from fundamental values might have led to higher volatility and the market liberalization could flatten these swings and lower volatility. Bekaert and Harvey (1997); De Santis and Imrohorogly (1997); Bekaert and Harvey (2000); and Kim and Singal (2000) find that the stock market liberalization and foreign capital flows do not significantly increase volatility and sometimes the volatility even decreases. Hence the claims that foreign investors destabilize financial markets are not supported by the data.

2.1.2 Diversification benefits

According to basic portfolio management theory, low correlation between assets in a portfolio leads to the overall risk reduction. As Li et al. (2003) point out; the general belief is that instead of targeting higher returns, the investors aim to reduce the variance of their portfolio when investing to abroad. Table 2 shows that although emerging market equity returns are highly volatile, their unconditional correlation with the U.S. markets is smaller than the correlation of developed markets. Thus they could provide a fruitful ground for portfolio diversification. Even though Bekaert and Harvey (2000) find that the correlations increase after liberalization, the magnitude of the increase is rather small. Early studies provided evidence of significant diversification benefits for emerging equity market investments (see Divecha et al. (1992); Harvey (1995); Bailey and Stulz (1990); Bailey and Lim (1992); Change et al. (1995); and Susmel (2001)). Bekaert and Urisas (1996, 1999) argue that many of these early studies use IFC indices which ignore high transaction costs, low liquidity and investment constraints associated with emerging market investments which could reduce the benefits. In addition, individual investors might have difficulties in replicating the country index behavior. They address these issues by studying closed- and open-end funds and ADR portfolios and find that in general, although the diversification benefits of funds are smaller when compared with market indices (and do not even necessarily exist for the U.S. funds), investing to emerging markets is still beneficial. Especially open-end funds are found to be able to mimic index behavior and thus good for diversification purposes. De Roon et al (2001) and Li et al. (2003) further extend the literature by using IFC indices but aim to take the market frictions into account with partly mixed results. De Roon et al. (2001) find that without the frictions the diversification benefits are significant but they disappear when the short sale constraints are introduced. Li et al. (2003) stress the short sale constraints and incorporate the uncertainty of finite samples, which might be problematic in the De Roon et al. (2001) study, by using Bayesian approach. They find that although the integration of global mar-

kets has reduced the diversification benefits, they still exist even after short-sale restrictions.

A large part of the diversification research during the last decade has been aimed to study whether the cross-market correlations have increased and should the diversification be done according to industries instead of countries (Heston and Rouwenhorst, 1994). Bekaert, Hodrick and Zhang (2009) provide a comprehensive study on the development of the market correlations during the last few decades and find that the cross-market correlations have not increased significantly during their observation period. Together with Baele and Inghelbrecht (2009), their results also show that there still exists significant benefits from international diversification and that the country factors dominate industry factors. However, these studies concentrate only on developed economies leaving emerging markets for a less notion. Although, the previous literature has found that emerging markets provide diversification benefits, these might be decreasing in the future as the globalization proceeds. Bekaert and Harvey (1997) and Bekaert and Harvey (2000) show that the emerging market return correlations increase after market liberalization and although Pukthuanthong and Roll (2009) argue that return correlation and market integration are not well related, Bekaert and Harvey (1997) and Morana and Beltratti (2008) present models in which the correlation of the market returns is positively related to the market integration. The integration and diversification is further studied in the studies by Baele and Inghelbrecht (2009) (for developed markets) and Berger, Pukthuanthong and Yang (2011) (for frontier markets), which both find a relationship between the integration and diversification benefits: increased integration lowers benefits while the low integration level of frontier markets can be related to high diversification benefits. However, Bartram and Bodnar (2009) and Yeyati and Williams (2012) provide troubling evidence of the co-movement of the emerging markets during the global crisis. The emerging market indices dropped in tandem with the developed market indices having negative returns, high correlation and high betas during the global crisis period and failing the investors just when they needed the diversification most. Whether this increase in the correlation was permanent or temporary can only be seen in the future.

2.1.3 Crises and Contagion

One of the most concerning sides of the emerging market investments is that the markets have been found to be more vulnerable to financial crises than their more developed counterparts. As Table 2 shows, the emerging markets have experienced more local crisis periods than the developed markets which reflects the nature of their still ongoing development process and the instability of their financial markets. However, three of the emerging market crises from the mid- and end-1990s have gained more attention in academic world. During the 1990s several emerging market currencies experienced speculative attacks that eventually lead to a crisis and devaluation of the currency. The most famous crises are the Mexican peso crisis in 1994, the Asian financial crisis in 1997 and the

Russian financial crisis in 1998, of which especially the first two have been academically interesting. Although, the above mentioned crises are often considered as currency crises, stock markets also experienced extreme movements during these periods. The research on emerging market crisis has not only examined the occurrence and the predictability of the crises, but also a great deal of attention has focused examining the spreading of the crises from one country to another, a phenomenon named contagion. In general, for equity markets, the contagion refers to a situation in which equity markets in different countries move more closely together than could be expected. This happens especially during the more turmoil periods. The literature on contagion is too vast to for an adequate inspection and thus only few chosen articles are presented here.

There is no consensus on a single clear definition for contagion. However, it has become clear that interpreting any increase in cross-country correlations as evidence of contagion can be misleading. Forbes and Rigobon (2002) define the contagion as a significant increase in market co-movement after a shock to one country or a group of countries. Previous studies on contagion using this definition have founded significant results for contagion but have not taken into account that higher correlations can be expected during a periods of high volatility. Forbes and Rigobon (2002) suggest a correction for this bias and test for the contagion for the Asian and Mexican crises as well as for the 1987 U.S. stock market crash finding no significant increases in cross-market correlation i.e. contagion. Instead, they report high levels of market co-movement during both, stable and crises periods, calling this interdependency. Studying the state-varying volatilities in Latin America during crisis periods, Edwards and Susmel (2001) end up to same conclusions. Corsetti, Pericoli, and Sbracia (2005) argue, however, that the tests in Forbes and Rigobon (2002) are biased as they proxy the volatility affecting all the markets with the variance of the stock returns of the country where the crisis originates and thus do not separate between country specific and common factors. Corsetti et al. (2005) derive a measure for interdependence that does not suffer from the same pitfall and examine the spreading of Asian crisis from Hong Kong as a case study. They find more evidence of contagion than some previous studies and especially provide evidence that contagion does not limit to just emerging markets but can infect industrialized economies as well. Bekaert, Harvey and Ng (2005) define the contagion as excess correlation i.e. correlation over and above what can be expected from the economic fundamentals. They avoid the criticism of Forbes and Rigobon (2002) by estimating a two-factor model with the U.S. equity market return and regional portfolio as factors and study the contagion around the Mexican and Asian crisis. Bekaert et al. (2005) do not find contagion during the Mexican crisis but their model presents evidence of increased correlations in Asia during the Asian crisis.

In general, the evidence on the existence of contagion is mixed. However, the general conclusion is that while contagion does not exist during the Mexican crisis, the Asian financial crisis was characterized by the excess co-

movements of the stock indices especially in Asian and also in some of the developed countries.

2.2 Liberalization, integration and capital flows

This section concentrates more on the effects of market liberalization, integration to global markets and increased capital flows that followed the liberalization of markets as well as their effects for both, economic growth and stock markets.

2.2.1 Liberalization and integration of the markets

The key concept in emerging financial market literature is the market liberalization which refers to the gradual removal of various international trade and investment barriers allowing both, foreign investors to invest in domestic markets and domestic investors to invest in foreign markets. In the end of 1980s and at the beginning of 1990s, several emerging markets began to lift investing barriers, creating a natural experiment for researches to study the effects of the market liberalization. As a consequence, during the 1990s, a large part of the emerging market literature concentrated on the market liberalization and how it affected the stock market and the general macroeconomic development.

Bekaert and Harvey (2000) and Henry (2000b) date the liberalization periods and find that, consistently with the theory, average returns decrease after the liberalization. Moreover, Bekaert and Harvey (2000) provide evidence that the emerging market correlations and betas with the world market increase and the political risk decreases after the liberalization. The latter result is important for international investors as several early studies have found political risk to be priced factor in emerging market returns (Erb et al. (1996); Diamonte et al. (1996); and Bekaert et al. (1997)).

The closely related concept to market liberalization is market integration. Markets are said to be integrated when the assets with a similar risk structure command the similar expected returns regardless of their domicile, while the markets where the expected return of an asset depends only on its location are said to be segmented. Bekaert (1995) recognizes three obstacles for market integration: legal barriers, which arise from the different legal status of the foreign and domestic investors for example in taxing and the government policies to restrict capital movements; barriers arising from the differences in available information, accounting standards and investor protection; and the emerging market specific risks that discourage foreign investment and thus lead to segmentation. These include for example political risks, economic policy risks and liquidity risk. Theoretically, removal of these barriers should lead to market integration with the global markets. It can be expected that the amount of diversification benefits seeking international investors in the local markets increases after the liberalization and the foreign investors drive up the prices of

the local stocks with diversification potential, reducing the cost of capital and diminishing the excess returns. Thus the development towards more liberalized markets should lead to a lower cost of capital, more diverse investment opportunities and increased investment rates, and eventually to higher economic growth (Bekaert and Harvey (2003); Carrieri, Errunza and Hogan (2007)). However, there has been some debate on these effects as Kose, Prasad and Taylor (2011) argue. They state that an economy needs to pass certain threshold levels of financial and institutional development before it can benefit from the financial liberalization and globalization and reduce its risks. On the other hand, Kose, Prasad, Rogoff and Wei (2009) also point out that the financial globalization can promote the local financial market development, improve corporate and public governance, generate efficiency gains among domestic firms who are forced to face international competition, and impose discipline on macroeconomic policies. These indirect channels might be even more significant sources of growth and stability than the above mentioned, traditional direct financial channels.

The financial markets theory suggest that in the fully integrated markets, while the investors bear both the global and local risks in their portfolios, only global risks are priced as the local risks are fully diversified internationally. In fully segmented markets the asset prices vary from one country to another and the prices (and thus the returns) reflect only the domestic risk factors. Early models of international asset pricing assumed either completely integrated or segmented markets, but since Bekaert and Harvey (1995), it has been acknowledged that the integration process is time-varying and most of the countries are only partially integrated (or segmented). In these cases the prices reflect both, local and global risks and the expected returns should be a combination of both of these risk sources. Thus the measure of stock market integration should be able to capture the time-varying and gradual nature of the integration process. It should also be stressed that market integration does not necessarily mean higher cross-correlation between markets as argued already in Harvey (1995). Pukthuanthong and Roll (2009) provide more evidence of this, as the authors show that the simple correlation across markets is a poor measure of integration and that even the perfectly integrated markets can exhibit zero correlation. Several studies have suggested alternative measures and reported that the emerging markets (and even some of the developed markets) are still in a state of partial integration (see for example Bekaert and Harvey (1995); Hardouvelis, Malliaropulos and Priestley (2006), Carrieri et al. (2007); Chambet and Gibson (2008); Bruner et al. (2008); Pukthuanthong and Roll (2009); Bekaert et al. (2011); and Arouri, Nguyen and Pukthuanthong (2012)). Although these studies find that local risks are still important determinants of the emerging markets returns, their importance has decreased during the recent years, indicating that the emerging markets are becoming more integrated. All of these studies however confirm the results, that although with the liberalization, foreigners have relatively free access to capital markets; this does not guarantee full market integration.

In addition to the early work of Bekaert (1995), the research on the determinants of integration has found several explanatory variables that contribute to the market integration. Although researchers have not reached an agreement on how the integration should be measured and thus the field of integration measures is quite colorful, some of the factors affecting the integration remain significant regardless of the measure. So far it has become clear that the globalization contributes to the financial integration. Carrieri et al. (2007) and Bekaert et al. (2011) find that the openness of the financial markets; and Chambet and Gibson (2008) and Bekaert et al. (2011) argue that the openness of the foreign trade are statistically important determinants of the integration. In addition, the development of the capital markets (measured with market capitalization to GDP) (Carrieri et al. (2007) and Bekaert et al. (2011)), political risks (Bekaert et al. (2011) and Frijns et al. (2012)) and the U.S. corporate credit spread (Bekaert et al. (2011)) also affect the integration level.

2.2.2 Capital flows

As an economy liberalizes its market, it could be expected that the capital inflows from other countries would increase significantly as international investors rush to the local market seeking for new investment possibilities and diversification benefits. Not surprisingly, Bekaert, Harvey and Lumsdaine (2002) find that the capital inflows increase after the capital controls are removed but this effect dissolves in 3 years. It is important to understand the dynamics, causes and implications of the capital flows to emerging markets and although, the capital flows are widely studied issue for both, developed and emerging markets, this subsection concentrates only to research on emerging market capital flows which can be roughly divided into two components: (i) effects of capital flows to returns, growth and financial stability and (ii) determinants of the capital flows to emerging markets and especially, why the capital flows are not larger and are actually directed away from emerging markets.

Since the opening of the emerging markets in the late 1980s and early 1990s, there has been debate on the role of the increased capital flows. On one hand, the growing empirical literature on the benefits of capital inflows provides support for the theory that the market liberalization lowers the cost of capital (Henry (2000b); and Bekaert and Harvey (2000)), increases real investments (Henry (2000a); Mitton (2006); and Chari and Henry (2008)) and eventually leads to increases in the productivity and economic growth (Bekaert, Harvey and Lundblad (2001, 2005, 2009)). However, the financial crises periods around the mid-1990s in Latin America and Asia raised questions whether benefits of liberalization surpass the negative effects as it was argued that foreign investors produced excess volatility to the markets and thus weakened the stability of the financial system. It has for example been found that when the capital leaves, it leaves faster than it came (Bekaert et al., 2002) and that the importance of the global factors, which are beyond the control of emerging economy policymakers, for the capital flow volatility has been increasing (Broto, Díaz-Cassou and Erce, 2011). Agosin and Huaita (2012) also argue that the best

predictor for a sudden stop of the capital flows to emerging markets is a preceding surge in them. Due to these reasons, some of the countries have introduced capital controls on their markets and eventually the capital inflows have slowed down and even reversed from emerging to more industrialized countries.

Another branch of this component of the capital flows examines the investors' point of view and especially the effects of increased capital flows to returns and investor behavior. In theory, as the foreign investors move to the market looking for diversification benefits and increasing liquidity, the expected returns should decrease and prices should rise implying a lower cost of capital. Empirically the relationship between capital flows and equity prices has been examined in several studies and the general consensus is that there is a positive relationship between unexpected capital flows and equity prices (see Froot et al. (2001); Clark and Berko (1997); and Bekaert et al. (2002)). However, while Froot et al. (2001) state that the increasing effect of higher capital inflows on prices is only temporary and Clark and Berko (1997) provide evidence for a more permanent effect, Bekaert et al. (2002) argue that although most of the positive effects of capital flows on returns diminish over time, there also appears to be a permanent impact which may reflect a long-lasting decrease in the cost of capital associated with the diversification benefits of the emerging markets. Related to the price rises, it has also been studied whether the investors are so called return chasers i.e. invest to emerging markets when the expected returns are high or do the investors invests based on momentum i.e. capital inflows increase after high past returns. The results on these questions are mixed as Froot, O'Connell and Seasholes (2001); and Bekaert et al. (2002) find some evidence that the investors are momentum investors as the portfolio inflows increase after the positive past returns while Clark and Berko (1997) fail to support this.

The second component concentrates on the determinants of the capital flows and especially their size and direction. Lucas (1990) argues, using India as an example, that compared to the U.S., poor countries have significantly higher marginal products and higher rates of return to investment. He ends up wondering why the capital does not flow from rich to poor countries even though the expected returns are much higher in the latter. Lothian (2006) uses this question as his starting point and examines the determinants of capital flows between rich and poor countries. His analysis concentrates especially to the institutional factors affecting investments and he argues that good policies, such as price stability, fewer direct interventions, property rights protection and sound institutional structures, are associated with higher capital flows while bad policies weaken the stream of capital. This conclusion gets empirical support in the study by Alfaro, Kalemli-Ozcan and Volosovych (2008) who examine theoretical explanations of the Lucas paradox in an empirical framework. In their analysis of both, direct and portfolio equity investment between 1970 and 2000, it is found that institutional quality is the leading causal variable explaining the differences in capital flows. Thus good institutional environment can be indirectly linked to a country's long-run development.

2.3 Emerging markets specific risks

Factors affecting stock markets can be roughly divided into three categories based on their propagation wideness: global, regional and local. While the equity returns in completely (or highly) integrated markets are mostly determined by global factors, partially integrated emerging markets are also affected by local risks. As the higher exposure to local risk factors is more typical to emerging than developed markets, this creates a source for emerging market specific risks.

Compared to developed markets, emerging markets are considered relatively riskier as they carry additional economic, financial and political risks which cannot be diversified away. Typically the higher economic risks in emerging markets are related to the macroeconomic conditions and industrial structure of the country. As emerging markets are growing rapidly, the inflation, which is found to be a prices factor in equity markets (Vassalou (2000) and Moerman and van Dijk (2010)), is also often high as Table 1 showed. Moreover, the stability of the emerging market currencies has caused worries to investors. Although, exchange risk is not limited just to emerging economics (see for example Jorion (1991); Dumas and Solnik (1995); De Santis and Gerard (1998); Phylaktis and Ravazzolo (2004); and Carrieri, Errunza and Majerbi (2006)), the crises periods of 1990s showed that the emerging market currencies are vulnerable to speculations, can depreciate rapidly and the turbulence may spread from one country to another affecting the whole region's economy. Several of the markets might also suffer from thin trading, higher liquidity risk and high transaction costs which lead the assets to trade at low prices relative to their expected cash flows. The trading volume might be low and zero day returns decrease the efficiency of the markets. Lesmond (2005) provides a detailed analysis of emerging equity market trading costs and their measures and argues that countries with weak political and legal institutions suffer from significantly higher liquidity costs than countries with stronger institutions. Using the proportion of zero daily returns in a month Bekaert, Harvey and Lundblad (2007) study the effects of liquidity in emerging markets and find that unexpected liquidity shocks are positively correlated with returns and negatively correlated with dividend yields in emerging markets.

Although emerging economies are growing rapidly, they might also be suffering from heavy debt burden. Countries in emerging state are found to default their debts more often than developed economies (Reinhart and Rogoff, 2009) and thus their sovereign risks are also higher. Emerging markets have also often gone through changes in their corporate structure and corporate governance. One of the most visible reforms, especially in the socialistic countries, is the privatization of the state-owned enterprises. Perotti and van Oijen (2001) study how the privatization sales may produce significant indirect benefits for the local stock market development and find that many countries have gradually reduced their political risks during their privatization period. These reductions are related to the growth in market capitalization, traded value and excess

returns and it is argued that the privatization reduces public debt and provides a better access for capital for the company. In theory, privatization should also enhance corporate governance and promote efficiency of the company leading to an increased integration to global markets. However, other problematic issues in corporate finance such as large grey area sector, disrespect of intellectual capital, corporate social responsibility and high levels of corruption still possess challenges to emerging economies and can reduce the benefits of privatization. Additional problems might cause the issue that the industry structure in emerging markets may be concentrated on only to few key industries and the country's export sector is heavily skewed on their goods which might have high price sensitivity.

Above mentioned risks are mostly related to financial and economic developments of the countries. The third risk category often mentioned with these is political risk which typically constitutes of all the other factors that do not fit into previous categories. Although political risk itself does not have one single definition, in general it can be understood as unanticipated transforms in the national and international business environment as a result of political changes. These changes include for example changes in the government via elections or coups, new governmental policies, changes in taxing laws, foreign and domestic conflicts, socioeconomic conditions such as unemployment and poverty as well as the governance system (autocracy vs. democracy). Using the International Country Risk Guide's (ICRG) political risk composite index, several previous studies have found that the political risk is statistically significant determinant of equity returns especially in emerging stock markets (see e.g. Erb et al. (1996); Diamonte et al. (1996); Bekaert et al. (1997); Perotti and van Oijen (2001); and Bilson et al. (2002)) while no effects have been found for developed markets.

One of the still overlooked aspects in the emerging markets finance research is the rich social, political and cultural environment the countries possess. As was already mentioned, the political systems vary between the emerging markets and for example, the effects of democracy have not been studied before for the emerging markets. Moreover, research on cultural, religious and sociological features and their relationship to finance has been quite thin so far although one example is given by Stulz and Williamson (2003). The authors examine whether the differences in culture, proxied by religion and language, can explain the differences in investor protection in different countries and find that country's principal religion predicts the variation in creditor rights better than a country's natural openness to international trade, its language, income per capita or the origin of the legal system. Moreover, a religious viewpoint is offered by Bialkowski, Etebari and Wisniewski (2012) who concentrate on studying market behavior during Ramadan. They find that during Ramadan, the stock returns of the 14 predominantly Muslim countries are significantly higher and less volatile than during the rest of the year and link this to the optimistic beliefs and especially to the investors' mood caused by solidarity and common social identity among Muslims promoted by Ramadan. These two offer examples of religious and cultural aspects related to emerging markets finance, but

their aim is also to demonstrate that this wide-open field still provides interesting topics for a variety of financial research.

2.4 Pitfalls of emerging financial market research

As the results of the previous studies already stated, the emerging markets differ significantly from developed markets and in several cases the models that suit for developed markets, should not be used for emerging markets as the latter cannot necessarily meet the assumptions the standard models require. Often these shortcomings in assumptions are related to emerging markets' weaker institutional structure as well as to less developed economic and financial environment. Based on the previous studies at least the assumptions of well diversified country portfolios (for some countries the number of shares is quite low and the markets might be dominated by only few companies); efficient markets (although the opening of the markets and the foreign investors have helped to incorporate global information faster to local prices and thus increased the market efficiency, there is some evidence of return predictability and locals might have information advantage); normal return distribution (although this assumption does not always even apply to developed markets, especially emerging market returns have been found to be non-normal), CAPM (international CAPM suits rather well for developed markets, it fails for emerging markets) and especially full market integration, which is a starting point for several of the global asset pricing models, are not necessarily met for the whole sample period, if for any of it. These limitations should be kept in mind when studying issues related to emerging financial markets.

3 ESSAYS, CONTRIBUTIONS AND FUTURE RESEARCH

There lies still a large amount of research gaps in the both, general emerging market and country specific, research. This dissertation moves in the interface of these two research lines, as some of its studies are country specific while others study the general effects of certain characteristics. The essays are independent of each other but still all the research questions are related to the emerging financial markets, investing to them and especially to their development status and institutions.

Figure 3 aims to illustrate the mutual relationship between the essays, their datasets and specifying areas. The shape of a cone is well suited for this purpose as used country sets, the topics of the essays, their influence to investment decisions as well as their relations to the fields of economic development and political institutions vary from one essay to another.

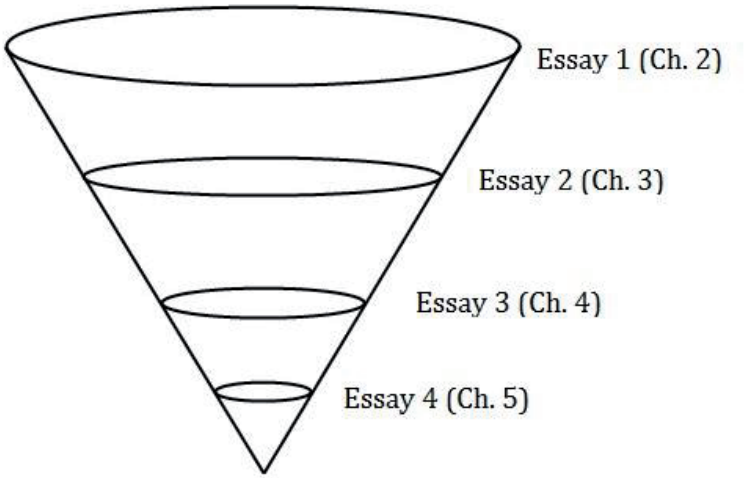

FIGURE 3 Relationship between the essays

Essay 1 has the largest dataset, consisting of both developed and emerging markets, and the topic of it relates well for both, the institutions and development while essay 2 concentrates on emerging markets and is more related to political institutions than to economic development. Essay 3 shrinks the country set even further, studying the differences between the BRIC countries and a set of developed economies while essay 4 concentrates only to Chinese stock markets and how they behave in comparison to more developed markets of Hong Kong. At the same time also the topics of the essays get more and more specific. In essay 4, the topic, stock market bubbles, although important, is only one small part of the financial literature and for example taken partly into account in the correlation literature which examines co-movement changes between markets (theme of essay 2), an important part of the portfolio management and risk assessment. The theme of essay 3, political environment's effect on stock market behavior, covers partly both of the previous studies while essay 4's topic, global market integration and its determinants, is related to all of the previous studies but does not drill very deeply into any of them. While essays 1 and 2 include several measures for both, institutional and development factors, in their datasets, essays 3 and 4 concentrate more on development as the comparison is simply done by comparing the emerging markets to industrialized economies, leaving the institutional factors to background.

This final section of the Chapter 1 summarizes the essays (section 3.1) and the main contributions of the thesis (section 3.2). In addition, possible future research topics are discussed (section 3.3).

3.1 Summaries of the essays

3.1.1 Stock Market Integration and the Global Financial Crisis

First research paper tackles one of the most important and most widely studied emerging market issue, global market integration. The study aims to examine the relationship between integration and crisis periods by studying the integration dynamics during global financial crisis periods and the effects of integration on crisis spreading with a new measure developed by Pukthuanthong and Roll (2009). In addition, the study aims to examine the long-term determinants behind the integration introducing new explanatory variables and examining the robustness of the previously used determinants. Also, instead of only studying all markets as a single entity, the emerging markets are studied separately from developed markets as it can be expected that the different factors contribute to their integration level due to their special characteristics.

The study is done using an unbalanced panel data with monthly and yearly frequency on 23 developed and 60 emerging markets between 1987 and 2011. Explanatory variables set comprises of a large amount of local and global explanatory variables including openness measures; stock market development

measures; political risk and institutional development measures; variables capturing local and global business cycles and investor sentiments; and information and growth measures.

The results indicate that integration decreased during the 2007-2009 financial crisis period for developed countries but increased slightly for emerging markets. It is also found that the greater market integration worked as a catalyst and propagated the crisis across the global markets at the beginning of the crisis. However, there is no evidence that integration's role would have continued throughout the crisis which implies that integration affected to the wideness of the crisis but not to its depth.

Supporting the previous studies, the estimations show that the integration has increased over the past three decades and, in general, financial liberalization, the institutional environment and variables related to global financial uncertainty affect to its level. Results also emphasize the development of information variables but surprisingly and contrary to the previous studies, only a small role is found for a country's financial development. Moreover, the results vary between developed and emerging market subsamples, as the former are more affected by factors related to the investment environment and market turnover, while for the latter, equity market openness, technological and economic development and improvements in political risk profile are the most important determinants.

These results show that economic, political and technological progress attracts foreign investors to emerging markets, while better investment protection and market liquidity are amongst the most important reasons to invest in developed markets.

3.1.2 Democracy, Political Risk and Stock Market Performance

Instead of examining the differences between emerging and developed markets, the second essay concentrates on political institutions and especially the governance of the emerging markets aiming to study whether country's democracy level affects to its stock market behavior. The underlying idea behind the essay is to investigate whether the stock market is affected by the direct or indirect effects of the democracy level and political risk. It is argued that instead of the simple linear relationship, the effect of democracy to political risk is parabolic implying that after the democracy passes some threshold level, the political risk begins to decrease and this is reflected in the stock prices. Although, some studies have examined the relationship between democracy and some political risks (see e.g. Gleditsch and Hegre (1997); Hegre et al. (2001); Reynal-Querol (2002a,b); and Rock (2009)), the democracy level and its effect on stock market behavior has not been studied at macrolevel previously. The study aims also to provide clarity to the sign –paradox of the relationship between political risks and stock returns. Previous studies have found varying signs for the effects of political risk to returns. On one hand, the political risk should be a priced risk (higher riskiness correlating with higher returns), but on the other hand, it has

been found that the decreases in riskiness also contribute positively to the returns.

Research uses a panel data on 38 emerging markets for the period 2000-2010, and examines whether the global market adjusted market returns can be partly explained with the country's democracy and political risk levels and the interaction terms of these. In addition, it is tested whether the democracy level can affect the stock markets crises.

There are two reasons why to concentrate only on emerging markets. First, the previous studies (see e.g. Erb et al. (1996); Diamonte et al. (1996); Perotti and van Oijen (2001); and Bilson et al. (2002)) have found that the political risk is more important in emerging stock markets than in developed markets. Second, while the developed markets are all full democracies, the governance regimes in emerging markets cover the whole democracy-autocracy spectrum. Democracy level is studied with two different methods and the political risk is measured using the ICRG's political risk component. In addition to these, a set of global and country specific variables are controlled while the estimations are performed with three panel data methods: pooled OLS with clustered standard errors, the difference GMM by Arellano and Bond (1991) and the system GMM by Blundell and Bond (1998).

No consistent evidence is found that the democracy itself would affect directly the emerging markets returns and a bit surprisingly, in many of the estimations, the political risk on its own is not statistically significant determinant of the excess returns. However, when the interaction terms are included, both of these factors become positive and significant indicating that the more democratic and less riskier countries have higher returns. Moreover, the interaction terms between democracy and political risk and the squared democracy and political risk are found to be significant. These results also survive a set of robustness checks rather well. Similar results are reported for several of the political risk subcomponents and as a byproduct, it is found that the exchange rate fluctuations, development of the local banking and financial sector as well as the global inflation have statistically significant and robust effect on the local returns. No evidence that the democracy level would affect to the stock market crises is found.

Results provide evidence that the effects of political riskiness to long term stock returns are political system dependent. As the country's democracy level reaches some threshold level, the effects of decreasing riskiness contribute positively to the returns while the effect is negative below the threshold level. The long term direct effects of political riskiness are partly mixed but mostly positive and thus the decreases in the political riskiness can be seen to affect positively to stock markets. These results should be interesting to both, academics as well as to practitioners, as they present rather robust results that the stock markets are not immune to country's governance system and the countries with higher democracy levels are also associated with smaller political risks and higher returns.

3.1.3 Timescale-Dependent Stock Market Integration: BRICs vs. Developed Markets

In essay 3, one of the most fundamental issues in international finance, international portfolio diversification, is studied. The aim is to examine how development and regional factors affect to cross-market correlations when several timescales of returns are studied.

To demonstrate how the correlations between different return periods differ, the stock market returns of the BRIC countries (Brazil, Russia, India and China), several developed markets from their regions (Canada, Hong Kong and Australia) and the major industrialized markets (the U.K., Germany and Japan) as well as the U.S. are decomposed to several timescales with discrete wavelet transform and the time-varying correlations with respect to the U.S. market of these timescales are compared with dynamic conditional correlation (DCC) method by Engle (2002). Wavelets provide a flexible mean to de-noise and decompose data to different frequencies and they have been applied in several scientific fields during the latest decades. They were introduced to economics by Ramsey and Lampart (1998a, b) and although the start has been rather slow, recently they have gained popularity at the end of 2000s and have been applied in finance for example by Rua and Nunes (2009) and Jammazi and Aloui (2010). DCC model by Engle (2002) belongs to the family of the multivariate GARCH models and generalizes the constant conditional correlation method by Bollerslev (1990) providing an effective way to study the time variations in asset return correlations. It has gained popularity due to its several attractive features and has been applied for example by Chiang et al. (2007) and Savva (2009).

Combining the wavelet decomposition and DCC and using a daily dataset from 1994 to 2010, several aspects of the market correlations can be studied: 1) do the correlations of the emerging markets (BRICs) differ from the developed markets and can BRICs be treated as a single group in this sense; 2) do the markets from same regions behave similarly as Groenen and Franses (2000) suggest; 3) are the previous results sensitive to the different timescales as Rua and Nunes (2009) have found for developed markets using continuous wavelet transform; and 4) have the correlations increased during the sample period?

The results provide interesting insights to the return correlations. It is found that the regional factors are more important determinants in the lower timescales (higher frequencies), as American markets (Brazil and Canada) have the highest, European markets (the U.K., Germany and Russia) the second highest and the Asian markets (Japan, Hong Kong, Australia, India and China) the lowest correlations with the U.S. market. However, when the timescale increases, the development factors begin to dominate and the co-movement of the developed markets eventually becomes higher than the co-movement of the BRIC countries. In addition, for all of the markets the correlations are lower with lower timescales but increase when the timescale grows implying that the underlying processes of the returns behave more similarly for the lower data frequencies. Of the BRICs, Brazil has the highest correlation with the U.S. market while China always experiences the lowest correlation and thus provides

the best diversification benefits. Almost no evidence of the significant increases in the correlations for any of the markets for any of the timescales is found. Moreover, the correlations among BRICs diverge largely and thus it is not justifiable to treat BRICs as a single homogenous group in terms of correlation.

While the previous literature has found that markets can be clustered according to their region, this study presents evidence that this clustering is conditional on the time-scale and development level of the markets. In addition, the framework enables to examine the correlation changes with different timescales and study the trend in correlation structure, generalizing some previous results to the emerging markets too.

3.1.4 Bubbles in China

The institutional setting of China's stock markets has been often used as a laboratory experiment in previous studies as the markets are segmented to two locations (Shanghai and Shenzhen) and the stocks are divided into two classes, A- and B-shares. While both of the share classes have the same voting rights and earn the same dividends, the former of these are meant only for Mainland Chinese and the latter for foreigners. Although, it has been claimed (Tan et al., 2008) that the A-share markets are dominated by domestic individual investors who lack the knowledge and investing expertise while B-markets are dominated by sophisticated foreign institutional investors, Jacobsen and Liu (2008) argue that the A-share markets could be better categorized as developed while the B-markets behave more like emerging markets.

The aim of the essay is to examine whether the stock markets in Mainland China have experiences bubble related behavior during the first 15 years of their existence. To gain deeper understanding of the institutional environment and its effects, the dataset is augmented with the China related indices from the older and more developed Hong Kong stock market. The previous bubble studies on the China's stock markets (e.g. Ahmed, Li and Barker Rosser (2006) and Sarno and Taylor (1999)) have been quite concerted in their conclusions, bubbles have developed to the markets. Although the explosive growth in China's stock indices during 2005 and 2007 led investors to suspect the existence of a bubble, a steep decline of the markets during the financial crises in 2007 and 2008 wiped away some of these suspicious and thus the question of bubbles is still relevant.

Bubble existence is studied from several different perspectives. Data are from both of the Mainland China's stock exchanges, Shanghai and Shenzhen, of both of their asset classes, A- and B-classes, and the results are compared with the ones from the Hong Kong stock exchange's China related China Enterprises and China Affiliated Corporations indices. In addition, as there does not exist clear evidence on what data frequency should be used for the bubble testing, the study uses both, weekly and monthly data, with the data spanning from the first observations of the indices till the end of October 2008. The bubbles are tested using the duration dependency test developed by McQueen and Thorley (1994) which has gained prominence in the bubble testing during the last dec-

ade. With this dataset, in terms of bubbles, it is possible to test the differences between the emerging markets of Mainland China and the more developed Hong Kong markets, the differences between the China's segmented (larger Shanghai vs. smaller Shenzhen; A-class vs. B-class) markets and at the same time study the sensitivity of the duration dependence test to the choice of data frequency.

The results show that in terms of bubble existence the stock markets of the Mainland China behave similarly but they cannot be compared to the more developed markets of Hong Kong. According to the results, only one of the datasets from the Hong Kong located China related indices shows some indication of bubbles. However, while weekly data finds bubbles from all of the Mainland Chinese indices, the monthly data does not confirm these, rejecting the existence of bubbles for all of the markets. In addition, the study provides more evidence that the duration dependence test is sensitive to the using of weekly versus monthly data and thus if it is applied in the future, the results should be confirmed by using both of these datasets and possible even with some another method.

In general, the results call into question the conclusions of Jacobsen and Liu (2008) and suggest that neither of the China's stock markets and nor their stock classes are comparable with more developed markets of Hong Kong when the comparability is measured by the existence of bubbles. However, as both of the Mainland China's stock indices behave similarly, it can be concluded that the segmentation does not play a significant role in their bubble behavior.

3.2 Empirical contributions to different topics

This subsection briefly summarizes the contributions of the essays for different topics.

3.2.1 Contributions to market integration research

This thesis is among the first ones to study the integration dynamics during crisis periods and to show statistically significant evidence that the higher integration helped to spread the global financial crisis of 2007-2009 across the global markets although it did not have long-term effects. Thus it can be concluded that the increased integration, together with its positive effects, also makes local markets more vulnerable to global shocks.

In addition, although the existing literature on stock market integration has developed several integration methods, the research on the determinants of the integration has remained rather modest with only few studies dealing with the issue. This thesis contributes to this literature by examining the determinants of integration with a measure that has not been used on it before and examining the developed and emerging markets together as well as separately.

It is shown that the variables affecting stock market integration are sensitive to the choice of country selection as it is found that different factors affect the integration of the developed and emerging markets. The roles of market openness, political environment as well as economic, technological and social development are emphasized for emerging markets while the integration levels in developed markets are more affected by institutional and market-liquidity and efficiency -related factors.

Of these variables, market openness and institutions have already been reported to be important for integration in Bekaert (1995), Carrieri et al. (2007) and Bekaert et al. (2011), although with different measures. However, unlike what could be expected based on those previous studies, only a minor role was found for variables capturing financial developed.

3.2.2 Contributions to stock market explanatory variable research

The literature on the emerging stock markets, their development and institutions is already wide and growing constantly. Nevertheless, as most of the research has concentrated on the economic and financial performance of the economies, political institutions have been mostly overlooked and the literature on them is even surprisingly thin. One of the main contributions in this thesis is to raise question on whether the political regime (i.e. democracy, semi-democracy, autocracy) could affect the stock market behavior in the long run. Although it seems generally that the political risk is decreasing in emerging markets, there are still differences between different countries. It is argued that the relationship between countries' democracy and political risk levels is U-shaped implying that the most democratic and most autocratic countries are politically less risky than semi-democracies. This relationship is found to affect the returns as after some threshold level; more democratic countries provide positive returns when the political riskiness decreases while the opposite is true for countries below the level. In addition, this thesis contributes to political risk literature by studying whether the political risk is priced in stock markets and are the changes in it related to positive or negative returns (see e.g. Erb, et al. (1996); Diamonte, et al. (1996); Perotti and van Oijen (2001) for significant but sign varying political risk results). Although the results are partly mixed and not always statistically significant, more evidence is provided for positive side i.e. decreases in political riskiness produce higher returns.

3.2.3 Contributions to correlation research

Due to their lower return correlation with developed markets, significant amount of emerging stock market literature has concentrated around the benefits of international diversification and whether they are deteriorating (Bekaert et al., 2009). This thesis contributes to this topic by examining different timescales separately and thus studying the correlation benefits for investors with varying investment horizons. Moreover, the country selection allows to study further whether regional and development factors are important determinants

of the correlation. Consistent with Rua and Nunes (2009), it is found that the co-movement of the markets varies across both, time and timescales. The correlation is found to increase with the timescale but no increase in the correlation trend is found. In addition, as e.g. Groenen and Franses (2000) argue, geographic distance is found to be significant determinant of correlation. However, this applies only for lower timescales as the significant declines with higher timescales and the development factors become more dominant. Thus the emerging markets, especially in Asia, provide still possibilities for diversification, especially for a U.S. investor, for each investing horizon.

3.2.4 Contributions to bubble research

China's stock markets have been under an intensive research during the last decades not only due to their tremendous growth and increasing importance to global capital markets, but also because of their special features such as segmentation to A- and B-shares and to segmentation into two different locations. Previous studies (Tan et al. (2008); Jacobsen and Liu (2008)) argue that segmented markets behave differently and are related to Hong Kong's market (Qiao, Chiang and Wong (2008). This thesis extends this comparison theme by examining stock market bubbles among China's stock markets and the China related indices of Hong Kong. It is found that in terms of bubbles, Mainland China's markets behave similarly but are more vulnerable bubbles than the Hong Kong markets. As a methodological contribution, it is also found that the duration dependence test, which is used to detect bubbles, is sensitive to the choice of data frequency. This should be kept in mind when applying the method and it is recommendable to use both weekly and monthly data as well as some other methods to verify the robustness of the results.

3.3 Concluding remarks and further research

Although, the topics and datasets behind all of the previous essays vary significantly and at first look it seems that the only common denominator between them is the emerging stock markets, they also entail other common features. Namely, the objective of this dissertation is to provide evidence on the effects of political institutions and development differences to stock market behavior. While financial and economic developments have been under heavy study in the financial literature; political, social and cultural environments have received less attention. This dissertation fills some of these gaps in the emerging market research but as the old wisdom states, "The more you know, the more you realize how little you know", it naturally raises some new questions. It is obvious that emerging markets still possess significant amounts of uncharted territory and the following only aims to list some possible topics where the research can be extended in the future.

