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Should the Government Pension Fund Global Invest More in Emerging Markets?

An analysis of potential diversification effects and oil price sensitivity

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Master in Business Administration

Preface

This thesis marks the end of a two-year Master's Degree in Business Administration at the Norwegian University of Life Science.

I would like to especially thank my supervisor Professor Ole Gjølberg for helpful comments and suggestions throughout the writing process. His guidance is deeply appreciated. I also want to thank PhD-student Tom Erik Sønsteng Henriksen for advice during this process. Lastly, I want to thank Bishar Mohamed Ali for helping me with my English writing skills for this thesis.

Neither the institution, nor my supervisor is responsible for weaknesses in either the methods or conclusions drawn in this thesis.

Karen Elise Røsandnes

Ås - May 15, 2018

Should the Government Pension Fund Global Invest More in Emerging Markets?

An analysis of potential diversification effect in emerging markets related to the Government Pension Fund Global, in addition to the relationship between these markets and changes in oil prices.

Abstract

This thesis examines the diversification effects from investing in 19 emerging markets for the period January 1998 to September 2017. How investments in these markets correspond to changes in oil prices are also investigated. The results indicate that emerging markets can give a diversification effect to the Fund. However, this requires exposure to high country-specific risk. The relationship between emerging markets and changes in oil prices is analyzed through a Distributed Lag Model. Most of the markets have a low sensitive to changes in the oil price, and this is perceived as beneficial for the Norwegian economy. This thesis conclude that emerging markets cannot be used to "hedge" against falling oil prices.

Table of Contents

1. Introduction

This thesis builds on work done by Norges Bank Investment Management (NBIM), regarding investment opportunities in emerging markets for the Government Pension Fund Global (called GPFG or the Fund). At the end of 2017, equity investments were 66,6% of the fund's asset allocation. The Fund is already working on increasing this share to 70%, which is why new investment opportunities are of interest. This report will evaluate emerging markets as an increased part on the portfolio.

The reason why these markets are of interest, is that emerging and developed markets may be affected by different risk factors. Benefits of investing in countries with diverse risk factors will be examined from two angels.

First, investments in countries affected by other risk factors can reduce the total risk of the portfolio; known as the diversification effect. Diversification effects will be examined by looking at how a selection of emerging markets have correlated with NBIM's Benchmark over the period from January 1998 to September 2017. This will be done at country, not company level. The aim is to determine whether some emerging markets have a low correlation with NBIM's Benchmark, and for this reason might be considered for a higher investment in the portfolio. The emerging markets used in this report is a selection of MSCI Emerging Market Indices and include a total of 19 countries.

Second, investments in emerging markets will be analyzed in the perspective of reducing Norway's sensitivity to oil price changes. Thus, some emerging markets will possibly have an exposure to changes in oil prices that is opposite to Norway, since a number of emerging markets are oil importers. In addition, emerging markets are expected to have large growth potential and for this reason consume an increasing share of the world's oil (Basher & Sadorsky, 2006).

This thesis will try to test two hypotheses:

H1: Investing in emerging markets generates diversification benefits to the Fund.
H2: Investments in emerging markets can be used to "hedge" against falling oil prices.

2. What are Emerging Markets?

Emerging markets are defined as economies which are in the process of becoming more advanced, shown by liquidity in local debt and equity market, including existence of market exchange and regulatory body (Investopedia, 2018c). The Norwegian Ministry of Finance define emerging markets based on the MSCI World Index (Norges Bank Investment Management, 2001). In the 1970s, these markets where known as "Less Developed Countries", the term "Emerging Markets" where first introduced in the 1980s (Calamos Investments, 2015).