Stock market integration and its determinants (topic of Chapter 2) have lately received more attention, but the recent global crisis and its effects opened this area for further research as the crisis raised questions on the benefits of more integrated markets. The channels behind integration changes during the crisis period and the persistency of the changes are some of the questions requiring more attention.

This thesis also provides evidence on the country's democracy levels direct and indirect effect to long term stock market behavior (Chapters 2 and 3). However, the issue on the relationship between political risks, democracy and financial markets could be extended even further. How do different party orientations in governments relate to the behavior of the financial markets and does the division to right- and left-wings matter in global context. Also an interesting question is what is the role of global political risk in the development and behavior of the financial markets. Cultural aspects, such as the role of religion and social norms, offer still a large playground for financial market research and should be emphasized in the future.

Moreover, the theme of Chapter 3, democracy and its effects to stock market behavior is currently an important topic in Europe and especially in Eurozone, which is struggling in the middle of a sovereign crisis that can bring down the whole currency union. Although, the full democracies are found to have lower political risk than the semi-democracies, the democratic institutions may sometimes also cause problems in the decision making process. As the essay itself studies the macro environment of the democracy and political risk, the future research could examine micro environment concentrating on certain specific risks. In addition, the macro framework of democracy and political risks could be extended to other financial markets such as bond markets and foreign direct investments. Another interesting topic would be to study how the different countries recover from the loss of their leaders. As the decision making is diversified in the more democratic countries, it could be assumed that they are not as depended of one person as full autocracies might be.

The dataset of Chapter 4 could still be further extended to include smaller emerging and frontier markets from all of the regions. With this it would be possible to see how robust the results about regional and development factors are. In addition, the benefits of the results could be tested by building longer and shorter horizon portfolios as the diversification benefits to foreign stocks are not only related to weak correlations but also to expected returns which are also dependent on the investing horizon. In addition, more attention could be paid to the underlying factors affecting the timescale returns. For example the question, what factors cause the regional and development related co-movements, need to be studied further.

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CHAPTER 2

STOCK MARKET INTEGRATION AND THE GLOBAL FINANCIAL CRISIS [2]

Abstract
We study the dynamics of stock market integration and its consequences during the recent financial crisis for 23 developed and 60 emerging markets. We find that integration increased slightly for emerging markets but decreased for developed countries during the crisis. Moreover, we argue that the high degree of integration propagated the crisis across the global financial markets at the beginning of the crisis, but it had little effect during the crisis. We also find that integration is mostly affected by financial openness, the institutional environment and global financial uncertainty but these determinants vary slightly between emerging and developed markets.

Keywords : Market integration, Global financial crisis, Integration determinants

JEL classification: F15, F36, F65, G15, G01

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1 INTRODUCTION

Market integration is one of the most important and therefore one of the most studied aspects of emerging financial markets. The removal of capital controls and trade barriers in emerging markets, primarily at the end of 1980s and in the early 1990s, opened up previously almost untouchable markets for foreign investors and provided more investing opportunities for domestic investors. Theoretically, more open and integrated markets should lead to a lower cost of capital, increased investment opportunities, increased savings and eventually enhanced economic growth through international risk sharing (Bekaert and Harvey (2003) and Carrieri, Errunza and Hogan (2007)). In addition, Kose, Prasad, Rogoff and Wei (2009) note that financial globalization can promote the development of local financial markets, improve corporate and public governance, generate efficiency gains among domestic firms who are forced to face international competition and impose discipline on macroeconomic policies. These indirect channels might be even more significant sources of growth and stability than the previously mentioned direct financial channels. In addition, more globalized markets should lead to narrower pricing differentials between different equity markets. However, increased integration can also work as a double-edged sword. On the one hand, integration has its benefits, as mentioned above, but it also makes countries more vulnerable to global shocks. The gains from globalization were especially questioned during the global financial crisis because of the belief that the highly interconnected markets helped to propagate the crisis across the global markets. The present study focuses on this issue by examining the relationship between the recent global financial crisis and global market integration, which has received little attention in previous studies.

We employ the integration measure developed by Pukthuanthong and Roll (2009) to study a sample of 83 countries and two of its subsamples, developed and emerging markets, over the period from 1987 to 2011. To our knowledge, this sample represents the largest number of markets covered thus far in integration research.

The contributions of this study can be divided into three parts. First, we study the integration dynamics during the major financial crisis periods of the last two decades. Second, we analyze the effects of integration on the crisis, i.e., whether integration played any role in the spread of the crises, and if so, whether more integrated markets suffered more during the crises. The emphasis in these sections is placed on the recent global financial crisis, but for comparison purposes, other international crises are also examined. The third contribution is the study of the long-term determinants of integration to present new insights into the factors that explain the integration process, to provide support for previous results and to examine possible channels of integration dynamics during times of crisis.

We show that integration decreased during the global financial crisis for developed markets, but it increased slightly for emerging markets. For the other global crises (the Asian financial crisis together with the Long-Term Capital Management (hereafter LTCM) crisis and the Dot-com bubble), the effects were almost the opposite: in general, integration did not change or it slightly increased, but for the emerging markets, the increases were smaller and in some cases negative. More importantly, however, while we find that integration did not affect local returns during the crisis period, the results indicate that at the beginning of the crisis, market integration helped to propagate the global stock market collapse in August 2007, demonstrating that the global integration process has its drawbacks.

To study the determinants of integration, we collect a large dataset on possible explanatory variables. Our dataset mostly consists of previously examined factors, but we also study some new ones. To examine whether integration is immune to political institutions, we include each country's democracy level as an explanatory variable, and to account for Frijns et al.'s (2012) finding that integration is sensitive to political crises, we also add the International Country Risk Guide's (ICRG) composite political risk to analyze local political conditions. Moreover, to capture the effects of the global political environment, we construct a measure for international political risk. For the other new variables, we use local crisis dummies to study whether domestic financial crises segment the markets (Chambet and Gibson (2008) suggest that integration decreased during the financial crises of 1990); we employ the TED spread to examine the effects of changes in global credit risk; we examine changes in exchange rates to account for the effects of exchange rate fluctuations, which can be large especially in emerging markets; and we use inflation to measure macroeconomic uncertainty.

We find that, in general, integration has increased over the past three decades, and financial openness, institutional and technological developments and factors related to global financial uncertainty are the most important determinants of integration. However, the results vary between developed and emerging markets because the former are more affected by better investor protections and liquidity, while the latter are more affected by market openness, technological and economic developments and decreases in political risks.

Moreover, unlike previous studies, we find only a small role for financial development in the dynamics of integration, and even then, financial development is only significant for developed markets. Thus, we can conclude that international investors are attracted by the possibilities that are created by decreasing political instabilities and increasing development in emerging markets, while they also look for better investor protections and more liquid markets in developed countries.

The estimations related to the crisis periods are performed with monthly data that better allow the identification of crises' start periods than annual data. For the determinants of integration, annual data are used as a basis because most of the explanatory variables are only measured at annual frequencies, but the robustness of the results is also examined with monthly data.

The remainder of the paper is organized as follows. The second section introduces the theories about market integration and some of the previous studies on its determinants. The third section presents the construction of the integration measure, the crisis variables and the development of market integration over the last 25 years. The fourth section studies integration dynamics and its effect on returns during the global crisis. The fifth section examines the determinants of integration, and the sixth section concludes.

2 PREVIOUS STUDIES ON STOCK MARKET INTEGRATION

Financial market theories suggest that in fully integrated markets, while investors bear both the global and local risks in their portfolios, only global risks are priced because the local risks are fully diversified internationally. As a complement, in fully segmented markets, asset prices vary from one country to another, and the prices (and thus the returns) reflect only the domestic risks. Most markets, and especially emerging markets, are partially integrated (or segmented) because the prices reflect both local and global factors, and the expected returns are determined according to both of these risk sources (Bekaert and Harvey (1995)). It has been widely accepted that the market integration process is time-varying and takes several years, with occasional reversals (Bekaert and Harvey (1995); Carrieri, et al. (2007); Pukthuanthong and Roll (2009); Bekaert, Harvey, Lundblad and Siegel (2011); and Arouri, Nguyen and Pukthuanthong (2012)). Although all of these studies find that local risks are still important determinants of emerging market returns, the importance of local risks has weakened over time for most markets, indicating that the markets have become more integrated. However, all of these studies confirm the idea that although foreigners now have relatively free access to capital markets with financial liberalization, such access does not guarantee full market integration.

The relationship between integration and financial crises has not gained much attention in previous studies. Bekaert et al. (2011) provide one figure of the segmentation dynamics for developed markets that shows that segmentation (integration) increased (decreased) toward the end of 2008 but then returned to its pre-crisis levels in 2009. However, this result contradicts the bull vs. bear market results of Pukthuanthong and Roll (2009) that support the idea that markets tend to co-move more during periods of more turmoil. With regard to integration's effects on crisis occurrences, Berger and Pukthuanthong (2012) develop a market fragility index and find robust evidence that the probability of a global financial crash is highest during periods when many countries are highly exposed to common global market factors because negative shocks to the

world market can simultaneously propagate to multiple markets. However, Bekaert, Ehrmann, Fratzscher and Mehl (2012) examine the globalization hypothesis and find that the most integrated countries did not suffer the most during the crisis. Our aim is to deepen these studies by particularly concentrating on the global financial crisis of 2007-2009 and the role that integration played in the spread of the crisis.

To gain insight into the factors that affect integration and that could serve as sources of change during crisis periods, we examine the determinants of integration. The academic world has developed several time-varying measures to capture the dynamics of market integration over the last two decades (see, for example, Bekaert and Harvey (1995); Hardouvelis, Malliaropulos, and Priestley (2006); Carrieri et al. (2007); Chambet and Gibson (2008); Pukthuanthong and Roll (2009); Bekaert et al. (2011); Arouri et al. (2012)), and although Carrieri et al. (2007) state that there is a broad understanding of the factors that drive market integration, systematic studies on the determinants of market integration remain rather scarce. Bekaert (1995) makes the first attempt to explain differences in integration and argues that there are three different obstacles to market integration: legal barriers that arise from the different legal status of foreign and domestic investors in taxation, for example, and government policies to restrict capital movement; barriers arising from differences in available information, accounting standards and investor protection; and emerging market specific risks such as political, economic policy and liquidity risks that discourage foreign investment and lead to segmentation. Poor credit ratings, high and variable inflation, and the lack of a high-quality regulatory and accounting framework are particularly mentioned as sources of segmentation. However, Bekaert's (1995) analysis suffers from some shortcomings (for example, a constant integration measure), and it should therefore be considered more as directional evidence of market integration. Carrieri et al. (2007) develop a measure for integration and test it for eight emerging markets. According to their results, the development of capital markets (measured by market capitalization to GDP) and the liberalization of stock markets are statistically important determinants of integration. Chambet and Gibson (2008) study the impact of the trade structure of emerging market economies on the evolution of integration. They find that the degree of openness for foreign trade contributes to the integration process such that the less diversified an economy is with respect to its foreign trade partners, the more integrated its financial market will be. Frijns, Tourani-Rad and Indriawan (2012) argue that political crises with certain characteristics reduce the integration of emerging markets. The authors particularly note that the start of crises, their severity, the number of parties, and U.S. involvement have significant impacts on integration. The most comprehensive study of market integration comes from Bekaert et al. (2011), who propose a new country-level measure for time-varying market segmentation (as opposed to market integration) and apply it to 69 emerging and developed countries. The authors examine how financial and trade openness (de jure globalization) contribute to decreases in segmentation levels, and they provide a comprehensive analysis of

other factors that might affect segmentation. The authors find that in addition to financial and trade openness, stock market development and the political risk profile as local factors and the U.S. corporate credit spread as a global factor are statistically and economically important determinants of market segmentation.

3 DATA

Our main interest lies in the development of integration processes in the share markets, and therefore we collect data from 60 emerging and 23 developed countries. The next subsections provide a description of our integration measure and define the crisis periods. The explanatory variables we use can be found in Appendix 1, Table A1.

3.1 Integration Measure and Descriptive Statistics

It seems reasonable that a quantitative measure for global integration should capture the proportion of a country's returns that can be explained by common global factors. The smaller this proportion is, the more dominated the market returns are by local and regional factors, while a high degree of integration is characterized by the significant influence of common global factors. In addition, the measure should satisfy several attributes. Naturally, it should be able to capture the time-varying dynamics of the integration process, and preferably it should not be tied to any specific asset-pricing model because there is no generally accepted global asset-pricing model. For these reasons, we use a principal component-based integration measure developed by Pukthuanthong and Roll (2009) that was originally designed to provide an alternative to the flawed cross-country correlation-related integration measures (although the authors argue that market correlation is a poor measure of market integration, the relationship between the two should theoretically be positive. See Bekaert and Harvey (1997) and Morana and Beltratti (2008)). This very intuitive, econometrically estimated method is simple to implement and requires only data on the country index returns, which are easily available for several countries from the typical data sources. The use of a different measure (for example, from Carrieri et al. (2007) and Bekaert et al. (2011)) also allows us to study whether previously found determinants of integration are sensitive to this method. The main char-

acteristics of the integration measure are explained here, while criticism and robustness checks can be found in Pukthuanthong and Roll (2009).

We use Thomson Datastream as our stock market data source as it provides stock market indices for most of the countries and the longest time periods. Although we mostly use the same indices as Pukthuanthong and Roll (2009), we also add some indices and change some others. All the indices, their starting years and division to price indices and total return indices (latter combining the price performance with the reinvested dividends) can be found, together with some descriptive statistics of integration, from Appendix 2 Table A2. Naturally, total return indices are preferable, and are selected whenever possible, but as they are not available for all of the countries, we are forced to satisfy with price indices in several cases. To reduce the noise caused by exchange rate movements, all of the indices are transformed to a common currency, the U.S. dollars, and due to our integration estimation method, the data frequency is chosen to be daily. The sample period ends in 2011 and, as the Appendix 2 Table A2 presents, we have several different starting periods. However, due to the availability of the explanatory variables and to equalize the length of the series a bit, we limit the earliest starting period for series to be 1987[3].

Because the data are daily, the indices include several observations that are not truly market determined. For example, in the case of holidays, the value of the index stays the same as in the previous trading day. Because most holidays are determined at the national level, a downward bias in the measure of market integration could be created. To solve this problem, we simply exclude the return value unless it is computed from two index values that are either one calendar day apart or, in the case of Friday and Monday, three calendar days apart. In addition, if the values for the previous trading days are identical, the return is removed. Such a case would indicate either a holiday, or in the case of a smaller country, an illiquid market. Although it is possible that an index can remain the same even if it is not a holiday, we believe this scenario to be quite unlikely because the indices consist of several stocks.

To estimate the global factors with the principal component analysis for the integration measure, we use 18 developed countries: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, Singapore, Spain, Sweden, Switzerland, the U.K. and the U.S.[4] To cover the sample size of the rest of the markets, we select data for these countries' indices that begin on January 1, 1986. These markets are some of the largest economies and have the longest tradition of free capital mobility; therefore, it can be claimed that these countries clearly represent the most globally integrated markets. To account for non-synchronous trading, the data are augment-

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3 In practice this shortens the observation periods for almost all of the developed markets but only for three emerging market indices (original starting periods in parenthesis): Malaysia (1980), South Africa (1973) and South Korea (1975).

4 We differ slightly from Pukthuanthong and Roll (2009) by dropping South Africa and adding Spain and Sweden, thus concentrating our analysis only on developed markets when estimating the global factors.

ed by the inclusion of the one-day lagged returns from the North American countries, Canada and the U.S.

For each year from 1986 to 2010, eigenvectors and eigenvalues are calculated and sorted from largest to smallest using a covariance matrix calculated from the returns of the previously mentioned indices[5]. The principal components are estimated from returns in the subsequent calendar year, i.e., the weightings (eigenvectors) computed from the 1986 covariance matrix are applied to the returns of the same 18 countries for 1987, and the process continues in this manner until the 2010 weightings are applied to the 2011 returns, which is the final full sample year available. This procedure produces 25 calendar years with out-of-sample principal components. As proxies for global variables, we retain the first 10 principal components, which generally account for more than 90% of the cumulative eigenvalues (or 90% of the total volatility in the covariance matrix). We use these 10 global variables (principal components) as our common explanatory variables and regress the daily returns of each country for each year with the variables. The annual market integration value is measured with the adjusted R-square from these regressions. For monthly data, integration is estimated with a rolling regression where the estimation window is two-hundred days and the last day of the month denotes the integration level for that month. The idea behind the measure is that 10 large industry groupings (represented by 10 principal components) should be able to capture the global shocks adequately. Obviously, the caveat of the method is that the measure might be biased for some (especially emerging and frontier) markets whose industry structure differs significantly from the developed markets.

Figure 1 presents the average annual adjusted R-squares of the developed and emerging markets. The emerging markets are divided into two groups depending on the beginning of their observation periods. There are 27 countries in the 1987-1993 cohort, and 33 countries in the post-1993 cohort. The developed markets are clearly more integrated than the emerging markets over the entire sample period, and the post-1993 cohort is the least integrated. However, the general trend is increasing for all of the data series, and there are several phases when all three of the integration curves behave similarly. The spikes around 1998, 2004 and 2008 followed by dips in 1999, 2005 and 2009 are clearly visible. Thus, it could be argued that the integration process is affected by some global variables that are common to all countries, although previous studies have found that local variables also play a role in market integration. The steepness of the integration trend differs between the groups; for example, the period from 2000 to 2003 presents an increasing trend for developed market integration and a decreasing trend for the emerging markets. This result could possibly be related to the burst of the Dot-com bubble, which mostly affected the developed markets.

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5 The total dimension of the covariance matrix is 20x20 (18 developed countries plus the lags of the U.S. and Canada)

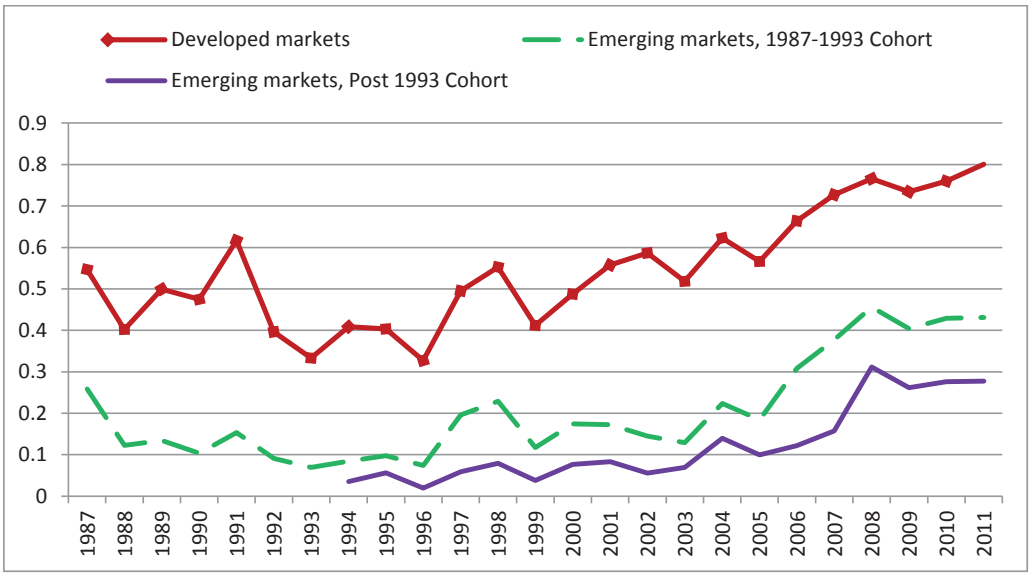

FIGURE 1 Average integration: Developed and emerging markets, 1987-2011

Global market integration for developed markets and two emerging market country cohorts. Integration is measured as an adjusted R-squared statistic from regressions of country index returns on global factors. Global factors are estimated using out-of-sample principal components based on the covariance matrix in the previous calendar year computed using the returns from 18 industrialized economies. The figure shows within-country cohort averaged annual R-square estimates. The cohorts are formed based on how countries initially appear in our dataset. Most developed markets and some emerging markets are limited to begin in 1987.

Appendix 2 Table A2 provides some descriptive statistics for integration in each of the markets. It shows the t-statistics of the time trends for the adjusted R-squares together with the means, standard deviations, minimums and maximums for integration. As already shown in Figure 1, the developed markets are more integrated than the emerging markets, and in general, the markets with longer observation periods are also more integrated. It is notable that the U.S. is somewhat unexpectedly quite modestly integrated with the global markets. This result could be related to the results of Rapach et al. (2013) that instead of following, the market in the U.S. leads other markets, and the global factors that are formed from other markets have only limited explanatory power for movements of the U.S. market. Most of the countries, and especially those that are the most integrated, show a significantly positive integration trend, while Bangladesh and Jamaica are the only markets that show statistically significant decreases in their integration levels. Other countries with negative but not significant trend coefficients include Malaysia, Jordan, Venezuela, Ecuador, Ghana and Trinidad & Tobago. Of the developed markets, only Japan and Luxembourg show positive but not significant trends.

3.2 Crisis Periods

We mostly concentrate on the global financial crisis of 2007-2009, but we also consider other global crises for comparison purposes. For the starting period of the global financial crisis, we use two different dates: the initial fall of the stock markets in 8/2007 and the month of the collapse of Lehman Brothers, 9/2008. For both of these periods, the end of the crisis period is determined to be 6/2009 because the National Bureau of Economic Research (hereafter NBER) considers that date to be the end of the recession in the U.S.

In addition, we examine market integration's role in other international crises to determine whether these crises caused or were caused by similar effects as the global financial crisis. We define the beginning of the Asian financial crisis as 10/1997, when the market in Hong Kong crashed. The Asian crisis period includes the collapse of LTCM (10/1998); therefore, we use just one common name for these crises: Asia and LTCM. The ending period for these crises is defined as 12/1998. The bursting of the Dot-com bubble is defined to be from 10/2000 to 12/2002. In addition, we examine all of the U.S. recession periods (determined by NBER) as a general measure of global recessions. The periods that are studied together are 6/1990-3/1991, 3/2001-11/2001 and 12/2007-6/2009.

4 INTEGRATION OF WORLD CAPITAL MARKETS AND THE GLOBAL FINANCIAL CRISIS

The global financial crisis is particularly well suited for our research framework for two reasons. First, the sheer size of the crisis makes it a good subject to test for integration dynamics and the possible effects of integration. Second, the crisis was uniquely wide and relatively synchronized across the international capital markets. Hence, a global sample of markets can be used to study the crisis, largely neglecting problems related to the timing of the crisis and possible spillover effects. In this section, we examine the relationship between the global financial crisis and the level of stock market integration. To the best of our knowledge, this issue has not been widely studied. We divide the study into two subsections. The first subsection examines what happened to the process of integration during the crisis period, while the second subsection concentrates on the crisis period to analyze whether integration directly affected local market returns. Because the monthly data provide more accurate determinations of starting periods than the annual data, we use the monthly data in this section. Additionally, we use dummy variables to capture the emerging markets as a group of their own. We use this method for two reasons. First, it has become a common practice to study emerging economies separately as their own entity because of their nature as developing, and therefore the division allows us to study the differences between developed and emerging markets. Second, no two crises are the same. The financial crises that affected the global financial markets were born for various reasons, and they could have affected emerging and developed countries differently. A good example of this phenomenon is the Asian financial crisis, which mostly hit the emerging markets in Asia, although it eventually spread to developed economies.

4.1 Global Crises and Stock Market Integration Dynamics

Only a few studies have examined the relationship between stock market integration and financial crises. As noted previously, Bekaert et al. (2011) and Pukthuanthong and Roll (2011) find contrary results about integration dynamics during crisis periods, as the former find that segmentation increases during crisis periods, while the latter find the opposite. Based on Figure 1 and the general notion that markets tend to co-move more during periods of turmoil, we expect that the explanatory power of the global variables should actually increase during crisis periods.

The following equation forms the basis of our analysis:

$$Integration_{i,t} = \beta_0 + \beta_1 Integration_{i,t-1} + \beta_2 Crisis + \beta_3 trend + EM\left(\alpha_0 + \alpha_1 Integration_{i,t-1} + \alpha_2 Crisis + \alpha_3 trend\right) + \gamma_i controls_{i,t} + \varepsilon_{i,t} \quad (1)$$

Our dependent variable is the integration level, and for independent variables, we use the lagged level of integration, trend and Crisis dummies. To study the differences between developed and emerging markets, an emerging market dummy (EM) and its interactions with the previously mentioned variables are included in the estimations. It can be argued that the extra volatility of the global factors during periods of more turmoil may create an upward bias to the Pukthuanthong and Roll (2009) integration measure because the R^2s tend to increase due to abnormal global volatility (see Forbes and Rigobon, 2002). To control for this possibility, we include measures for the VIX index and world volatility in Equation (1) to control for the effects of extra volatility. In addition, we also estimate the results using the segmentation measure by Bekaert et al. (2011) to examine the robustness of the results[6]. However, the last observations for this measure for the emerging markets are from 12/2005, and therefore the data are only partially available for the 2007-2009 crisis period (for 20 developed countries). Hence, the conclusions based on this measure for the global financial crisis period can only be kept as directional.

The results from Model (1) are presented in Table 1 with four different sub-models (numbered I-III). Models I and II study the global financial crisis using 8/2007 and 9/2008 as the starting months, respectively, while the crisis period ends in 6/2009. Model III examines the U.S. recession periods in general: 6/1990-3/1991, 3/2001-11/2001 and 12/2007-6/2009. Each sub-model in the table consists of two columns: the columns on the left present the direct effects of the variables ($\beta_i's$), while the columns on the right show the coefficients of the interaction term with the emerging markets dummy ($\alpha_i's$).

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[6] We are grateful for the segmentation measure data for Geert Bekaert, Campbell R. Harvey, Christian T. Lundblad and Stephan Siegel.

TABLE 1 Market integration and global financial crisis

Dependent variable: $Integration_t$						
	I		II		III	
		EM-dummy		EM-dummy		EM-dummy
$Integration_{t-1}$	0.9833***		0.9834***	0.0016	0.9832***	0.0022
	(0.0037)		(0.0037)	(0.0044)	(0.0036)	(0.0043)
Global crisis 2007	-0.0026*	0.0043**				
	(0.0015)	(0.0018)				
Global crisis 2008			-0.0074**	0.0069*		
			(0.0030)	(0.0036)		
Recession					-0.0015	-0.0011
					(0.0018)	(0.0019)
EM	-0.0039***		-0.0041***		-0.0048	
	(0.0014)		(0.0014)		(0.0014)	
VIX	0.0006***		0.0006***		0.0006***	
	(0.0001)		(0.0001)		(0.0001)	
World volatility	-1.3914***		-1.5187***		-1.6617***	
	(0.2968)		(0.2705)		(0.2993)	
$Trend * 100$	0.0034***	-0.0019**	0.0034***	-0.0017**	0.0030***	-0.0012
	(0.0007)	(0.0008)	(0.0007)	(0.0008)	(0.0007)	(0.0009)
Intercept	-0.0050***		-0.0056***		-0.0048***	
	(0.0013)		(0.0012)		(0.0012)	
Countries	82		82		82	
N	17655		17655		17655	
R^2	0.98		0.98		0.98	

Table presents the relationship between the stock market integration level and the global financial crisis. In columnn I and II and III the crisis period is defined to be from 8/2007-6/2009 and 9/2008-6/2009, respectively. Column III studies the U.S. recession periods: 6/1990-3/1991, 3/2001-11/2001 and 12/2007-6/2009. In all cases, estimated model is Equation (1) where crisis are measured at monthly level. All the regressions also include the previous period's integration level and the time-trend as well as a constant. Each of these variables is also regressed with the emerging market –dummy to study whether there are differences between emerging and developed markets. As control variables, to control for possible bias created by abnormal volatility of the markets, measures for VIX and world volatility are also included. Table reports the coefficient estimates from pooled OLS regressions and the clustered standard errors which account for cross-sectional correlation across country indices. *, ** and *** denote statistical significance level at 10%, 5% and 1% levels, respectively. N denotes the number of observations and R^2 is the coefficient of determination.

In general, it can be observed that the model captures the integration dynamics rather well (R-squared is 0.98) due to the significant contribution of the previous period's integration level (β_1 is almost one). In addition, the integration level itself is smaller for emerging markets ($\alpha_0 < 0$), and while the time trend is generally positive and significant in all of the models ($\beta_3 > 0$), the effect is

smaller for the emerging markets ($\alpha_3 < 0, \beta_3 + \alpha_3 > 0$). However, our main interest lies in the crisis dummy coefficients (β_2 and α_2) that capture the effects of the crisis period. According to Table 1, Models I and II provide slightly different results. In Model I, when the start of the crisis is defined as 8/2007, integration decreased in general but increased slightly for the emerging markets ($\beta_2 < 0$, $\alpha_2 > 0$ and $\beta_2 + \alpha_2 > 0$). When the start of the crisis is defined as 9/2008, again $\beta_2 < 0$ and $\alpha_2 > 0$, but this time, $\beta_2 + \alpha_2 < 0$ i.e., integration decreased during the crisis period but the decrease was smaller for the emerging markets. Thus, although it can be concluded that the integration of the emerging markets suffered less than the integration in the developed markets, the results partially depend on how we define the beginning period of the crisis[7]. To provide a general picture of the integration dynamics during recessions, Model III shows the integration level during the U.S. recessions that fall to the sample period. Although the results show some indication that integration decreases during the U.S. recession periods, the effect is not statistically significant[8]. Thus, these results support the conclusions of Bekaert et al. (2011) that during crisis periods, globalization tends to decrease, although the effect might be different between developed and emerging markets.

To further examine the integration dynamics during crisis periods, Table 2 presents the coefficients for β_2 and α_2 in Panel A for the segmentation measure. Panel B shows the coefficients for the integration measure for the Asian financial crisis and the LTCM together (10/1997-12/1998) and for the Dot-com crisis (10/2000-12/2002) as well as all of these crisis periods taken together. In Panel C, the segmentation measure is used for the same periods.

It must be noted that although the entire sample consists of 68 countries, there are only 20 developed countries listed in Panel A for the global financial crisis period. This issue could affect the results, which are not significant for Models I and II. For Model III, the emerging markets show significant increase in segmentation during the U.S. recession periods. However, the results are more interesting in Panels B and C, where we can examine whether the measures provide similar results for the other financial crisis periods. In Panel B for Asian and LTCM crises, integration is found to increase, but this increase is smaller for the emerging markets ($\beta_2 > 0$, $\alpha_2 < 0$ and $\beta_2 + \alpha_2 > 0$). The segmentation measure provides similar results, except the emerging markets became more segmented instead of integrated ($\beta_2 < 0$, $\alpha_2 > 0$ and $\beta_2 + \alpha_2 > 0$). However, for the Dot-com crisis, the results are identical in that the emerging markets became more segmented during the period because the crisis mostly affected the developed markets. When all of these crisis periods are combined, we find that integration weakens during crisis periods for the emerging markets, but it may actually increase for the developed countries, at least according to the segmentation results.

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7 If we define the beginning period according to NBER, i.e., from 12/2007 to 6/2009, the conclusions are similar to Model II.

8 If the results are estimated without the volatility control variables, there is a significant increase in integration during all of the studied periods, and the increase is even higher for the emerging markets, as Figure 1 suggests.

TABLE 2 Integration and stock market crises

Panel A	Dependent variable: Segmentation					
	Global crisis 2007		Global crisis 2008		Recession	
		EM-dummy		EM-dummy		EM-dummy
Crisis period	0.0005		-0.0010		0.0003	0.0012*
	(0.0004)		(0.0007)		(0.0003)	(0.0007)
Countries	68		68		68	
N	11257		11257		11257	
R^2	0.90		0.90		0.90	
Panel B	Dependent variable: Integration					
	Asia and LTCM		Dot-com		All Crises	
		EM-dummy		EM-dummy		EM-dummy
Crisis period	0.0080***	-0.0063**	0.0003	-0.0065***	0.0006	-0.0046***
	(0.0017)	(0.0024)	(0.0009)	(0.0012)	(0.0012)	(0.0014)
Countries	82		82		82	
N	17655		17655		17655	
R^2	0.98		0.98		0.98	
Panel C	Dependent variable: Segmentation					
	Asia and LTCM		Dot-com		All Crises	
		EM-dummy		EM-dummy		EM-dummy
Crisis period	-0.0015***	0.0030***	-0.0001	0.0009*	-0.0007**	0.0019***
	(0.0003)	(0.0008)	(0.0002)	(0.0005)	(0.0003)	(0.0005)
Countries	68		68		68	
N	11257		11257		11257	
R^2	0.90		0.90		0.90	

Table presents the relationship between the stock market integration level and the global financial crisis using Equation (1). To save space, only the coefficients β_2 and α_2 are presented. In panel A, the dependent variable is segmentation measure by Bekaert et al. (2011) and the estimated models are similar to Table 1. In panels B and C, the crises variable are Asian financial crisis and LTCM crises: 10/1997-12/1998, Dot-com crisis: 10/2000-12/2002 and all the previously used crises combined. Table reports the coefficient estimates from pooled OLS regressions and the clustered standard errors which account for cross-sectional correlation across country indices. *, ** and *** denote statistical significance level at 10%, 5% and 1% levels, respectively. N denotes the number of observations and R^2 is the coefficient of determination.

Overall, the results vary slightly between crises and integration measures. The Dot-com crisis was mostly related to the developed markets, while the Asian crisis mostly affected emerging economies in Asia, although the effects eventually spread to developed countries. Thus, it is reasonable to conclude that the integration of the emerging markets suffered during both of those crises, although the size of the effect is dependent on the specific measure used. However, both of the measures provide evidence that integration among the developed

countries increased during the times of crisis; therefore, we can conclude that, in general, the past crises have made the emerging markets less integrated but have increased the developed markets' integration.

4.2 Stock Market Returns, Global Financial Crisis and Stock Market Integration

In this second subsection, we focus on examining the consequences of integration with respect to the spreading of crisis. Berger and Pukthuanthong (2012) argue that negative global market shocks could propagate simultaneously to multiple markets when several countries are exposed to common global factor. However, Bekaert et al. (2012) report that the most integrated countries did not suffer the most during the global financial crisis. Thus, it could be that a higher degree of integration could be related to lower returns, especially at the beginning of a crisis, but the effects may not necessarily persist for the whole crisis.

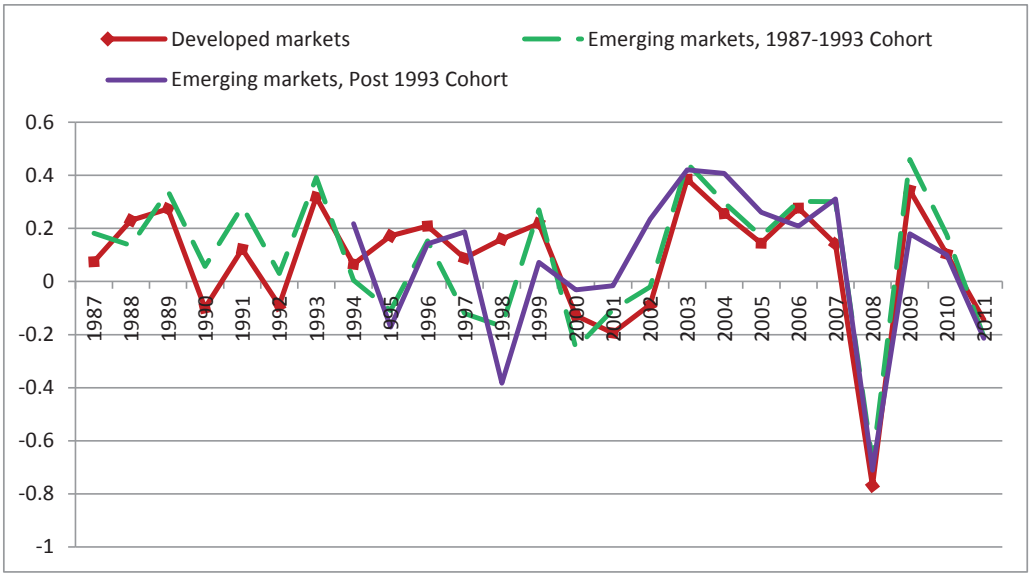

FIGURE 2 Average annual returns: Developed and emerging markets, 1987-2011

Average returns for developed markets and two emerging market country cohorts measured as annual returns and denominated in U.S. dollars.

Figure 2 presents the development of the average annual returns for developed markets and the two emerging market country cohorts[9]. It is notable that the

[9] We use annual returns to avoid noise that the monthly returns would introduce to the figure.

developed markets and the 1987-1993 emerging markets cohort move quite similarly before the mid-1990s and after 2003, while the post-1993 cohort shows more independent return dynamics. The effects of the Asian financial crisis in 1997 and the bursting of the Dot-com bubble in the early 2000s can be easily observed as negative returns for each index. However, the most outstanding return period is the sudden drop in 2008, when the global financial crisis swept over the markets, and the recovery of 2009. It is especially visible that each of the three average annual return indices moves almost identically during the crisis period, first declining sharply and then increasing again in the next year. During the aftermath of the crisis, some claimed that the integration of the capital markets was the reason for the collapse of the financial markets around the world. Figure 3 presents some evidence for this theory; it shows the relationship between the integration level of July 2007 and the returns of August 2007. A line fits between the observations with a clearly negative slope, indicating that the more integrated countries suffered more at the beginning of the crisis.

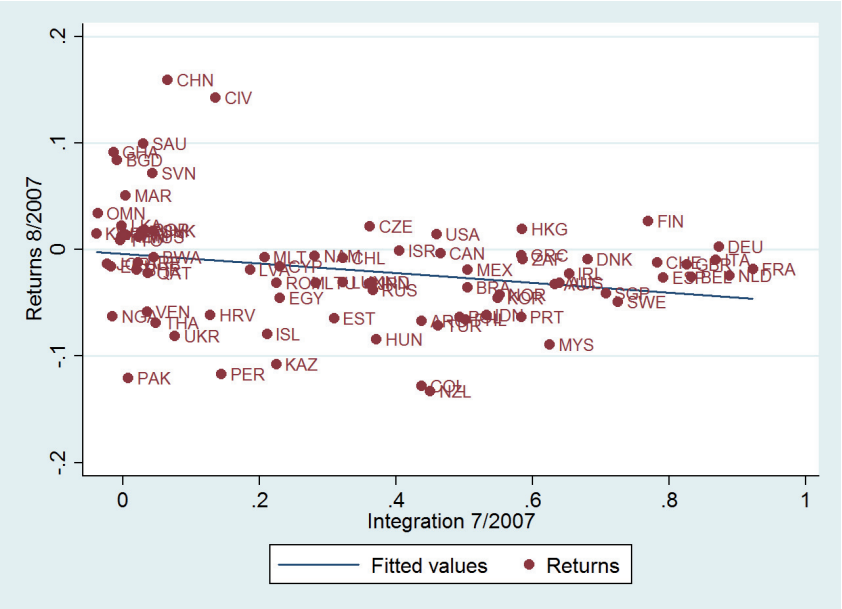

FIGURE 3 Local stock market returns in 8/2007 and integration level in 7/2007

Our aim is to further examine this issue by studying whether the level of integration played any role in the spread of the crisis both at the beginning of the crisis and during the crisis. Thus, we estimate the following model:

$$Returns_{i,t} = \beta_0 + \beta_1 Integration_{i,t-1} + \beta_2 EM + \beta_3 EM * Integration_{i,t-1} + CrisisStart * \left(\alpha_1 + \beta_4 Integration_{i,t-1} + EM\left(\alpha_2 + \beta_5 Integration_{i,t-1}\right)\right) + Crisis * \left(\alpha_3 + \beta_6 Integration_{i,t-1} + EM\left(\alpha_4 + \beta_7 Integration_{i,t-1}\right)\right) + \beta_8 Returns_{i,t-1} + \vartheta_i + \tau_t + \varepsilon_{i,t} \quad (2)$$

where $Returns_{i,t}$ and $Integration_{i,t-1}$ are the local market returns and integration level of country i at time t and $t-1$, respectively. Coefficient β_1 represents the direct effect of the past integration level on local market returns. EM, $CrisisStart$ and $Crisis$ are the dummy variables for the emerging countries, the first period of the crisis and the crisis period, respectively. With β_2, we can examine whether the emerging markets produced larger returns than the developed markets, while β_3 shows whether the integration level in the emerging markets significantly affected the returns. α_1 captures the effects of the starting period of the crisis, and β_4 displays the effects of the interaction between the starting period of the crisis and integration. α_2 is included to study the effects of the starting period of the crisis in the emerging markets, while β_5 is used to capture integration's effects on the emerging markets during the same period. The idea is that α_1, α_2, β_4 and β_5 capture the effects of the starting period of the crisis, and α_3, α_4, β_6 and β_7 capture the effects of the crisis period. ϑ_i and $\tau_t$are the country and time fixed effects, respectively, controlling for an unobserved country and time heterogeneity. ε_{it} is an error term, with $E(\varepsilon_{it}) = 0$ for all is.
Here, we divide the question about the effects of integration on the spread of the crisis into two parts. First, we examine the effects of integration at the beginning of the crisis, referring to the propagation of the crisis, while the second part of Equation (2) determines the effects of the past integration levels on the returns during the crisis period. Thus, Equation (2) aims to determine whether integration played any role in the spread of the crisis at its beginning and whether integration affected the returns during the crisis. An analogy from everyday life would be a meeting on the street between two strangers, A and B. Person A has the flu and happens to sneeze just when A and B pass one another, thus spreading the flu virus to B, who catches the flu and suffers from it for some time in the future. Hence, the coefficients of the first part of Equation (2) (β_4 and β_5) test whether the sneezing (integration) spread the flu (crisis) to different countries. Continuing with the analogy, the coefficients of the second part of Equation (2) (β_6 and β_7) measure whether A follows B, constantly sneezing towards him and trying to spread the flu. Bekaert et al. (2012) examine only this latter part in their contagion study[10].