Emerging economies are affected by different risk factors related to the industry structure, which often differ from the ones for developed markets. These include differences in monetary and fiscal policy, institutional and legal systems, and the challenges that the economies are facing (Norges Bank Investment Management, 2001). Investments in emerging markets will therefore add characteristics that differ from those found in developed markets, which may represent a diversification benefit. This entails that they can reduce the total risk of the portfolio, at the same time as these economies, in many cases, may contribute to higher returns than developed markets for the same period. The higher returns may be due to the higher growth potential for these economies. However, these economies may be linked to higher country risk (political and macroeconomic) (Norges Bank Investment Management, 2001).

Over the recent decades, investments in the so-called BRICs have been popular among many investors. BRIC is a common expression used when talking about promising economies. It was first introduced by Goldman Sachs in 2001 (O'Neill, 2001). BRIC stands for; Brazil, Russia, India, and China. India and China are estimated to become the world's most dominant supplier of manufactures goods and services by 2050. Brazil and Russia will become the dominant supplier of raw materials. Economic and geopolitical climate has shifted since the report came out, which stimulates criticism to these allocations regarding the growth model (Investopedia, 2018a).

BRIC was expanded in 2005 when the *Next 11* where introduced, also by Goldman Sachs. Next-11 or N-11 includes; Bangladesh, Egypt, Indonesia, Iran, South Korea, Mexico, Nigeria, Pakistan, Philippines, Turkey, and Vietnam. Goldman Sachs use a Growth Environment Score (GES) to evaluate how each of the world's economies score in terms of sustaining a healthy

environment for growth. GES summarize the structural conditions and policy settings. This includes factors like; macroeconomic stability, political institutional development, trade and investment openness, and education (O'Neill et al., 2005).

Bloomberg announced this January 2018 that Mexico and Turkey are presently the most attractive emerging markets. This outcome emerges from analyzing different metrics including growth, yields, current-account position, and asset valuation. The study includes 20 developing economies. These two countries emerge as the most attractive based on their real effective exchange rates which are more competitive. India and China's growth are expected to be lower than in the past decade. The BRIC countries are in the bottom 6 (Teso et al., 2018).

There are different opinions regarding which countries can be classified as emerging. Table 1 describe the classification of emerging markets within three different indices: Morgan Stanley Capital International (MSCI), International Monetary Fund (IMF), Standard and Poor's (S&P), and Dow Jones (Investopedia, 2018c).

*Table 1: Emerging markets defined by MSCI, IMF, S&P, and Dow Jones (MSCI, 2018c) (Investopedia, 2018c). * Entails the countries which are <u>not</u> equal for all the indices.*

MSCI	IMF	S&P	Dow Jones
Brazil	Brazil	Brazil	Brazil
Chile	Chile	Chile	Chile
China	China	China	China
Colombia	Colombia	Colombia	Colombia
Hungary	Hungary	Hungary	Hungary
Indonesia	Indonesia	Indonesia	Indonesia
India	India	India	India
Malaysia	Malaysia	Malaysia	Malaysia
Mexico	Mexico	Mexico	Mexico
Peru	Peru	Peru	Peru
Philippines	Philippines	Philippines	Philippines
Poland	Poland	Poland	Poland
Russia	Russia	Russia	Russia
South Africa	South Africa	South Africa	South Africa
Thailand	Thailand	Thailand	Thailand
Turkey	Turkey	Turkey	Turkey
Egypt	Egypt	Egypt	Egypt
Czech Republic	Czech Republic	Czech Republic	Czech Republic
Greece	Greece	Greece	Greece
Taiwan	Taiwan	Taiwan	Taiwan
Pakistan *	Qatar *	Bangladesh *	Qatar *
Qatar *	South Korea *		United Arab Emirates *
South Korea *	Bangladesh *		
United Arab Emirates *	United Arab Emirates *		

NBIM's Benchmark is an adjusted version of FTSE Global All Cap Index. The two most important differences between these two are geographical distribution and ethical exclusions. NBIM's Benchmark has a larger weight in European developed markets, and lower weights in the US and Canada. In addition, Norway and securities denominated in Norwegian kroner are excluded from the benchmark (Norges Bank Investment Management, 2017d).

FTSE Russell divides markets into *Developed, Advanced Emerging, Secondary Emerging,* and *Frontier.* Table 2 lists the FTSE classification of the last three categories as of March 2018. Some of the classifications are different than the ones presented in Table 1. For instance, Bangladesh is classified as a frontier market by FTSE, but as an emerging market by IMF and S&P. Whereas FTSE classify South Korea as a Developed market, both MSCI and IMF classify it as an emerging economy (FTSE Russell, 2018a). FTSE Russells' criteria's for classifying the different markets are presented in Appendix 1.

Table 2: FTSE classification of Advanced Emerging, Secondary Emerging, and Frontier markets as at March 2018 (FTSE Russell, 2018a).

Advanced Emerging	Secondary Emerging	Frontier
Brazil	Chile	Argentina
Czech Republic	China	Bahrain
Greece	Colombia	Bangladesh
Hungary	Egypt	Botswana
Malaysia	India	Bulgaria
Mexico	Indonesia	Côte d'Ivoire
Poland *	Pakistan	Croatia
South Africa	Peru	Cyprus
Taiwan	Philippines	Estonia
Thailand	Qatar	Ghana
Turkey	Russia	Jordan
	United Arab Emirates	Kazakhstan
		Kenya
	Kuwait**	Latvia
	Saudi Arabia***	Lithuania
		Macedonia
		Malta
		Mauritius
		Morocco
		Nigeria
		Oman
		Palestine
		Romania
		Serbia
		Slovakia
		Slovenia
		Sri Lanka
		Tunisia
		Vietnam

* Poland will be promoted to Developed market status, effective from September 2018
** Kuwait to be promoted to Secondary Emerging market status as of September 2018
*** Saudi Arabia will be promoted to Secondary Emerging market as of March 2019

In March 2018, FTSE Russel reviewed the classification of economies to evaluate if Romania and Saudi Arabia should be classified as Secondary Emerging. From earlier assessments, Kuwait will be promoted to Secondary Emerging market status as of September 2018.

Romania will remain a frontier market, but will be reviewed for possible reclassification as a Secondary Emerging market in September 2018. The single outstanding criterion is "*Liquidity – Sufficient broad market liquidity to support sizable global investment*" (FTSE Russell, 2018a).

Saudi Arabia will be assigned Secondary Emerging market status in March 2019. One of the reasons why they are now changing their classification, is "that the Capital Market Authority of Saudi Arabia and the Saudi Arabia Stock Exchange (Tadawul) introduced a number of improvements to the market infrastructure aimed at opening up the domestic market to international investors" (FTSE Russell, 2018a).

The reference index for the equity stake of the portfolio (called NBIM Benchmark) originate, as mentioned earlier, from the FTSE Global All Cap Index. This index consists of 7 536 listed companies (Norges Bank Investment Management, 2018c). Each of the stocks are assigned a factor depending on which country they originate from (Finansdepartementet, 2010). The countries are weighted as follows;

$$Country\ Weight = \frac{Market\ Capitalization_i \cdot factor_i}{\sum_i Market\ Capitalization_i \cdot factor_i}$$

Table 3 lists the emerging markets included in this benchmark, and the investments done by NBIM for the Fund. FTSE Russel promoted South Korea from an Advanced Emerging to a Developed market as of 21st of September 2009 (FTSE Russell, 2018b). NBIM defined South Korea as an emerging market in later discussion notes (Norges Bank Investment Management, 2012b), it is still categorized as emerging by MSCI, and it is also included in the *Next 11*. For these reasons, South Korea will be included in this thesis when discussing emerging markets.

The strategic benchmark has set the equity share of the portfolio to 70%. As of 31st of December 2017 the equity share in the benchmark index was 67,1% (Norges Bank Investment Management, 2017d). Emerging markets accounted for 12,39% of the equity portfolio in the

benchmark, whereas for the investments the fund accounted for 12,47%. This means that the fund deviated 0,08% from NBIM's Benchmark through active management.