The results of Model (2) are presented in Table 3. Column I shows the simple relationship between returns and the past integration level without interaction terms and crisis periods. Columns II and III present the monthly data

[10] It could be argued that β_4 and β_5 are the coefficients that actually measure the contagion in its meaning as a way of spreading the crisis. However, to remain consistent with the previous contagion literature, we name their effect propagation.

results with slightly different starting periods. In the estimations, the starting period of the crisis is defined as the first month of the crisis. In Column II, the start of the crisis period is 8/2007, while in Column III, the start of the crisis period is 9/2008. In both cases the crisis period begins in the next month and lasts until 6/2009[11]. Columns IV and V present robustness checks using the segmentation measure of Bekaert et al. (2011). Column IV has the same starting period as Column II, and Column V has the same starting period as Column III.

TABLE 3 Stock market returns, Global Financial Crisis and Market Integration

Dependent variable: Local market returns					
	I	II	III	IV	V
$Integration_{t-1}$	-0.0068***	-0.0103*	-0.0139**	0.0104	-0.0026
	(0.0025)	(0.0057)	(0.0058)	(0.0590)	(0.0611)
EM	-0.0032**	-0.0074**	-0.0082**	-0.0122***	-0.0127***
	(0.0012)	(0.0034)	(0.0035)	(0.0029)	(0.0030)
$CrisisStart$		-0.0454*	-0.0765***	-0.0702***	-0.0889***
		(0.0254)	(0.0212)	(0.0180)	(0.0192)
$CrisisPeriod$		-0.1154**	-0.1532**	-0.0515***	-0.0550***
		(0.0447)	(0.0641)	(0.0167)	(0.0165)
$EM * Integration_{t-1}$		0.0016	0.0031	0.1228	0.1356
		(0.0075)	(0.0074)	(0.0822)	(0.0838)
$CrisisStart * Integration_{t-1}$		-0.0463*	-0.0440*	1.0429**	0.2619
		(0.0235)	(0.0247)	(0.4259)	(0.3111)
$CrisisPeriod * Integration_{t-1}$		0.0479	0.0980	-0.1115	-0.0170
		(0.0511)	(0.0758)	(0.1704)	(0.1557)
$CrisisStart * EM$		0.0171	-0.0424*		
		(0.0199)	(0.0243)		
$CrisisPeriod * EM$		0.0457	0.0746		
		(0.0426)	(0.0650)		
$CrisisStart * EM * Integration_{t-1}$		0.0201	-0.0219		
		(0.0396)	(0.0481)		
$CrisisPeriod * EM * Integration_{t-1}$		-0.0587	-0.0883		
		(0.0517)	(0.0785)		
$Return_{t-1}$	0.1306***	0.0493**	0.0495**	0.0349	0.0350
	(0.0195)	(0.0210)	(0.0209)	(0.0228)	(0.0229)
Intercept	0.0099***	0.0786***	0.0812***	0.0446***	0.0453***
	(0.0016)	(0.0161)	(0.0161)	(0.0164)	(0.0163)
Country fixed	No	Yes	Yes	Yes	Yes
Time fixed	No	Yes	Yes	Yes	Yes
Countries	82	82	82	68	68

[11] It should be noted that in these estimations, the results for the beginning of the crisis are not subject to the possible upward bias in the integration measure due to the abnormal volatility. However, when controlling for VIX and world market volatility, the estimations yield similar results.

N	18452	18452	18452	11925	11925
R^2	0.02	0.30	0.30	0.27	0.27

Table presents the relationship between stock market returns, past integration level and global financial crisis using Equation (2) for the full country sample including EM-dummy variables for the emerging markets. Column I measures the effect of past integration level to stock returns. Columns II and III study the effects of past integration to propagation of the crisis and its effect on the returns during crisis using monthly data and integration measure. Columns IV and V study the same question with segmentation measure of Bekaert et al. (2011) instead of integration. All estimations in columns II-V control for the country and time fixed effects to estimations. Table reports the coefficient estimates from pooled OLS regressions and the clustered standard errors which account for cross-sectional correlation across country indices. *, ** and *** denote statistical significance levels at 10%, 5% and 1% levels, respectively. N denotes the number of observations and R^2 is the coefficient of determination.

The results from Column I show that in the simple model, past integration negatively affects returns. The constant term is positive and somewhat surprisingly, the EM-dummy is negative and significant, which implies that the emerging markets show lower returns. The estimations also show that positive past returns are related to positive returns. However, in Columns IV and V, the model does not find a significant relationship between current and past returns and past segmentation.

The main interests in Table 3 are the interactions between past integration levels and the start of the crisis (β_4) and over the entire crisis period (β_6). A significant and negative coefficient for β_4 would imply that greater integration negatively contributed to returns and therefore helped to propagate the crisis globally at the beginning of the crisis period, while significant results for β_6 would provide evidence that integration affected returns over the entire crisis period. The results in Columns II and III are very similar, showing both the starting period of the crisis and the entire period to be characterized by negative returns. In addition, the interaction term between the start of the crisis and the past integration level (β_4) is negative and significant, implying that global market integration actually played a role in spreading the crisis internationally. However, consistent with Bekaert et al. (2012), the results also show that integration did not have a significant effect on the overall market performance during the crisis period because β_6 is insignificant in both of the columns. Several countries introduced policy responses to the crisis (capital injections, deposit and debt guarantees) during the crisis period, and these measures might have diminished the role of integration. Altogether, these results imply that the integration of the global markets helped to propagate the crisis globally, but it did not have long-term effects i.e. it affected to the wideness of the crisis but not to its depth. In Column IV, the segmentation measure provides similar results: the more segmented (less integrated) the market, the higher its returns at the beginning of the crisis. However, the results in Column V are not significant because the markets became more segmented in the previous year; therefore, the role of integration in the spread of the crisis is more uncertain in this case.

Overall, the results still provide support for the argument that the integration of the global markets helped to spread the crisis in 2007; i.e., continuing with the analogy, a single sneeze was enough for the flu to spread in 2007.

To further examine the effects of integration and the global crisis periods, we also estimate the results for other crises (Asian & LTCM and Dot-com). The estimation results for β_4 and β_6 can be found in Table 4, where Panel A reports the results for integration and Panel B for the segmentation measure. In Panel A, the relationship between the integration level, the start of the crisis and returns is not significant for the Dot-com crisis, while for the Asian and LTCM crisis, the effect is positive. For the entire crisis period, the interaction term is significant and positive for the Asian and LTCM crisis, but it is otherwise insignificant. The results are consistent between the panels except in Panel B, the coefficient for segmentation at the start of the crisis is not significant. Based on these results, it is evident that integration's role in the spread of the crisis was different for the financial crisis of 2007-2009 compared with other crisis periods.

TABLE 4 Stock market returns, Financial Crises and Market Integration

Panel A	Dependent variable: Local market returns		
	Asian and LTCM	Dot-com	All Crises
$CrisisStart * Integration_{t-1}$	0.1466***	0.0252	-0.0234
	(0.0365)	(0.0437)	(0.0193)
$CrisisPeriod * Integration_{t-1}$	0.0320**	-0.0153	0.0019
	(0.0159)	(0.0109)	(0.0118)
Country fixed	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes
Countries	82	82	82
N	18452	18452	18452
R^2	0.30	0.30	0.30
Panel B	Dependent variable: Local market returns		
	Asian and LTCM	Dot-com	All Crises
$CrisisStart * Segmentation_{t-1}$	-0.2893	0.4338	0.1418
	(1.5024)	(1.0473)	(0.4252)
$CrisisPeriod * Segmentation_{t-1}$	-1.0243**	0.3592	-0.2296
	(0.5021)	(0.2342)	(0.1540)
Country fixed	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes
Countries	68	68	68
N	11925	11925	11925
R^2	0.28	0.28	0.28

Table presents the relationship between stock market returns, past integration level and financial crises using Equation (2) for the full country sample including EM-dummy variables for the emerging markets. Only coefficients β_4 and β_6 are reported. In panel A, the integration is measured with the measure by Pukthuanthong and Roll (2009) while in panel B, the segmentation measure of Bekaert et al. (2011) is used. All estimations control for the country and time fixed effects to estimations. Table reports the coefficient estimates from

pooled OLS regressions and the clustered standard errors which account for cross-sectional correlation across country indices. ** and *** denote statistical significance levels at 5% and 1% levels, respectively. N denotes the number of observations and R^2 is the coefficient of determination.

5 DETERMINANTS OF INTEGRATION

As the last contribution of this study, we examine the factors that affect integration and that serve as possible channels of increasing (or decreasing) integration during crisis periods. These factors could be understood to capture the reasons why international investors invest to the country's stock market. The basic model for our unbalanced panel dataset is

$$Integration_{i,t} = \alpha + \beta' x_{i,t} + \varepsilon_{i,t} \quad (3)$$

where $Integration_{i,t}$ is the time t measure of integration for country i, $x_{i,t}$ represents the explanatory variables and ε_{it} is an error term capturing all other omitted variables, with $E(\varepsilon_{it}) = 0$ for all is. We estimate the model for all countries jointly with pooled ordinary least squares (OLS), but we account for cross-sectional dependence by clustering the standard error across country indices. To add robustness to the results, estimations are performed for both yearly and monthly data and to account for any possible upward bias created by extra volatility during times of crisis, the estimations are also performed for a dataset where the crisis periods are omitted[12].

5.1 Estimation Strategy

To gain insight into the determinants of stock market integration, we estimate Model (3) with the full set of explanatory variables (see Appendix 1 and Table A1 for a description and the sources of the variables). We analyze three different sample sets: the full sample, consisting of both developed and emerging markets, developed markets only and emerging markets only. However, because we are estimating several highly correlated financial, political and economic variables, an estimation of the full model generates a large number of

[12] For the variables that are measured with annual frequency, monthly values are created for the end of the period values, as in Bekaert et al. (2012).

insignificant regressors that produce unnecessary noise to the results. Thus, our aim is to reduce the number of variables into a more manageable set that best explains the variation in integration. In this task, we follow Bekaert et al. (2011) and Bekaert et al. (2012) and employ a general-to-specific algorithm, as explained, for example, in Hendry and Krolzig (2005). The algorithm constitutes a multiple-step process that eliminates variables with coefficient estimates that are not statistically significant. Concretely, we start by estimating Model (3) with all of the variables. We then eliminate the least statistically significant variable, using a significance threshold of 15%. The use of a relatively high significance level reflects the preference of keeping a model with some useless regressors over eliminating important regressors. We continue step-by-step by estimating the model and excluding the individual variables, simultaneously testing at each step whether an already-excluded variable should be included again, until we arrive at a final model specification. After we have found the final model, we investigate the economic significance of the explanatory variables by adopting the methods of Bekaert et al. (2011) to conduct two examinations on the effects of each of the variables on the overall integration process.

To save space, we only report the results from the OLS estimations for the full sample[13]. These results are reported in Table 5. The models in Table 5 explain integration rather well, as the R-square results are between 64% and 68%. We can observe that several factors remain consistent across the estimations, namely, equity market openness, investment profile, international political risk, French legal origin, exchange rate, market turnover, past GDP growth, TED spread, VIX, the number of telephones, life expectancy, population growth and the trend. Of these factors, the only inconsistent signs occur with VIX, which has a positive sign for the monthly data but a negative sign for the annual data, which is most likely due to measurement frequency. In most cases, the coefficients have the expected signs, but in two cases, the results seem slightly counterintuitive: the negative effect on integration from improvements in the international political risk environment and positive past GDP growth. When the data are divided into developed and emerging countries, we find that for the developed countries, the institutional and market-development-related factors remain consistently significant across the estimations, while for the emerging markets, the openness of the markets, exchange rate changes, the growth and information variables, the TED spread and the trend remain significant[14].

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13 The results for the developed and emerging market subsamples can be found in Appendix 3, Tables A3.1 and A3.2.

14 It should be noted that we assume that the capital markets in developed countries are open; therefore, the effects of the openness variables on integration dynamics cannot be tested for the developed countries.

TABLE 5 Determinants of Stock Market Integration: Full sample

Dependent variable: Stock market integration			
Full sample	Monthly	Monthly excl. crises	Annual
Variable			
Equity Market Openness	0.1714***	0.1524***	0.1785***
	(0.0296)	(0.0311)	(0.0317)
Investment Profile	0.0190*	0.0280***	0.0229***
	(0.0072)	(0.0060)	(0.0071)
Quality of Institutions		0.0122*	
		(0.0066)	
Political Risk	0.0037**		0.0029
	(0.0018)		(0.0017)
International Political Risk	-0.0274***	-0.0302***	-0.0086**
	(0.0039)	(0.0043)	(0.0033)
Legal origin (French)	0.1168***	0.1219***	0.1294***
	(0.0394)	(0.0430)	(0.0372)
Past Local Equity Market Returns		-0.0517***	0.0175*
		(0.0194)	(0.0097)
Local crisis			0.0346
			(0.0211)
Exchange rate	-0.2186**	-0.2862**	-0.1068***
	(0.0909)	(0.1278)	(0.0359)
Local Market Turnover	0.0005**	0.0005**	0.0005**
	(0.0002)	(0.0002)	(0.0002)
Inflation			-0.0022***
			(0.0006)
Past Local GDP Growth	-0.0071***	-0.0064**	-0.0062***
	(0.0018)	(0.0025)	(0.0019)
World GDP Growth		0.0043	
		(0.0028)	
U.S. Corporate Bond Spread	-0.0291***		
	(0.0086)		
TED Spread	0.0409***	0.0704***	0.1607***
	(0.0068)	(0.0176)	(0.0220)
World Market Volatility	14.8342*		
	(7.5321)		
VIX	0.0028***	0.0023***	-0.0023***
	(0.0006)	(0.0007)	(0.0006)
U.S. Money Growth		-0.0036**	-0.0067***
		(0.0017)	(0.0019)
Number of Telephones	0.0045***	0.0042***	0.0044***
	(0.0012)	(0.0014)	(0.0012)
Life Expectancy (log)	-0.3391*	-0.3689*	-0.3594**
	(0.1711)	(0.1912)	(0.1704)

Population Growth	-0.0139*	-0.0211*	-0.0191**
	(0.0080)	(0.0107)	(0.0085)
Trend	0.0007***	0.0008***	0.0052***
	(0.0002)	(0.0002)	(0.0029)
Intercept	2.9690***	3.4075***	1.7850**
	(0.8042)	(0.9069)	(0.7762)
N	12084	8425	999
R^2	0.66	0.64	0.68

Table reports the relationship between country market integration level and several independent variables, Equation (1), for the full sample with monthly data, monthly data excluding crises periods and annual data. Integration is regressed with the independent variables that have survived the model reduction algorithm described above. For the detailed description of all variables, see Appendix 1 Table A1. Table reports the coefficient estimates from pooled OLS regressions and the clustered standard errors which account for cross-sectional correlation across country indices. *, ** and *** denote statistical significance level at 10%, 5% and 1% levels, respectively. N denotes the number of observations and R^2 is the coefficient of determination.

However, the economic significance of the variables is even more interesting. Table 6 presents the economic significance of the annual variables for each dataset that survived the model selection algorithm and the R-squares of the estimations[15]. Panel A of Table 6 presents the changes in integration level when the independent variable moves from the average value for the emerging markets to the average value for the developed markets. For the global and the U.S. variables, which experience only time-series variation, we examine the response to a one-standard-deviation change. Columns I, II and III refer to the full sample, the developed markets and the emerging markets, respectively. The results show that equity market openness is one of the most important factors for the full sample and for emerging markets, and the development of the information variables is important for all of the datasets. For the developed markets, the investment profile, inflation and the TED spread are the most important factors, while GDP per capita and the political risk profile are important for the emerging markets.

15 To limit the amount of results in the future, we concentrate only on annual data because the annual data can be considered the least affected by the possible excess volatility bias and all of the explanatory variables are measured at annual frequencies.

TABLE 6 Contribution of Integration Variables

Panel A: Effect on integration			
Variable	I	II	III
Equity Market Openness	0.1074		0.0847
Capital Account Openness			-0.0343
Investment Profile	0.0285	0.0531	
Democracy			0.0140
Political Risk	0.0532		0.0464
International Political Risk	-0.0187	-0.0366	
Legal origin (French)	-0.0110	-0.0169	-0.0050
Past Local Equity Market Returns	0.0001	0.0002	0.0001
Local crisis	-0.0034	-0.0074	-0.0049
Exchange rate	0.0053	0.0061	0.0050
Local Market Turnover	0.0161	0.0349	
Private Credit/GDP		-0.0614	
Inflation	0.0450	0.2043	0.0268
GDP per capita (log)			0.0545
Past Local GDP Growth	0.0108	0.0171	0.0035
U.S. Corporate Bond Spread		-0.0495	
TED Spread	0.0688	0.0848	0.0350
World Market Volatility		0.0355	
VIX	-0.0184		
U.S. Money Growth	-0.0252		
Number of Telephones	0.1458	0.1393	
Number of Internet Connections			0.0622
Life Expectancy (log)	-0.0430		-0.0424
Population Growth	0.0120		0.0133
Trend	-0.0124		-0.0117
Panel B: Overall contribution to market integration			
Variable	I	II	III
Equity Market Openness	0.2537		0.1985
Capital Account Openness			-0.0358
Investment Profile	0.1335	0.3533	
Democracy			0.0653
Political Risk	0.1118		0.0891
International Political Risk	0.0061	0.0344	
Legal origin (French)	0.0281	0.2773	0.0003
Past Local Equity Market Returns	0.0016	-0.0001	0.0112
Local crisis	-0.0001	0.0297	0.0235
Exchange rate	0.0164	0.0110	0.0287
Local Market Turnover	0.0515	0.2037	
Private Credit/GDP		-0.0155	
Inflation	0.0422	0.0207	0.0312
GDP per capita (log)			0.1317

Past Local GDP Growth	0.0354	0.0456	0.0084
U.S. Corporate Bond Spread		-0.1249	
TED Spread	0.0514	0.1508	0.0956
World Market Volatility		0.0453	
VIX	-0.0043		
U.S. Money Growth	-0.0051		
Number of Telephones	0.3108	-0.0313	
Number of Internet Connections			0.2450
Life Expectancy (log)	-0.1060		-0.0682
Population Growth	0.0536		0.1194
Trend	0.0196		0.0562
Total variance contribution	1.00	1.00	1.00
N	999	396	566
R^2	0.68	0.54	0.43

Columns I, II and III refer to the full sample, developed markets and emerging markets, respectively. In panel A, we report the effects of each integration variable when it experiences either a change with a value of one standard deviation (for global and the U.S. variables) or the change with a magnitude of the difference between the mean value of developed countries and the mean value of emerging countries (for the rest of the variables). Panel B reports the contributions for each of the explanatory variable to the predicted integration level, defined as the ratio of the covariance between the given variable and the predicted integration level relative to the variance of the predicted integration level. N denotes the country-years and R^2 the coefficient of determination.

To gain a better understanding of the significance of the variables, we examine in Panel B how much of the variation in integration is explained by each of the variables and each variable's individual contribution. First, we calculate the R^2 measure as $\frac{Var(I\hat{n}t_{i,t})}{Var(Int_{i,t})}$, where $I\hat{n}t_{i,t} = \hat{\alpha} + \hat{\beta}' x_{i,t}$, and $x_{i,t}$ is a vector of explanatory variables. The denominator is defined as $Var(Int_{i,t}) = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{T_i}\sum_{t=1}^{T_i}(Int_{i,t} - I\bar{n}t)^2$, where $I\bar{n}t = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{T_i}\sum_{t=1}^{T_i} Int_{i,t}$, and the numerator is defined analogously as $Var(I\hat{n}t_{i,t}) = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{T_i}\sum_{t=1}^{T_i}(I\hat{n}t_{i,t} - I\bar{\hat{n}}t)^2$, where $I\bar{\hat{n}}t = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{T_i}\sum_{t=1}^{T_i} I\hat{n}t_{i,t}$. As can be seen, of the observed market integration of the data, our predicted models explain 43% of the variation for the emerging countries, 54% of the variation for the developed countries and 68% of the variation for the full sample.

To examine the contributions of each of the variables to the overall variation in integration individually, we compute the following covariance:

$$Cov(I\hat{n}t_{i,t}, \hat{\beta}_j x_{i,j,t}) = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{T_i}\sum_{t=1}^{T_i}\hat{\beta}_j(I\hat{n}t_{i,t} - I\bar{\hat{n}}t)(x_{i,j,t} - \bar{x}_j),$$

where $\bar{x}_j$ is the mean of variable $x_{i,j}$ across countries and time. The sum of these covariances should be exactly the variance of the predicted market integration, i.e., the sum of $\sum_j \frac{Cov(I\hat{n}t_{i,t}, \hat{\beta}_j x_{i,j,t})}{Var(I\hat{n}t_{i,t})}$ should be one. These results are reported in Panel B of Table 6, where Columns I, II and III, again refer to full sample, the developed countries and the emerging markets, respectively.

As with Panel A, equity market openness (25% and 20%, respectively) and the development of information variables (31% and 24%, respectively) are the most important variables for the full sample and for the emerging markets. In addition, the investment profile (13%) and political risk (11%) stand out for the full sample, although the latter is statistically significant only at the 15% level. These variables explain 80% of the total variance in the estimated integration and therefore can be considered the most important explanatory variables. For the emerging markets, the logarithm of GDP per capita (13%), population growth (12%), the TED spread (10%) and political risk (9%) (which for emerging markets is significant at the 5% level) are the next most influential variables, accounting for 88% of the total variance (together with openness and the amount of internet connections). For the developed markets, the investment profile is by far the most important variable, explaining more than 35% of the total variance. The investment profile is followed in importance by French legal origin (28%), local market turnover (20%) and the TED spread (15%).

Overall, these results show that while integration has increased over the last thirty years, the variables affecting integration differ between developed and emerging markets. Emerging markets' integration has mostly been affected by the openness of the capital markets, economic development (logarithm of GDP per capita), technological development (number of internet connections) and social development (population growth) as well as decreases in the political risk profile. However, for developed markets, the most important factors affecting integration have been institutional (investment profile and French legal origin) and market-liquidity and efficiency-related (market turnover) factors. Of the global factors, only the TED spread, which reflects global credit risk, was found to be an economically important variable. Contrary to previous studies, we find that a country's financial development plays only a small role in the integration process, and even then, it only applies to developed countries.

The results provide evidence that the higher the stage of economic and technological development and the less the political instability of an emerging market, the greater its integration, i.e., international investors are attracted by these characteristics. However, investors also prefer better investor protections and more efficient financial markets, especially during crisis periods, and these characteristics can be found in developed markets.

6 CONCLUSIONS

Previous research on market integration has found that, although the process is gradual and time-varying, the international markets are becoming more integrated over time. We examine the dynamics of the stock market integration process for 23 developed and 60 emerging economies using a multi-factor integration measure developed by Pukthuanthong and Roll (2009), and we contribute to the growing integration literature in three ways. First, we examine monthly integration behavior during the global financial crisis of 2007-2009, and we find that while general integration decreased during the crisis, it increased for the emerging markets, i.e., global factors explained a greater portion of the market movements in emerging markets during the crisis period. For other global crises, the results vary slightly. However, in general, while markets tend to get more integrated during crisis periods, emerging markets became more segmented or at least the effect of integration was not as high for the emerging markets. These results highlight the unique nature of financial crises in that no two crises can be treated the same. Second, we investigate the role of integration in the spread of the crisis, and we find that greater market integration worked as a catalyst, propagating the global financial crisis across the global markets at the beginning of the crisis. However, there is no evidence that integration's role would have continued throughout the crisis which indicates that integration affected to the wideness of the crisis but not to its depth. Third, we examine the long-term determinants of integration. Our results confirm the finding from previous studies that integration has increased over the last several decades and financial liberalization, the institutional environment and variables related to global financial uncertainty affected the degree of integration. Our results also emphasize the development of information variables, but unlike previous studies, we only find a small role for a country's financial development. The results also vary between developed and emerging market subsamples, as the former are more affected by factors related to the investment environment and market turnover, while for the latter, equity market openness, technological and economic development and improvements in the political risk profile are the more important issues. The results show that economic, po-

litical and technological progress attracts foreign investors to emerging markets, while better investment protection and market liquidity are among the most important reasons to invest in developed markets, especially during periods of higher turmoil.

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APPENDIX 1

A1 Determinants of the Stock Market Integration

To ease the comparison to previous works, we use quite similar explanatory variable set as Bekaert et al. (2011) and divide the variables in several different categories. The justification of most of the factors can already be found from Bekaert et al. (2011) and thus, in the following subsections, we only explain the reasoning behind our additional variables, limitations of our dataset as well as some simplifying assumptions we make.

A1.1 Measures of Openness

As in Bekaert (1995) and Edison and Warnock (2003), equity market openness measure is based upon the ratio of the market capitalization of the Standard and Poor's/International Finance Corporation (S&P/IFC) Investable to the S&P/IFC Global indices in each country. Value of one means that all the stocks in the local market are available to foreigners and a value of zero the exact opposite. Unfortunately, these data are limited such that they are not available for several countries and they are often limited from below to the early- and mid-1990s and from above to year 2008. Also, since the values are from IFC's Emerging market database, the measure is only available for emerging markets. Hence, we make an assumption that the developed markets have completely open equity markets for their whole observation period.

To measure capital account openness, we use the Chinn-Ito financial openness index, which is available for most of our sample countries (see Chinn and Ito (2008) for details and summary statistics of the index). The index attempts to measure regulatory restrictions on capital account transactions and is based on the information from the IMF's Annual Report on Exchange Arrangements and Exchange Regulations (AREAER). Chinn and Ito (2008) calculate the standardized principal component of the several subcomponents affecting the capital openness. The higher the index value, the more open the country is to cross-border transactions. We normalize the index to a unit interval.

For trade openness, we use the binary-measure developed by Sachs et al. (1995) and Wacziarg and Welch (2008). The measure is based on five criteria: high tariff rates, extensive non-tariff barriers, large black-market exchange rate premia, state monopolies on major exports, and socialist economic systems. Country receives a value zero if it meets any of these criteria and is deemed closed, otherwise it gets a value one. However, in our use this measure is problematic as it ends already in 2001 and the last ten years in our sample are not covered. Thus, we make an assumption that as the trade is opened, i.e. the measure gets value one, it will not be closed anymore afterwards. In practice, all our developed markets are open for the whole observation period. Our other

measure for trade openness is the sum of exports and imports as a share of gross domestic product.

A1.2 Political Risk and Institutions

Institutional features and political instabilities could affect to the integration of the markets. Lothian (2006) argues that good policies, such as price stability, fewer direct interventions, property rights protection and sound institutional structures are associated with higher capital flows while bad policies, weak institutions and political risks such as wars, internal conflicts and unexpected changes in the government structure affect negatively to the preferences of foreign investors to invest in a country. In addition, Alfaro, Kalemli-Ozcan and Volosovych (2008) end up concluding that institutional quality is the leading causal variable explaining the differences in global capital flows.

To study the effects of institutions and political environment, we use the political risk component of the International Country Risk Guide (ICRG) and several of its subcomponents separately. Instead of studying just the quality of institutions vector, which combines corruption, law and order, and bureaucracy quality and its first two subcomponents separately, as has been done previously, we also examine the composite political risk index on its own as well as its democratic accountability subcomponent. More information about the composition of these indices can be found from Appendix 1 Table A1. The higher values of the indices are associated with less risk. Our democracy measure aims to capture the executive constraints, their accountability to their electorate as well as free and fair elections with open political participation. These can all be related to sound political structures, which for example prevent sudden political changes. We also add dummies for countries' legal origins (Anglo-Saxon, French, and other). As a final institutional factor, we introduce an international political risk–measure, which is a GDP-weighted sum of political risks across countries divided with global GDP[16]. It aims to capture the current global political uncertainty weighting each country's political risk with its proportion of the global economy. Thus, conflicts in small countries do not change the measure a lot but changes in the political environment of a major economy has more significant effects.

A1.3 Financial Development

We measure the development of the banking sector by the amount of private credit divided by GDP and the development of the stock market with a logarithm of the number of the listed companies and by market capitalization to GDP–ratio. In addition, we also use the market turnover as the value traded relative to GDP to proxy for equity market liquidity and efficiency. These are all standard measures of the financial sector development and widely used in pre-

16 Global GDP is calculated only from the list of countries included in the political risks.

vious literature (see, for example, King and Levine (1993); and Atje and Jovanovic (1993)).

A1.4 Risk Appetite and Business Cycles

Our local and global variables, which aim to capture investor risk appetite and business cycles. Global liquidity is measured with the U.S. broad money supply (M2); and the U.S. corporate bond spread and the Chicago Board Options Exchange Market Volatility (VIX) Index proxy for risk aversion or sentiments of world investors. To measure world business cycle, we include the world GDP growth and the five-year rolling variance of the world market portfolio return. As an additional global variable, which the previous studies have not included, we also add TED spread to reflect global credit risk. All the above variables exhibit only time-series variation as they are based on the U.S. or global data. As of local variables, we include the past returns of the country portfolio to proxy for momentum investing by international investors and the past GDP growth, which aims to capture the economic performance of the previous year and can, hence, affect investors' interests. Inflation has not been used to explain integration in a panel data setting and thus it is included to measure macroeconomic uncertainty. Although the global returns and country specific portfolio returns already capture some of the market behaviour, we also include dummy variables to measure local crises. We follow Mishkin and White (2002), and let the dummy get value 1, if the country's market index drops by more than 20% in a single month during the year in question and is zero otherwise. It can be expected that the local crisis would drive away risk averse international investors and thus, decrease the integration of the market. In addition, as all the returns are measured in the U.S. dollars, they are affected by the exchange rate fluctuations. Thus we include the change in exchange rate of local currency against the U.S. dollar as an explanatory variable. The appreciation of the exchange rate means the depreciation of the domestic currency with respect to the U.S. dollar.

A1.5 Growth and Information Variables

We include the common measures of growth to be included as a part of our explanatory variables: logarithm of GDP per capita, secondary school enrollment, log of life expectancy and population growth. In addition, to control for the information frictions, we also include measures for the number of telephone line subscribers per one hundred people and the number of internet users per hundred people.

TABLE A1 Description of Variables

Variable	Source:	Description:
Integration	Datastream	Integration measures the integration of local stock markets to global markets. Following Pukthuanthong and Roll (2009) the integration is calculated taking principal components of the 18 most developed markets and using 10 first principal components as explanatory variables for daily local market returns. The integration variable for each country-year is the adjusted R-square. For monthly data, a 200-day rolling window is used for estimations. Frequency: Monthly and annual.
Segmentation	Bekaert et al. (2011)	Segmentation measures the value-weighted average of the absolute difference between country's local industry earnings yield and the corresponding global industry earnings yield. Availability: Developed markets: 1987-2009, Emerging markets: 1987-2005. Frequency: Monthly and annual.
Crisis periods		Global financial crisis: 8/2007 – 6/2009 and 9/2008 – 6/2009. Asian financial crisis and LTCM: 10/1997-12/1998. Dot-com bubble: 10/2000-12/2002.
U.S. recession periods	NBER	Periods: 6/1990-3/1991, 3/2001-11/2001 and 12/2007-6/2009.
Openness		
Capital account openness	Chinn-Ito (2008)	Chinn-Ito (2008) capital openness index normalized to an interval [0,1]. Chinn and Ito measure the capital account openness as a standardized principal component of the capital account restrictions presented in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions.
Equity market openness	Emerging Market Database, S&P/Compustat	The equity market openness measure is based on the ratio of the market capitalization of the constituent firms composing the International Financial Corporation (IFC) Investable index to those that compose the IFC Global index for each country. The IFC Global index is designed to capture the overall market portfolio for each country, whereas the IFC Investable index is designed to represent a portfolio of domestic equities that are available to foreign investors. A ratio of one means that all of the stocks are available to foreign investors while a value of zero means that the market is completely closed from foreigners. Frequency: Annual.
Trade openness	Wacziarg and Welch (2008)	The trade measure from Wacziarg and Welch (2008) used for example in Bekaert et al. (2012). Wacziarg and Welch look at five factors: average tariff rates of 40% or more; non-tariff barriers covering 40% or more of trade; a black market exchange rate that is depreciated by 20% or more relative to the official exchange rate, on average, during 1970s and 1980s; a state monopoly on major exports; and a socialist economic system. Country gets a value zero if it meets any of these criteria, otherwise one.

Trade/GDP	WDI	The sum of exports and imports of goods and services measured as a share of gross domestic product. Frequency: Annual.
Political Risk and Institutions		
Political Risk	ICRG	The sum of ICRG political risk sub components excluding democratic accountability. Frequency: Annual.
Quality of intstitutions	ICRG	The sum of ICRG subcomponents: Corruption, Law and Order, and Bureaucracy quality. Frequency: Annual.
Conflicts and Tensions	ICRG	The sum of ICRG subcomponents: Internal conflict, External conflict, Ethnic tensions, and Religious tensions. Frequency: Annual.
Government stability	ICRG	ICRG political risk subcomponent. Measures both, government's ability to carry out its declared programs and its ability to stay in office. The measure consists of three subcomponents, each scored 0-4 points: Government unity, Legislative strength and Popular support. Thus the data ranges from 0-12 points, higher number denoting lower risk. Frequency: Annual.
External conflicts	ICRG	ICRG political risk subcomponent. Measures the risk of the foreign actions to the governance. The actions could range from diplomatic pressures, trade restrictions, sanctions etc to violent external pressure. The variable is measured with three subcomponents ranging from 0-4: War, Cross-border conflict and Foreign pressures. The maximum points 12 denote very low risk. Frequency: Annual.
Internal conflicts	ICRG	ICRG political risk subcomponent. Measures the political violence and its actual or potential impacts to governance with three subcomponents, each scored 0-4 points: Civil War/Coup threat, Terrorism/Political violence, Civil disorder. Maximum points 12 denote very low risk. Frequency: Annual.
Ethnic tensions	ICRG	ICRG political risk subcomponent. The component is an assessment of the degree of tension within a country attributable to racial, nationality or language divisions. Higher ratings are given to countries where tensions are minimal while lower ratings are given to countries where racial and nationality tensions are high because opposing groups are intolerant and unwilling to compromise. Maximum points are 6. Frequency: Annual.
Military in politics	ICRG	ICRG political risk subcomponent. Assesses in what measure military is involved in politics with 0-6 point scale. The higher the number, the lower the military participation to the politics and the lower the risk. Frequency: Annual.
Religion in politics	ICRG	ICRG political risk subcomponent. Measures with a scale of 0-6 points whether single religious group is able to affect country's politics. The higher the number, the lower the single religion

		group's effect. Frequency: Annual.
Sosio-economic conditions	ICRG	ICRG political risk subcomponent. Measures sosioeconomic pressures in society that could affect government actions or fuel social dissatisfaction with three subcomponents scored 0-4: Unemployment, Consumer confidence and Poverty. Maximum points 12 denote very low risk. Frequency: Annual.
Investment profile	ICRG	ICRG political risk subcomponent. Measures the factors of investment risks that are not covered by other political, economic and financial risk components with three subcomponents scored 0-4: Contract viability/Expropriation, Profits repatriation, Payment delays. Maximum points 12 denote very low risk. Frequency: Annual.
Bureaucracy quality	ICRG	ICRG political risk subcomponent. Measures whether the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services. In low risk countries, the bureaucracy tends to be somewhat autonomous from political pressure and to have an established mechanism for recruiting and training. Maximum points: 4. Frequency: Annual.
Corruption	ICRG	ICRG political risk subcomponent. Measures the corruption within the political system with a scale of 0-6, the higher points denoting less corruption. Frequency: Annual.
Law and order	ICRG	ICRG political risk subcomponent. Law and order are assessed separately, with each sub-component consisting of zero to three points. The Law sub-component is an assessment of the strength and impartiality of the legal system, while the Order subcomponent is an assessment of popular observance of the law. Thus a country can enjoy a high rating (3) in terms of its judicial system, but a low rating (1) if it suffers from a very high crime rate or if the law is routinely ignored without effective sanction. The higher number denotes lower risk. Frequency: Annual.
Legal origin	La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997)	Dummy variables capturing the origin of the company law or commercial code of each country (English, French or other).
International political risk	ICRG and WDI	GDP weighter sum of political risks across countries divided with global GDP. Frequency: Annual.
Financial Development		
Equity market turnover	WDI	The ratio of equity market calue traded to the market capitalization. Frequency: Annual.

Private credit/GDP	WDI	Private credit divided by gross domestic product. Credit to private sector refers to financial resources provided to the private sector, suc as through loans, purchases of non-equity securities, and trade credits and other accounts receivable that establish a claim for repayment. Frequency: Annual.
MCAP/GDP	WDI	Equity market capitalization divided by gross domestic product. Frequency: Annual.
Number of public firms	WDI	The log of the number of publicly traded firms in a given country. Frequency: Annual.
Risk Appetite and Business Cycle		
U.S. Money supply growth	WDI	Annual growth in money supply (M2) for the United States. Frequency: Annual.
World GDP Growth	WDI	Growth of real world per capita gross domestic product. Frequency: Annual.
U.S. Corporate bond spread	Federal Reserve Bank of St. Louis.	The yield spread between U.S. Baa and Aaa rated bond spreads. Frequency: Monthly and annual.
VIX option volatility index	Chicago Board Options Exchange	The VIX option volatility index available from the CBOE (http://www.cboe.com). Frequency: Monthly and annual..
TED spread	Federal Reserve Bank	The difference between the interest rates for the three-month Eurodollars contracts and the three-month Treasury bill interest rate. Frequency: Monthly and annual.
Past local equity market return	Datastream	The lagged annual return, from December to December, on the country-level market portfolio. Available for all countries. Frequency: Monthly and annual.
World equity market volatility	Datastream	The variance of the world market portfolio returns, measures as the five-year rolling variance of the monthly return on the world market portfolio. Frequency: Monthly and annual..
Local Crisis	Datastream	Dummy variable gets value one if the local market has experienced a 20% drop during a single month in a year. Frequency: Monthly and annual.
Past GDP growth	WDI	Lagged annual percentage growth rate of GDP. Frequency: Annual.
Inflation	WDI	Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a

		whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. Frequency: Annual.
Exchange rate change	Datastream	Exchange rate is measured against the U.S. dollar. The appreciation of the exchange rate means the depreciation of the domestic currency with respect to the U.S. dollar. Frequency: Monthly and annual.
Information variables		
Phone lines per 100 people	WDI	Number of fixed lines and mobile phone subscribers per 100 people. Frequency: Annual.
Internet users per 100 people	WDI	Number of internet users per 100 people. Frequency: Annual.
Growth determinants		
log GDP per capita	WDI	Logarithm of real per capita gross domestic product measured as current US dollars. Frequency: Annual.
Secondary school enrollment	WDI	Secondary school enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the secondary level of education. Accordingly, the reported value can exceed (or average) 100%. Frequency: Annual.
Log life expectancy	WDI	Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Frequency: Annual.
Population growth	WDI	Growth rate ot total population that counts all residents regardless of legal status or citizenship. Frequency: Annual.

NBER is the National Bureau of Economic Research. WDI refers to World Bank's World Development Indicators and ICRG to the International Country Risk Guide by the Political Risk Services.