Pakistan was included in the benchmark index in 2017. However, there have been no investments done in this market as of 31st of December 2017. The only countries in the fund which do not deviate from NBIM's Benchmark are Brazil, Mexico, Colombia, and Czech Republic. The remaining countries are either weighted higher or lower than the benchmark.

Table 3: Emerging market composition of the fund's equity holdings, both actual portfolio (Norges Bank Investment Management, 2018b) and actual benchmark (Norges Bank Investment Management, 2018a) as of 31st of December 2017. Ranked after market value.

	Market Value (USD)	Portfolio Weight	NBIM Benchmark	Strategic Benchmark Index
Total	86 487 053 783	12,47 %	12,39%	70 %
China	24 781 117 975	3,57 %	3,08 %	
South Korea	13 502 611 077	1,94 %	1,88 %	
Taiwan	11 101 821 517	1,60 %	1,63 %	
India	8 105 951 063	1,17 %	1,26 %	
Brazil	6 023 034 521	0,87 %	0,87 %	
South Africa	4 964 819 233	0,72 %	0,90 %	
Thailand	2 799 691 335	0,40 %	0,43 %	
Russia	2 775 970 034	0,40 %	0,39 %	
Mexico	2 436 566 877	0,35 %	0,35 %	
Indonesia	1 956 176 926	0,28 %	0,26 %	
Malaysia	1 853 512 278	0,27 %	0,32 %	
Turkey	1 299 767 433	0,19 %	0,14 %	
Philippines	1 123 499 936	0,16 %	0,17 %	
Chile	981 671 408	0,14 %	0,15 %	
Poland	961 149 113	0,14 %	0,15 %	
Greece	559 960 841	0,08 %	0,05 %	
Egypt	374 440 209	0,05 %	0,02 %	
Colombia	322 990 409	0,05 %	0,05 %	
United Arab Emirates	306 060 451	0,04 %	0,10 %	
Peru	139 104 052	0,02 %	0,04 %	
Hungary	52 636 590	0,01 %	0,04 %	
Czech Republic	32 352 712	0,01 %	0,01 %	
Qatar	32 147 793	0,01 %	0,07 %	
Pakistan			0,03 %	

China is the emerging market with the highest share of NBIM's Benchmark, following by South Korea. The BRICs are among the top eight countries. Hungary, Czech Republic, and Qatar has

the lowest share of 0,1% of the equity portfolio. However, Qatar is not weighted the lowest in the benchmark.

Three of the countries in the *Next 11*, Bangladesh, Nigeria, and Vietnam, are not categorized as emerging markets by any of the indices mentioned in this thesis. FTSE Russel categorizes them as frontier markets (Table 2). Even though FTSE Russel considers frontier markets as uninvestable (Norges Bank Investment Management, 2008), NBIM still invest in these markets (Table 4). Frontier markets accounted for 0,35% of the equity portfolio as of 31st of December 2017.

As seen in Table 3, the lowest rated emerging markets were 0,01% of the equity portfolio. 13 frontier markets have at least this share of portfolio as well. Saudi Arabia, Vietnam, Bangladesh, and Kuwait are the top four investments of the frontier share of the portfolio. As mentioned earlier, FTSE Russel as of March 2019 and September 2018 will promote Saudi Arabia and Kuwait to Secondary Emerging status respectively.

Table 4: Frontier market composition of the fund's equity holdings for the actual benchmark as of 31st of December 2017 (Norges Bank Investment Management, 2018b). Ranked after market value.

	Market Value (USD)	Portfolio Weight
Total	**2 461 440 556**	**0,35 %**
Saudi Arabia	831 516 289	0,120 %
Vietnam	534 171 154	0,077 %
Bangladesh	244 415 098	0,035 %
Kuwait	130 264 308	0,019 %
Kenya	117 069 881	0,017 %
Morocco	103 521 605	0,015 %
Nigeria	94 239 385	0,014 %
Romania	86 755 794	0,012 %
Sri Lanka	85 229 020	0,012 %
Bahrain	56 832 937	0,008 %
Slovenia	43 260 820	0,006 %
Oman	37 408 496	0,005 %
Croatia	36 069 615	0,005 %
Tunisia	21 347 704	0,003 %
Estonia	14 216 671	0,002 %
Mauritius	8 278 846	0,001 %
Lithuania	7 231 406	0,001 %
Jordan	4 947 304	0,001 %
Latvia	2 900 904	0,000 %
Ghana	1 763 319	0,000 %

Since inception, the fund's deviation from the benchmark has been 28 basis points higher. Through active management, the fund has outperformed the benchmark in 16 out of 20 years since January 1998 (Norges Bank Investment Management, 2017d).

This thesis will try to evaluate if some of the emerging markets should be weighted differently in the equity portfolio. For the weight to be significantly different than the benchmark, the country weights in FTSE Global All Cap must change since this is the basis for NBIM's Benchmark.

3. Investing in Emerging Markets: Risk Issues

Emerging markets are, as mentioned earlier, popular to invest in due to the expected growth generating high returns. Higher returns are generally associated with higher risk. This risk includes factors like political instability, domestic infrastructure problems, currency volatility, and limited equity opportunities (Investopedia, 2018c). The World Bank Group publishes Worldwide Governance Indicators report each year. This includes six dimensions to describe governance for the period of 1996 – 2016. These are previously used by NBIM to evaluate investment opportunities in emerging markets. Table 5 illustrates the numbers from 2016. Higher number corresponds to higher risk under each category.

Table 5: World Governance Indicators for governance 2016 (The World Bank Group, 2018). Selected countries are the same used in NBIM's evaluation of emerging markets from 2012 (Norges Bank Investment Management, 2012b). This is for illustration purposes, which is why only a selection of the 19 indices are presented.

Global Percentile Ranking	Brazil	Chile	China	India	Indonesia	Malaysia	Mexico	Poland	Russia	South Africa	Taiwan	Thailand	Turkey
Voice and Accountability	62	77	7	59	50	33	44	72	15	68	80	21	30
Political Stability	30	64	27	14	33	50	20	63	17	42	79	16	6
Government Effectiveness	48	79	68	57	53	76	60	74	44	65	89	66	55
Regulatory Quality	47	90	44	41	50	76	64	80	37	62	87	60	61
Rule of Law	52	85	46	52	39	71	33	75	21	58	86	55	49
Control of Corruption	39	82	49	47	43	62	23	76	19	60	79	41	51

The Voice and Accountability category captures the extent to which a country's citizens can select their own government, in addition to freedom of expression and association, and free media (The World Bank Group, 2018). China and Russia are the countries that scored the lowest in 2016, while Taiwan and Chile have the highest score in this category.

The next category, political stability, is somewhat intuitive but measures the likelihood of political instability and/or politically motivated violence (The World Bank Group, 2018). Here, multiple countries have a low score, including India, Russia, Thailand, and Turkey.

Chile and Taiwan have the highest scores for the following four categories. Government Effectiveness measures the quality of public services, civil service and the degree of its independence from political pressure. Regulatory Quality captures the government's ability to enhance sound policies and regulations that permit development within the private sector. The category Rule of Law captures the extent to which agents have confidence in the laws, especially regarding the quality of contract enforcement, property rights, the police, and the courts. The last category, Control of Corruption, captures to what degree public power is exercised for private gain (The World Bank Group, 2018). In this category, Russia score markedly low compared to the others.