APPENDIX 2

TABLE A2 Country Indices and the Descriptive Statistics of Annual Integration

Emerging markets								
Country	Index	First observation	Years	t-stat	mean	standard deviation	min	max
Argentina	ARGENTINA MERVAL - PRICE INDEX (~U$)	1990	22	4.91	0.254	0.233	0.009	0.681
Bahrain	DOW JONES BAHRAIN - PRICE INDEX (~U$)	2000	12	0.29	0.013	0.038	-0.034	0.104
Bangladesh	BANGLADESH SE ALL SHARE PRICE - PRICE INDEX (~U$)	1990	22	-3.90	0.022	0.045	-0.030	0.155
Botswana	S&P BOTSWANA BMI - PRICE INDEX (~U$)	1996	16	5.41	0.100	0.130	-0.022	0.376
Brazil	MSCI BRAZIL - TOT RETURN IND (~U$)	1988	24	8.58	0.235	0.291	-0.025	0.741
Bulgaria	BULGARIA SE SOFIX - PRICE INDEX (~U$)	2001	11	4.80	0.221	0.172	0.017	0.466
Chile	CHILE SANTIAGO SE GENERAL (IGPA) - PRICE INDEX (~U$)	1987	25	6.67	0.261	0.196	0.000	0.641
China	SHANGHAI SE A SHARE - PRICE INDEX (~U$)	1992	20	3.85	0.074	0.108	-0.017	0.316
Colombia	COLOMBIA-DS Market - TOT RETURN IND (~U$)	1993	8	1.41	0.398	0.204	-0.037	0.558
Cote d'Ivoire	S&P COTE D'IVOIRE BMI - TOT RETURN IND (~U$)	1996	9	2.61	0.199	0.103	0.065	0.363
Croatia	CROATIA CROBEX - PRICE INDEX (~U$)	1997	15	4.30	0.248	0.220	0.011	0.626
Cyprus	CYPRUS GENERAL - PRICE INDEX (~U$)	2005	7	1.23	0.359	0.168	0.087	0.581
Czech	CZECH REP.-DS Market - TOT RETURN IND (~U$)	1994	18	6.09	0.348	0.217	0.061	0.693
Ecuador	ECUADOR ECU (U$) - PRICE INDEX (~U$)	1994	18	-1.50	-0.002	0.028	-0.054	0.067
Egypt	EGYPT HERMES FINANCIAL - PRICE INDEX (~U$)	1995	17	3.66	0.064	0.120	-0.035	0.328
Estonia	OMX TALLINN (OMXT) - PRICE INDEX (~U$)	1997	15	5.21	0.289	0.170	0.030	0.619
Ghana	S&P GHANA BMI - PRICE INDEX (~U$)	1996	16	-0.42	0.004	0.041	-0.039	0.109
Greece	ATHEX COMPOSITE - PRICE INDEX (~U$)	1989	23	5.04	0.322	0.200	0.042	0.724
Hungary	BUDAPEST (BUX) - PRICE INDEX (~U$)	1991	21	6.76	0.336	0.215	0.065	0.721
India	INDIA BSE (100) NATIONAL - PRICE INDEX (~U$)	1987	25	7.53	0.155	0.197	-0.023	0.566

Indonesia	MSCI INDONESIA U$ - PRICE INDEX (~U$)	1988	24	6.13	0.219	0.218	-0.021	0.654
Israel	ISRAEL TA 100 - PRICE INDEX (~U$)	1988	24	5.00	0.208	0.164	0.000	0.530
Jamaica	JAMAICA SE MAIN INDEX - PRICE INDEX (~U$)	1988	24	-1.77	0.016	0.043	-0.034	0.182
Jordan	AMMAN SE FINANCIAL MARKET - PRICE INDEX (~U$)	1989	23	-1.23	0.035	0.061	-0.029	0.188
Kazakhstan	MSCI KAZAKHSTAN U$ - TOT RETURN IND (~U$)	2006	6	0.57	0.289	0.155	0.072	0.502
Kenya	KENYA NAIROBI SE (NSE20) - PRICE INDEX (~U$)	1990	22	1.12	0.021	0.028	-0.021	0.074
Kuwait	KUWAIT KIC GENERAL - PRICE INDEX (~U$)	1995	17	1.40	0.023	0.032	-0.028	0.097
Latvia	OMX RIGA (OMXR) - TOT RETURN IND (~U$)	2000	12	4.24	0.148	0.134	-0.006	0.407
Lebanon	S&P LEBANON BMI - TOT RETURN IND (~U$)	2001	4	1.38	0.044	0.063	0.007	0.139
Lithuania	OMX VILNIUS (OMXV) - TOT RETURN IND (~U$)	2000	12	3.12	0.312	0.172	0.114	0.580
Malaysia	FTSE BURSA MALAYSIA KLCI - PRICE INDEX (~U$)	1987	25	-0.91	0.399	0.221	0.024	0.736
Malta	MALTA SE MSE - PRICE INDEX (~U$)	1996	16	2.31	0.228	0.113	0.004	0.394
Mauritius	S&P MAURITIUS BMI - PRICE INDEX (~U$)	1996	16	1.99	0.036	0.074	-0.057	0.192
Mexico	MEXICO IPC (BOLSA) - PRICE INDEX (~U$)	1988	24	8.12	0.377	0.234	0.005	0.788
Morocco	MOROCCO SE CFG 25 - PRICE INDEX (~U$)	1988	24	2.98	0.152	0.113	-0.015	0.447
Namibia	S&P NAMIBIA BMI - PRICE INDEX (~U$)	2001	11	10.70	0.284	0.215	-0.004	0.530
Nigeria	S&P NIGERIA BMI - PRICE INDEX (~U$)	1996	16	1.40	0.001	0.027	-0.031	0.064
Oman	OMAN MUSCAT SECURITIES MKT. - PRICE INDEX (~U$)	1997	15	2.45	0.037	0.066	-0.025	0.199
Pakistan	KARACHI SE 100 - PRICE INDEX (~U$)	1989	23	0.50	0.029	0.036	-0.045	0.108
Peru	LIMA SE GENERAL(IGBL) - PRICE INDEX (~U$)	1991	21	4.77	0.199	0.167	0.009	0.571
Philippines	PHILIPPINE SE I(PSEi) - PRICE INDEX (~U$)	1987	25	4.09	0.203	0.173	0.032	0.601
Poland	WARSAW GENERAL INDEX - TOT RETURN IND (~U$)	1992	20	6.72	0.370	0.268	-0.001	0.824
Portugal	PORTUGAL PSI GENERAL - PRICE INDEX (~U$)	1988	24	5.61	0.533	0.197	0.148	0.852
Qatar	MSCI QATAR $ - TOT RETURN IND (~U$)	2006	6	1.62	0.123	0.080	0.016	0.203
Romania	ROMANIA BET (L) - PRICE INDEX (~U$)	1998	14	7.00	0.224	0.261	-0.021	0.635

Russia	RUSSIA RTS INDEX - PRICE INDEX (~U$)	1996	16	4.44	0.321	0.226	-0.016	0.657
Saudi Arabia	S&P SAUDI ARABIA $ - TOT RETURN IND (~U$)	1998	14	2.50	0.058	0.080	-0.024	0.225
Slovakia	SLOVAKIA SAX 16 - PRICE INDEX (~U$)	1994	18	3.63	0.108	0.087	-0.013	0.280
Slovenia	MSCI SLOVENIA - TOT RETURN IND (~U$)	2003	9	2.71	0.271	0.212	0.037	0.602
South Africa	SOUTH AFRI-DS Market - TOT RETURN IND (~U$)	1987	25	3.83	0.386	0.223	0.055	0.708
South Korea	MSCI KOREA U$ - PRICE INDEX (~U$)	1988	24	11.69	0.286	0.268	-0.025	0.703
Sri Lanka	COLOMBO SE ALL SHARE - PRICE INDEX (~U$)	1987	25	0.08	0.022	0.043	-0.027	0.168
Thailand	THAILAND-DS MARKET $ - TOT RETURN IND (~U$)	1987	25	2.67	0.239	0.137	0.018	0.498
Trinidad	S&P TRINIDAD & TOBAGO BMI - PRICE INDEX (~U$)	1996	15	-0.06	0.033	0.056	-0.050	0.165
Tunisia	TUNISIA TUNINDEX - PRICE INDEX (~U$)	1998	14	0.88	0.204	0.106	0.077	0.403
Turkey	ISTANBUL SE NATIONAL 100 - PRICE INDEX (~U$)	1988	24	6.26	0.200	0.223	0.002	0.653
UAE	MSCI UAE $ - PRICE INDEX (~U$)	2006	6	1.60	0.151	0.109	-0.018	0.276
Ukraine	S&P UKRAINE BMI - PRICE INDEX (~U$)	1999	13	3.53	0.108	0.197	-0.031	0.647
Venezuela	VENEZUELA-DS Market - TOT RETURN IND (~U$)	1990	22	-0.22	0.025	0.058	-0.028	0.181
Vietnam	MSCI VIETNAM U$ - TOT RETURN IND (~U$)	2007	5	0.00	0.086	0.061	0.014	0.155

Developed markets

Country	Index	First observation	Years	t-statistic	mean	standard deviation	min	max
Australia	AUSTRALIA-DS Market - TOT RETURN IND (~U$)	1987	25	5.03	0.467	0.193	0.144	0.804
Austria	AUSTRIA-DS Market - TOT RETURN IND (~U$)	1987	25	3.60	0.556	0.182	0.277	0.890
Belgium	BELGIUM-DS Market - TOT RETURN IND (~U$)	1987	25	4.93	0.666	0.169	0.382	0.928
Canada	S&P/TSX COMPOSITE INDEX - TOT RETURN IND (~U$)	1987	25	3.07	0.475	0.199	0.021	0.797
Denmark	DENMARK-DS Market - TOT RETURN IND (~U$)	1987	25	4.43	0.558	0.163	0.318	0.880
Finland	OMX HELSINKI (OMXH) - TOT RETURN IND (~U$)	1991	21	7.44	0.595	0.202	0.233	0.918
France	FRANCE-DS Market - TOT RETURN IND (~U$)	1987	25	6.95	0.764	0.200	0.289	0.981
Germany	DAX 30 PERFORMANCE - TOT RETURN IND (~U$)	1987	25	6.60	0.742	0.138	0.446	0.937
Hong Kong	HONG KONG-DS Market - TOT RETURN IND (~U$)	1987	25	4.53	0.469	0.158	0.186	0.765

Iceland	OMX ICELAND ALL SHARE - PRICE INDEX (~U$)	1993	19	3.30	0.163	0.126	0.011	0.518
Ireland	IRELAND-DS Market - TOT RETURN IND (~U$)	1987	25	3.20	0.512	0.174	0.234	0.886
Italy	ITALY-DS Market - TOT RETURN IND (~U$)	1987	25	6.07	0.622	0.283	0.134	0.948
Japan	TOPIX - TOT RETURN IND (~U$)	1987	25	1.20	0.314	0.135	0.057	0.589
Luxembourg	LUXEMBURG-DS Market - TOT RETURN IND (~U$)	1992	20	1.47	0.296	0.147	0.031	0.639
Netherlands	NETHERLAND-DS Market - TOT RETURN IND (~U$)	1987	25	6.08	0.797	0.127	0.530	0.971
New Zealand	NEW ZEALAND-DS MARKET $ - TOT RETURN IND (~U$)	1988	24	4.49	0.417	0.180	0.127	0.767
Norway	NORWAY-DS MARKET $ - TOT RETURN IND (~U$)	1987	25	4.19	0.529	0.173	0.258	0.878
Singapore	SINGAPORE-DS Market - TOT RETURN IND (~U$)	1987	25	2.38	0.486	0.176	0.190	0.780
Spain	MADRID SE GENERAL (IGBM) - PRICE INDEX (~U$)	1987	25	6.28	0.674	0.195	0.309	0.925
Sweden	OMX STOCKHOLM (OMXS) - PRICE INDEX (~U$)	1987	25	6.40	0.624	0.179	0.313	0.912
Switzerland	SWITZ-DS Market - TOT RETURN IND (~U$)	1987	25	2.43	0.698	0.121	0.446	0.860
UK	UK-DS MARKET $ - TOT RETURN IND (~U$)	1987	25	6.46	0.643	0.175	0.352	0.900
USA	S&P 500 COMPOSITE - DS TOT RETURN IND (~U$)	1987	25	4.06	0.389	0.199	0.018	0.685

The table reports countries divided into emerging and developed market groups, their corresponding indices and the first full observation years and the number of observation years. In total, there are 60 emerging market indices and 23 developed market indices. Whenever possible, a total return index is preferred to a price index. All the indices have been converted into the U.S. dollars. In addition, for each market, the table lists the t-statistics from the simple linear time trend test, the mean integration level and its standard deviation, as well as minimum and maximum values.

APPENDIX 3

TABLE A3.1 Determinants of Stock Market Integration: Developed markets

Dependent variable: Stock market integration			
Developed markets	Monthly	Monthly excl. crises	Annual
Variable			
Investment Profile	0.0507***	0.0505***	0.0427***
	(0.0077)	(0.0086)	(0.0089)
International Political Risk	-0.0478***	-0.0496***	-0.0170***
	(0.0047)	(0.0058)	(0.0057)
Legal origin (French)	0.1979***	0.2007***	0.1993***
	(0.0356)	(0.0369)	(0.0358)
Past Local Equity Market Returns	0.0626*		0.0447***
	(0.0354)		(0.0141)
Local crisis	-0.0458*		0.0742*
	(0.0265)		(0.0377)
Exchange rate			-0.1233**
			(0.0502)
Local Market Turnover	0.0009*	0.0011**	0.0011*
	(0.0005)	(0.0005)	(0.0005)
Private Credit/GDP	-0.0006*	-0.0008**	-0.0010**
	(0.0003)	(0.0004)	(0.0004)
Inflation			-0.0101
			(0.0065)
Past Local GDP Growth			-0.0098
			(0.0060)
World GDP Growth	-0.0069**		
	(0.0029)		
U.S. Corporate Bond Spread	-0.0251*		-0.0918***
	(0.0146)		(0.0221)
TED Spread		0.0468*	0.1981***
		(0.0245)	(0.0354)
World Market Volatility		28.7773	0.4796**
		(18.6082)	(0.2109)
VIX	0.0050***	0.0037***	
	(0.0008)	(0.0010)	
Number of Telephones	0.0040	0.0046*	0.0042
	(0.0025)	(0.0024)	(0.0025)
School Enrollment	0.0014*	0.0016	
	(0.0008)	(0.0010)	
Population Growth	-0.0825**	-0.0743*	
	(0.0388)	(0.0404)	
Intercept	3.3605***	3.3548***	1.1738***
	(0.3613)	(0.4687)	(0.3831)

N	4818	3534	396
R^2	0.56	0.58	0.57

Table reports the relationship between country market integration level and several independent variables, equation 1, for developed markets with monthly data, monthly data excluding crises periods and annual data. Integration is regressed with the independent variables that have survived the model reduction algorithm. For the detailed description of all variables, see Appendix 1, Table A1.1. Table reports the coefficient estimates from pooled OLS regressions and the clustered standard errors which account for cross-sectional correlation across country indices. *, ** and *** denote statistical significance level at 10%, 5% and 1% levels, respectively. N denotes the number of observations and R^2 is the coefficient of determination.

TABLE A3.2 Determinants of Stock Market Integration: Emerging markets

Dependent variable: Stock market integration			
Emerging markets	Monthly	Monthly excl. crises	Annual
Variable			
Equity Market Openness	0.1435***	0.1194***	0.1407***
	(0.0211)	(0.0221)	(0.0234)
Capital Account Openness		-0.0421	-0.0872**
		(0.0275)	(0.0358)
Trade Openness		0.0529***	
		(0.0193)	
Democracy	0.0133**	0.0151*	0.0101
	(0.0065)	(0.0077)	(0.0061)
Political Risk	0.0026**		0.0025**
	(0.0011)		(0.0012)
International Political Risk	-0.0083*	-0.0145***	
	(0.0041)	(0.0038)	
Legal origin (French)		0.0460**	0.0586**
		(0.0200)	(0.0237)
Past Local Equity Market Returns	-0.0309**		0.0205**
	(0.0148)		(0.0092)
Local crisis		-0.0198	0.0489**
		(0.0127)	(0.0198)
Exchange rate	-0.1196*	-0.1988**	-0.1008**
	(0.0658)	(0.0777)	(0.0408)
Private Credit/GDP	0.0007**	0.0009***	
	(0.0003)	(0.0003)	
Trade/GDP	-0.0004*		
	(0.0002)		
Inflation		-0.0001	-0.0013***
		(0.0001)	(0.0004)
GDP per capita (log)			0.0266**

			(0.0125)
Past Local GDP Growth	-0.0037**	-0.0039**	-0.0020*
	(0.0015)	(0.0015)	(0.0012)
TED Spread	0.0236**	0.0543**	0.0817***
	(0.0095)	(0.0213)	(0.0177)
VIX	0.0016**		
	(0.0007)		
Number of Internet Connections	0.0025***	0.0023***	0.0030***
	(0.0008)	(0.0009)	(0.0007)
Life Expectancy (log)	-0.1951**	-0.2763***	-0.3543***
	(0.0766)	(0.0859)	(0.1254)
Population Growth	-0.0156***	-0.0407***	-0.0211***
	(0.0054)	(0.0086)	(0.0052)
Trend	0.0006**	0.0005**	0.0049*
	(0.0002)	(0.0002)	(0.0025)
Intercept	1.1830**	2.1616***	1.0839**
	(0.4753)	(0.4819)	(0.4912)
N	6902	4068	566
R^2	0.45	0.47	0.49

Table reports the relationship between country market integration level and several independent variables, equation 1, for emerging markets with monthly data, monthly data excluding crises periods and annual data. Integration is regressed with the independent variables that have survived the model reduction algorithm. For the detailed description of all variables, see Appendix 1, Table A1.1. Table reports the coefficient estimates from pooled OLS regressions and the clustered standard errors which account for cross-sectional correlation across country indices. *, ** and *** denote statistical significance level at 10%, 5% and 1% levels, respectively. N denotes the number of observations and R^2 is the coefficient of determination.

CHAPTER 3

DEMOCRACY, POLITICAL RISK AND STOCK MARKET PERFORMANCE[17]

Abstract
This study proposes that the level of democracy and political risk have an impact on the emerging stock market performance. We show new evidence that the relationship between the level of democracy and political risk is parabolic i.e., there is a threshold level of democracy after which political risk begins to decline that is reflected in stock prices. Using annualized panel data for 38 emerging markets and controlling for several domestic and international factors, we find fairly robust evidence that this relationship holds during the 2000-2010 period; after passing a democracy threshold, the more democratic countries produce higher returns. Moreover, we report evidence that decreases in political risk lead to higher returns and identify several variables that contribute to the annual returns of emerging stock markets. We also test whether the polynomial relationship between democracy and political risk can help explain stock market crises, but we find no significant results for that proposition.

Keywords : Democracy, Political risk, Emerging markets, Stock market performance

JEL classification: G15, G12, F52

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1 INTRODUCTION

The beginning of 2011 witnessed the Arab Spring, which consisted of large pro-democracy demonstrations against dictatorships in the MENA region that even escalated to civil war in Libya. The riots began in Tunisia and spread to Egypt, Libya and several other countries leading to political instability in the entire area. Because the unrest seemed to be transmitted from one country to another, investors became more and more worried; for example, on January 27, 2011, Egypt's benchmark index, the EGX 30, dived 10% and even the world's major markets in the USA, Europe and Asia tumbled because the protests were expected to continue moving to other oil producer countries in the area. The unrest in Egypt lasted for all of 2011 because the Egyptian military, which seized control of the government after the revolution, refused to release power to the democratically elected government. Between January 3, 2011 and January 2, 2012, the EGX 30 index lost almost 50% of its value, dropping from 7073.12 to 3679.96.

In 2006, after several months of political crisis, the Thai military ousted the elected prime minister from power and, together with the ruling elite, appointed a new prime minister in 2008 to lead the country during the next several years, which consisted of more-or-less violent demonstrations between the supporters of the ousted prime minister and his opposition. The political instabilities led foreign investors to reduce their exposure to the Thai market, dragging down prices for a period; however, because the demonstrations remained peaceful, the markets calmed and began to rise.

These are examples of political instabilities that involved democratic institutions and affected investors' willingness to invest in the country's stock markets. The effects of political risk have been found to be statistically significant in emerging stock markets (see, e.g., Erb, Harvey and Viskanta (1996a), Diamonte, Liew and Stevens (1996) and Perotti and van Oijen (2001)). Moreover, it might be expected that ever increasing international capital flows could reinforce the impact of political turmoil on stock markets. Although these studies incorporated democracy as a part of their political risk component, there has not been a study to our knowledge that examined whether democracy can

directly or indirectly affect the long-term behavior of the stock markets[18]. This study aims to fills this gap by investigating the effects of democracy and political risks to the stock market performance for a set of emerging markets. Our approach is to study both the direct and indirect channels of democracy because we argue that the level of democracy affects stock markets directly and via political risk. Several studies on democracy and political risk (see, e.g., Gleditsch and Hegre (1997); Hegre, Ellingsen, Gates, and Gleditsch (2001); Reynal-Querol (2002a,b); and Rock (2009) and their references) have observed that the semi-democracies are more prone to conflicts, corruption and other political risks than full democracies and autocracies. This reflects that the semi-democracies, unlike full democracies and full autocracies, have not yet established strong institutions that might prevent protests and other anti-government activities, which makes these countries more vulnerable to political instabilities. Thus, it might be argued that democratization initially increases political risk and reduces it only after a certain threshold level of democracy has been reached. For this to hold, democracy's relationship with political risk should be described by a U-curve that indicates that the countries at the ends of the curve have smaller political risks than the countries in the middle. This behavior is also shown in Figures 1 and 2, in which the x-axis presents the level of democracy and the y-axis represents the political risk level for several emerging markets. Motivated by this, instead of assuming a simple linear relationship, we use the following quadratic polynomial to represent the relationship between democracy and political risk: $polrisk = \beta_0 + \beta_1 dem + \beta_2 dem^2$, where $polrisk$ denotes the countries' political risk, dem represents the democracy level and dem^2 its square. It is notable in this that although the coefficient β_1 is negative, β_2 is positive, which indicates that, after passing a threshold level, the higher levels of democracy decrease political risk, in this functional form.

[18] However, institutions related to democracy and their stock markets have been studied. The relationship between democratic elections and international stock returns has been examined before by Foerster and Schmitz (1997); Panzalis, Stangeland and Turtle (2000); and Bialkowski, Gottschalk and Wisniewski (2008), for example.

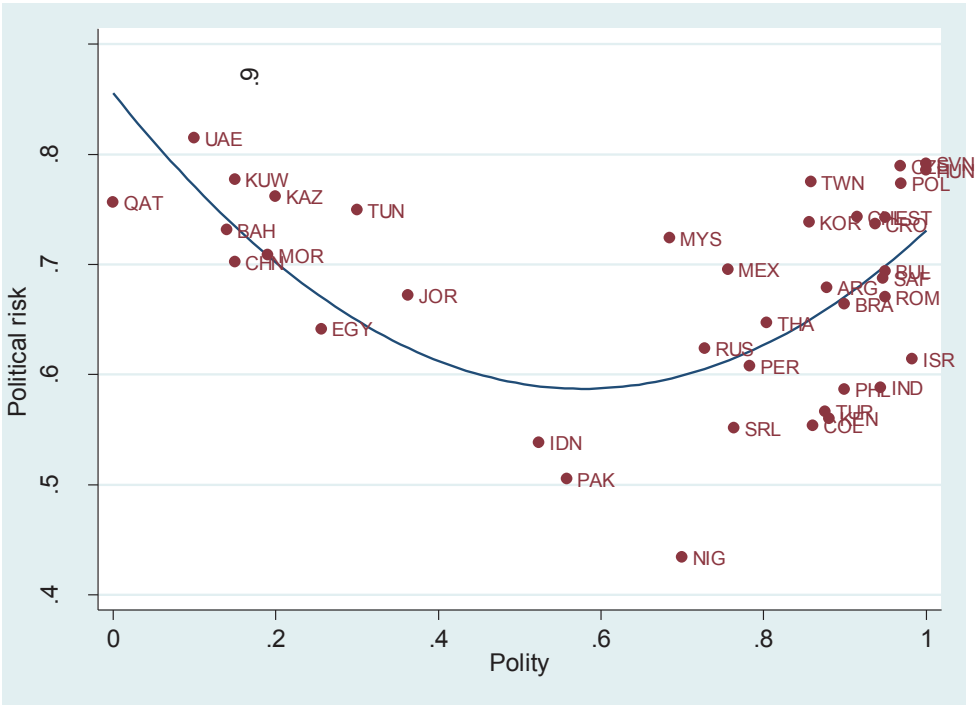

FIGURE 1 Democracy (*polity*) and political risk

The data on democracy measured with *polity* and political risk measured with ICRG averaged over a maximum period of 1988 to 2010 with several starting years (see Table 1 for the starting year for each market). Both measures are normalized to an interval from zero to one, with a higher number indicating more democratic country and lower political risk. In total, there are 39 countries represented. A squared curve is fitted to the data points. The OLS regression of democracy on political risk with both the democracy and its squared value as independent factors yields the following: $polrisk = 0.78 - 0.62 * dem + 0.55 * dem^2$, with p-values of 0.000 and 0.000, respectively, and $R^2 = 0.11$.

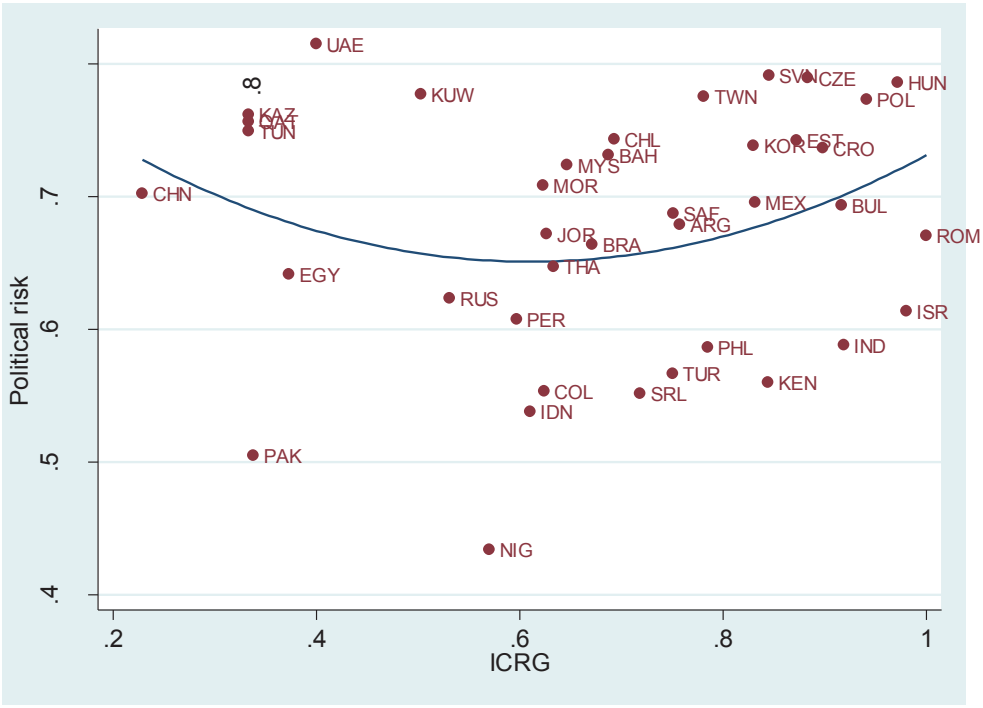

FIGURE 2 Democracy *(icrg)* and political risk.

The data on democracy measured with *icrg* and political risk measured with ICRG averaged over a maximum period of 1988 to 2010 with several starting years (see Table 1 for the starting year for each market). Both of the measures are normalized to an interval from zero to one, where a higher number indicates a more democratic country and lower political risks. In total, there are 39 countries represented. A squared curve is fitted to the data points. The OLS regression of democracy on political risk with both the democracy and its squared value as independent factors yields the following: $polrisk = 0.64 - 0.07 * dem + 0.14 * dem^2$, with p-values of 0.478 and 0.073, respectively, and $R^2 = 0.06$.

The main questions this study aims to answer are as follows: Does democracy have any effect on stock market performance or are these markets immune to the political environment? Are more democratic countries less prone to political instabilities, and does it therefore pay to invest in the stock markets of these countries? We divide the question into the following two subcomponents: (i) Does democracy have any direct or indirect effects on stock market returns? and (ii) Does democracy play any role in local stock market crises? As a by-product of our analysis, we also contribute to the political risk sign paradox and identify several determinants of emerging stock market returns.

There is no commonly accepted theory relating democracy to stock market returns; thus, the issue between their relationship is mainly empirical. On the one hand, consistent with ICRG (International Country Risk Group) classifications, the lack of democracy, or democratic accountability, is part of the total political risk; thus, it should be priced in share prices together with

other risks, following Erb et al. (1996a). On the other hand, Perotti and van Oijen (2001) find that political risk has a positive sign that indicates that politically safer countries have higher excess returns than markets with more political risk; supporting this, Diamonte et al. (1996) posit that portfolios that experienced decreases in their political risk also produced larger returns than portfolios with increased political risk. It could also be argued that democracies are generally associated with better institutions, such as the protection of private property and better enforcement of laws and regulations. However, because democracies are subject to frequent change of government officials, they might be considered as politically more unstable than autocracies with respect to governmental stability and political predictability. Conversely, this attribute might indicate that democracies are better able to adjust to political and economic environments

Aggregate stock market returns are fundamentally related to economic growth. The evidence for the effects of democracy on economic growth are far from unanimous, however. Among others, Tavares and Wacziarg (2001) posit that democracy has both positive and negative effects; after all the effects are accounted for, the total impact is slightly negative. Persson and Tabellini (2007), in turn, find that democracy has positive effects on economic growth. Acemoglu, Johnson, Robinson and Yared (2008) show that, after controlling for factors affecting both democracy and economic growth, the relationship between democracy and growth disappears. Instead, the authors argue that the cross-country correlation between income and democracy reflects only the common development paths of political and economic environment. However, regardless of the potential connection between economic growth and stock market performance, it is possible that democracy and political stability might continue to have a direct impact on stock market performance over and above their impact on economic growth.

We utilize two different sources for measuring democracy, the Polity variable from Polity IV and the democratic accountability subcomponent from the International Country Risk Guide's (ICRG's) political risk component. Political risk itself is quantified by the ICRG's political risk composite index, excluding Democratic accountability (more information on these indices can be found from Section 2 and Appendix 1). In addition to the composite index, we study its subcomponents individually to discover which risks have the most significant effects on stock market performance. These subcomponents are Government stability, Socioeconomic environment, Investment profile, Internal conflicts, External conflicts, Corruption, Military in politics, Religious tensions, Ethnic tensions, Law and order and Bureaucracy quality. We also examine two risk vectors that aggregate several political risk subcomponents. The first is Conflicts and tensions from Internal and External conflicts, in addition to Religious and Ethnic tensions. The second is Quality of institutions, which incorporates Corruption, Law and order and Bureaucracy quality.

As our core sample, we study annual data on 38 emerging markets for the years 2000-2010. Using a large set of control variables for both local and global

factors, we aim to capture both the effects of democracy and its interaction with political risk by using the following three methods: pooled OLS with clustered standard errors and two dynamic panel data models (Arellano and Bond (1991) and Blundell and Bond (1998)). We use a logit model to study the relationship between democracy and market crises and extend the sample period to 1988.

The results do not find consistent and statistically significant direct effects between democracy or its squared term and the world market adjusted returns. Consistent with Perotti and van Oijen (2001), we report some evidence of the positive relationship between political risk and returns because – somewhat counter intuitively – decreases in political risks are shown to be related to higher returns. However, this result is model dependent. In addition, the interaction effects between the democracy level and political risk are negative, whereas those of squared democracy and political risk are positive. Of the control variables, exchange rate changes, development of the local banking and financial sector and the global inflation rate affect emerging market returns. No statistically significant effect of democracy and crises occurrence is found.

In addition to using three estimation methods and two measures for democracy, we also test the robustness of the results with several ways: by altering the observation periods; by using the mean of our democracy measures to quantify democracy; by different estimation method; and by excluding markets from our core sample data based on their political risks and democracy level. The effects of the interaction terms remain rather consistent in our estimations.

The rest of the study is organized as follows. Section 2 presents our data and the descriptive statistics. Section 3 describes our estimation strategy, and section 4 reports the estimation results. Section 5 examines the robustness of the results and section 6 concludes.

2 DATA

The governmental systems and the democracy level of emerging markets varies along the entire autocracy-democracy spectrum from more centrally led systems, such as China, to full democracies, such as Israel, when compared with the more developed countries (that are all closer to full democracies). Because of this and because it has been noted in the previous studies (Diamonte et al. (1996), Erb et al. (1996a), Bilson et al. (2002)) that emerging markets are more vulnerable to political instabilities than developed markets, we concentrate our analysis on emerging stock markets. As our core dataset, because of our estimation strategy and data availability, we utilize an unbalanced panel data on 38 developing countries over the 2000-2010 period. In addition, for the robustness tests and the crisis study, we extend our data to begin in 1988, with several different starting periods, aiming to provide a comprehensive picture of the developing stock markets and their macroeconomic and political environments. Table 1 summarizes the descriptive statistics for our variables.

TABLE 1 Summary statistics

Market	First observation	Local returns	Polity	ICRG	Political Risk	Crisis
Hungary	1995	0.01453	1.000	0.972	0.786	3
Slovenia	2003	0.00545	1.000	0.845	0.791	0
Israel	1993	0.00725	0.983	0.981	0.614	0
Poland	1993	0.01541	0.969	0.941	0.773	5
Czech Republic	1995	0.00910	0.969	0.884	0.789	1
Estonia	2003	0.00940	0.950	0.872	0.742	1
Bulgaria	2006	-0.01653	0.950	0.917	0.694	1
Romania	2006	-0.00383	0.950	1.000	0.670	2
South Africa	1993	0.01229	0.947	0.751	0.687	1
India	1993	0.01102	0.944	0.919	0.588	2
Croatia	2003	0.00654	0.938	0.898	0.737	1
Chile	1988	0.01816	0.915	0.693	0.743	1
Brazil	1988	0.07924	0.900	0.671	0.664	8
Philippines	1988	0.00884	0.900	0.785	0.586	3
Kenya	2003	0.02032	0.881	0.845	0.560	1
Argentina	1988	0.04715	0.878	0.758	0.679	9
Turkey	1988	0.03648	0.876	0.751	0.566	14
Columbia	1993	0.01859	0.861	0.624	0.553	2
Taiwan	1988	0.00578	0.859	0.781	0.775	3
South Korea	1988	0.00780	0.857	0.830	0.738	3
Thailand	1988	0.00766	0.804	0.633	0.647	4
Peru	1993	0.01885	0.783	0.597	0.607	2
Sri Lanka	1993	0.01149	0.764	0.719	0.551	3
Mexico	1988	0.02289	0.757	0.832	0.695	3
Russia	1995	0.01253	0.728	0.531	0.623	7
Nigeria	2003	0.01316	0.700	0.570	0.434	2
Malaysia	1988	0.00825	0.685	0.647	0.724	4
Pakistan	1993	0.01036	0.558	0.338	0.505	4
Indonesia	1988	0.01621	0.524	0.610	0.538	6
Jordan	1988	0.00601	0.363	0.627	0.672	0
Tunisia	2005	0.01614	0.300	0.333	0.749	0
Egypt	1995	0.01762	0.256	0.373	0.641	0
Kazakhstan	2006	0.00627	0.200	0.333	0.762	2
Morocco	1995	0.01024	0.191	0.623	0.708	0
China	1993	0.00006	0.150	0.229	0.702	6
Kuwait	2006	-0.00090	0.150	0.503	0.777	1
Bahrain	2006	-0.01793	0.140	0.688	0.731	2
UAE	2006	-0.02263	0.100	0.400	0.815	3
Qatar	2006	-0.00051	0.000	0.333	0.756	1

Notes: First observation is the starting year of the data for each of the markets. Local returns refer to 12-month mean of local returns of MSCI country indices denominated in local currency. The democracy variables *polity* and *icrg* are from Polity IV and International Country Risk Guide (ICRG), respectively. The data are normalized to lie between zero and one, where a higher number indicates a more democratic country. Political risk is the composite index of ICRG political risk index normalized to an interval from zero to one consisting of 11 subcomponents: Bureaucracy quality, Corruption, Ethnic tensions, External conflicts, Internal conflicts, Government stability, Investment proficiency, Law and Order, Military in politics, Religious tensions and Socioeconomic conditions. The higher number indicates a smaller political risk. The crisis variable indicates in how many years the MSCI

country index has declined more than 20% in a month. The table is sorted according to *polity*.

2.1 Stock market performance

To be included in our dataset, a country must have a functioning stock market with active trading in terms of market capitalization and turnover ratio and at least five years of observations[19]. The fact that most of the emerging markets were founded and opened their stock markets to foreign investors at the beginning of the 1990s limits both the number of suitable markets and the observation period. Our sample period ends in 2010 and has the following six different starting years: 1988 (Argentina, Brazil, Chile, Mexico, Indonesia, South Korea, Jordan, Malaysia, Philippines, Thailand and Turkey), 1993 (China, Colombia, India, Israel[20], Pakistan, Peru, Poland, South Africa and Sri Lanka), 1995 (Czech Republic, Egypt, Hungary, Morocco and Russia), 2003 (Croatia, Estonia, Kenya, Nigeria and Slovenia), 2005 (Tunisia) and 2006 (Bahrain, Bulgaria, Kazakhstan, Kuwait, Qatar, Romania and United Arab Emirates). For each of the above-mentioned markets, we take the MSCI Standard Total Return index, which combines price performance with reinvested dividend payments, and use the MSCI World index to measure the general development of the world's stock markets. All the price data are denominated in local currency. Because the political environment – the main object of interest in this study – is rather rigid, the data frequency is chosen to be annual. We adjust local returns to global returns by regressing the local returns on the world returns over the full sample period and using the 12-month averages of residuals as our dependent variables. As Table 1 shows, local returns have been positive in most of the markets. However, for countries with shorter observation periods, the effects of the global financial crisis of 2007-2009 are visible as negative average returns.

2.2 Democracy

Democracy is a complex political and social phenomenon and as such the concept is challenging to measure accurately. To measure democracy, its attributes must be understood. These include – at the least – free and competitive elections with open political participation and constraints on representatives, in addition to their accountability to their electorate. There has been some criti-

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19 The last condition excludes Ukraine, Vietnam, Lithuania, Serbia, Bangladesh, Ghana and Jamaica from our dataset. We also drop Taiwan because it does not have observations in the World Bank's World Development Indicators.

20 Although MSCI Barra has announced that it will classify Israel as a developed country as of May 2010, we include it in our dataset because it was an emerging market during our sample period.

cism of the typically used measures of democracy (Munck and Verkuilen (2002) provide a comprehensive study of the conceptualization, measuring and aggregating problems related to the measures), and we acknowledge that neither of the measures we use to quantify democracy is perfect. Furthermore, Casper and Tufis (2003) warn that even highly correlated democracy measures can produce different results; thus, researchers must justify their measurement choices carefully. Therefore, to take into account as many aspects of democracy as possible and to address data selection issues, we use two different measures for democracy: the Polity index of Polity IV and the democratic accountability index from the Political Risk Service, published in ICRG. Both of these measures are available for the entire sample period for all of our studied markets. The data from Polity IV are available for free, whereas ICRG data are not.

Our first and primary measure of democracy, the Polity index, *polity*, is the difference between Polity IV's Democracy and Autocracy indices ranging from -10 (full autocracy) to 10 (full democracy). Polity IV's Democracy index measures the competitiveness and openness of executive recruitment, constraints on chief executive representatives and the institutions and procedures that allow citizens to participate in politics. The values range from zero to ten, and a higher rating implies higher levels of democracy. Polity IV's Autocracy index is constructed similar way to the Democracy index and is based on the competitiveness of political participation, the regulation of participation, the openness and competitiveness of executive recruitment and the constraints on the chief executive. Its values range from zero to ten, with a higher value denoting higher autocracy.[21] Although Munck and Verkuillen (2002) list several strengths of the *polity* index, they also argue that the index is too minimalistic in its measurement of democracy because it lacks one important component of political participation (the right to vote) and suffers from redundancy issues in some of its measures and aggregates its components too simply.

As a second measure of democracy, we use the Democratic accountability index, *icrg*, from ICRG. The data measure the level of democracy by examining governance on the basis of how free and fair elections are, the presence of (opposition) political parties, the existence of legal protection of personal liberties and government accountability to its electorate. The index ranges from one to six, with the higher number denoting better democracy.[22]

We also considered one more widely used democracy variable (used, for example, by Barro (1999), Acemogly et al. (2008) and Asiedu and Lien (2011)), the political rights metric by Freedom House, which does not explicitly measure democracy or democratic performance. Instead, it aims to measure rights and freedoms that are related to democracy with a list of 10 questions that range from whether there are free and fair elections to the right to vote and form political parties, whether the opposition has any role to play in government and

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21 For more information about the Polity IV Project, the Polity index and user manual can be found at http://www.systemicpeace.org/inscr/inscr.htm

22 More information about ICRG's democratic accountability index and other risk components can be found at http://www.prsgroup.com/ICRG_Methodology.aspx

whether the freely elected government actually holds power, is free of corruption and is accountable for its actions[23]. The highest ranking of one indicates the highest degree of freedom whereas seven denotes the absence of political rights. Munck and Verkuillen (2002) criticize the usefulness of the index because it includes too many components (some of which are not even relevant to democracy), the measuring and coding of the components is unclear and the aggregation of the components is overly simple. The most serious problem with the Freedom House data in our case is, however, that it incorporates several of the subcomponents (government stability, corruption, foreign and domestic military involvement in politics and ethnic tensions) of our political risk component index into its democracy index; thus, using the Freedom House data as our democracy measure might contaminate our regressions. Freedom House also provides an index for civil liberties but this works no better for us than the political rights index because it includes subcomponents such as socioeconomic conditions, external and internal conflicts, law and order and ethnic tensions. Thus, we exclude the Freedom House's democracy measurement from our dataset.