FTSE Global All Cap regional indices have been used as index supplier for the Fund since the first investments made in 1998. As mentioned earlier, FTSE divide countries into three categories: Developed, Advanced Emerging, and Secondary Emerging. They highlight that countries outside these categories, known as frontier markets, are uninvestable. FTSE emphasize the importance of four areas when assessing which category countries fit into; Market and regulatory environment, Custody and settlement, Dealing landscape, and Derivatives market. NBIM uses the same process as FTSE to establish which countries to include in the investment universe, including some additional steps (Norges Bank Investment Management, 2008).

The Ministry of Finance in Norway has established ethical boundaries for the investments made by NBIM. They have appointed an Ethical Board to evaluate if any of the investments are against these regulations for the Government Pension Fund Global. They also give advice regarding observations and exclusion of companies (Etikkrådet, 2018). NBIM can propose recommendation, like they did when they wanted to exclude investments related to coal (Norges Bank Investment Management, 2018d).

Norges Bank emphasize that issues related to corporate governance in emerging markets are a part of the risk valuation made at company and sector level, and not whether to invest in a market at all. They have the same standpoint related to matters of human rights and the

environment (Norges Bank Investment Management, 2008). This report will not include these boundaries in the evaluation of investments opportunities in emerging markets.

4. Literature on Emerging Market Investment

The Fund has invested in emerging markets since its inception in 1998. The first two years, 1998 and 1999, they only invested in one country; China. 2000 is the only year where there were no investments in emerging markets. The reason for this was that the Ministry of Finance opened for equity investments in seven emerging markets in the National Budget 2000, but Norges Bank needed time to prepare for an expansion of the investment universe (Norges Bank Investment Management, 2001). Equity investments in emerging markets expanded in 2001 to include Brazil, Mexico, Turkey, and South Korea.

The main argument to invest in these markets has been, since the beginning, differences in policies, institutional and legal system, and the challenges these markets are facing. For an international investor, these differences may reduce the total risk in the portfolio (Norges Bank Investment Management, 2001).

The Ministry of Finance asked in 2007 for an updated assessment of emerging equity markets from Norges Bank Investment Management (NBIM). Norges Bank were asked to focus on settlement and clearing systems, in addition to issues related to corporate governance. In their response, Norges Bank emphasized that they will *not* continue to exclude countries that do not add meaningful contributions to risk and return, like previously recommended. Their argument for this include the size of the investments in emerging markets, which are a relatively small part of the portfolio, in addition to the correlation in volatility, both making it hard to argue for a "meaningful contribution to risk" (Norges Bank Investment Management, 2008).

In 2012 NBIM revised the Funds' geographical allocation which resulted in a broader, more diversified portfolio with more invested in emerging markets, and less in Europe (Norges Bank Investment Management, 2012b). The fund's increase in emerging markets was related to higher returns over the previous two decades than equivalent investments in developed markets. They believed that this increase was related to the relationship between economic growth and stock market returns. This relationship can be in both the same and opposite direction. If this relationship is in the opposite direction, NBIM argues that the cause may be because globalization makes companies more dependent on developments in the global economy, rather than the countries by themselves (Norges Bank Investment Management, 2012a). They

emphasize that risk factors associated with emerging markets are related to a short-term perspective. Though, at the Fund's long-term investment perspective they highlight the importance of reducing the risk by holding a diversified global portfolio.

NBIM state that the correlation between emerging and developed markets have continued to increase, which results in a reduced diversification effect from investing in both markets (Norges Bank Investment Management, 2017a). However, they still find that diversification is beneficial.

One of the proposed solutions to the challenges regarding political motives are that Sovereign Wealth Funds should be encouraged to invest in well-diversified equity indices in individual countries. The argument is that such investments will offer diversification at the same time as they minimize the opportunity to buy control in entities (Aizenman & Glick, 2007). This is however not a significant problem for the Government Pension Fund Global, since they have regulations stating that the fund cannot own more than 10% of the voting shares in a single company (Finansdepartementet, 2010).

There exists numerous studies on international diversification of portfolios. Levy and Sarnat (1970) analyzed in their paper that the diversification benefits markets have on the portfolio depends on the correlation among security returns. Security returns which are highly correlated, but not perfectly correlated, will reduce the risk through diversification. Whereas if they are not correlated, diversification could eliminate risk. Through analyzing the efficient frontier for different weighted portfolios, they suggest that restrictions on international trade and/or capital flows have a significant effect on the pattern of security returns and permit inefficient markets to persist. These benefits through international investments are further stated in Solnik (1995) paper, originally published in 1974. He asks how effective is diversification in reducing the variability or risk of the portfolio? And concludes that: "The benefits from international diversification are so large that they should rapidly resuscitate the development in the U.S. of successful international mutual funds – under the leadership, presumably, of the most respected groups of Wall Street, rather than some adventurer of dubious honesty".

Moving three decades forward, the literature on international diversification shifted to more specific markets, such as emerging markets. Bowman and Comer (2000) found an increased correlation among the world's equity markets, and stated that including emerging markets into

an internationally diversified portfolio may be beneficial. One of the reasons for this is that the integration between developed countries is greater than between emerging countries, which result in a more effective diversification by including both markets, than if emerging markets are excluded. Clark and Tunaru (2001) focus on emerging markets exposure to political phenomena, not just market risk. They emphasize that this political risk differ from what is present in developed economies. The paper enhances a framework that not only evaluates the political risk, but also the diversification aspect associated with cross-country correlations.

Bekaert and Harvey (2014) highlight that the focus in the literature regarding emerging markets has shifted. Earlier the question was *if* you should invest in emerging markets or not, but today the question is more about *how much* you should invest. They still classify developed and emerging market as separate asset classes, even though the correlation between the two has increased. In addition, they emphasize the diversification effect of investing in all of the world's equity markets, especially regarding the differences in volatility and Sharpe ratio for the two markets. Unlike Bekaert and Harvey, Bekiros et al. (2016) emphasize the low correlation between these markets and developed ones, and states that the increased integration with the rest of the world is due to both financial and trade links.

The diversification benefits are further analyzed by Meric et al. (2016) who conclude that some emerging markets generate high diversification benefits to the portfolio for investors who invest in developed stock markets. However, some emerging markets do not generate the same benefits since they are highly correlated with developed stock markets. These markets include the Brazilian, South African, Mexican, Peruvian, Russian, Chilean, Argentine, Turkish, and Colombian.

The impact of oil price changes on emerging stock market returns have also been investigated previously. An example is Basher and Sadorsky (2006) article that found strong evidence that oil price risk impacts stock price returns in emerging markets. They also investigated the impact skewness and kurtosis have on emerging stock market return, but found little evidence that they have much impact.

This thesis will contribute to earlier assessments done by NBIM and academic literature through analyzing both potential diversification effects in emerging markets and their sensitivity to changes in the oil price.

5. Data

The data sample used in this thesis includes monthly Total Return of a selection of MSCI indices for the period January 1998 to September 2017. All data series are in U.S. Dollars to facilitate comparison between different countries. The data are obtained from Datastream (Thomson Reuters). The exception is NBIM's Benchmark (or NBIM BM) used by the Government Pension Fund Global, which is obtained from NBIMs' website (Norges Bank Investment Management, 2017c). Simple arithmetic returns are used to analyze the data, since this is appropriated for data that follows a random walk (according to the efficient market hypothesis, stock prices do follow a random walk).

The MSCI indices used include 19 emerging countries; Russia, Brazil, India, China, Egypt, Indonesia, Mexico, South Africa, South Korea, Turkey, Pakistan, Chile, Colombia, Hungary, Peru, Poland, Thailand, Taiwan, and Czech Republic. In addition, three broad indices are obtained to facilitate emerging market behavior collectively (MSCI Emerging Markets Index and MSCI BRIC) and developed markets are represented by MSCI World. MSCI Korea is an index designed to measure the performance of the large and mid cap segments of the South Korean market. Therefore, this index will be referred to as MSCI South Korea or South Korea throughout this thesis (MSCI, 2018e).