To ease the comparison between these measures, we follow Barro (1999), Acemogly et al. (2008) and Asiedu and Lien (2011) and normalize the measures between zero and one, with the higher number indicating a more democratic country. Although both of our democracy variables measure slightly different aspects of democracy, their correlation is high at 0.70. However, as Table 1 shows, *polity* presents an average value of 0.56 for Pakistan, whereas *icrg* measures its democracy at a level of 0.34. Conversely, for Bahrain, *polity* shows only 0.14, whereas *icrg*'s average democracy value is 0.69. To account for these differences in the democracy variables, we also consider the average of these measures as our democracy variable as a robustness check.

2.3 Political risk

Political risk does not have one single definition, although it may generally be understood as the risk of unanticipated transformations in the national and international business environment as a result of political changes, such as sudden changes in taxation laws and government policies, foreign and domestic conflicts, in addition to the quality of the governing institutions. Quantifying political risk is difficult, although the events related to it are clearly visible. We rely on ICRG's Political Risk components, which provide a means of assessing the political stability of the countries on a relative basis. The index has been widely used e.g. by Diamonte et al. (1996), Erb et al. (1996a), Bilson et al. (2002), Bekaert et al. (2011) and Asiedu and Lien (2011) to study foreign direct investment and stock market behavior. ICRG's index was originally designed to ana-

[23] Complete checklist questions and guidelines for the Freedom House political rights data can be found at http://old.freedomhouse.org/template.cfm?page=351&ana_page=364&year=2010

lyze potential risks to international business operations but as share-issuing companies face identical risks, the measure can also be used to study stock market behavior. The ICRG index is constructed using subjective staff analysis of available information; in that sense, it can be considered a forward looking measure. Thus, it may be suitable for stock market analyses because share prices reflect expectations of future income. The index is composed of 11 components, including Government stability, External conflicts, Internal conflicts, Ethnic tensions, Military in politics, Religious tensions, Socioeconomic conditions, Investment profile, Bureaucracy quality, Corruption and Law and order (in addition to Democratic accountability as the twelfth, but we study it separately)[24]. The political risk rating is performed by assigning risk points to these components with minimum points being zero and maximum depending on the maximum weight that the particular component is given in the overall political risk assessment, which ranges from 4 to 12, with higher points denoting lower risks. In addition to the political risk composite index, we build two additional risk ratings from its sub-components. The conflicts and tensions component sums the external and internal conflicts with the ethnic and religious tensions, on the one hand, whereas our quality of institutions component follows Bekaert et al. (2011) and sums corruption, law and order, and bureaucratic quality. As with democracy measures, the data are normalized to lie between zero and one. Table 1 presents the political risk component for each of the markets and shows the same as Figures 1 and 2. With the exception of South Korea, the political risk component is slightly higher (i.e., the risk is lower) when the democracy level is either high or low and lower for the countries at the middle parts of the Table 1.

According to the standard portfolio model, investors demand higher return for higher risk; thus, it would be expected that our political risk components would have a negative effect on excess returns, which is actually the case with some of the previous results from Erb et al. (1996a) and Bilson et al. (2002). However, Perotti and van Oijen (2001) find a significant positive relationship between political risk and excess returns (decreases in risks lead to higher returns), which is further supported by the results from Diamonte et al. (1996) and Erb et al. (1996a) that state that emerging countries receiving upgrades to their political risk profile also receive higher returns than those being downgraded. This setting creates a political risk sign paradox because it is unclear what sign the political risk and democracy components should take. One of our intensions is to examine this paradox and study whether political risk is even a significant determinant of returns.

It might be argued that the democracy level is highly correlated with political risks. The political risk component includes a measure for Military in politics, for example, which measures the military's presence (or absence) in the governance system. Because democracies should not have any military presence in their governance, it could be expected that the correlation between these

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[24] More accurate definitions of each of these terms are provided in Appendix 1 Table A1.

two is close to 1. To account for possibly multicollinearity suspicions, we calculate the pairwise correlations between our democracy measures and the political risk component – in addition to its subcomponents – and report these in Table 2. Correlation between democracy and political risk is not high and that even the sign varies between the democracy measures (*polity*: -0.0547, *icrg*: 0.1679). Of the individual subcomponents, Bureaucracy quality has the highest positive correlation, which is followed by Corruption, Military in politics, Investment profile and Religious tensions. Naturally, Government stability has negative and rather low correlation with democracy because of elections. In general, however, the correlations in our basic setting are not too high to affect the estimation results.

TABLE 2 Correlations between democracy and political risk measures

	Polity	ICRG
ICRG	0.7514	
Political risk	-0.0547	0.1679
Bureaucracy quality	0.3896	0.4928
Corruption	0.2399	0.3258
Ethnic tensions	-0.2727	-0.1200
External conflict	-0.0922	0.0056
Internal conflict	0.0085	0.1284
Government stability	-0.5631	-0.5482
Investment profile	0.1881	0.4277
Law and order	-0.2238	0.0371
Military in politics	0.2351	0.4224
Religious tensions	0.2708	0.2652
Socioeconomic conditions	-0.1538	0.0087

2.4 Control variables

Because we are studying return data with yearly frequency, the stock prices compress a large amount of information. We must control changes in both the financial and economic environments in our econometric framework. A significant amount of literature has previously studied the effects of macroeconomic factors and their relationship to equity returns (see e.g., Chen et al. (1986), Flannery and Protopapadakis (2002) and Rapach et al. (2005) and references therein) and has found monthly evidence, for example, that inflation, industrial production, term spread and interest rates are priced factors on the U.S. and other developed markets. However, because emerging markets do not report or do not possess some of these factors that are typically used, our control variables dataset choice is partly dictated by the availability of the reliable data. We aim to control both domestic and foreign factors and capture the countries' current level of economic development with a logarithm of GDP per capita in the U.S.

dollars and annual GDP growth; rate the macroeconomic uncertainty of the economy with inflation measured with a GDP deflator; study the markets' relationship to changes in industrial activity with the change in industrial production; and use the narrow money growth (M1) and broad money growth (M2) metrics to measure the financial development of each country. We also include the exchange rate with the U.S. dollar to measure the foreign exchange exposure for each currency and proxy the stock market openness with the ratio of market capitalization to GDP. To capture the level of banking sector development we include a variable for domestic credit to private sector as a percent of GDP to our dataset and use the equity markets turnover to GDP ratio to proxy market liquidity.

Our global factors aim at capturing fluctuations on the world business cycle and include world inflation, changes in oil prices, world industrial production, the U.S corporate bond spread (Moody's Baa minus Aaa bond yields) and the term-structure spread (U.S. 10-year bond yield minus 3-month U.S. Treasury bill rate).

With the exception of exchange rates, industrial production and world factors, which are provided by Datastream, and the default spread, which is provided by the Federal Reserve Bank of St. Louis, all of the other control variables are obtained from the World Bank's World Development Indicators. See Table A1 in Appendix 1 for details.

2.5 Crises

We define a stock market crisis as a sharp and rapid decrease in a stock index. Following Mishkin and White (2002), we use a 20% decline in a stock index in one month as a threshold to identify a stock market crisis. Instead of studying world-adjusted returns, we decrease MSCI World index returns from local market returns to remove the effects of worldwide stock market crises.

Using this definition and data, we construct an indicator function denoted $I_{i,t}$, which is composed solely of 0s and 1s. For a country i and year t, the indicator gets a value of 1 if, during the year, at least one monthly excess return has experienced a drop of 20% or more. With this measure, we find 111 years that have been characterized by a stock market crisis, and a large part of those are dated in 2008 and 2009; however, the economic problems in Argentina and Brazil at the end of the 1980s and the early 1990s, the effects of the Asian financial crises in 1997 and the Russian crisis in 1998 are clearly visible. Table 1 summarizes the number of years that the markets have declined by more than 20% in one month for each country. Table 1 shows that most of the markets have experienced more than one year with sharp monthly drops (Turkey has 14 of these).

In addition, for crisis study, we reinforce our explanatory variables dataset with a measure of the total reserves as a ratio of broad money, annual GDP growth and the year-by-year change in stock prices.

3 ESTIMATION METHODS

To capture the effects of democracy and political risk on stock market performance, we use several different methods; we begin with a pooled regression (clustering the standard errors across countries) and continue with linear dynamic panel data models that are designed for short, wide panels. These can be used for unbalanced panels and to avoid the dynamic panel data bias in which the models contain unobservable panel-level effects that are correlated with a lagged dependent variable that renders standard errors inconsistent. Models also accommodate multiple endogenous variables by using internal instruments, which makes them a particularly attractive alternative to finding external instruments that remain valid and robust across all panels.

More specifically, together with pooled OLS, we use two GMM-based estimator methods developed by Arellano and Bond (1991), Arellano and Bover (1995) and by Blundell and Bond (1998). The Arellano-Bond estimator takes the first difference of the data and uses the lagged values of the endogenous variables as instruments. That is why it is often referred to as the difference estimator. Arellano and Bover (1995) note, however, that the lagged levels make poor instruments for first differences, particularly if the variables are close to the random walk; thus, they formulated the basis for a new, more efficient estimator, the system GMM, which gained its final form (and the conditions under which the estimator is valid) in Blundell and Bond (1998). System GMM avoids problem of poor instruments by introducing additional moment conditions; Hayakawa (2007) has shown theoretically that system GMM is less biased in small samples than difference GMM. However, Roodman (2009) warns that the downside of both of the estimators – and particularly of the system GMM – is that they use too many instruments, which may give a false sense of certainty because a large number of internal instruments can over-fit the endogenous variables and weaken the Hansen tests for instrument validity. This problem arises when the number of time observations in the dataset increases, in particular. Moreover, Bun and Windmeijer (2010) have shown that the weak instrument problem may be problematic also for the system GMM approach. Even more criticism of the system GMM is aimed at its requirements. For system

GMM to be valid, both the country-fixed effects and omitted variables must be orthogonal to the lagged differences of the right hand side variables that are used as instruments for the level equation. Because neither of these assumptions can be tested, Hauk and Wacziarg (2009) have concluded in their Monte Carlo study that an even larger problem than the weak instruments of the system GMM, is the validity of its moment conditions, which leads to some bias in its results. Despite its shortcomings, because the system GMM can handle the close-to-random-walk stock returns and small samples better than difference GMM, it is used as our main method in the formal econometric tests. However, to increase the credibility of our results, we also report the results from pooled OLS and the difference GMM estimators whenever it is deemed appropriate.

Both dynamic panel data estimation procedures assume that there is no autocorrelation in idiosyncratic errors. Thus, for each regression, we test for autocorrelation and the validity of the instruments and report the p-values for the test for second order autocorrelation and for the Hansen (1982) J-test statistic for overidentifying restrictions. However, as Roodman (2009) notes, the Hansen's test statistic loses power when the number of instruments is large relative to the cross-section sample size (here, the number of countries). A sign of this is a p-value of 1.000 for the Hansen J-statistic. To avoid this, the typical rule of thumb is that the number of instruments, i, should be less than the number of the cross section sample size, n, i.e., the instrument ratio $r = n/i$ should be more than one. When $r < 1$, the assumptions underlying the dynamic panel data models may be violated. Furthermore, a low ratio between sample size and instruments raises the susceptibility of the estimates to a Type 1 error, i.e., significant results are produced even though there is no underlying association between the variables involved. The simplest solution to this problem is to reduce the instrument count. We use two methods to accomplish this. Because the instrument number increases significantly with the length of the sample period, we limit our data sample to begin in the year 2000 and limit the number of lagged levels to be included as instruments by collapsing the instrument set as described by Roodman (2009). However, because it is not clear that $n = i$ really is a threshold level for reliable results, we present the results for both the limited and unlimited instrument sets. In the robustness regressions, we also study different sample periods.

Roodman (2009) also makes an important point that researchers should not interpret the results of the autocorrelation test and Hansen's test based on the conventional significance levels of 0.05 or 0.10. These levels, although useful for defining the significance of the coefficient, are not appropriate when trying to exclude specification problems, which are based on not rejecting the tests. Thus, when the p-value obtains a value only slightly higher than 0.10, this should not be considered as strong evidence for the model.

As our basic estimation method, we use the two-step GMM estimator with Windmeijer (2005) correction in our estimations because it is asymptotically efficient and robust to heteroskedasticity. However, as a robustness test, we also estimate the results with a robust one-step estimator.

4 BENCHMARK REGRESSIONS

This section studies the following question: Does democracy have any effect on stock market performance? The economic reasoning of the equity market dynamics stems loosely from the APT theory. As Equation (1) – the basis of our work – presents, we estimate the impacts of democracy and political risk on stock market performance controlling for a large number of economic and financial variables that we believe to be important for the stock market performance.

$$R_{it} = \beta_0 + \beta_1 dem_i + \beta_2 dem_{it}^2 + \beta_3 polrisk_{it} + \beta_4 dem_{it} * polrisk_{it} + \beta_5 dem_{it}^2 * polrisk_{it} + \beta_6 R_{it-1} + \sum_{j=1}^{J} \gamma_j Z_{ijt} + \theta_i + \varepsilon_{it} \quad (1)$$

where i refers to markets; t to time; θ_i is the country-specific effect; R_{it} is the world market adjusted return of market i at time t; dem is a measure of democracy and dem^2 its square; $polrisk$ refers to different political risks; $dem * polrisk$ and $dem^2 * polrisk$ are the interaction terms; $Z_{ijt}$is a control variables vector comprising of all other potential covariates; and ε_{it} is an error term that captures all other omitted variables, with $E(\varepsilon_{it}) = 0$ for all is. In effect, we are estimating the emerging stock market integration with respect to world returns as a by-product. If the emerging stock markets would be completely integrated $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \gamma_j = 0$ should hold, i.e., global factors would explain all the movements in the returns. The previous studies (e.g., Bekaert (1995), Erb et al. (1996b) and Bekaert et al. (2011)) have indicated that the political factors, in particular, might be of importance for market segmentation.

In all of these forms, the lagged value is included to capture the possible persistency of the left-side variable and the potential mean-reverting dynamics. Our main interest, however, is in the parameters, $\beta_1, \ldots, \beta_5$, which measure the causal effects of democracy, political risk and their interactions on stock market performance.

4.1 Variables affecting emerging stock market performance

Because we have several highly correlated financial, political and economic variables, an estimation of the full model will generate a large amount of insignificant regressors that increase the number of instruments and needlessly inject noise into the estimated model. Thus, our aim is to reduce the number of variables into a more manageable set that best explains the variation in integration. In this task, we follow Bekaert et al. (2011) and Bekaert et al. (2012) and employ general-to-specific algorithm, explained in Hendry and Krolzig (2005). The algorithm constitutes of a process that eliminates variables with coefficient estimates that are not statistically significant over multiple steps. Concretely, we begin by estimating Equation (1) with all variables. We then eliminate the least statistically significant variable by using a significance threshold of 15%. The use of relatively high significance levels reflects the preference of keeping a model with some useless regressors instead of eliminating any important variables. We continue step-by-step estimating the model and excluding the individual variables – simultaneously testing at every step whether an already excluded variable should be included again – until we arrive at a final model specification. However, we make few exceptions in the selection algorithm and leave the previous returns to the model; because we are concentrating on democracy, political risk and their interaction terms, we do not eliminate these variables either, although they might be insignificant.

4.1.1 Direct effects of democracy and political risk

We begin by studying the direct effects of democracy and political risk on stock market performance by estimating Equation (1) without the squared term dem^2 and the interaction terms $dem * polrisk$ and $dem^2 * polrisk$. We present the results for all of our control variables and collapsed instrument set in Table 3 using the *polity* index as our democracy measure in columns (1), (3) and (5); and *icrg* in columns (2), (4) and (6). The columns (1) and (2) in Table 3 report the estimation results from pooled OLS, whereas columns (3) and (4) are from system GMM and columns (5) and (6) are from difference GMM. The dependent variable in all the estimations is the world market adjusted returns.

TABLE 3 The direct effects of democracy and political risk to stock market behavior

	Pooled OLS		System GMM		Difference GMM	
	Polity	ICRG	Polity	ICRG	Polity	ICRG
Dependent variable: Global adjusted returns	(1)	(2)	(3)	(4)	(5)	(6)
Lagged dependent variable	-0.1317**	-0.1346**	-0.0301	-0.0307	-0.0462	-0.0506
	(0.0620)	(0.0618)	(0.0915)	(0.0915)	(0.1000)	(0.1089)
dem	-0.0039	-0.0025	-0.0006	-0.0022	0.0225	0.0678**
	(0.0042)	(0.0040)	(0.0047)	(0.0071)	(0.0189)	(0.0335)
polrisk	-0.0025	-0.0067	0.0299***	0.0317***	0.1235	0.1293
	(0.0117)	(0.0121)	(0.0101)	(0.0103)	(0.0914)	(0.0850)
Inflation	-0.00035*	-0.000289				
	(0.00021)	(0.0002)				
Turnover	0.00003*	0.00003	0.00008***	0.00007***	0.00012**	0.00011**
	(0.00002)	(0.00002)	(0.00002)	(0.00002)	(0.00006)	(0.00005)
GDP growth	0.00066	0.00078*				
	(0.00041)	(0.00041)				
M2			-0.0039***	-0.0039***	-0.0039***	-0.0038***
			(0.0014)	(0.0014)	(0.0010)	(0.0010)
Exchange rate	-0.5000***	-0.5025***	-0.5367***	-0.5397***	-0.3623**	-0.3254*
	(0.1283)	(0.1308)	(0.1473)	(0.1483)	(0.1809)	(0.1757)
Domestic credit	-0.00007*		-0.00016***	-0.00016***	-0.00059**	-0.00066**
	(0.00004)		(0.00006)	(0.00006)	(0.00028)	(0.00029)
Market capitalization	0.00007***	0.00004**	0.00014***	0.00014***	0.00030***	0.00028***
	(0.00002)	(0.00002)	(0.00004)	(0.00004)	(0.00006)	(0.00006)
World Inflation	-0.0027**	-0.0026**	-0.0026**	-0.0026**	-0.0043***	-0.0047***
	(0.0012)	(0.0013)	(0.0010)	(0.0010)	(0.0015)	(0.0015)
Oil price	0.1105**	0.1234**	0.1072**	0.1079**		
	(0.0441)	(0.0462)	(0.0456)	(0.0471)		
World industrial production	0.6817	0.6538			0.6637**	0.6352**
	(0.4090)	(0.4048)			(0.3291)	(0.3140)
Credit spread	-0.0088**	-0.0091**	-0.0077**	-0.0076**		
	(0.0035)	(0.0035)	(0.0032)	(0.0033)		
Constant	0.0273*	0.0259*				
	(0.0153)	(0.0151)				
Number of groups, n			38	38	38	38
Number of instruments, i			20	20	18	18
Instrument ratio, r=n/i			1.90	1.90	2.11	2.11
Number of observations	311	311	314	314	276	276
Hansen J test			[0.250]	[0.238]	[0.249]	[0.156]
AR(2) test			[0.736]	[0.745]	[0.808]	[0.701]
R^2	0.44	0.44				

Notes: Estimation results of Equation (1) without interaction terms with a 12-month average of world market adjusted local returns as dependent variable. The estimations are per-

formed with the following three methods: pooled OLS (columns (1) and (2)), system GMM by Blundell and Bond (1998) (columns (3) and (4)) and difference GMM by Arellano and Bond (1991) (columns (5) and (6)). The base sample is an unbalanced yearly panel data from 2000 to 2010 for 38 emerging stock markets. For more detailed data, definitions and sources, see Appendix 1, Table 1. ***, ** and * denote statistical significance at a 1%, 5% and 10% level, respectively. In the Hansen test, the null hypothesis is that the instruments are not correlated with residuals, whereas in the AR(2) test, the null hypothesis is that the errors in the first difference regression exhibit no second order serial correlation. Heteroskedasticity robust standard errors are in parenthesis.

As shown, different estimation methods produce somewhat different results, particularly between the pooled OLS and the dynamic panel data methods. It is also notable that the signs of the democracy and political risk variables vary between estimation methods. Democracy's sign is mostly negative and insignificant, whereas political risk has positive coefficients for the dynamic panel data methods and negative coefficients for pooled OLS. For political risks, the former indicates that lower risks indicate higher returns whereas the latter would be consistent with the risk pricing models. However, almost none of the coefficients for democracy and only the system GMM estimations for political risk are significant. This suggests that neither, democracy nor political risk affects the emerging market returns consistently. However, because system GMM is most likely our most trustworthy estimation method, our scale on the political-risk sign paradox turns slightly to a positive relationship between political risk and returns (i.e., decreases in political riskiness increase returns).

Of the local variables, exchange rate and domestic credit supply to the private sector (banking sector development) both have negative signs, which indicates that appreciation of the local currency and increases in the credit supply would lead to smaller local returns. The large coefficient of the exchange rate can be explained by our data selection in which all the local and global portfolios are measured in local currency. Moreover, financial market development, measured by market capitalization and turnover, has a consistent and positive effect on returns, although the sizes of the coefficients vary between the estimation methods. Dynamic panel data models also indicate that broad money growth (measured as the changes in M2) has a negative and significant effect on returns, and the pooled OLS shows some evidence that higher inflation negatively affects returns.

World inflation is the only global variable that is consistently significant and negative across all the estimations, which indicates that increases in global price levels negatively affect emerging market returns. Of the other global variables, credit spread is statistically significant and negative whereas changes in oil prices are significant and positive for the pooled OLS and system GMM (with similar coefficient values); however, both are excluded from the final model that utilizes difference GMM. Difference GMM finds that growth in world industrial production positively affects local returns.

At the end of the table, we report observation numbers and the coefficient of determination for pooled OLS, in addition to the numbers of instruments and the instrument ratios for the dynamic panel data models. As the instrument sets

are collapsed, all the instrument ratios are higher than one as recommended by Roodman (2009)[25]. In addition, we report the p-values for the AR(2) test and Hansen's J test. The former indicates that the assumption of no serial correlation in error term is valid for all of our estimations, whereas the latter examines the validity of our instruments and does not reject our results.

We also study each of the political risk components separately for each of the methods with the previous models, but we do not report these results because none of the political risk components is a consistently significant determinant of returns. Actually, pooled OLS and system GMM do not find any significant political risk components; however, the conflicts and tensions vector and ethnic tensions subcomponent in difference GMM are positive and significant at the 10% level, whereas military in politics is significant at the 5% level.

4.1.2 Indirect effects of democracy and political risk

We continue by estimating the Equation (1) in its full form, including interaction terms. Although our previous results did not find a significant and consistent direct relationship between democracy, political risk and global market adjusted returns, indirect effects might yet be shown. We proceed through the model selection algorithm for each of the estimations again and report the results in Table 4. Because these are the main results of this study, we examine them with several methods. Columns (1) and (2) report the results from pooled OLS, whereas columns (3), (4), (7) and (8) are the results from system GMM and (5), (6), (9) and (10) are the results from difference GMM. Roodman (2009) provides examples and argues that the high number of instruments can generate both invalid results and can lead to the weakening of the Hansen's test statistic. Thus, we report the results for both, the full instrument set (columns (3)-(6)) and for the limited instrument set (columns (7)-(10)). Odd columns use *polity* as their democracy measure, whereas even columns use *icrg*.

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25 For a concerned reader, it might be mentioned that once the results were estimated without collapsing instrumental sets, the estimation results were very similar but the p-values for AR(2) and Hansen's test were close to one. This, as was previously mentioned, is an indication that Hansen's test loses its power.

TABLE 4 Indirect effects of democracy and political risk to world market adjusted local returns

	Pooled OLS		System GMM		Difference GMM		System GMM		Difference GMM	
Dependent variable: World market adjusted local returns	Polity	ICRG	Polity	ICRG	Polity	ICRG	Polity	ICRG	Polity	ICRG
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged dependent variable	-0.1144*	-0.1213**	-0.0976	-0.0746	-0.2325***	-0.1715**	-0.0304	-0.0593	-0.0511	-0.0561
	(0.0586)	(0.0581)	(0.0838)	(0.0758)	(0.0723)	(0.0705)	(0.0976)	(0.1079)	(0.0868)	(0.0968)
dem	0.1526*	0.4492***	0.1742	1.1347	1.1236	2.0377**	0.5357**	0.7311***	1.4310**	1.7204***
	(0.0873)	(0.1124)	(0.1118)	(0.7172)	(1.1750)	(0.7995)	(0.2415)	(0.1869)	(0.6307)	(0.4693)
dem^2	-0.1229	-0.3482***	-0.1461	-0.8773	-0.8731	-1.4979**	-0.4253**	-0.5517***	-1.0977*	-1.1674***
	(0.0906)	(0.0978)	(0.1193)	(0.5509)	(0.9335)	(0.6548)	(0.2005)	(0.1549)	(0.5879)	(0.3962)
$polrisk$	0.0567***	0.1973***	0.0969***	0.5079	0.4574	0.9711**	0.2040***	0.3482***	0.7028***	0.9196***
	(0.0148)	(0.0478)	(0.0312)	(0.3223)	(0.6079)	(0.3768)	(0.0740)	(0.0840)	(0.2210)	(0.2509)
$dem * polrisk$	-0.2906**	-0.6854***	-0.3635**	-1.7706	-1.7315	-3.3774**	-0.8331**	-1.1511***	-2.3521**	-2.6354***
	(0.1248)	(0.1808)	(0.1801)	(1.1316)	(1.8201)	(1.3319)	(0.3296)	(0.3094)	(0.9215)	(0.8119)
$dem^2 * polrisk$	0.2306*	0.5182***	0.3071	1.3595	1.3754	2.5832**	0.6671**	0.8594***	1.8108**	1.8668***
	(0.1290)	(0.1552)	(0.1870)	(0.8631)	(1.3859)	(1.0707)	(0.2769)	(0.2506)	(0.8273)	(0.6816)
Inflation	-0.0003	-0.0005**			-0.0011***	-0.0008**		-0.0005		
	(0.0002)	(0.0002)			(0.0004)	(0.0004)		(0.0003)		
Turnover	0.00004*	0.00006**	0.00005**	0.00007**	0.00015***	0.00014***	0.00007***	0.00008***	0.00012*	0.00011**
	(0.00002)	(0.00003)	(0.00002)	(0.00003)	(0.00004)	(0.00005)	(0.00003)	(0.00003)	(0.00006)	(0.00005)
ln(GDP per capita)			-0.0035*		-0.0166**	-0.0170*			-0.0187**	
			(0.0020)		(0.0079)	(0.0097)			(0.0082)	

M2			-0.0035**	-0.0044***	-0.0039***	-0.0038***	-0.0040***	-0.0041***	-0.0037***	-0.0034***
			(0.0017)	(0.0012)	(0.0013)	(0.0009)	(0.0013)	(0.0014)	(0.0011)	(0.0008)
Exchange rate	-0.5497***	-0.5286***	-0.5847***	-0.5405***	-0.4025*	-0.4641**	-0.5558***	-0.5196***	-0.5144***	-0.3794**
	(0.1232)	(0.1235)	(0.1735)	(0.1433)	(0.2121)	(0.2338)	(0.1451)	(0.1453)	(0.1788)	(0.1782)
Domestic credit	-0.00008**	-0.00012***	-0.00015**	-0.00021***	-0.00077***	-0.00078**	-0.00015**	-0.00022***		-0.00060**
	(0.00004)	(0.00004)	(0.00006)	(0.00006)	(0.00028)	(0.00032)	(0.00006)	(0.00005)		(0.00025)
Market capitalization	0.00009***	0.0001***	0.00016**	0.00016***	0.00033***	0.00035***	0.00017***	0.00018***	0.00030***	0.00026***
	(0.00003)	(0.00003)	(0.00006)	(0.00004)	(0.00008)	(0.00009)	(0.00005)	(0.00004)	(0.00008)	(0.00007)
World Inflation	-0.0026**	-0.0020	-0.0037**	-0.0038***		-0.0025	-0.0049***	-0.0045***	-0.0033**	-0.0058***
	(0.0013)	(0.0012)	(0.0016)	(0.0014)		(0.0016)	(0.0012)	(0.0012)	(0.0015)	(0.0012)
Oil price	0.0899*	0.1081**								
	(0.0463)	(0.0476)								
World industrial production	0.7674*	0.6935	1.2597***	0.9714***	1.6757***	1.1120***			0.7639**	
	(0.4198)	(0.4151)	(0.4401)	(0.3411)	(0.3900)	(0.4080)			(0.3383)	
Credit spread	-0.0108***	-0.0103***					-0.0122***	-0.0111***		-0.0088**
	(0.0031)	(0.0032)					(0.0032)	(0.0032)		(0.0037)
Term spread			-0.0029***	-0.0032***						
			(0.0010)	(0.0010)						
Constant		-0.0993***		-0.2966			-0.0997*	-0.1792***		
		(0.0320)		(0.2009)			(0.0564)	(0.0499)		
Number of groups, n			38	38	37	37	38	38	38	38
Number of instruments, i			68	68	58	59	23	24	21	21
Instrument ratio, r=n/i			0.56	0.56	0.64	0.63	1.65	1.58	1.81	1.81
Number of observations	311	311	314	314	273	273	314	311	251	276
Hansen J test			[0.998]	[1.000]	[0.939]	[0.994]	[0.251]	[0.286]	[0.274]	[0.274]

AR(2) test			[0.794]	[0.882]	[0.131]	[0.868]	[0.806]	[0.748]	[0.939]	[0.659]
R^2	0.46	0.45								

Notes: Estimation results of Equation (1) with 12-month average of world-market-adjusted local returns as dependent variable. The estimations are performed with the following three methods: pooled OLS (columns (1) and (2)), system GMM by Blundell and Bond (1998) (columns (3) and (4)) and difference GMM by Arellano and Bond (1991) (columns (5) and (6)). The base sample is an unbalanced yearly panel data from 2000 to 2010 for 38 emerging stock markets. For more detailed data, definitions and sources, see Appendix 1 Table A1. ***, ** and * denote statistical significance at a 1%, 5% and 10% level, respectively. In the Hansen test, the null hypothesis is that the instruments are not correlated with residuals, whereas in the AR(2) test, the null hypothesis is that the errors in the first difference regression exhibit no second order serial correlation. Heteroskedasticity robust standard errors are in parenthesis.

The results of the variables of interest differ partly from the direct effect results because several of the democracy and political risk measures and their interactions are now statistically significant. When interaction terms are taken into account, both the dem and the $polrisk$ –variables are found to be positive in all of the estimations and statistically significant in most of them. This supports the view that increases in levels of democratization and decreases in a country's political risk level increase local stock market returns. In addition, Table 4 presents evidence that the coefficient of dem^2 is statistically significant and negative, which indicates that when the democracy level reaches a certain threshold, its effect on returns becomes negative. Columns (3)-(5), however, cast some doubt on the results because the coefficients in them are not statistically significant, although they have identical signs as the results in the other columns. Thus, the results should be interpreted with some caution. In addition, it may be noted from the pooled OLS estimations that the coefficient of determination increases only 1-2 percentage points; thus, the total contributions of interaction terms remain small.

An interesting and somewhat surprising result is that the coefficient of $dem * polrisk$ is statistically significant and negative, although neither of the coefficients is negative independently. This would indicate that the higher the democracy level and lower the political risk, the smaller the returns which is by contrast to the expectations from the previous results. We relate this result to the quadratic relationship between political risk and democracy level which was demonstrated in Figures 1 and 2 with the following: $polrisk = \beta_0 + \beta_1 * dem + \beta_2 * dem^2$. In this relationship, β_1 is negative and β_2 is positive, which indicates that political riskiness increases until a certain threshold democracy level and then begins to decrease after that. Thus, when the squared term of democracy, dem^2, is included in the regression, dem has a negative effect on political risk, which causes their interaction to be negative. Conversely, dem^2has a positive effect on $polrisk$. Table 4 shows further that separately estimated dem^2 is negative and $polrisk$ positive but their interaction term $dem^2 * polrisk$ is positive.

Overall, these results suggest that, with this model specification, the democracy level has effects on returns, both directly and indirectly. From Equation (1) it can be derived that the total effect of democracy levels change to returns – all else equal – is

$$\frac{\partial R_i}{\partial dem} = \beta_1 + 2\beta_2 dem + \beta_4 polrisk + 2\beta_5 dem * polrisk.$$

Interpreting this is more complicated than for typical interaction terms. A one unit increase in $polrisk$-variable indicates that democracy's total effect on returns, $\beta_1 + 2\beta_2 dem + \beta_4 + 2\beta_5 dem$, is positive if

$$dem > -\frac{1}{2}\frac{(\beta_1+\beta_4)}{(\beta_2+\beta_5)}.$$

For example, with the values of *icrg* from columns (2) and (8) of Table 4, the limit value (although artificial because it is difficult to verify when this limit is crossed) for the positive effect of democracy is approximately 0.69 and 0.68, respectively. The results imply that increases in the levels of democracy and polit-

ical risk lead to larger excess returns in highly democratic countries, whereas the effect is negative in countries with lower democracy levels. For example, when the political risk level increases (i.e., riskiness decreases) in Israel, this has larger positive effects on stock market returns that compared to a similar-sized increase in risk level of Egypt because the former has a democracy level above the threshold, whereas the latter is below that threshold.

The weakening of the power of Hansen's test through the large number of instruments can be observed from the Hansen's test results in Table 4. When the instrument ratio is small (columns (3)-(6)), Hansen's test never rejects the validity of the instruments; thus, it might be more appropriate to study the results with a collapsed instrument set (columns (7)-(10)). In these results, Hansen's test does not reject any of our estimations with conventional significance levels and neither does the AR(2) test. In addition, because our pooled OLS estimations are not subject to either of these tests and continue to provide similar results with columns (7)-(10), we consider our results to be rather reliable. However, we continue to study the robustness of the results in section 5.

4.1.3 Indirect effects of democracy and political risk components

Next, we study the effects of democracy on stock market performance more carefully and decompose the political risk component into its subcomponents and use these in Equation (1) separately as political risks. We aim to study whether these subcomponents exhibit similar behavior as the political risk component and report the results in Table 5. For each estimation method, we utilize the models found in the previous subsection; however, to converse space, we present the results only for the *polity* index estimated with system GMM with collapsed instrument set and do not report results for the control variables. Full estimation results are available from the authors upon request.

TABLE 5 Indirect effects of democracy and individual political risks to stock market behavior

Dependent variable: World market adjusted local returns													
Political variable	Conflicts and tensions	Quality of institutions	Government stability	Socio-economic conditions	Investment profile	Internal conflict	External conflict	Corruption	Military in politics	Religious tensions	Law and order	Ethnic tensions	Bureaucracy quality
dem	0.7748***	0.0422	0.1915	0.0088	0.2431	0.6554***	0.3121	-0.1095	0.1708*	0.3215***	0.0777	0.0793	0.0452
	(0.2296)	(0.2222)	(0.1941)	(0.0867)	(0.2073)	(0.1782)	(0.3181	(0.1313)	(0.0975)	(0.1001)	(0.2031)	(0.1388)	(0.0877)
dem^2	-0.5867***	-0.0370	-0.1159	0.0162	-0.2449	-0.4766***	-0.3150	0.0862	-0.1557**	-0.2495***	-0.0712	-0.0627	-0.0100
	(0.1827)	(0.1678)	(0.1694)	(0.0721)	(0.1694)	(0.1426)	(0.2815	(0.1067)	(0.0791)	(0.0821)	(0.1531)	(0.1089)	(0.0752)
$polrisk$	0.2907***	0.0216	0.0989**	0.0447	0.0356	0.2683***	0.0540	-0.0555	0.0580*	0.1459***	0.0337	0.0412	0.0710**
	(0.0747)	(0.1138)	(0.0482)	(0.0344)	(0.0606)	(0.0606)	(0.0623	(0.0746)	(0.0320)	(0.0342)	(0.0822)	(0.0395)	(0.0301)
$dem * polrisk$	-1.0884***	-0.2253	-0.2910	-0.0762	-0.4176*	-0.9036***	-0.4626	0.1033	-0.3298**	-0.5794***	-0.2179	-0.1801	-0.2143*
	(0.2914)	(0.3690)	(0.2460)	(0.1222)	(0.2519)	(0.2164)	(0.4092	(0.3150)	(0.1312)	(0.1513)	(0.2570)	(0.1695)	(0.1123)
dem^2	0.8357***	0.1933	0.1898	0.0219	0.4040*	0.6669***	0.4511	-0.0674	0.2911***	0.4560***	0.1914	0.1483	0.1314
$l \quad k$	(0.2362)	(0.2699)	(0.2191)	(0.1049)	(0.2085)	(0.1754)	(0.3611	(0.2500)	(0.1079)	(0.1268)	(0.1936)	(0.1355)	(0.0941)
Number of groups, n	38	38	38	38	38	38	38	38	38	38	38	38	38
Number of instruments, i	23	23	23	23	23	23	23	23	23	23	23	23	23
Instrument ratio, r=n/i	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Number of observations	314	314	314	314	314	314	314	314	314	314	314	314	314
Hansen J test	[0.268]	[0.250]	[0.230]	[0.276]	[0.254]	[0.255]	[0.276]	[0.238]	[0.265]	[0.277]	[0.255]	[0.232]	[0.256]
AR(2) test	[0.853]	[0.582]	[0.661]	[0.623]	[0.745]	[0.984]	[0.665]	[0.532]	[0.697]	[0.899]	[0.589]	[0.706]	[0.615]

Notes: Heteroskedasticity robust standard errors in parenthesis. ***, ** and * denote statistical significance at 1, 5 and 10% level, respectively.

Table 5 shows that all other political risk subcomponents except Corruption have positive signs but less than half of them are statistically significant. Of the components, Conflicts and tensions vector, Investment profile, Internal conflicts, Military in politics and Religious tensions behave similarly as the political risk component with significant interaction terms with democracy and its squared term. Apart from Investment profile, these variables also remain significant for pooled OLS and difference GMM. None of the estimations can be rejected based on the AR(2) test and Hansen's J test. It should, however, be noted that as was already mentioned in section 2.3, Military in politics and Religious tensions have positive correlations with the democracy that might affect the results for these subcomponents.

4.2 Democracy and stock market crisis

We extend our analysis also to the stock market crisis of the emerging stock markets and study whether the democracy level has affected the sharp drops of the emerging stock market indices.

We begin by widening our data to its full length, i.e., all the way to 1988 for certain of the markets. This allows us to study several crises that have affected emerging markets during the last two decades, such as the Mexican crisis of 1994, the Asian financial crisis of 1997, the Russian financial crisis of 1998, Argentina's and Brazil's economic crisis from 1998 to 2002, the Turkish crisis of 2000-2001 and the global financial crisis of the late 2000s. All of these crises have been examined individually in separate studies; thus, we aim only to concentrate on general lines and the reasons behind them. We complement our core dataset with three new variables, the ratio of total reserves to M2, annual GDP growth and the yearly change in stock prices; we use these and the original variables from stock market performance analysis to analyze whether democracy has had any effect on these stock market crises.

As discussed in the Data-section, the crisis is defined as occurring if the stock index declines more than 20% over one month from its previous month's value. In this case, the year gets a value of 1, and otherwise, it takes a value of 0.

Our model for crisis determining is

$$\Pr(I_{i,t} = 1) = f\left(\beta_0 + \sum_{k=1}^{n} \beta_k X_{i,t}^k\right)$$

where $I_{i,t}$ is the crisis indicator, $X_{i,t}^k$ are the possible explanatory variables for the crisis(es) and f is a logistical function of the type $f(z) = \frac{e^z}{1+e^z}$.

We estimate the above logit model for the crisis but find no statistically significant relation between the levels of democracy and political risk and stock market crises. However, we find that a decrease in annual returns, a fall in international reserves relative to broad money, depreciation of the local currency (i.e., appreciation of the U.S. dollar against it), a decrease in GDP and a rise in inflation from the local variables and decreases in oil prices and in the term structure spreads from the global factors are associated with crisis periods.

Again, to conserve space we do not report the results here in detail, but they are available from the authors upon request.

5 ROBUSTNESS TESTS

Our original estimation strategy already included robustness checking by utilizing three different estimation methods, two different measures for democracy and results with and without limiting the instrument amount, we will provide further robustness checks as evidence for our results.

For these robustness regressions, we use the *polity* index as our measure for democracy and limit the number of instruments when required (i.e., when the instrumental ratio would be higher than one otherwise) to avoid biased results that might be caused by a high ratio between the number of countries and instruments. We use the models found in subsection 4.1.2. To conserve space, we do not report all of the results, instead we concentrate on the direct and indirect effects of political risk and democracy for market returns and summarize the estimations in Tables 6, 7 and 8. In general, we aim to test the robustness of our results from several different angles by using Equation (1) as our base model.

(i) Analysis period and time fixed effects. It is possible that our results might be driven by the choice of our analysis period. Thus, we will examine the results for several starting periods: 1988, 1995 and 2005. In addition, as Roodman (2006) recommends, we introduce the time dummies to the specifications to control for potential time-related shocks and to increase the probability that there is no correlation across individuals in idiosyncratic disturbances, which is the assumption behind the autocorrelation test. The instrument sets are collapsed in all cases except for the 2005-2010 period. The results for these estimations, and for our original time period with time fixed effects, can be found in Table 6. As the estimations show, the significance of our results is affected by both the estimation method and the time interval. System GMM estimations produce statistically significant results for almost all the cases, whereas the estimations of difference GMM and pooled OLS produce results that vary more. However, the political risk variable and the interaction terms remain rather significant and with identical signs as before. It should be noted that the instru-

ment ratio is high for the period 1988-2010 and this is also shown in the high Hansen J-test values. In addition, the Hansen test for difference GMM for period 2000-2010 is rejected at the 10% level; thus, these results should be interpreted with caution. The results remain similar when estimated with the *icrg* measure.

(ii) Outliers. It is also possible that certain countries that are more vulnerable to political instabilities might affect our results. We investigate the sensitivity of our results for outliers by dropping several of the most (Sri Lanka, Indonesia, Pakistan and Nigeria) and the least (UAE, Slovenia, Chile and Kuwait) politically risky countries from our dataset. In addition, because we are studying democracy, we also drop separately several of the most (Israel, Hungary, Slovenia and Poland) and the least (Qatar, UAE, Bahrain and Kuwait) democratic countries from our dataset. These results can be found in Table 7. As the estimations show, our original results remain identical in terms of statistical significance, and for the political risk component and the interaction terms in particular. When the estimations are performed with the *icrg* –democracy measure, the statistical significance of the results increases. It should also be noted that the coefficient of determination remains independent of the dataset and neither the AR test nor Hansen's test rejects the estimated models.

TABLE 6 Robustness tests: Analysis period

	2000-2010			1988-2010			1995-2010			2005-2010		
	Pooled OLS	System GMM	Diffe-rence GMM	Pooled OLS	System GMM	Diffe-rence GMM	Pooled OLS	System GMM	Diffe-rence GMM	Pooled OLS	System GMM	Difference GMM
dem	0.3306	0.5884***	1.2214**	0.3063**	0.4204**	0.3968	0.2001	0.4052	0.9994*	0.2118	0.5972***	0.7898
	(0.1986)	(0.2003)	(0.5401)	(0.1440)	(0.1744)	(0.4367)	(0.1698)	(0.2554)	(0.5599)	(0.2089)	(0.2207)	(0.9563)
dem^2	-0.2512	-0.4527***	-1.0156**	-0.2083	-0.3168**	-0.3212	-0.1509	-0.3584*	-0.9852*	-0.1203	-0.4191**	-0.8705
	(0.1623)	(0.1695)	(0.4960)	(0.1253)	(0.1458)	(0.3915)	(0.1474)	(0.2137)	(0.5135)	(0.1674)	(0.1920)	(0.8163)
$polrisk$	0.1319*	0.2553***	0.4553**	0.1465***	0.1598**	0.1464	0.0905*	0.0910	0.1412	0.1214	0.3128***	-0.0719
	(0.0677)	(0.0698)	(0.2234)	(0.0462)	(0.0709)	(0.1992)	(0.0531)	(0.0855)	(0.1939)	(0.0735)	(0.0745)	(0.4879)
$dem * polrisk$	-0.5327*	-0.9246***	-1.9207**	-0.5439**	-0.7316***	-0.6855	-0.4127*	-0.7266**	-1.6740**	-0.3945	-0.9549***	-0.8371
	(0.2637)	(0.2777)	(0.8469)	(0.2112)	(0.2681)	(0.7240)	(0.2342)	(0.3663)	(0.8304)	(0.2682)	(0.3133)	(1.6644)
dem^2 $* polrisk$	0.4045*	0.7215***	1.6248**	0.3856**	0.5655**	0.5778	0.3186	0.6352**	1.6507**	0.2466	0.6955**	1.0882
	(0.2176)	(0.2387)	(0.7295)	(0.1836)	(0.2251)	(0.6267)	(0.2048)	(0.3061)	(0.7527)	(0.2171)	(0.2764)	(1.3280)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of groups, n		38	37		38	37		38	37		38	37
Number of instruments, i		31	30		55	54		41	40		21	20
Instrument ratio, r=n/i		1.23	1.23		0.69	0.69		0.93	0.93		1.81	1.85
Number of observations	311	314	273	530	533	492	436	439	398	176	179	138
Hansen J		[0.191]	[0.089]		[0.914]	[1.000]		[0.200]	[0.362]		[0.276]	[0.278]
AR(2) test		[0.542]	[0.245]		[0.788]	[0.562]		[0.398]	[0.550]		[0.901]	[0.327]
R^2	0.48			0.46			0.52			0.57		

Notes: Heteroskedasticity robust standard errors in parenthesis. ***, ** and * denote statistical significance at 1, 5 and 10% level, respectively.

TABLE 7 Robustness tests: Outliers

	Most politically riskiest removed			Least politically riskiest removed			Least democratical removed			Most democratical removed		
	Pooled	System GMM	Diffe-rence GMM	Pooled	System GMM	Difference GMM	Pooled	System GMM	Diffe-rence GMM	Pooled	System GMM	Difference GMM
dem	0.2496**	0.6255	1.5103	0.1769*	0.5169*	1.3181**	0.1704*	0.7036**	1.2375**	0.1395	0.4639	1.3227**
	(0.1073)	(0.3904)	(0.9478)	(0.0960)	(0.2919)	(0.6119)	(0.0887)	(0.2982)	(0.6189)	(0.0941)	(0.2858)	(0.6163)
dem^2	-0.2321**	-0.5153	-1.1100	-0.1539	-0.4139*	-1.0352*	-0.1397	-0.5276**	-0.9768*	-0.0971	-0.3491	-1.0024*
	(0.1062)	(0.3277)	(0.7990)	(0.1014)	(0.2382)	(0.5924)	(0.0920)	(0.2336)	(0.5837)	(0.1007)	(0.2557)	(0.5793)
$polrisk$	0.0569***	0.2020*	0.7854**	0.0558***	0.2036**	0.6152***	0.0556***	0.3083***	0.5794***	0.0623***	0.1961**	0.6895***
	(0.0152)	(0.1086)	(0.3133)	(0.0152)	(0.1012)	(0.2049)	(0.0183)	(0.1180)	(0.2025)	(0.0161)	(0.0801)	(0.2378)
$dem * polrisk$	-0.4439***	-0.9467*	-2.4607*	-0.3206**	-0.8093*	-2.1425**	-0.2996**	-1.1389**	-2.0609**	-0.2835**	-0.7139*	-2.1322**
	(0.1506)	(0.5369)	(1.3546)	(0.1386)	(0.4152)	(0.9078)	(0.1288)	(0.4418)	(0.8902)	(0.1362)	(0.3872)	(0.9079)
$dem^2 * polrisk$	0.3982**	0.7845*	1.8142	0.2726*	0.6545*	1.6860**	0.2419*	0.8642**	1.6373**	0.2053	0.5450	1.6181**
	(0.1493)	(0.4535)	(1.1139)	(0.1468)	(0.3425)	(0.8521)	(0.1308)	(0.3468)	(0.8137)	(0.1456)	(0.3508)	(0.8205)
Number of groups, n		34	34		34	34		34	34		34	34
Number of instruments, i		23	21		23	21		23	21		23	21
Instrument ratio, r=n/i		1.48	1.62		1.48	1.62		1.48	1.62		1.48	1.62
Number of observa-tions	274	277	243	290	291	257	302	302	268	274	277	243
Hansen J		[0.458]	[0.617]		[0.224]	[0.215]		[0.214]	[0.269]		[0.211]	[0.203]
AR(2) test		[0.336]	[0.400]		[0.731]	[0.978]		[0.714]	[0.992]		[0.981]	[0.944]
R^2	0.45			0.45			0.46			0.46		

Notes: Heteroskedasticity robust standard errors in parenthesis. ***, ** and * denote statistical significance at 1, 5 and 10% level, respectively.

(iii) Development. Although we already take into account a country's development level in our base model, we continue to study whether the development level affects our results. However, dividing countries into low-, middle- and high-income countries would lead to subsamples that are too small[26] and to low estimation reliability levels because the instrument ratio would be high. Instead, we include the $\ln(GDP\ per\ capita)^2$ variable and its interaction with the democracy variable, $dem * \ln(GDP\ per\ capita)^2$, to the model and test whether there is some limit at which the GDP per capita begins to affect excess returns and whether this is related to an effect of democracy. As the results in Table 8 columns (1)-(3) show, the original results about the interactions of political risk and democracy level do not change much. We also find evidence that first the interaction of the democracy level and $\ln(GDP\ per\ capita)$ increases local returns; but after a certain threshold level this effect begins to decline. This is indicated by the negative coefficient of $dem * \ln(GDP\ per\ capita)^2$. Thus it can be concluded that the democracy might also affects stock returns via the economic development of the country.

(iv) Estimation method. To study whether the estimation method has any effect on the results, we also estimate the results for system GMM with a robust one-step estimator. As shown in Table 8, columns (4) and (5), the original results remain similar and their statistical significance even increases. The same applies to the *icrg* measure.

(v) Measure of democracy. Although, the definitions of *polity* and *icrg* democracy measures differ from one another, suggesting that the information in these measures is not identical, the large correlation between them indicates that they share many common features. To study whether our results are driven be the choice of our democracy variable we compute the average of these two of the democracy variables and use that as an alternative measure for democracy. The results are reported in Table 8 columns (6)-(8) and remain highly significant and similar to the original estimations, particularly the system and difference GMM.

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26 When the division is performed according to the limits set by the World Bank, the low-income subgroup would be composed of 1 country, the lower-middle-income group of 8 countries, the upper-middle-income group of 17 countries and the high-income group of 12 countries.

TABLE 8 Robustness tests: Development, Estimation method and Democracy measure

	Development			One-step estimation		Mean democracy		
	Pooled	System GMM	Difference GMM	System GMM	Difference GMM	Pooled	System GMM	Difference GMM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
dem	0.2253	0.5208*	-0.0551	0.6026***	1.3220**	0.1538*	0.7565***	1.2668**
	(0.1719)	(0.3127)	(0.9636)	(0.1962)	(0.5358)	(0.0847)	(0.2404)	(0.4960)
dem^2	-0.3510**	-0.6415***	-1.1876*	-0.4803***	-1.0951**	-0.1301	-0.5825***	-0.8623*
	(0.1572)	(0.2014)	(0.6722)	(0.1650)	(0.5095)	(0.0880)	(0.1961)	(0.5097)
$polrisk$	0.2440**	0.4473***	0.6795***	0.2257***	0.5524***	0.0651***	0.3370***	0.7207***
	(0.1021)	(0.0886)	(0.1861)	(0.0687)	(0.2054)	(0.0189)	(0.0837)	(0.1793)
$dem * polrisk$	-0.7830**	-1.4112***	-2.4107**	-0.9324***	-2.1991**	-0.2981**	-1.2245***	-2.1555**
	(0.3000)	(0.3570)	(0.9985)	(0.2712)	(0.8250)	(0.1437)	(0.3553)	(0.9029)
$dem^2 * polrisk$	0.5545**	0.9997***	1.8982**	0.7467***	1.8484**	0.2394	0.9466***	1.5848*
	(0.2190)	(0.2970)	(0.9053)	(0.2314)	(0.7388)	(0.1440)	(0.2942)	(0.8782)
$\ln(GDP\ per\ capita)$	-0.0288**	-0.0554	-0.3285					
	(0.0134)	(0.0473)	(0.2092)					
$dem * \ln(GDP\ per\ capita)$	0.0638*	0.0801**	0.3727*					
	(0.0337)	(0.0403)	(0.2114)					
$\ln(GDP\ per\ capita)^2$	0.0014**	0.0024	0.0184					
	(0.0006)	(0.0026)	(0.0127)					
$dem * \ln(GDP\ per\ capita)^2$	-0.0036*	-0.0038*	-0.0221*					
	(0.0019)	(0.0022)	(0.0130)					
Number of groups, n		38	38	38	38		38	38
Number of instruments, i		27	24	23	21		23	21
Instrument ratio, r=n/i		1.41	1.58	1.65	1.81		1.65	1.81
Number of observations	311	314	276	314	276	311	314	276
Hansen J		[0.274]	[0.289]	[0.251]	[0.274]		[0.265]	[0.274]

AR(2) test		[0.996]	[0.972]	[0.947]	[0.656]		[0.746]	[0.941]
R^2	0.47					0.46		

Notes: Heteroskedasticity robust standard errors in parenthesis. ***, ** and * denote statistical significance at 1, 5 and 10% level, respectively.

6 CONCLUSIONS

We study 38 emerging financial markets to discover whether their long-term performance is related to their country's democracy level and, in particular, to its interaction with political risk. We use two measures for democracy and three panel data methods, pooled OLS, system GMM and difference GMM, to capture the direct and indirect effects of democracy and political risk on the global market adjusted 12-month average returns. In addition, we study whether political risks and democracy might have affected the crises in these emerging markets during the last two decades with a logit model.

We find rather robust evidence that the level of democracy of a country affects stock market returns interacting with political risk, particularly during the 2000-2010 period, but there is no evidence of democracy's role in stock market crises. We also provide (partly counter-intuitive) evidence that lower political risks are associated with higher returns. In addition, we also show that the exchange rate fluctuations, the development of the local banking and financial sector and global inflation have statistically significant and robust effects on local returns. In part, this result also provides evidence about the segmentation of the emerging stock market from the world market. Our results also highlight the importance of using several different democracy measures for estimations that include democracy because the results might differ among them. Nonetheless, a word of caution is in order. The results do not pass all robustness tests and they are found to be partly method and time-period dependent. In addition, because our regressions include squared variables and interaction terms that share a strong linear relationship with the original variables, it is likely that certain of our results might be affected by multicollinearity. However, because the presence of multicollinearity should increase standard errors and produce statistically less significant estimates, our basic results are expected to be valid.

Because the data on emerging market returns remains limited, more accurate results can only be obtained in the future as both the number of markets increases and the observation periods are elongated. However, this study may operate work as a pioneer study between democracy, political risk and the financial markets because the basic idea can be extended to other sectors in fi-

nance, such as the bond markets and FDI flows. Moreover, the channels of democracy outside political risks might be studied further. For example, whether more democratic countries can allocate resources better than less democratic countries is an interesting topic. In addition, because we are using low data frequency, we are not able to capture all the effects of different political risks. As this research examines only the political risks in a macro environment, it would be useful to extend the research to the microenvironment and to more specific political risks (such as sudden tax reforms or the deaths of heads of government) for higher frequency data. These ideas, however, are left for future studies.

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APPENDIX 1

TABLE A1 Description of the variables

Variable	Description
Dependent variable	
Annual global market adjusted returns	12-month mean of global market adjusted local returns. Local market performance is measured with the MSCI Standard Total Return indices that combine the prices with reinvested dividends. Global market is measured with the MSCI World index. All indices are denominated in local currency. Source: MSCI Global Equity Indices.
Measures of democracy	
Institutionalized democracy vs. autocracy	The difference between Polity IV's Democracy and Autocracy indices. Both of the indices measure the competitiveness of political participation, the regulation of participation, the openness, the competitiveness of executive recruitment and constraints on the governmental chief executive; these range from 0 to 10. Thus the Polity index varies between -10 and 10, where a higher number indicates higher democracy. Source: Polity IV.
Democratic accountability	Measures the level of democracy by studying the type of governance on the basis of the freedom and fairness of the elections, the presence of political parties and opposition, the existence of legal protection of personal liberties and the accountability of the government to its electorate. The index ranges from one to six, where a higher number denotes higher democracy. Source: International Country Risk Guide.
Measures of political risk	
Government stability	Measures both the government's ability to undertake its declared programs and its ability to stay in office. The measure consists of the following three subcomponents, each scored 0-4 points: Government unity, Legislative strength and Popular support. Thus the data ranges from 0-12 points, where a higher number denotes lower risk. Source: International Country Risk Guide.
External conflicts	Measures the risk of foreign actions on governance. The actions could range from diplomatic pressures, trade restrictions, sanctions, etc. to violent external pressure. The variable is measured with three subcomponents ranging from 0-4: War, Cross-border conflict and Foreign pressures. The maximum of 12 points denotes very low risk. Source: International Country Risk Guide.
Internal conflicts	Measure political violence and its actual or potential impacts to governance with the following three subcomponents, each scored 0-4 points: Civil War/Coup threat, Terrorism/Political violence, Civil disorder. Maximum points 12 denote very low risk. Source: International Country Risk Guide.
Ethnic tensions	An assessment of the degree of tension within a country attributable to racial, nationality or language divisions. Higher ratings are given to countries in which tensions are minimal whereas lower ratings are given to countries in which racial and nationality tensions are high because opposing groups are intolerant and unwilling to compromise. Maximum points are 6. Source: International Country Risk Guide.
Military in politics	Assesses in what measure the military is involved in politics on a 0-6 point scale. The higher the number, the lower the military participation to the politics and the lower the risk. Source: International Country Risk Guide.

Religious tensions	Measures with a scale of 0-6 points whether a single religious group is able to affect a country's politics. The higher the number, the lower the single religion group's effect. Source: International Country Risk Guide.
Socio-economic conditions	Measures socioeconomic pressures in society that might affect government actions or fuel social dissatisfaction with three subcomponents scored 0-4: Unemployment, Consumer confidence and Poverty. Maximum of 12 points denotes very low risk. Source: International Country Risk Guide.
Investment profile	Measures the factors of investment risks that are not covered by other political, economic and financial risk components with the following three subcomponents scored 0-4: Contract viability/Expropriation, Profits repatriation, Payment delays. Maximum 12 points denotes very low risk. Source: International Country Risk Guide
Bureaucracy quality	Measures whether the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services. In low-risk countries, the bureaucracy tends to be somewhat autonomous from political pressure and to have an established mechanism for recruiting and training. Maximum points: 4. Source: International Country Risk Guide.
Corruption	Measures the corruption within the political system on a scale of 0-6, where the higher points denote less corruption. Source: International Country Risk Guide.
Law and order	Law and order are assessed separately, with each sub-component consisting of zero to three points. The Law sub-component is an assessment of the strength and impartiality of the legal system, whereas the Order sub-component is an assessment of popular observance of the law. Thus a country can enjoy a high rating (3) in terms of its judicial system, but a low rating (1) if it suffers from a high crime rate or if the law is routinely ignored without effective sanction. A higher number denotes lower risk. Source: International Country Risk Guide.
Quality of institutions	The sum of the following International Country Risk Guide (ICRG) political risk sub-components: corruption, law and order, and bureaucratic quality. Source: International Country Risk Guide.
Conflicts and tensions	The sum of the following ICRG political risk sub-components: External conflicts, internal conflicts, ethnic tensions and religious tensions. Source: International Country Risk Guide.
Banking sector development	
Domestic credit to private sector (% of GDP)	Domestic credit to private sector refers to financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable that establish a claim for repayment.
Measures of financial development	
Market capitalization of listed companies	The share price times the number of shares outstanding of listed domestic companies. Measured as percentage of GDP. Source: World Bank Development Indicators.
Turnover	Turnover ratio is the total value of shares traded during the period divided by the average market capitalization for the period. Source: World Bank Development Indicators.

Macroeconomic and demographic measures	
GDP per capita	GDP per capita is gross domestic product divided by midyear population. Measured in U.S. dollars. Source: World Bank Development Indicators.
GDP growth	Annual percentage growth rate of GDP at market prices based on constant local currency. Source: World Bank Development Indicators.
Inflation	Inflation as measured by the annual growth rate of the GDP implicit deflator. Measures the rate of price change in the economy as a whole. Source: World Bank Development Indicators.
Exchange rate	Annual exchange rate change against the U.S. dollar. Source: Datastream.
M1	Annual narrow money growth. Source: World Bank Development Indicators.
M2	Annual broad money growth. Source: World Bank Development Indicators.
Industrial production	Annual changes in the industrial production indices. For oil-producing countries, the industrial production is calculated as the annual logarithmic changes in the production multiplied by the price of the oil. Source: Datastream.
International risk factors	
World inflation	World inflation measured with the GDP deflator, annual percentage. Source: Datastream.
World industrial production	12-month mean of the logarithmic changes in the world industrial production (advanced countries). Source: Datastream.
Oil price	12-month mean of the logarithmic changes in Brent oil price returns. Source: Datastream.
Credit spread	Corporate bond yield spread between U.S. Baa and Aaa rated bonds. Source: Federal Reserve Bank of St. Louis.
Term spread	The U.S. 10-year bond yield minus 3-month U.S. Treasury bill rate. Source: Datastream.

CHAPTER 4

TIMESCALE-DEPENDENT STOCK MARKET CO-MOVEMENT: BRICS VS. DEVELOPED MARKETS[27]

Abstract
This paper examines the differences in the asset return co-movement of the BRIC countries (Brazil, Russia, India and China), the other developed economies in their regions (Canada, Hong Kong and Australia) and the major industrialized economies (the U.K., Germany and Japan) with respect to the U.S. for different return periods. The novelty of the paper is that the stock return indices are decomposed to several timescales using wavelet analysis and that the results are further used as inputs for the dynamic conditional correlation (DCC) framework, which is used as a measure of integration. The results propose that the level of stock market co-movement depends on regional aspects, the level of development and especially on the timescale of returns. These factors should be carefully considered in designing internationally diversified portfolios. The BRICs provide some portfolio diversification benefits, but it is not justifiable to treat all BRICs as a homogeneous group of emerging economies in terms of stock market integration

Keywords : International stock markets, BRIC, Co-movement, Wavelets, Dynamic conditional correlation

JEL classification: C22, C40, E32, F30, G15

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1 INTRODUCTION

Stock market interdependence has been recognized as an important topic in international finance in both the developed and emerging markets (see, e.g., Korajczyj and Viallet (1989), Chan, Karolyi and Stulz (1992), Bekaert and Harvey (1995), Foerster and Karolyi (1999), Dumas, Harvey and Ruiz (2003), Carrieri, Errunza and Sarkissian (2004), Bekaert, Harvey and Ng (2005) and Carrieri, Errunza and Hogan (2007)). One of the major motivations for these studies is the exploration of the level of co-movement in the international stock market, which impacts portfolio diversification and the stability of the global financial system, given that shocks to the stock market can quickly spread across the world.

Irrespective of the growing importance of emerging market for global portfolio allocation studies have largely overlooked the stock market integration among the emerging market. The purpose of this study is to reveal the time-dependencies and the evolving nature of stock market integration among the BRIC countries (Brazil, Russia, India and China), the other important economies in their regions (Canada, Australia and Hong Kong) and the major industrialized countries (Germany, the U.K. and Japan) with respect to the U.S.[28]. As a result, we are able to make inferences about whether the BRIC countries' equity markets can be clustered into a single BRIC group and appropriate levels of stock market segmentation of BRIC countries compared to the U.S. and other major industrial economies. The analysis also provides some evidence of whether the stock markets could be divided into American, Asian and European regions. The time-dependence of the stock market integration is carefully considered by combining wavelet analysis and dynamic condition correlation, which are relatively new techniques.

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[28] In this study, the market integration is understood in a broad sense and also includes correlation. In the literature, market interdependence and high market co-movement often refer to high correlations between returns in different markets. Our interpretation lent support to Bekaert and Harvey (1997) and Morana and Beltratti (2008), who present models in which the correlation of the market returns is positively related to the degree of market integration. For an alternative interpretation of stock market integration, see, e.g., Pukthuanthong and Roll (2009).

Emerging countries have received much interest during the last few decades, mainly because the economic performance of the BRIC countries has strongly exceeded the economic growth of industrialized countries.[29] For many years, economic growth and stock market performance in the BRIC countries have exceeded the figures produced in more advanced economies and they have been recognized as motors for global economic growth. It is expected that under favorable economic growth conditions, the combined economies of the BRICs could grow larger than the combined economies of the G6 nations (the U.S., Japan, Germany, France, Italy and the United Kingdom) in the U.S. dollar terms in less than 40 years.

Since Longin and Solnik (1995) and Bekaert and Harvey (1995), it is recognized that stock market integration is a time-varying process. Rua and Nunes (2009) provide evidence that the degree of stock return co-movement varies across different return frequencies. The dynamicity of the integration is even more evident for the emerging countries, which have just recently opened their markets and are now gradually integrating into the global stock market, as shown for example by de Jong and de Roon (2005). The time-dependence of integration is important for stock markets, as the market participants are a very heterogeneous group. Active investors, such as large investment banks, are more interested in short-term movements of the indices than more passive investors, such as the commercial banks, insurance companies, individuals and financial arms of non-financial corporations that pay more attention to the long-term performance of the portfolio balances. Thus, investors from different groups are also associated with different risk characteristics.

Because the co-movement of stock returns varies over time, the investigation must be able to capture this time-varying feature. It has been generally accepted that multivariate models are appropriate for studying transmission mechanisms and correlation dynamics between the markets (Martens and Poon, 2001). Along these lines, Bhar and Nikolova (2009) study the level of integration of the BRIC countries with their respective regions and the world using a bivariate EGARCH structure, which allows for a time-varying conditional correlation of the index equity returns. They use return and volatility spillovers as proxies for the level of integration and find that India has the highest level of integration on regional and global levels, followed by Brazil and Russia, while China shows no evidence of regional integration. The weaknesses of their study is that they do not identify the differences between short- and long-term integration and fail to indicate the dynamics of the integration process.

The novel contribution of this study is the combination of two rather new techniques, wavelet analysis and dynamic condition correlation (DCC), to reveal the stock market dependencies between the BRIC countries and the more advanced economies at different return frequencies. The differences and the

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[29] The abbreviation BRIC has become an everyday term among finance professionals, and it is expected that the importance of these countries will grow in equity portfolios. The term BRIC was made famous by a Goldman Sachs's report by Wilson and Purushothaman (2003) and the follow-up paper by O'Neill et al. (2005).

time-varying nature of stock market integration are examined using the wavelet-DCC analysis. The multiresolution analysis of wavelets filter and disentangle the national stock market dynamics at different frequencies. These filtered series are further used as inputs for the DCC model by Engle (2002). As a result, we are able to detect the BRIC countries' stock market integration at different frequencies and identify the timescales in which the co-movement is higher and the benefits of portfolio diversification in terms of risk management are lower.[30]

We find that the dynamicity and strength of the correlation depend on the timescale of the returns such that for the lower timescales, the dynamicity is higher and strength is lower than for the higher timescales. The regional and developmental factors also play a role in stock market co-movements. For the lower timescales, the clustering of Asian, European and American markets is justified, supporting the results of Groenen and Franses (2000), while for the higher timescales, the developmental factors begin to dominate as the developed markets become more interdependent than the BRICs. In general, we cannot find evidence of a positive time-trend in the correlations for the sample period.

The remainder of this paper is organized as follows. Section 2 presents the measure of co-movement, briefly the wavelet decomposition and the dynamic conditional correlation. Section 3 provides the data and the results. Section 4 concludes the paper.

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[30] For previously applications of wavelets for stock market integration, see Rua and Nunes (2009) who used continuous wavelet transform framework. Our discrete version enables us to study more carefully the trend, dynamicity and strength of the correlation structure. For other applications of wavelets for economic research, see e.g Crowley and Lee (2005) who analyze the business cycles in the euro area and other industrialized economies

2 MEASURING THE CO-MOVEMENT

We sudy the emerging market time-varying and partial stock market integration in terms of international US investor utilizing a variant of the model of Black (1974), Stulz (1981), Errunza and Losq (1985), Eun and Janakiramanan (1986), Bekaert and Harvey (1995), Cooper and Kaplanis (2000) and Hardouvelis, Malliaropulos and Priestley (2006 in particular. Our contribution to the theory of stock market integration is the introduction of several timescales to the expected returns to study different investing periods.

First, investors are divided into p groups according to their investing horizons. Superscript d_k, $k = 1, \dots, p$, refers to different periods of returns that are studied to take into account these p horizons. Second, equities in each market for each return period are divided into two groups: local assets owned by domestic residents only and international global assets owned by international investors. Costs of holding local assets exceed the portfolio diversification benefits for international investors for holding those assets. The pricing of the local assets reflect the local market risk. Instead, the well-diversified international investors hold the global assets as their expected benefits are higher than the costs. As a result the global assets are priced according to their exposure to the U.S. capital market risk (international market risk) and currency risk. The expected excess return of a country i's local stock market index $E_{t-1}(r_{i,t})$ is constituted from three risk premia: (a) the U.S. risk premium ($\lambda_{U.S.}$) (international premium), (b) a local currency premium (λ_C) and (c) a local equity premium of the individual country i (λ_i).

Thus, the expected timescale-dependent excess return of the ith stock market index can be written as

$$E_{t-1}(r_{i,t}) = \sum_{k=1}^{p} \eta_{d_k} E_{t-1}(r_{i,t})^{d_k}, \quad (1)$$

where η_{d_k} denotes the share of each investing horizon group in the total expected excess returns and

$$E_{t-1}\left(r_{i,t}\right)^{d_k} = \mu_{i,t-1}^{d_k}\left[\lambda_{U.S.,t-1}^{d_k} cov_{t-1}\left(r_{i,t}, r_{U.S.,t}\right)^{d_k} + \lambda_{C,t-1}^{d_k} cov_{t-1}\left(r_{i,t}, r_{C,t}\right)^{d_k}\right] + (1-\mu_{i,t-1}^{d_k})\lambda_{i,t-1}^{d_k} var_{t-1}\left(r_{i,t}\right)^{d_k}, \quad (2)$$

where $E_{t-1}\left(r_{i,t}\right)^{d_k}$ denotes the expected excess return on the local stock market based on information up to time $t-1$ at scale k, $r_{U.S.,t}$ is the excess return on the U.S. stock market, $r_{C,t}$ is the excess currency return, cov_{t-1} is the conditional covariance operator and var_{t-1} is the conditional variance operator.

The time-varying parameter $\mu_{i,t-1}$ measures the conditional level of integration of market i with respect to US market given information up to time $t-1$ ($0 \leq \mu_i \leq 1$) at scale k. It sums up all three premia for the particular return period. In Bekaert and Harvey (1995), (1997) set up μ_i describes the conditional probability that market i is fully integrated with the U.S. equity market. Inferences about the dispersion of the BRIC stock market are based on the differences of the individual country's stock market integration with respect to the U.S. equity market. The level of co-movement is measured in terms of correlation. We propose that markets i and j have perfect co-movermnt at time $t-1$ with a scale k when $corr\left(\mu_{i,t-1}^{d_k}, \mu_{j,t-1}^{d_k}\right) = 1$, $i \neq j$. Our framework allows that the level of co-movement may be different for different return periods. Moreover the time varying correlation measeure enables us to detect the possible changes in co-movement for given return periods d_k

$$corr\left(\mu_{i,t-1}^{d_k}, \mu_{j,t-1}^{d_k}\right),\ i \neq j, \text{ for all } d_k,\ k = 1, \ldots, p. \quad (3)$$

Inference about the co-movement of national stock market is done by studying correlation structures between several markets for different timescales. The U.S. market is used as a numeral for the measures of integration. This enables us to compare the level of stock market integration among the BRIC countries and among the developed industrialized economies, as well as with respect to their neighboring countries. Estimates of the neighboring countries' stock market integration are expected to facilitate inferences about the potential importance of the regional factors for integration. Thus, in addition to the BRICs, we study the integration of the leading, major industrialized countries' equity markets (the U.K., Germany and Japan) as well as the impacts of geographical proximity and regional factors by including developed neighboring countries (Canada, Australia and Hong Kong) to our dataset (i = Brazil, Russia, India, China, the U.K., Germany, Japan, Canada, Australia, Hong Kong).

In this study, time-varying stock market integration is examined using correlation structures between countries for different periods of return: d_k: daily (d_1), weekly (d_2), half-monthly (d_3), monthly (d_4), quarterly (d_5) and semiannual returns (d_6) The return periods are filtered utilizing wavelets and the filtered series are used as an inputs in DCC. The following chapters describe the utilized methods: 1) wavelet transformation and its multiresolution analysis,

which decomposes the return series into several timescales and 2) dynamic conditional correlation, which measures the time-varying correlation dynamics.

2.1 Wavelet transform

Wavelets are small waves that begin at a finite point in time and end at a later finite point in time. They can be seen as an extension of the Fourier analysis and possess some useful properties for signal processing. Wavelets provide an attractive and flexible tool for decomposing and filtering the data to different frequencies. With this filtering we are able to study the various return layers that constitute the total returns instead of studying the returns from different periods. Previously, wavelets have been applied in astronomy, engineering, forensics, geology, medicine and physics but have largely been overlooked in finance and economics with only a few exceptions. Wavelet analysis was introduced to economics by Ramsey and Lampart (1998a, b), who used it to analyze the money-income and money-expenditure relationships. Recently they have been applied by Rua and Nunes (2009), Jammazi and Aloui (2010) and Masih, Alzahrani and Al-Titi (2010). All of these studies stress the importance of using wavelets to de-noise and decompose data.

This paper offers only a very short introduction to the technique; for a more formal presentation, see Daubechies (1992), Percival and Walden (2000) and Gençay, Selçuk and Whitcher (2002). Schleicher (2002) and Crowley (2007) provide a more intuitive approach to the topic with economic applications in mind.

Wavelets have two characteristics that make them useful in signal analysis. First, while Fourier transform decomposes the time series into infinite-length sines and cosines, discarding all time-localization information, wavelet transforms are well localized with respect to both time and scale, which makes them useful in analyzing a variety of non-stationary signals. Second, wavelets can separate a signal into multiresolution components. The wavelet transform techniques split up a signal into a large timescale approximation (coarse approximation) and a collection of fine resolution layers, which capture the finer details of the signal at smaller timescales.

Any function $f(t) \in L^2(R)$ that is represented by a wavelet analysis can be built up as a sequence of projections onto father and mother wavelets generated from ϕ and ψ through scaling and translation, as follows:

$$\phi_{j,k}(t) = 2^{-j/2}\phi\left(\frac{t-2^j k}{2^j}\right) \tag{4}$$

and

$$\psi_{j,k}(t) = 2^{-j/2}\psi\left(\frac{t-2^j k}{2^j}\right), \tag{5}$$

where j indexes the scale and k indexes the translation. 2^j is a measure of the scale or the width of the functions $\phi_{J,k}(t)$ and $\psi_{J,k}(t)$. That is, the larger the index j, the larger the scale factor 2^j, and thus the function gets shorter and more spread out. The translation parameter $2^j k$ is matched to the scale parameter 2^j in that as the functions $\phi_{J,k}(t)$ and $\psi_{J,k}(t)$ get wider, their translation steps become correspondingly larger.

The wavelet representation of a signal or function $f(t) \in L^2(R)$ can now be given as a linear combination of wavelet functions as follows:

$$f(t) = \sum_k s_{J,k}\phi_{J,k}(t) + \sum_k d_{J,k}\psi_{J,k}(t) + \sum_k d_{J-1,k}\psi_{J-1,k}(t) + \cdots + \sum_k d_{1,k}\psi_{1,k}(t), \quad (6)$$

where the basis functions $\phi_{j,k}(t)$and $\psi_{j,k}(t)$ are assumed to be orthogonal and the wavelet coefficients $s_{J,k}$ and $d_{j,k}$ are approximated by the following projections

$$s_{J,k} \approx \int f(t)\,\phi_{J,k}(t)dt \quad (7)$$

$$d_{j,k} \approx \int f(t)\,\psi_{j,k}(t)dt \quad (8)$$

for $j = 1,2,\ldots,J$, where J is the number of multiresolution components and k ranges from 1 to the number of coefficients in the specified component. $s_{j,k}$ are the smooth coefficients that represent the underlying smooth behavior of the series, while $d_{j,k}$ are the detail coefficients that represent the scale deviations from the smooth process. The magnitude of these coefficients reflects a measure of the contribution of the corresponding wavelet function to the total signal. Thus, the father wavelets represent the smooth and low-frequency parts of a signal (the trend) and the mother wavelets describe the detail and high-frequency components (deviations from the trend).

The number of observations controls the number of scales that can be produced. In discrete wavelet transform (DWT), the number of observations has to be dyadic, i.e., the number of observations is an integer power of two and only j scales can be produced given that the number of observations is $N \geq 2^j$. In this study, we use 4,096 observations that can easily produce the six scale levels that are used.

This study uses symmlets, which are also known as the least asymmetric wavelets, for the calculations. Based on the recommendations of Percival and Walden (2000) and Crowley (2007), the tap length of the wavelets is chosen to be eight, which should be the most appropriate length for a financial and volatile economic time series. This selection means that the symmlet starts with a width of eight observations for its support, which corresponds to the wavelet used to obtain the d_1 coefficients.

Figure 1 shows the wavelet decomposition of the U.S. stock returns between the period December 23, 1994 to September 3, 2010 to six scales using

symmlets with widths of eight. As can be seen from Figure 1, for the smaller timescales, the return variation is larger because the turbulent periods usually last only for a few days or weeks. However, the major worldwide shocks, such as the dot-com bubble at the beginning of the millennium and the financial crisis of the late-2000s, are clearly visible in all timescales.

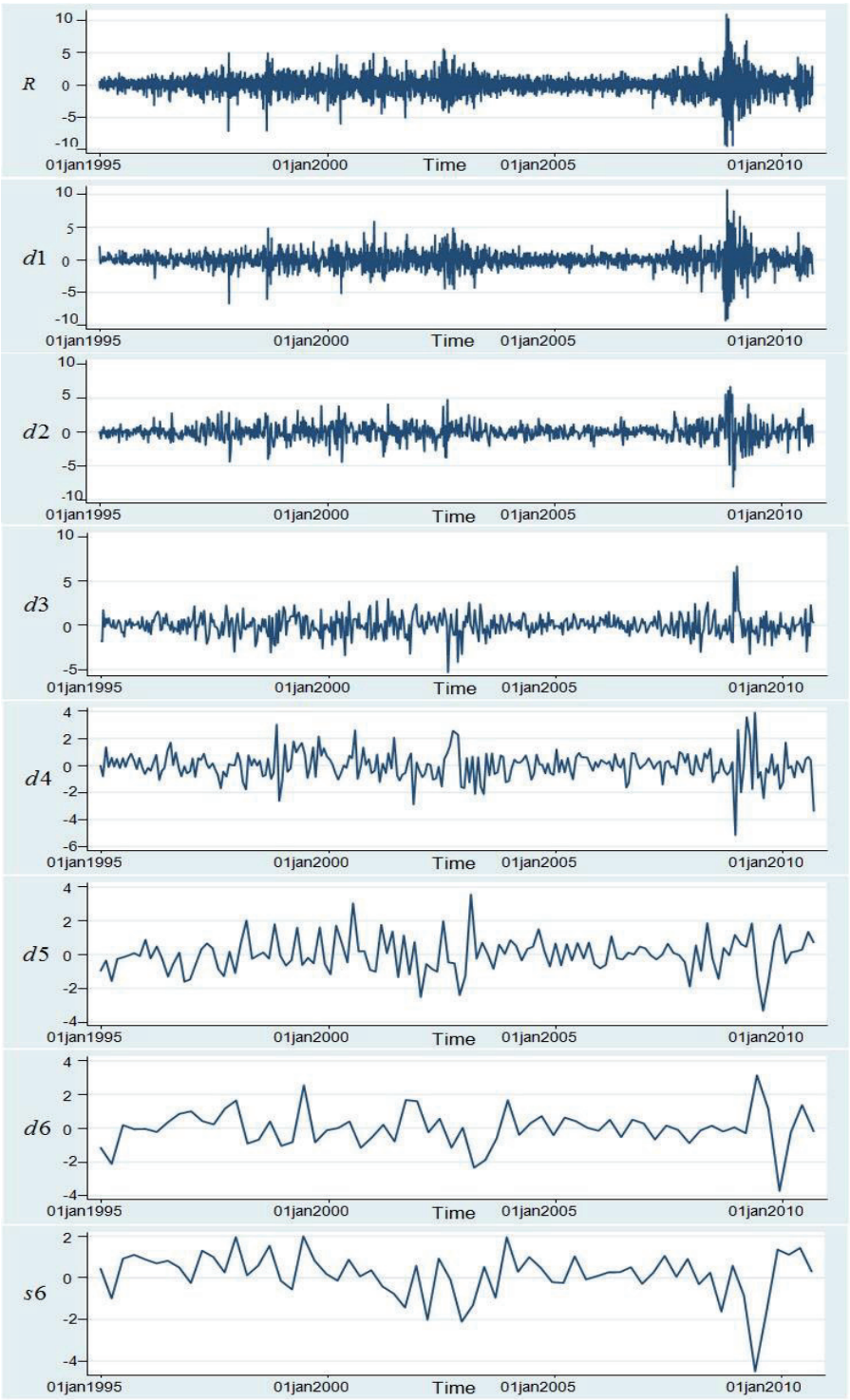

FIGURE 1 The U.S. returns and LA (8) wavelet transform for 6 scales

2.2 Dynamic conditional correlation

The dynamic conditional correlation (DCC) model by Engle (2002) is a generalization of Bollerslev's (1990) constant conditional correlation (CCC) model and offers an effective way to investigate time variations in correlations of asset returns. Previously, it has been used to study correlation structures for example by Chiang, Jeon and Li (2007), Syriopoulos and Roumpis (2009) and Savva (2009). DCC belongs to the family of multivariate GARCH models that are able to capture the time-varying nature of the correlations and can model large covariance matrices[31]. The DCC has many attractive features with which to study highly volatile financial series. It directly considers the heteroskedasticity of the return volatility[32], allows the inclusion of additional explanatory variables to the mean equation[33] and can be used to examine multiple asset returns simultaneously without adding too many parameters[34].

For each timescale, the return equations are specified as AR(p)-models to take into account the autocorrelation of stock returns

$$r_{i,t} = \gamma_{i,0} + \sum_{j=1}^{p} \gamma_j \, r_{i,t-j} + \varepsilon_{i,t}, \tag{9}$$

where $i = 1,2,\dots,n$ and $\varepsilon_{i,t}|\Omega_{t-1} \sim N(0, H_t)$, Ω_{t-1} is the information set at time period $t-1$ and the lag order p is determined by the Schwartz-Bayesian information criterion using a maximum of 10 lags. The multivariate conditional variance is specified as

$$H_t = D_t R_t D_t \tag{10}$$

where D_t is the $(n \times n)$ diagonal matrix of time-varying conditional standard deviations from univariate GARCH models with $\sqrt{h_{i,t}}$ on the ith diagonal ($D_t = diag\{\sqrt{h_{i,t}}\}$), $i = 1,2,\dots,n$, and R_t is the $(n \times n)$ time-varying conditional correlation matrix ($R_t \equiv \{\rho_{i,j}\}_t$).

Engle (2002) proposed a two-stage estimation for the conditional covariance matrix H_t. In the first stage, a univariate GARCH model,

$$h_{i,t} = \omega_i + \varphi_1 \varepsilon_{i,t-1}^2 + \varphi_2 h_{i,t-1}, \tag{11}$$

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31 For a comprehensive presentation of multivariate GARCH models, see Bauwens, Laurent and Rombouts, 2006.

32 During turmoil periods, the correlation between countries might rise due to increased and transmitted volatility.

33 In this study, several autocorrelation coefficients are included in the return equation. A better model may be found for each time scale by including additional variables *ex post*, but as Longin and Solnik (1995) state, that would be a result of data mining.

34 Other popular multivariate GARCH models, such as VECH (Bollerslev, Engle and Wooldridge, 1988) and BEKK (Engle and Kroner, 1995), suffer from a rapid increase in the estimated parameters when additional dependent variables are added.

where $i = 1,2, \dots, n$ and $h_{i,t}$ is the conditional variance of the error term $\varepsilon_{i,t}$, is fitted for each of the stock return series, and estimates of $\sqrt{h_{i,t}}$ are obtained. These estimates are subsequently used as inputs in the second stage to calculate the standardized residuals $u_{i,t} = \varepsilon_{i,t}/\sqrt{h_{i,t}}$. Standardized residuals $u_{i,t}$ are used to estimate the DCC parameters that capture the dynamics of the time-varying conditional correlation in the dynamic conditional correlation specification:

$$Q_t = (1 - \alpha - \beta)\,\bar{Q} + \alpha u_{t-1} u'_{t-1} + \beta Q_{t-1} \tag{12}$$

where $Q_t = \left(q_{ij,t}\right)$ is the $(n \times n)$ time-varying covariance matrix of u_t, $\bar{Q} = E[u_t u'_t]$ is the $(n \times n)$ unconditional covariance matrix of u_t, and α and β are nonnegative scalar parameters that capture the effects of previous shocks and previous dynamic conditional correlations on current dynamic conditional correlations. Parameters α and β satisfy $\alpha + \beta < 1$, ensuring that Q_t is positive and mean-reverting. This restriction implies that after a shock occurs, the correlation between the underlying assets will return to the long-run unconditional level.[35] When $\alpha + \beta = 0$, the DCC model reduces to CCC.

Because Q_t does not generally have ones on the diagonal, it is scaled to obtain a proper correlation matrix R_t:

$$R_t = \left(diag(Q_t)\right)^{-1/2} Q_t \left(diag(Q_t)\right)^{-1/2} \tag{13}$$

where $\left(diag(Q_t)\right)^{-1/2} = diag(1/\sqrt{q_{11,t}}, \dots, 1/\sqrt{q_{nn,t}})$ is a diagonal matrix involving the square root of the diagonal elements of Q_t.

R_t in equation (13) is a correlation matrix with ones on the diagonal and off-diagonal elements less than one in absolute value, as long as Q_t is positive definite. A typical element of R_t is of the form

$$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t} q_{jj,t}}} \text{ for } i, j = 1,2, \dots, n \text{ and } i \neq j. \tag{14}$$

In a bivariate case, the time-varying correlation coefficient can be written as

$$\rho_{12,t} = \frac{(1-\alpha-\beta)\overline{q_{1,2}} + \alpha u_{1,t-1} u_{2,t-1} + \beta q_{12,t-1}}{\sqrt{\left\{(1-\alpha-\beta)\overline{q_{11}} + \alpha u_{1,t-1}^2 + \beta q_{11,t-1}\right\}\left\{(1-\alpha-\beta)\overline{q_{22}} + \alpha u_{2,t-1}^2 + \beta q_{22,t-1}\right\}}}. \tag{15}$$

As proposed by Engle (2002), the DCC model can be estimated using a two-stage approach to maximize the log-likelihood function. Let θ denote the parameters in D_t and ϕ the parameters in R_t; the log-likelihood function is then

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[35] A typical element of Q_t is given by $q_{ij,t} = (1 - \alpha - \beta)\bar{q}_{ij} + \alpha u_{i,t-1} u_{j,t-1} + \beta q_{ij,t-1}$, where $\bar{q}_{ij}$ is the unconditional correlation of $u_{i,t} u_{j,t}$.

$$l_t(\theta,\phi) = \left[-\frac{1}{2}\sum_{t=1}^{T}(nlog(2\pi) + log|D_t|^2 + \varepsilon_t' D_t^{-2})\right] + \left[-\frac{1}{2}\sum_{t=1}^{T}(log|R_t| + u_t' R_t^{-1} u_t - u_t' u_t)\right]$$

where the first part corresponds to the volatility, which is the sum of the individual GARCH likelihoods. The log-likelihood function can be maximized in the first stage over the parameters in D_t. Given the estimated parameters in the first stage, the second part of the likelihood function, the correlation component, can be maximized to estimate correlation coefficients.

3 STOCK MARKET CORRELATIONS AMONG THE BRICS AND DEVELOPED ECONOMIES

We use the U.S. market as a numeral for the measures of integration and examine the level of stock market integration among the BRIC countries as well as the leading, major industrialized economies (the U.K., Germany and Japan) and the developed neighboring countries (Canada, Australia and Hong Kong). Estimates of the neighboring countries' stock market integration are expected to facilitate inferences about the potential importance of the geographical proximity and regional factors for integration.

3.1 The Data

The data used in this research are the most commonly used representative daily closing equity market price indices for the seven developed markets of the U.S. (S&P 500 Composite Index), Canada (S&P TSX Composite Index), the U.K. (FTSE 100 Price Index), Germany (DAX 30 Index), Japan (Nikkei 225 Stock Average Index), Australia (S&P ASX 200) and Hong Kong (Hang Seng) and for the four emerging markets of Brazil (Bovespa Index), Russia (RTS Index), India (BSE 100 Index) and China (Shanghai SE A Share Index)[36]. Canada is added to the sample as a developed market from the American region while Hong Kong enables us to study the differences between Mainland China's markets and the more developed market next to it. Australia is chosen because it represents a western market in Asia and thus could behave differently compared to other markets in the Asian region. The sample period ranges from December 23, 1994 to September 3, 2010, totaling 4,096 observations. The exception is Russia because the RTS Index was launched in September 1, 1995 and thus has only 3,915

[36] Due to the significant limitations to the foreign investors' participation in China's A-share markets, the results were also estimated to the Shanghai SE B Share Index. The results were qualitatively similar with the A-share index. The results are available from the authors.

observations. As the use of discrete wavelet transform requires that the dataset's length is dyadic (i.e., the number of observations is an integer power of two), the sample mean is used for Russia to expand the series to proper length. All indices are measured in the U.S. dollars and are obtained from Thomson-Datastream.

A well-known and major problem with the use of daily returns across countries is the nonsynchronous periods for the different markets around the globe[37]. This issue is especially important when focusing on links between Asian, European and American markets, as they are not open at the same time. Several studies address this problem by using weekly or monthly data (e.g., Longin and Solnik (1995) and Bekaert, Hodrick and Zhang (2009)), essentially giving up on inspecting higher frequencies. This approach leads to smaller samples that might be problematic for the estimation of time-varying parameters in multivariate models. This problem is avoided in this study as the wavelet analysis decomposes the return series into different timescales, with the smallest scale being 2-4 days.

Stock returns are calculated as the difference of the logarithm of the price index. Because the data originates from different countries, it is inevitable that different holidays are included for each market; thus some data are unavailable. The problem is bypassed by assuming that stock prices stay the same as those on the previous trading day. Thus, the sample for each country consists of all weekdays excluding weekends. This solution is needed to use wavelet multiresolution decomposition because the analysis requires that the data be sampled at equally spaced intervals (Crowley, 2007).

Table 1 presents the descriptive statistics for the stock markets, including mean returns, standard deviations, skewness and kurtosis as well as the Jarque-Bera statistics testing for the normality of returns.

All markets except Japan show positive average returns over the sample period. It is notable that for each region, the emerging markets have higher mean returns and standard deviations than the developed markets, implying higher expected returns with greater risks. Russia possesses the highest values in both categories, with a mean of 0.069% and standard deviation of 2.794% per day, while Japan has the lowest mean of -0.014% and the U.S. has the lowest standard deviation of 1.259%. It can also be noted that daily returns are negatively skewed for all markets except for Japan, Hong Kong and China and that all of the return series are leptokurtotic (i.e., peaked relative to the normal distribution and have fat tails). Consequently, all of the series display strong evidence of non-normality as confirmed by the Jarque-Bera statistics. The Augmented Dickey-Fuller test proposes that the return series are stationary.

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37 Martens and Poon (2001) argue that non-synchronous data underestimate the true correlations between stock markets.

TABLE 1 Descriptive statistics

Share Index	N	Mean	SD	Skewness	Kurtosis	Jarque-Bera	ADF
the U.S.	4096	0.021	1.259	-0.200	11.267	21693.35	-68.536
Canada	4096	0.033	1.369	-0.878	13.826	33150.12	-59.244
Brazil	4096	0.050	2.695	-0.079	9.800	16394.01	-59.291
the U.K.	4096	0.014	1.349	-0.093	12.626	27214.68	-65.248
Germany	4096	0.027	1.600	-0.059	8.131	11286.57	-64.858
Russia	3915	0.069	2.794	-0.441	10.550	18281.99	-55.142
Japan	4096	-0.014	1.633	0.054	7.004	8375.282	-68.506
Australia	4096	0.026	1.447	-0.911	14.586	36876.02	-63.171
Hong Kong	4096	0.022	1.738	0.125	13.049	29071.95	-64.647
India	4096	0.031	1.796	-0.140	9.293	14752.27	-57.962
China	4096	0.039	1.867	0.473	21.126	76321.48	-63.139

Notes: The table summarizes the statistics of mean, standard deviation, minimum, maximum, skewness, kurtosis, the Jarque-Bera normality test and the Augmented Dickey-Fuller (ADF) unit root test of the market returns. The null hypothesis of a unit root is rejected in the ADF test with 5% and 1% critical values of -2.860 and -3.430, respectively.

After calculating the return series for each share index, a wavelet analysis is used to decompose each series into its constituent multiresolution components. To this end, a discrete wavelet transform is applied on the daily return series by sampling the return series at evenly spaced points in time. As such, the return series is transformed from a time domain into a scale domain to elucidate the frequency with which the activity in the time series occurs. In this study, the daily return series are sampled to six scales (j) with symmlets (least asymmetric wavelets) with widths of eight as follows: d_1 (2-4 days), d_2 (4-8 days), d_3 (8-16 days), d_4 (16-32 days), d_5 (32-64 days), and d_6 (64-128 days), and s_6 which captures the lower frequencies. We also examine the dynamicity of the original daily return series R.

3.2 Volatility modeling

The GARCH-DCC estimations are carried out using residuals from AR-filtered returns[38]. Since the AR-GARCH structure itself is not a subject of interest in the study and to save space, the results from AR-filtering as well as the GARCH-parameters are not reported here[39]. It can be mentioned from AR-estimates, however, that for those countries which have significant AR structure, the AR(1)-coefficient is always negative and AR(2)-coefficient positive. As the time scale increases, the AR-coefficients become less and less significant and after d_3,

38 The most suitable AR-filtration was chosen based on the Schwarz-Bayesian information criterion (SBIC).

39 The results are available from the authors.

none of the coefficients are statistically significant and thus the results are estimated with returns without AR-filtration[40].

As for the GARCH-structure, the coefficients φ_1 and φ_2 measure the ARCH and GARCH effects, respectively. For the original return series, R, and for smaller time scales, d_1, d_2 and d_3 the coefficients are positive and highly significant. For the same return periods the persistency of the volatility, measured by $\varphi_1 + \varphi_2$, varies between 0.85 and 1 indicating that the volatility is time-varying and the GARCH-specification is in most cases appropriate although IGARCH could also be used. For higher time scales (d_4, d_5 and d_6) most of the coefficients are still statistically significant, but the magnitudes of φ_2 are lower than before implying that the volatility is not as persistent for higher scales as it is for smaller scales. In some cases the coefficients are even zero and not statistically signifinicant indicating that the framework is unsuitable for them. This supports the view that the estimations of GARCH models are unreliable with small samples.

3.3 Dynamic conditional correlation with the U.S.

Table 2 reports the results from the DCC(1,1) model in a bivariate framework and the log-likelihood values of the DCC and CCC models, the likelihood-ratio test between them and some descriptive statistics of the correlation dynamics[41]. The estimated parameters α and β in the DCC model capture the effects of the lagged standardized shocks $u_{t-1}u'_{t-1}$ and the lagged conditional correlations Q_{t-1} on current dynamic conditional correlations. The statistical significance of these coefficients indicates the presence of dynamic (time-varying) equity market correlations. When the parameters α and β are zero, the DCC model is reduced to a CCC model.

For all of the estimated coefficients, the estimates are non-negative and for almost all, $\alpha + \beta < 1$ indicating that the dynamic correlations move around a constant level and the dynamic process appears to be mean-reverting. For d_2 in Germany, d_3 in India and d_6 in Australia, the sums of the DCC parameters are equal to 1. Although it is recognized that this is a possible source for model misspecification, it is not considered as a serious problem as it is a result of rounding up. In most of the return series, the estimates are also statistically significant, supporting the presence of a dynamic correlation over time. This finding is especially true for R, d_1, d_2, d_3 and d_4, most of which have the ter β greater than 0.90 implying that the correlation between two markets is time-varying, with a high level of persistence. It is notable, however, that for several Asian markets, the parameters are insignificant or small when com-

40 All the calculations were also estimated with an without appropriate AR-filtrations but the results were alike.

41 As a robustness check the correlations were also estimated with BEKK model by Engle and Kroner (1995). The results were similar with DCC although with higher standard deviations. The BEKK model estimations are available from the authors.

pared to other markets. In R, Hong Kong has zero β parameter and in d_1 both, India and Hong Kong, have zero α and β parameters while China has a small β estimate. For d_2, Japan and Australia have insignificant β parameters, and India has zero parameters for d_4. For d_5 and d_6 the dynamicity of the correlation breaks down in several markets, as many β parameters are zero and less than half of the markets experience dynamicity in correlation.

Figures 2-6 show the development of pairwise correlations between the stock returns of the U.S. and those of Canada, Germany, Japan and the BRICs during the period between December 23, 1994 to September 3, 2010 for R and for the timescales d_1, d_2, d_4 and d_6[42]. As can be seen from these figures and the statistics in Table 2, a market's correlation may vary during the whole sample period, albeit its variance can be so small as to render the CCC model appropriate. Although the significance of the parameters provides evidence regarding the dynamicity of the correlation, it is necessary to test it formally. We compare the log-likelihood values of the dynamic and constant correlation models. For this purpose, the CCC model is estimated and its log-likelihood result is compared with the log-likelihood of the DCC model. The null hypothesis of no dynamic conditional correlation is $\alpha + \beta = 0$. This is tested using the likelihood-ratio test (LRT) which is asymptotically distributed as χ^2 with two degrees of freedom: LRT = -2 [LL CCC – LL DCC] $\sim\chi^2_2$. LRT values are reported on the seventh column of Table 2. For R, the DCC model captures the dynamics better than the CCC model for all equity markets except Hong Kong and China. For d_1, there is evidence for DCC for all markets except Hong Kong, India and China; in d_2 for all markets except Japan, Australia, Hong Kong and China; and in d_3 for Hong Kong and China. This finding is interpreted as evidence that the correlation with the U.S. has remained rather constant in the Asia region with smaller timescales. When the timescale increases, the dynamicity becomes insignificant for other markets too. In the case of d_4, only Brazil, Japan and Hong Kong; India for d_5 and only Germany for d_6 experience dynamic conditional correlation. Accordingly, for the higher timescales, CCC would be sufficient for most of the markets. For portfolio allocation this implies constant benefits.

42 To clarify the figures, some markets are excluded and only the most important regional markets are presented. To save space, the figures are only presented for d_1, d_2, d_4 and d_6. Figures for d_3 and d_5 are available from the authors.

TABLE 2 Parameter estimates of the bivariate DCC(1,1) models with the U.S. equity market

R : 4096 observations										
	α	β	$\alpha+\beta$	DCC LL	CCC LL	LRT	Mean	S.D.	Min	Max
Canada	0.0298***	0.9555***	0.9853	-10985.9	-11061.0	150.14***	0.609	0.108	0.238	0.894
	(0.0000)	(0.0001)								
Brazil	0.0176***	0.9795***	0.9971	-14385.3	-14472.3	174.00***	0.507	0.138	0.207	0.792
	(0.0000)	(0.0000)								
the U.K.	0.0063***	0.9915***	0.9978	-11618.0	-11637.8	39.51***	0.409	0.077	0.231	0.641
	(0.0000)	(0.0000)								
Germany	0.0143***	0.9839***	0.9982	-12333.0	-12429.1	192.24***	0.430	0.167	0.066	0.747
	(0.0000)	(0.0000)								
Russia	0.0051***	0.9943***	0.9994	-14598.5	-14619.9	42.77***	0.180	0.089	-0.021	0.443
	(0.0000)	(0.0000)								
Japan	0.0043***	0.9902***	0.9945	-13311.0	-13314.9	7.86**	0.064	0.042	-0.042	0.185
	(0.0000)	(0.0000)								
Australia	0.0060***	0.9891***	0.9951	-12313.4	-12320.3	13.68***	0.149	0.056	0.026	0.333
	(0.0000)	(0.0003)								
Hong Kong	0.0115***	0.0000	0.0115	-13058.0	-13058.4	0.68	0.163	0.011	0.072	0.265
	(0.0004)	(0.1933)								
India	0.0058***	0.9925***	0.9983	-13474.7	-13493.4	37.44***	0.110	0.089	-0.097	0.335
	(0.0000)	(0.0000)								
China	0.0038***	0.9897***	0.9935	-13756.3	-13758.5	4.37	-0.004	0.037	-0.141	0.137
	(0.0000)	(0.0001)								
d_1 : 2048 observations										
	α	β	$\alpha+\beta$	DCC LL	CCC LL	LRT	Mean	S.D.	Min	Max
Canada	0.0392***	0.8922***	0.9314	-5599.40	-5617.48	36.16***	0.560	0.079	0.263	0.894
	(0.0002)	(0.0031)								
Brazil	0.0217***	0.9657***	0.9874	-7315.70	-7339.35	47.31***	0.456	0.118	0.135	0.705
	(0.0001)	(0.0003)								
the U.K.	0.0082***	0.9858***	0.9940	-6129.65	-6135.69	12.09***	0.212	0.070	0.066	0.458
	(0.0001)	(0.0004)								
Germany	0.0314***	0.9603***	0.9918	-6460.04	-6519.22	118.37***	0.246	0.221	-0.337	0.681
	(0.0001)	(0.0001)								
Russia	0.0074***	0.9864***	0.9937	-7446.57	-7453.92	14.70***	0.051	0.071	-0.146	0.221
	(0.0000)	(0.0000)								
Japan	0.0068***	0.9840***	0.9908	-6804.02	-6807.17	6.29**	-0.138	0.050	-0.257	-0.004
	(0.0000)	(0.0001)								
Australia	0.0170***	0.9373***	0.9542	-6216.36	-6220.54	8.36**	-0.137	0.061	-0.294	0.140
	(0.0001)	(0.0023)								
Hong Kong	0.0000	0.0000	0.0000	-6635.50	-6635.50	0.00	-0.088	0.000	-0.088	-0.088
	(0.0000)	(0.1072)								
India	0.0000	0.0000	0.0000	-6770.91	-6770.91	0.00	-0.005	0.000	-0.005	-0.005
	(0.0000)	(0.5982)								
China	0.0433***	0.1192**	0.1625	-6942.36	-6944.35	3.99	-0.010	0.041	-0.466	0.576
	(0.0005)	(0.0683)								
d_2 : 1024 observations										
	α	β	$\alpha+\beta$	DCC LL	CCC LL	LRT	Mean	S.D.	Min	Max
Canada	0.0429***	0.9019***	0.9447	-2872.02	-2880.89	17.74***	0.602	0.081	0.295	0.784
	(0.0004)	(0.0013)								

Brazil	0.0415***	0.9471***	0.9887	-3757.26	-3786.07	57.63***	0.501	0.167	-0.118	0.801
	(0.0004)	(0.0007)								
the U.K.	0.0496***	0.8389***	0.8886	-2944.18	-2951.25	14.15***	0.488	0.081	0.174	0.701
	(0.0005)	(0.0038)								
Germany	0.0171***	0.9829***	1.0000	-3127.12	-3139.62	25.00***	0.473	0.105	0.228	0.759
	(0.0007)	(0.0019)								
Russia	0.0115***	0.9847***	0.9963	-3815.32	-3819.82	8.99**	0.182	0.092	-0.015	0.418
	(0.0000)	(0.0001)								
Japan	0.0252***	0.8251	0.8503	-3415.01	-3416.75	3.48	0.087	0.044	-0.135	0.253
	(0.0020)	(0.7107)								
Australia	0.0108***	0.0000	0.0108	-3177.08	-3177.17	0.18	0.245	0.010	0.182	0.302
	(0.0012)	(8.9834)								
Hong Kong	0.0085***	0.9872***	0.9957	-3322.78	-3324.67	3.77	0.199	0.058	0.049	0.337
	(0.0000)	(0.0001)								
India	0.0095***	0.9872***	0.9967	-3474.67	-3482.23	15.11***	0.082	0.103	-0.137	0.349
	(0.0000)	(0.0000)								
China	0.0307***	0.5760***	0.6067	-3623.42	-3624.03	1.21	-0.040	0.036	-0.387	0.105
	(0.0008)	(0.0253)								

d_3 : 512 observations

	α	β	$\alpha+\beta$	DCC LL	CCC LL	LRT	Mean	S.D.	Min	Max
Canada	0.0755***	0.8406***	0.9160	-1459.49	-1465.95	12.91***	0.694	0.084	0.366	0.858
	(0.0021)	(0.0075)								
Brazil	0.0906***	0.8528***	0.9434	-1919.22	-1926.85	15.26***	0.555	0.133	0.057	0.820
	(0.0085)	(0.0368)								
the U.K.	0.0693***	0.8288***	0.8982	-1443.92	-1449.45	11.06***	0.634	0.083	0.243	0.828
	(0.0027)	(0.0224)								
Germany	0.1034***	0.8053***	0.9087	-1533.36	-1544.14	21.55***	0.628	0.122	0.107	0.847
	(0.0106)	(0.0834)								
Russia	0.0461***	0.9167***	0.9628	-1987.06	-1992.88	11.64***	0.246	0.146	-0.152	0.546
	(0.0011)	(0.0022)								
Japan	0.0678***	0.7603***	0.8280	-1669.62	-1673.48	7.71**	0.362	0.100	-0.126	0.650
	(0.0014)	(0.0160)								
Australia	0.0480***	0.9073***	0.9553	-1577.00	-1581.16	8.32**	0.456	0.101	0.075	0.694
	(0.0009)	(0.0013)								
Hong Kong	0.0564***	0.8092***	0.8656	-1658.96	-1661.72	5.52*	0.488	0.074	0.097	0.751
	(0.0039)	(0.0092)								
India	0.0305***	0.9695***	1.0000	-1778.16	-1791.41	26.51***	0.249	0.203	-0.145	0.723
	(0.0002)	(0.0002)								
China	0.0181***	0.9142***	0.9323	-1787.36	-1787.97	1.22	0.031	0.048	-0.078	0.191
	(0.0007)	(0.0150)								

d_4 : 256 observations

	α	β	$\alpha+\beta$	DCC LL	CCC LL	LRT	Mean	S.D.	Min	Max
Canada	0.0061***	0.9906***	0.9967	-688.68	-688.99	0.63	0.713	0.012	0.646	0.730
	(0.0003)	(0.0088)								
Brazil	0.0437***	0.8115***	0.8552	-924.15	-929.06	9.80***	0.540	0.089	0.132	0.783
	(0.0006)	(0.0047)								
the U.K.	0.0162***	0.9653***	0.9815	-653.94	-655.96	4.03	0.717	0.041	0.616	0.803
	(0.0001)	(0.0003)								
Germany	0.0146***	0.9756***	0.9903	-707.81	-709.91	4.20	0.732	0.044	0.626	0.827
	(0.0001)	(0.0001)								
Russia	0.0205***	0.9392***	0.9598	-955.16	-955.86	1.40	0.425	0.053	0.292	0.532

	(0.0010)	(0.0179)								
Japan	0.0222***	0.9592***	0.9815	-794.17	-798.70	9.07**	0.369	0.129	-0.023	0.699
	(0.0002)	(0.0002)								
Australia	0.0200***	0.9574***	0.9774	-747.32	-750.19	5.74*	0.558	0.078	0.398	0.752
	(0.0001)	(0.0007)								
Hong Kong	0.1288***	0.6356***	0.7645	-795.02	-800.04	10.03***	0.465	0.141	-0.307	0.802
	(0.0056)	(0.0117)								
India	0.0000	0.0000	0.0000	-875.94	-875.94	0.00	0.277	0.000	0.277	0.277
	(0.0068)	(21.7019)								
China	0.0078***	0.9781***	0.9859	-882.14	-882.33	0.39	-0.026	0.034	-0.074	0.066
	(0.0001)	(0.0001)								

d_5: 128 observations

	α	β	$\alpha+\beta$	DCC LL	CCC LL	LRT	Mean	S.D.	Min	Max
Canada	0.0130***	0.0000	0.0130	-345.23	-345.25	0.04	0.686	0.008	0.646	0.709
	(0.0018)	(0.9502)								
Brazil	0.1148***	0.6120***	0.7268	-432.35	-433.87	3.05	0.602	0.086	0.208	0.792
	(0.0104)	(0.0195)								
the U.K.	0.0969***	0.0553	0.1522	-320.18	-320.80	1.25	0.750	0.038	0.566	0.872
	(0.0080)	(1.1368)								
Germany	0.1585***	0.2959***	0.4545	-365.33	-366.38	2.09	0.741	0.064	0.406	0.888
	(0.0261)	(0.0324)								
Russia	0.0000	0.0000	0.0000	-495.02	-494.85	-0.33	0.408	0.000	0.408	0.408
	(0.0000)	(28.6099)								
Japan	0.0000	0.0000	0.0000	-371.66	-371.66	0.00	0.608	0.000	0.608	0.608
	(0.0000)	(0.8599)								
Australia	0.0040	0.0000	0.0040	-357.50	-357.50	0.00	0.685	0.002	0.678	0.692
	(0.0006)	(2.5409)								
Hong Kong	0.1486***	0.0000	0.1486	-375.67	-377.40	3.45	0.732	0.059	0.421	0.867
	(0.0183)	(1.1118)								
India	0.3113***	0.0821***	0.3934	-441.82	-446.21	8.79**	0.403	0.207	-0.363	0.867
	(0.0152)	(0.0412)								
China	0.1517***	0.0615	0.2132	-443.25	-443.63	0.75	0.060	0.111	-0.514	0.466
	(0.0503)	(0.1088)								

d_6: 64 observations

	α	β	$\alpha+\beta$	DCC LL	CCC LL	LRT	Mean	S.D.	Min	Max
Canada	0.0151***	0.9332***	0.9482	-173.91	-174.04	0.25	0.785	0.014	0.747	0.813
	(0.0024)	(0.0098)								
Brazil	0.0359***	0.9092***	0.9450	-238.93	-238.83	-0.19	0.632	0.039	0.562	0.694
	(0.0071)	(0.0186)								
the U.K.	0.2325***	0.5676***	0.8001	-147.49	-150.05	5.12*	0.830	0.089	0.525	0.952
	(0.0677)	(0.0509)								
Germany	0.4871***	0.0000	0.4871	-171.00	-176.13	10.27***	0.746	0.152	0.009	0.967
	(0.0230)	(0.0234)								
Russia	0.0000	0.0000	0.0000	-260.21	-259.97	-0.48	0.416	0.000	0.416	0.416
	(0.0000)	(0.7478)								
Japan	0.4618***	0.0000	0.4618	-197.64	-200.06	4.84*	0.606	0.210	-0.270	0.953
	(0.0269)	(0.0268)								
Australia	0.0291	0.9709	1.0000	-179.82	-179.87	0.09	0.720	0.027	0.643	0.770
	(0.1023)	(2.5466)								
Hong Kong	0.0662***	0.0000	0.0662	-197.45	-197.57	0.24	0.664	0.029	0.554	0.757
	(0.0032)	(0.5691)								

India	0.1248***	0.8159***	0.9407	-220.08	-222.79	5.43*	0.303	0.249	-0.306	0.775
	(0.0042)	(0.0041)								
China	0.0000	0.0000	0.0000	-220.11	-220.14	0.06	-0.059	0.000	-0.059	-0.059
	(0.0587)	(1144.82)								

Notes: The table summarizes the DCC estimates in bivariate framework with the U.S. for original returns and six time scales. α and β are the DCC parameters capturing the effects of the lagged standardized shocks and lagged conditional correlations on current correlations, respectively. The table also presents the log-likelihood values of the DCC and CCC models and the results of the likelihood-ratio test (LRT). The critical values for LRT~ χ_2^2 are 4.605, 5.99 and 9.21 for 10%, 5% and 1% significance levels, denoted with *, ** and ***, respectively. A number of descriptive statistics for the dynamic correlations are also presented, including the values for the mean, standard deviation, minimum and maximum. Figures in parentheses denote standard errors.

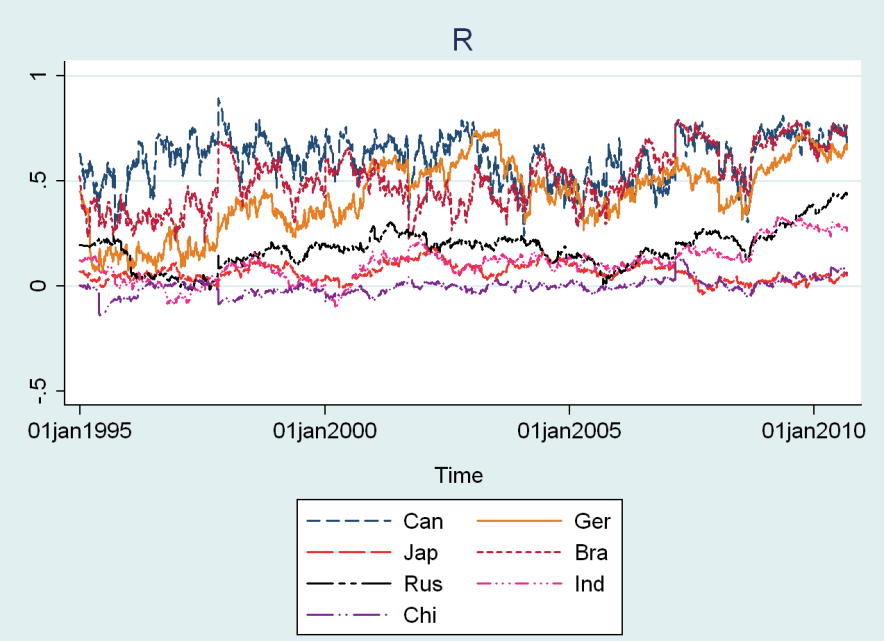

FIGURE 2 DCCs with the U.S. Dec. 23, 1994 - Sep. 3, 2010

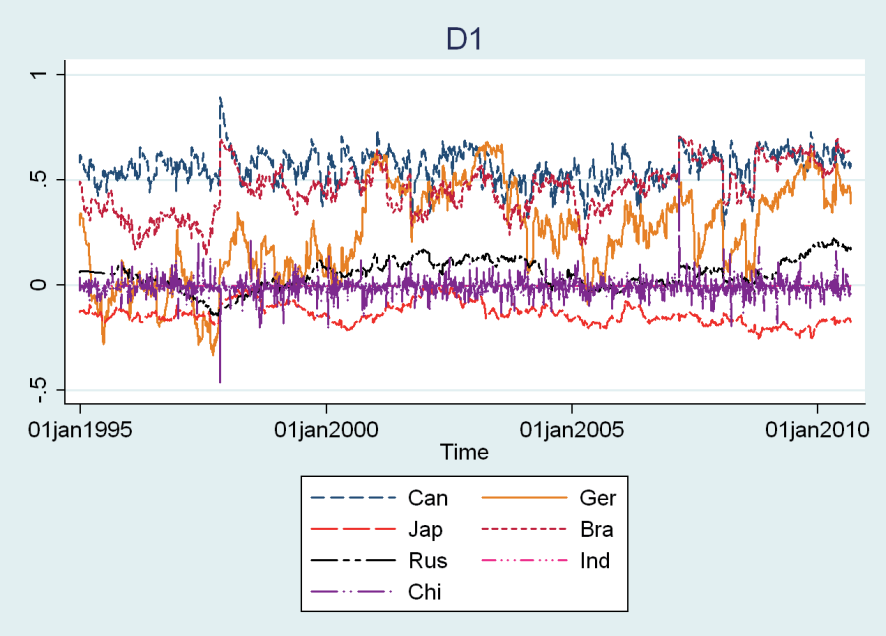

FIGURE 3 D1 DCCs with the U.S. Dec. 23, 1994 - Sep. 3, 2010

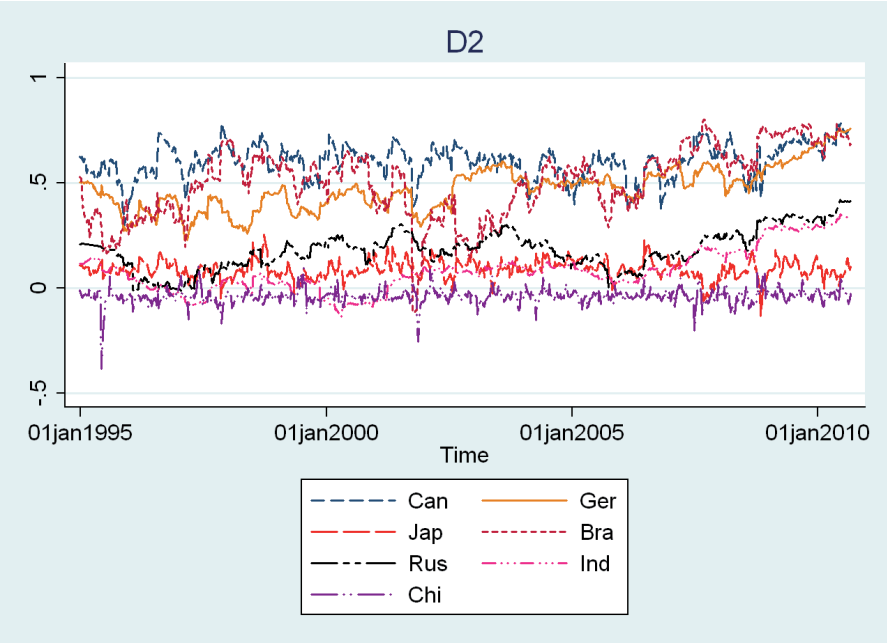

FIGURE 4 D2 DCCs with the U.S. Dec. 23, 1994 - Sep. 3, 2010

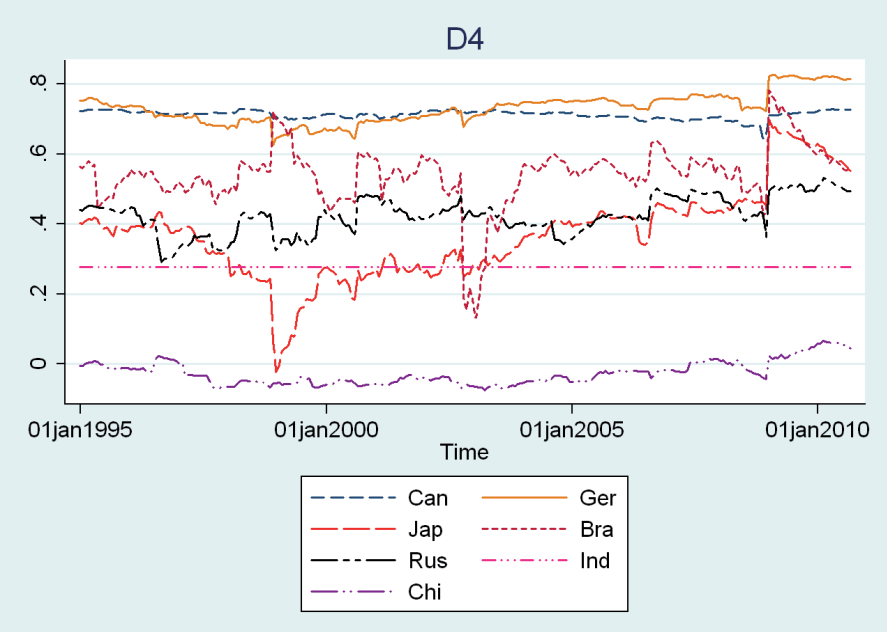

FIGURE 5 D4 DCCs with the U.S. Dec. 23, 1994 - Sep. 3, 2010

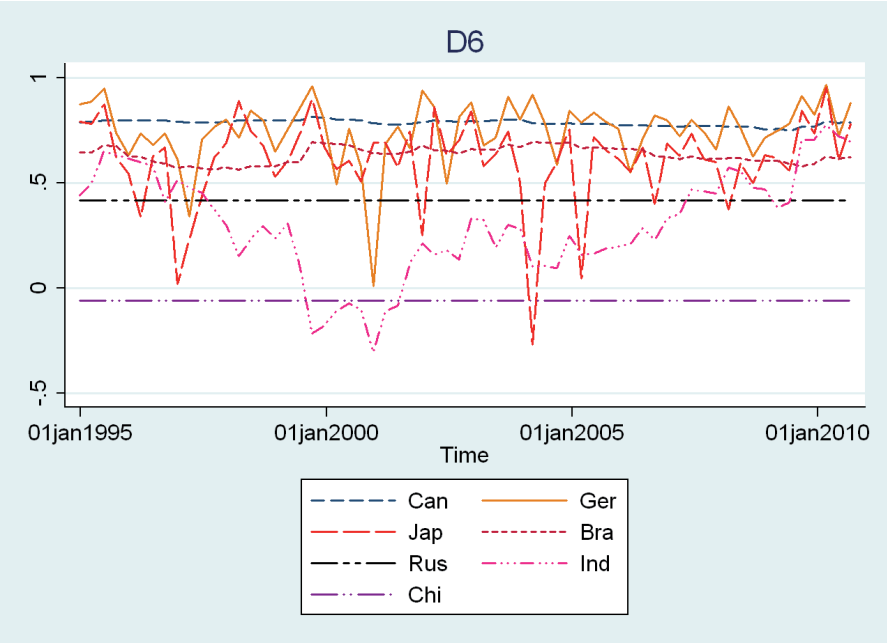

FIGURE 6 D6 DCCs with the U.S. Dec. 23, 1994 - Sep. 3, 2010

3.4 Development vs. regional factors and portfolio diversification benefits

Figure 3 indicates that in d_1 at the beginning of the period, all markets except Canada and Brazil experience a rather weak co-movement with the U.S., while the Asian regional markets are even negatively correlated with the U.S. It is notable that, while the correlations of the emerging Asian markets such as India and China are negative and almost constant, the best diversification benefits for an investor from the U.S. with an investing horizon of 2-4 days are provided by Japan and Australia. These two markets have negative correlations with the U.S. for almost the entire sampling period. It is also notable that the correlations of the European markets (Germany and Russia) have grown rather steadily after 2005. The results for d_1 provide evidence that the regional effect is a dominating factor in the correlation determination at a small scale, while the development factor does not have a significant role.

For d_2 (4-8 days) case, some of the diversification benefits are lost because the correlation is higher for all of the markets. The markets could be divided into highly correlated markets (Canada, Brazil, Germany and the U.K.), moderately correlated markets (Russia, Hong Kong, Australia and India), and mildly correlated markets (Japan and China). At the end of the sample period, the correlation among the highly correlated markets is around 0.60-0.75, between 0.20-0.40 for the moderately correlated and between -0.10-0.20 for the mildly corre-

lated markets. The steady rise in correlation during the last five years is now more visible for all other markets except Japan, Australia and China.

The correlations experience substantial dynamicity for d_3 (8-16 days) scale as the LRT test provides statistically significant results for almost all of the markets. In addition, the strength of the co-movement increases and the mean correlations for the U.K. and Germany rise to the same levels as Canada, passing that of Brazil. For each region, the BRIC countries are clearly less correlated with the U.S. than the developed markets.

The differences in stock market integration between the emerging and developed markets start to show for d_4 and d_5 correlations. Canada, the U.K. and Germany are clearly the most correlated markets with the U.S. during the sample period, with the correlation measuring at almost 0.80 at the end of the period. For d_4, the correlations of Japan and Australia increase during the sample period and, among others, they jump to a new level during the late-2000s financial crisis. The d_4 correlations among the BRIC countries are approximately at the same level as the d_2 correlations. Brazil and Russia are in the same class with Japan and Hong Kong. For d_5, the correlations are mostly higher than those of smaller scales and remain rather constant for the entire sampling period. The mean of the correlations for the BRIC countries are smaller than that of any of the developed countries, regardless of their region. The results from d_4 and d_5 suggest that the development factor, instead of the regional factor, begins to dominate the correlation structure as the timescale increases.

For d_6, the co-movement levels are almost constant for several markets. The developed markets are the most correlated, with the values for the U.K. and Germany being close to 0.90 and those Canada, Japan and Australia being approximately 0.80. India's correlation varies substantially and is eventually slightly lower than Hong Kong's, at approximately 0.70 while Brazil's stays rather steady between 0.60 and 0.70. Russia's is approximately 0.40. China is clearly the least correlated, with a constant correlation of -0.06. Figure 6 and Table 2 show that the developed markets experience higher co-movement with the U.S. than the BRIC countries, with only Brazil reaching the same level as the developed markets.

For U.S. short-term investors, Japan and Australia provide the best diversification benefits at the daily (d_1) level. However, when the timescale begins to increase, the benefits also disappear, although China's correlation with the U.S. stays rather small for all of the tested timescales. It can also be noted that the developed markets follow the long-term trends of the U.S. more closely than the BRIC countries. Nonetheless, at shorter timescales, Japan, Australia and Hong Kong have generally lower correlations with the U.S. than Brazil, Russia and India. Accordingly, it can be concluded that at lower timescales, regional effects dominate in correlation structure, while the development factors start to play a role for longer scales. The results also suggest that clustering the BRICs into one homogenous group is not justified.

3.5 Testing for correlation trends

The DCC framework presents the correlation dynamics as a function of time, which enables us to study the trends in co-movement with a simple linear and nonparametric trend test. We formally test the long-run behavior of the correlation by using Perron and Yabu's (2009) method. Our results are consistent with the findings of Bekaert et al. (2009) that the correlations generally have not increased during the sample period, as only a few markets have experienced growing trends and the slope coefficient for most of them is insignificantly small. [43]

3.6 Tests for Robustness of the Results

3.6.1 MODWT results

As for a robustness check, the results are also estimated using the maximal overlap discrete wavelet transform (MODWT). MODWT does not subsample the filtered outputs and relaxes the orthogonality property needed in DWT.[44]

The results are largely immune to the method of estimation. The correlation means are qualitatively similar regardless of the method of estimation, although MODWT produces higher standard deviations, higher maximums and smaller minimums.[45] As a result, the DCC is more desirable in case of MODWT-filtered returns than CCC. However, our fundamental results regarding the stock market integration in the BRIC countries still apply.

3.6.2 Dividend adjusted returns

The original results were estimated using price indices that exclude dividends. This approach is a potential source of misspecification, especially for the lower scales. To evaluate the importance of the dividends for BRICs stock market integration, wavelets and DCCs were also estimated using the MSCI Global Investable Market Indices (GIMI) family on total returns, which comprise both the price performances and the dividend payments. Unfortunately, this procedure produces some data limitations because for Russia, the index is only available from August 20th, 1997. In addition, the index for China does include the major Chinese indices available for foreign investors, China B and the Mainland China related indices of Hong Kong, China H and Red Chips, but omits the China

43 More accurate results for the Perron-Yabu trend test are available from the authors.
44 For a thorough discussion between the MODWT and DWT, see Percival and Walden (2000).
45 To save space, the MODWT-DCC results are not presented here but are available from the authors.

A shares. The available data period for the MSCI GIMI China A-share index, in turn, is too short for a precise analysis.

Overall, the results were broadly immune to the inclusion of dividends with the exception of China, the integration of which became significantly higher for all scales higher than d_2 and became rather similar with that of India[46]. The Chinese results, however, could be mostly due to the composition of the China Investable index.

46 Results are available from the authors.

4 CONCLUSIONS

This paper examines the differences between several return periods by studying the asset return co-movement of the so-called BRIC countries (Brazil, Russia, India and China) with respect to the U.S. market for several timescales. We study the stock market dynamics of the major developed markets (the U.K., Germany, and Japan) as well the neighboring countries (Canada, Australia and Hong Kong) to capture the potential effects of geographical proximity and regional factors for the co-movement dynamics. Our results lend support to the necessity of modeling international stock market dynamicity using time-varying estimation methods.

The analysis is performed using wavelet analysis, which decomposes the return series into a large timescale approximation and a collection of finer resolution layers, which capture the finer details of the signal. The timescales can be examined individually, which enables us to study the risks for both short- and long-term investors. To capture the time-varying features of the stock return co-movements, the relationship between asset returns is studied with pairwise dynamic conditional correlation with the U.S. market. This setting allows us to study whether there are differences between the regions, how the level of development of the market affects the correlations and has the correlation increased.

In part, our results are in line with the findings of previous studies, but due to the flexibility of wavelet analysis and DCC, we were also able to provide some new and novel results regarding the co-movement of the stock market and potential benefits of international portfolio diversification. The results indicate that the dynamicity and strength of the return co-movement depends on the timescale as correlation increases and its dynamicity decreases when the timescale increases for all the markets.

Our results lend support for the benefits of international portfolio diversification both within the BRICs and between the BRICs and the industrial economies. For the smaller timescales, our results support the conclusions of Groenen and Frances (2000) that the stock markets can be divided into three clusters: Asia, Europe and America. The correlation structures for these scales

vary substantially during the sample period and differ significantly between the markets. As the timescale increases, the variations in the co-movement levels deteriorate and become insignificantly small for almost all of the markets and the gaps between the market correlations decrease. In accordance with Bekaert et al. (2009), we do not generally detect increases in the correlation trends for any of the timescales. For the lower scales (i.e. for the higher frequencies), regional factors dominate as the American region experiences the highest co-movement, while the Asian region and especially the markets of Japan, Australia and China are very weakly correlated with the U.S. However, for the higher scales (i.e. for the lower frequencies), the level of economic development begins to dominate over regional factors as the developed markets are more correlated with the U.S. than the BRICs. Thus, for higher scales, the diversification benefits are almost lost for the developed markets, while emerging markets, and particularly China, still provide a fruitful ground for international diversification. Our results also show, that in terms of correlation with the U.S., BRICs cannot be clustered into a single group.

These findings lead us to conclude that the developed markets share similar long-term return fundamentals even though their short-term fundamentals might differ. The results stress the importance of the time- and frequency-varying properties of the stock return co-movements for international portfolio design. To analyze the determination of the correlations with different timescales among the stock markets more precisely, a formal investigation on the explanatory variables of returns, as well as the effects of industrial factors, is needed. This work is, however, left for future research.

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CHAPTER 5

BUBBLES IN CHINA[47]

Abstract[48]
This study examines rational bubbles in Chinese stock markets and China-related share indices in Hong Kong. A duration dependence test is employed for both monthly and weekly abnormal market returns of the Shanghai and Shenzhen A- and B-markets as well as for the Hong Kong China Enterprises and China Affiliated Corporations indices. The test results are mixed, as weekly data demonstrate bubbles for all of the Mainland Chinese stock markets, but monthly data do not show bubbles for any of the examined markets. Neither of the datasets indicates bubbles in the Hong Kong markets. Results indicate that, in terms of bubbles, segmentation does not play a significant role in bubble existence and that the stock markets of Mainland China behave similarly but cannot be compared to the more developed markets of Hong Kong. In the light of the results, the argument that duration dependence test is sensitive to the use of weekly versus monthly data, can also be generalized to emerging markets. Thus for consistent bubble results, it is recommendable to employ the duration dependence test to both weekly and monthly data together with fractional integration test.

Keywords: Duration dependence; Rational bubbles; Chinese stock market

JEL classification: G14; C41; C52

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1 INTRODUCTION

China's stock market has been under an intensive investigation during the last decade. Its ever-growing size and importance to the world's capital markets and especially to the development of East Asia as well as its unique characteristics have gained the interests of both scholars and practitioners. This research studies the presence of stock market bubbles in Chinese stock markets by examining both of China's stock exchanges, Shanghai and Shenzhen, and their A- and B-share markets. For the comparison, also the China-related share indices of Hong Kong are studied. Using of weekly and monthly dataset works both as a robustness check and simultaneously as a sensitivity test for duration dependence method that is used for bubble testing.

Since the founding of the stock markets of China at the beginning of 1990s, they have experienced, together with China's economy, a tremendous growth. The number of stocks has increased from 13 in 1990 to 1434 in 2006 and the market capitalization has grown from $1.3 billion to more than $1000 billion during the same time. When measured with market capitalization, China is the second biggest economy in Asia-Pacific region after Japan and the most important emerging market in the world. An explosive growth of China's stock markets between 2005 and 2007 led investors to suspect of an existence of a bubble in the markets. However, a steep decline between 2007 and 2008 wiped away these suspicions. So far there has not been a systematic study on whether the bubble really burst or was there still air in the prices after the decline. This paper aims to clarify this situation.

For academics, China's stock markets create an interesting research environment since they have several unique characteristics. Due to historical reasons, until year 2006, a typical firm's shares were split into state shares, legal-entity shares and tradable shares from which only tradable shares, which accounted about 30% of all shares, were tradable in stock exchanges. The stock exchanges themselves, located in Shanghai and Shenzhen, are segmented into A- and B-share classes which are all studied in this research. A- and B-shares are similar in the sense that they have the same voting rights and earn the same dividends, however A-shares cost about four times more than B-shares (Fernald

and Rogers, 2002). A-stocks were originally intended only for the Mainland Chinese while B-stocks were meant for foreigners. The boundaries have afterwards diminished, since in 2001 the Mainland Chinese were allowed to invest in B-stocks and in 2002 a Qualified Foreign Institutional Investor program was established allowing certain foreign institutions to invest in A-shares. However, there still exist differences between the stock classes. For example, Tan et al. (2008) report that the A-share markets are dominated by domestic individual investors who typically lack the knowledge and experience in investing while the B-markets are dominated by more sophisticated foreign institutional investors. In addition, Jacobson and Liu (2008) have found that an A-share stock market can be better categorized as a developed market than as an emerging market, while the results for B-shares are the opposite. For this comparison, the China-related indices from Hong Kong's more efficient and more developed stock markets are also studied. Eun and Huang (2007) mention also that the stock markets of China are claimed to be chaotic, rather irrational and inefficient. Thus the environment is suitable for a development of a bubble and due to the short selling prohibition, the bubble bursting would cause losses to all investors and the effects could also reach the countries under China's influence, especially Asia's emerging markets.

The last contribution of the study is related to bubble testing. This paper employs the duration dependence test developed by McQueen and Thorley (1994) which has gained prominence in bubble testing during the last decade and has been used, for example, by Zhang (2008). By using weekly and monthly data, both, the robustness of the results and the sensitivity of the test to the data choices can be examined.

So far, market bubbles in China have been studied with daily (Ahmed et al., 2006), weekly (Zhang, 2008) and monthly (Ling et al., 2007; Sarno and Taylor, 1999) data, and the results have been rather similar: a bubble has developed in Chinese stock markets. While the time period for the previous studies is mostly limited to the 1990s, with Zhang (2008) reaching 2001, this study extends the data period from the beginning of 1990s all the way to the end of 2008, and thus takes into account the steady decrease in the market in the beginning of the 21st century, the explosive growth that followed, and the steep decline of the indices after October 2007 mainly resulting from the global economic crisis.

At the moment, many existing bubble tests have one thing in common: they are not very good at detecting bubbles (Gürkaynak, 2008). The duration dependence test can overcome most of the criticisms laid against the traditional bubble tests; its advantages are that it is unique to bubbles, it addresses nonlinearity and it does not require the correct identification of the observable fundamental variables. However, Harman and Zuehlke (2004) have examined the method using securities data from the New York and the American Stock Exchanges and recognize several sensitivities resulting from the specification decisions of the test. They have found inconsistency in the results obtained using weekly and monthly data. Thus, in order to increase the robustness of the results and also to study the sensitivity of the duration dependence method in an

emerging market, this research studies bubbles using both weekly and monthly data. Zhang (2008) also uses both datasets, but does not report the duration dependence results of monthly data at all.

The results of the bubble tests are mixed. For weekly data, bubbles can be found in both of the Mainland Chinese stock exchanges' share classes. However, monthly data do not confirm these results, as they fail to find bubbles in any of the studied markets. Neither dataset reveals bubbles in the Hong Kong Stock Exchange. Though the results leave the question of bubbles in China still open, they provide evidence that the segmentation of the markets does not play a significant role in bubble existence. It can also be concluded that China's stock markets have not yet reached the efficiency level of the Hong Kong stock exchange and neither of their share classes can be categorized as developed when categorizing is done according to the existence of bubbles. In addition, the results expand the conclusions of Harman and Zuehlke (2004), regarding the sensitivity of the duration dependence test for the use of different data periods, to also concern emerging markets. Thus the duration dependence test should be used carefully and the results should be confirmed by using at least both, weekly and monthly data. It is preferrable to use another promising bubble method, fractional integration test, together with the duration dependence test as Hassan and Yu (2007) have done.

Remainder of this study is organized as follows: The second section presents a rational bubble model and the duration dependence test, which is used to test for the existence of bubbles. The third section presents the data and the test results, and the fourth section concludes.

2 RATIONAL BUBBLE MODEL AND DURATION DEPENDENCE TEST

The rational bubble model allows the stock prices to diverge from the fundamental value, even though investors are not irrational. This kind of bubble arises if investors realize that the stocks are overpriced but are prepared to pay the higher price, expecting that other investors will pay an even higher price. Thus, the risk that the bubble will burst is compensated for by higher positive returns.

A simple efficient market model suggests that the expected return of an asset is equal to the required return

$$E_t[R_{t+1}] = r_{t+1}, \tag{1}$$

where E_t denotes mathematical expectations given the information set at time t, r_{t+1} is the time-varying required rate of return and R_{t+1} is the return of an asset at time $t + 1$,

$$R_{t+1} = \frac{p_{t+1} - p_t + d_{t+1}}{p_t}, \tag{2}$$

A rearrangement of equation (2) leads to the implication that the current price of a stock equals the sum of expected future price and dividends discounted at the return required by investors,

$$p_t = \frac{E_t[p_{t+1} + d_{t+1}]}{(1 + r_{t+1})}. \tag{3}$$

Calculating this forward k periods yields the semi-reduced form

$$p_t = E_t\left[\sum_{i=1}^{k} \left(\frac{1}{1+r_{t+1}}\right)^i d_{t+i}\right] + E_t\left[\left(\frac{1}{1+r_{t+k}}\right)^k p_{t+k}\right]. \tag{4}$$

In order to obtain a unique solution to the equation (4), it is assumed that the expected discounted value of the stock in the indefinite future converges to zero:

$$\lim_{k\to\infty} E_t\left[\left(\frac{1}{1+r_{t+k}}\right)^k p_{t+k}\right] = 0. \tag{5}$$

With this assumption, a fundamental value of the asset can be solved from the equilibrium condition

$$p_t^* \equiv E_t\left[\sum_{i=1}^{\infty}\left(\frac{1}{1+r_{t+1}}\right)^i d_{t+1}\right]. \tag{6}$$

However, as Blanchard and Watson (1982) among many others note, abandoning the convergence assumption leads to an infinite number of solutions. Any price of the form

$$p_t = p_t^* + b_t, \tag{7}$$

where

$$E_t[b_{t+1}] = (1 + r_{t+1})b_t, \tag{8}$$

is also a solution for the given equation. Equation (7) states that the market price of an asset can deviate from the fundamental value by a bubble factor b_t if on average the factor grows at the required rate of return. Equation (7) also rules out negative bubbles since they would have to grow more negative over time, yet total stock prices will never be negative.
The rational speculative bubble model allows for unexpected price changes $\varepsilon_{t+1} \equiv (R_{t+1} - r_{t+1})p_t$ from two unobservable sources: unexpected changes in the fundamental value,

$$\mu_{t+1} = p_{t+1}^* + d_{t+1} - (1 + r_{t+1})p_t^*, \tag{9}$$

and unexpected changes in the value of the bubble,

$$\eta_{t+1} = b_{t+1} - (1 + r_{t+1})b_t. \tag{10}$$

The observable unexpected price change, $\varepsilon_{t+1} = \mu_{t+1} + \eta_{t+1}$, equals the sum of the fundamental and bubble changes,

$$\varepsilon_{t+1} = \begin{cases} \mu_{t+1} + \frac{(1-\pi)}{\pi}\left((1 + r_{t+1})b_t - a_0\right), \text{with probability } \pi \\ \mu_{t+1} - (1 + r_{t+1})b_t + a_0, \text{with probability } (1 - \pi) \end{cases} \tag{11}$$

As required by the efficient market condition, the expected value of total price innovation is zero. However, the probability of a positive innovation or an abnormal return increases if the fundamental innovations are symmetric around zero. This is due to the inherent skewness of the bubble innovations.

As the bubble component grows, it begins to dominate the fundamental component—i.e., that portion of the stock price determined by the discounted value of future cash flows. The bubble's innovation is positive and small relative to an infrequent but large negative innovation if it bursts. The asymmetry of bubble innovations results in observed abnormal returns that tend to be a positive while the bubble continues, causing autocorrelation and longer runs of positive abnormal return than expected from a temporally independent series. This is the logic behind the duration dependence test for rational speculative bubbles.

The duration dependence test developed by McQueen and Thorley (1994) has gained prominence in testing for rational bubbles. Duration dependence is a characteristic of the hazard function for duration times. If f_i denotes the density function for duration times and F_i the corresponding distribution function, then the hazard function h_i is defined as the conditional density function for duration of length i, given that duration is not less than i; that is, $h_i = f_i/(1 - F_i)$. The hazard function exhibits positive (negative) duration dependence if h_i is increasing (decreasing) in i. If prices contain bubbles, the runs of positive abnormal returns will exhibit negative duration dependence; i.e., the conditional probability of a run ending, given its duration, is a decreasing function of the duration of the run. The duration dependence test requires that returns are transferred into a series of run lengths on positive and negative observed abnormal returns and the numbers of runs of particular length i are then counted. A run is defined as a sequence of abnormal returns of the same sign. Formally, the examined data consist of a set, S_T, of T observations on the random run length. Tests for duration dependence are implemented by examining the hazard rate h_i for positive and negative runs. The hazard rate is defined as the probability of obtaining a negative return ($\varepsilon_t < 0$) given a sequence of i prior positive returns ($\varepsilon_{t-i} > 0$). In the presence of a rational bubble, the hazard rate $h_i = P(\varepsilon_t < 0 | \varepsilon_{t-1} > 0, \varepsilon_{t-2} > 0, \dots, \varepsilon_{t-i} > 0, \varepsilon_{t-i-1} < 0)$ decreases with i —i.e., $h_{i+1} < h_i$ for all i. Since bubbles cannot be negative, a similar inequality does not hold for runs of negative abnormal returns. Thus bubbles generate duration dependence in runs of positive, but not negative, abnormal returns.

The sample hazard rate for each run length $i$is computed as $\hat{h}_i = N_i/(M_i + N_i)$, which is derived from maximizing the log likelihood function of the hazard function with respect to h_i

$$L(\theta|S_T) = \sum_{i=1}^{\infty} N_i ln h_i + M_i ln(1 - h_i) + Q_i ln(1 - h_i), \qquad (12)$$

where N_i is the number of completed runs of length i in the sample, and M_i and Q_i are the numbers of completed and partial runs with lengths greater than i, respectively. The term containing Q_i in the log likelihood (equation (12) is included to incorporate information contained in partial runs and may be ignored in large samples.

To test the null hypothesis of no rational bubbles, it is necessary to choose a proper functional form for hazard function. The duration dependence in this paper are based on the logistical transformation of the log of i:

$$h_i = \frac{1}{1+e^{-(\alpha+\beta lni)}}. \quad (13)$$

The log-logistical function changes the unbounded range of α and βlni into the (0,1) space of h_i, which is the conditional probability of ending a run. The null hypothesis of no bubbles suggests that positive and negative abnormal returns occur randomly—i.e., the probability of a run's ending is independent of prior returns. Therefore, the null hypothesis of no duration dependence is $H_0: \beta = 0$, which means a constant hazard rate. The alternative bubble hypothesis suggests that the probability of a negative abnormal returns occur randomly but a positive run's ending should decrease with the run length, which means that the value of the slope parameter β is negative ($H_1: \beta < 0$, decreasing hazard rate). The duration dependence test is performed by substituting Equation (13) in Equation (12) and maximizing the log likelihood function with respect to α and β. The parameters of the hazard function are estimated via a logit regression where the independent variable is the log of the current run length and the dependent variable is 1 if the run ends in the next period and 0 if it does not. Under the null hypothesis of no bubble ($\beta = 0$), the likelihood ratio test (LRT) is asymptotically distributed χ^2 with one degree of freedom: LRT = 2 [Log unrestricted – Log restricted] ~ χ^2.

3 DURATION DEPENDENCE AND CHINESE STOCK MARKETS

This study focuses on investigating the price indices of both Mainland China and Hong Kong. The starting dates of the indices are January and March 1992 for Shanghai A (SHA) and B (SHB), October 1992 for Shenzhen A (SZA) and B (SZB), and January and July 1993 for the Hong Kong China Enterprises (HKE) and China Affiliated Corporations (HKA) indices, respectively. To add robustness to the results, both monthly and weekly returns are examined. There are several reasons for this. First, the bubble theory gives no indication of the typical length of a bubble, though practical literature implies that bubbles may build up over a number of months and even years. Second, monthly returns may be appropriate, since a high signal-to-noise ratio in weekly returns could cause bubble-related runs to be interrupted by noise, making bubble detection difficult. However, taking into account the relatively short data series of the research, monthly returns may lack the power and thus weekly returns may be more appropriate. The use of two datasets also helps to investigate the sensitivity of the duration dependence test for the use of monthly versus weekly abnormal returns.

The data pertaining to the monthly indices are based on the closing prices for the 15th of each month. The duration dependence tests for weekly data are conducted using weekly data for Wednesday closing prices. In the event that the Wednesday is a holiday or a non-trading day, that Tuesday's close is used. If Tuesday's data are also unavailable, that Monday's close is used. In the rare case where the Monday close is also unavailable, the returns for the week are combined with those for the following week. All price indices are expressed in local currencies, except for Shanghai B and Shenzhen B, which are denominated in US and Hong Kong dollars, respectively. The data are available in Datastream. The prices are transformed into continuously compounded returns, $R_t = 100 * (lnP_t - lnP_{t-1})$, where P_t is the index closing price for period t, and P_{t-1} is the price for the preceding period. All tests are conducted on nominal returns.

To provide general understanding of the nature of the different Chinese stock markets, Table 1 presents some stylized evidence regarding stock market behavior using weekly data. The table contains the number of return observations for the stock indices and statistics, testing the null hypothesis for return series independence. The descriptive statistics for the returns are the mean, standard deviation, skewness and kurtosis for the stock returns of each market. In addition, Ljung-Box Q-statistics for the autocorrelation are also presented.

TABLE 1 Descriptive statistics of weekly returns

Share index	N	Mean	SD	Skewness	Kurtosis	Q(5)-statistics
SHA	865	0.208	6.165	2.05	26.05	20.87 (0.0009)
SHB	856	-0.031	5.571	0.24	5.65	23.33 (0.0003)
SZA	824	0.069	5.266	0.19	10.7	9.51 (0.0903)
SZB	824	0.053	5.477	0.67	9.95	39.80 (0.0001)
HKE	825	0.051	5.652	-0.17	5.44	12.79 (0.0255)
HKA	797	0.062	5.547	-0.41	6.75	19.03 (0.0019)

The rational speculative bubble model implies negative skewness in returns. This can be observed from Hong Kong but not from Mainland China. All of the market returns are leptokurtotic—i.e., they have "fat tails," which is also consistent with the presence of bubbles (greater standard deviations as the bubble grows). According to the rational speculative bubble model, stock returns should be autocorrelated, since returns tend to be positive as the bubble grows. Thus, the independence of the returns series needs to be investigated. The Ljung-Box portmanteau test statistics for five lags (denoted by Q(5)) indicate that all of the markets except Shenzhen A have significant autocorrelation, which is consistent with rational bubbles. For monthly returns, the skewness and kurtosis results are quite similar, but significant autocorrelation can be found only in SHA and HKA.

One characteristic of a rational bubble is that the hazard rate should be a declining function of positive runs; otherwise, a bubble cannot be sustained. The sample hazard rates can be used to determine the probability that a specific positive run lasts for a particular length of time i, given that the run has lasted until i. The no-bubble null hypothesis implies a constant hazard rate ($\beta = 0$), and the bubble alternative suggests that the probability of a positive run's ending should decrease with the run length; i.e., the value of the slope parameter is negative ($\beta < 0$), which signifies decreasing hazard rates.

Tables 2 and 3 present the results of duration dependence test for weekly and monthly returns, respectively, by showing the numbers of returns and the maximum likelihood estimates of the log-logistic function parameters of Equation (13). Weekly runs are created using the sign of the error term from an AR(4) model of weekly returns and for the monthly returns, positive and negative abnormal returns are defined relative to the in-sample mean.

TABLE 2 Duration dependence test results for weekly returns

Market	SHA	SHB	SZA	SZB	HKE	HKA
Number of returns						
Positive	208	198	201	183	191	203
Negative	208	199	202	184	191	204
Total	416	397	403	367	382	407
Positive run test						
α	0.290**	0.194	0.228*	0.091	0.003	-0.192
β	-0.620***	-0.396**	-0.462***	-0.385**	-0.264*	-0.021
LRT	20.473***	6.056**	8.916***	6.258**	2.974*	0.019
(p-value)	(0.0001)	(0.014)	(0.003)	(0.012)	(0.085)	(0.891)
Negative run test						
α	-0.068	-0.324**	-0.089	-0.131	-0.087	0.157
β	0.023	0.121	0.069	-0.241*	0.164	0.073
LRT	0.020	0.595	0.161	3.009	0.788	0.135
(p-value)	(0.888)	(0.440)	(0.689)	(0.083)	(0.375)	(0.714)

Notes: The duration dependence test is performed on monthly nominal returns. Positive and negative abnormal returns are defined relative to the sign of the error from a weekly AR(4) model. Actual run counts do not include the partial runs which may occur at the beginning or at the end of period investigated. Total runs are the number of total positive and negative runs. β is the hazard rate which is estimated using a logit regression where the independent variable is the log of current length of runs and dependent variable is 1 if a run ends and 0 if it does not end in the next period. The likelihood ratio test (LRT) of the null hypothesis of no duration dependence or constant hazard rate ($H_0: \beta = 0$) is asymptotically distributed χ^2 with one degree of freedom. p-value is the marginal significance level, which is the probability of obtaining the value of the LRT or higher under the null hypothesis. ***, ** and * indicate significance at 1%, 5% and 10% levels.

From tables 2 and 3, it can be seen that for weekly data the Shanghai A-share index has a significant negative β_{sha} coefficient of -0.620 for the sample period. The likelihood ratio test (LRT) of the null hypothesis of no duration dependence or constant hazard rate ($H_0: \beta = 0$) is rejected at the 1% significance level with the LRT=20.4731. Similar findings are also reported for Shanghai B- and Shenzhen A- and B-indices. As for runs of negative abnormal returns the constant hazard rate is not rejected for any of the markets, the results imply existence of bubbles in all of the Mainland Chinese stock markets. However, monthly data lead to different conclusions. For Shenzhen B, the point estimate β_{szb} is negative, but the coefficient is not significant. For the rest of the markets, β is positive. Thus, the null hypothesis of no bubbles cannot be rejected in any of the markets. The results for HKE and HKA show no evidence of rational speculative bubbles.

The empirical findings from weekly data indicate that rational bubbles can be found in all of the Mainland China markets. These results are consistent with the results obtained by previous studies (Ahmed et al., 2006; Sarno and Taylor, 1999; Zhang, 2008), which have usually used the 1990s as their time period. However, the monthly data question these results as they fail to yield evidence of bubbles in any of the markets. The stock indices in the more developed markets of Hong Kong show no evidence of bubbles with either dataset.

TABLE 3 Duration dependence results for monthly returns

Market	SHA	SHB	SZA	SZB	HKE	HKA
Number of returns						
Positive	42	46	45	44	37	44
Negative	42	47	46	45	37	44
Total	84	93	91	89	74	88
Positive run test						
α	-0.316	-0.199	-0.047	0.235	-0.619**	-0.789***
β	0.299	0.364	0.142	-0.014	0.277	0.781**
LRT	0.626	0.898	0.137	0.001	0.719	4.637**
(p-value)	(0.429)	(0.343)	(0.711)	(0.974)	(0.397)	(0.031)
Negative run test						
α	-0.471	-0.330	-0.240	-0.301	-0.436	0.306
β	-0.016	0.178	0.044	-0.163	0.152	-0.417
LRT	0.003	0.266	0.017	0.296	0.175	1.241
(p-value)	(0.959)	(0.606)	(0.896)	(0.587)	(0.675)	(0.265)

Notes: The duration dependence test is performed on monthly nominal returns. Positive and negative abnormal returns are defined relative to the in-sample mean. Actual run counts do not include the partial runs which may occur at the beginning or at the end of period investigated. Total runs are the number of total positive and negative runs. β is the hazard rate which is estimated using a logit regression where the independent variable is the log of current length of runs and dependent variable is 1 if a run ends and 0 if it does not end in the next period. The likelihood ratio test (LRT) of the null hypothesis of no duration dependence or constant hazard rate ($H_0: \beta = 0$) is asymptotically distributed χ^2 with one degree of freedom. p-value is the marginal significance level, which is the probability of obtaining the value of the LRT or higher under the null hypothesis. ***, ** and * indicate significance at 1%, 5% and 10% levels.

The results confirm the conclusions of Harman and Zuehlke (2004) that the duration dependence test is sensitive to the use of weekly versus monthly results. Thus, the reliability of duration dependence test for bubble detection is questionable.

4 CONCLUSIONS

Rapid growth in Chinese stock markets during 2006 and 2007 led to bubble suspicions among investors, but the steep decline of the indices that followed changed situation to be more unclear. This study attempts to shed light on these issues by investigating bubbles from both of China's stock exchanges, using weekly and monthly datasets ranging from the beginning of 1992 to October 2008. The main econometric method employed is the duration dependence test, and the results are compared to the ones obtained from the China-related indices of the Hong Kong Stock Exchange. The use of two datasets has two functions: it adds robustness to the results and simultaneously works as a sensitivity test for the duration dependence test.

Descriptive statistics indicate the possible existence of bubbles, since some autocorrelation and nonnormality of returns, which are consistent with the bubble model, can be found in most of the markets. However, the duration dependence test yields mixed results. For weekly data, it shows bubbles in all of the Mainland Chinese markets, but monthly data do not support this, as they fail to find bubbles from any of the markets. Although the results do not give a clear answer to the bubble question, they dampen bubble suspicions and at the same time, lead to the conclusion that the laws and regulations of Chinese stock markets have not yet reached the same level as the ones in Hong Kong, where neither of the datasets show bubbles. It can also be concluded that even though the A-shares are dominated by individual and B-shares by more sophisticated institutional investors, there are no differences in bubble existence. Thus the segmentation does not have a significant effect in bubble development. The results also question the conclusions of Jacobsen and Liu (2008) by suggesting that neither of China's stock exchanges and neither of their stock classes are comparable with developed markets when the comparability is measured by the existence of bubbles. Interesting future research topics would include investigating the means of improving the efficiency of Chinese stock markets as well as the cointegration between the share indices of Mainland China and Hong Kong.

The uncertainty about the bubble existence weakens the investors' confidence to China's stock markets. Due to the prohibition of short selling it is impossible to benefit from declining prices and thus investors should be extra careful when deciding whether to invest to China or not. In addition, as the short selling restriction has not been able to prevent the development of strong bubble suspicions, its effectiveness as a bubble preventing measure is dubious.

The results support the conclusion made by Harman and Zuehlke (2004) about the duration dependence test's sensitive to the use of weekly versus monthly returns. As the results from China support this conclusion the finding can be generalized to include emerging markets as well. This has to be taken into account when using the duration dependence test and in order to get more consistent results the bubble existence should be studied at least with both weekly and monthly data. Bubbles can also be studied by using another promising method, the fractional integration test, which is used for example by Cuñado et al. (2005) and Koustas and Serletis (2005). The most preferable option is to use both, the duration dependence and fractional integration tests, as Hassan and Yu (2007) have done.

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SUMMARY IN FINNISH (YHTEENVETO)

Esseitä kehittyvistä rahoitusmarkkinoista, poliittisista instituutioista ja kehityseroista

Viimeisimpien vuosikymmenten aikana yksi merkittävimpiä ilmiöitä maailman taloudessa on ollut kehittyvien markkinoiden kokema voimakas talouskasvu. Samaan aikaan kehittyvien rahoitusmarkkinoiden tärkeys maailmanlaajuisessa kontekstissa on myös kasvanut sijoittajien rynnätessä avautuneille markkinoille korkeiden tuotto-odotusten ja hajautushyötyjen perässä. Tämä väitöskirja koostuu neljästä empiirisestä tutkimuksesta, joista jokainen tarkastelee kehittyvien markkinoiden rahoitusmarkkinoita hieman eri perspektiiveistä ja eri laajuuksin. Keskeisenä teemana tutkimusten välillä on kuitenkin osakemarkkinoihin keskittyminen, vertailu kehittyneiden ja kehittyvien markkinoiden välillä sekä instituutioiden vaikutukset. Tutkimuksia edeltää johdantoluku, joka esittelee kehittyvien markkinoiden sijoitusympäristön ja käsittelee aikaisempaa kirjallisuutta. Lisäksi johdantoluku esittelee tutkimuskysymykset, keskeiset tulokset ja kontribuutiot sekä heränneitä, uusia mahdollisia tutkimusideoita.

Ensimmäinen tutkimus (toinen luku) tarkastelee yhtä kaikkein tärkeimmistä ja eniten tutkituista kehittyvien markkinoiden tutkimuskohteista, markkinoiden integraatiota kansainvälisiin markkinoihin. Erityisesti tutkitaan sitä kuinka integraatio muuttui vuosien 2007-2009 maailmanlaajuisen finanssikriisin aikana ja vaikuttiko integraatio kriisin leviämiseen tai sen syvyyteen. Lisäksi tutkimuksessa tarkastellaan integraatiotasoon vaikuttavia tekijöitä. Tutkimusaineisto koostuu 23 kehittynyttä ja 60 kehittyvää markkinaa kattavasta kuukausi- ja vuositason paneelidata-aineistosta aikaväliltä 1987-2011. Tutkimuksen tulosten perusteella, kriisin aikana integraatio heikkeni kehittyneissä maissa, mutta kasvoi kehittyvillä markkinoilla. Tulokset myös osoittavat, että integraatio toimi kriisin levittäjänä alkuvaiheessa, mutta ei varsinaisesti vaikuttanut lopullisen kriisin syvyyteen. Itse integraation tasoon löydetään useita vaikuttavia tekijöitä. Kehittyvien markkinoiden tapauksessa pääomamarkkinoiden avoimuus sekä taloudellinen, teknologinen että sosiaalinen kehittyminen ja poliittisten riskien pieneneminen ovat tärkeimmät tekijät integraation kasvulle. Kehittyneiden maiden tapauksessa taas sijoitusympäristön institutionaalinen laatu sekä markkinoiden tehokkuuteen liittyvät tekijät houkuttelevat kansainvälisiä sijoittajia markkinoille. Kansainvälisistä muuttujista ainoastaan luottoriskiä kuvaavan muuttujan löydettiin vaikuttavan integraatioon. Huomattavaa on myös, että toisin kuin aikaisemmat tutkimukset, rahoitusmarkkinoiden kehittymisen löydettiin vaikuttavan vain vähän integraation tasoon.

Kolmas luku tarkastelee kehittyvien markkinoiden poliittista ympäristöä tutkimalla vaikuttaako maan demokratiataso osaketuottoihin joko suoraan tai poliittisen riskin kautta. Tutkimuksessa esitetään, että demokratiatason ja poliittisen riskin suhde on ennemminkin käänteisen U-käyrän muotoinen kuin lineaarinen eli riskit ovat pienimmät maissa, joilla on suuri tai pieni demokratian taso, kun taas poliittiset riskit ovat korkeampia maissa, joissa vallitsee vain osit-

tainen demokratia. Tarkasteluun käytetään vuositason paneeliaineistoa 38 kehittyvästä markkinasta vuosilta 2000-2010. Tulosten mukaan, kun maan demokratiataso ylittää tietyn kynnyksen, sen osaketuototkin suurenevat. Lisäksi löydetään, hieman epäintuitiivisesti, että poliittisen riskin pieneneminen johtaa korkeampiin tuottoihin.

Neljäs luku pyrkii kontribuoimaan portfolion hajauttamiskirjallisuuteen vertailemalla ns. BRIC-maiden (Brasilia, Venäjä, Intia, Kiina) sekä useiden kehittyneiden maiden yhteisliikeen kehittymistä Yhdysvaltojen markkinan suhteen. Hyödyntämällä väredekompositiota ja dynaamista, ehdollista korrelaatiota voidaan tarkastella niin aikaskaalasta riippuvaa, kuin myös ajassa muuttuvaa korrelaatiota. Täten voidaan tutkia mikäli markkinoiden yhteisliike on muuttunut ajan myötä ja havaita myös poikkeavuuksia eri aikaskaalojen välillä. Tulosten mukaan markkinoiden yhteisliike riippuu niin maantieteellisesta sijainnista, taloudellisesta kehittymisestä kuin aikaskaalastakin. Yleisesti ottaen korrelaatio on suurempaa korkeammilla aikaskaaloilla. Matalammilla aikaskaaloilla markkinat voidaan ryhmitellä Aasian, Euroopan ja Amerikan markkinoihin, kun taas korkeammilla aikaskaaloilla talouskehitys alkaa dominoimaan ja kehittyneiden markkinoiden yhteisliike on suurempaa kuin kehittyvien markkinoiden.

Viides luku keskittyy Kiinan osakemarkkinoihin ja siihe, että esiintyykö niillä rationaalisia kuplia ja voidaanko manner-Kiinan segmentoituja osakemarkkinoita verrata Hongkongin markkinoihin osakekuplien esiintymisen suhteen. Tutkimuksessa tarkastellaan kuukausi- ja viikkoaineistolla manner-Kiinasta niin Shanghain kuin Shenzenin osakemarkkinoiden A- ja B-osakkeita sekä Kiinaan liittyviä osakeindeksejä Hongkongista. Kuplien olemassaolon tutkimiseen käytetään duraatioriippuvuustestiä. Tulokset poikkeavat toisistaan viikko- ja kuukausiaineistolla, sillä siinä missä viikkodatan perusteella manner-Kiinan markkinoilla on kuplia, kuukausidata ei vastaava löydä. Näiden tulosten perusteella voidaan duraatioriippuvuustestin todeta olevan sensitiivinen datan valinnalle. Kummallakaan datafrekvenssillä kuplia ei kuitenkaan löydy Hongkongin markkinoilta, joten manner-Kiinan ja Hongkongin markkinoiden ei tässä suhteessa voida arvioida käyttäytyvän samalla tavoin.