Part of this thesis will focus on emerging markets dependence related to changes in oil prices, which is why time series for Brent crude oil are collected to represent the development in oil prices for the period. Brent oil are chosen as a proxy for the world price of crude oil, since it serves as a benchmark in the crude oil market (Maghyereh, 2004). Monthly Brent Oil prices are also obtained from Datastream (Thomson Reuters Datastream, 2018). One month U.S. Treasury Bill is obtained from Kenneth French website, and will be used as risk-free rate (French, 2018).

Figure 1 illustrates how the two broad emerging market indices and NBIM's Benchmark has developed from January 1998 to September 2017. If an investor had invested 100 dollars in one of these indices, the largest return would have been from investing in MSCI BRIC over the whole period.

It is observed that all three indices are moving in the same direction for most of the period. The exception is that MSCI BRIC and MSCI EM had a negative direction in the beginning of the period. NBIM's Benchmark only outperformed the two other indices from 1998 to 2003. After 2003, both MSCI BRIC and MSCI Emerging Market Index has had a larger growth rate than NBIM's Benchmark. It may seem that the MSCI Emerging Markets Index and MSCI BRIC have more extreme outcomes.
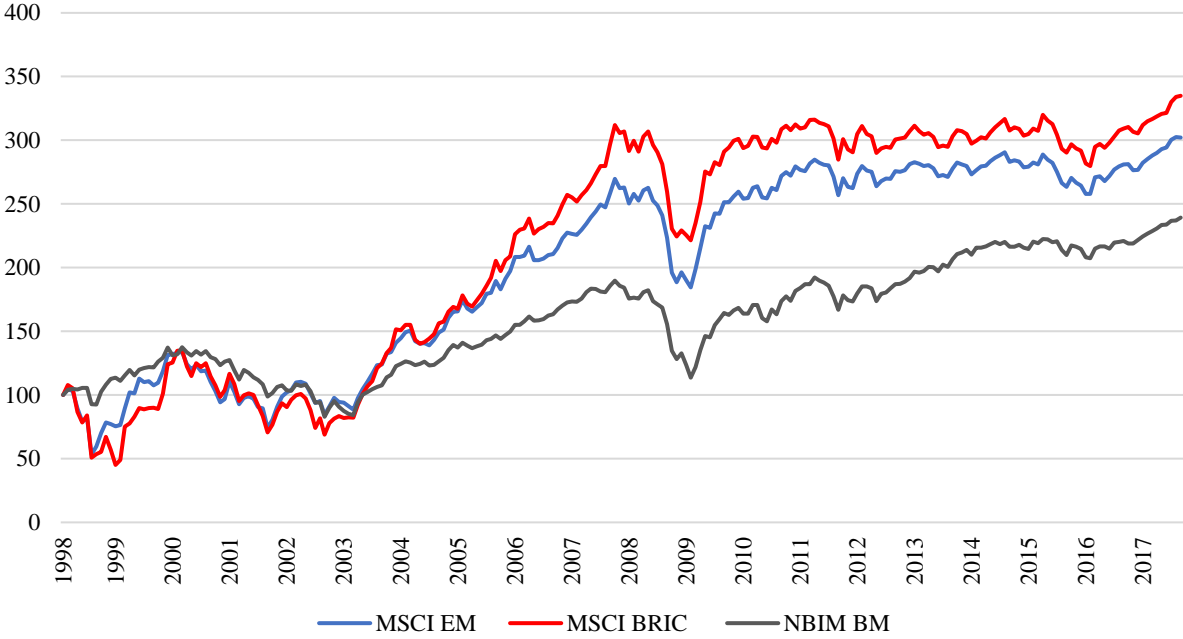
Figure 1: Price development for MSCI Emerging Market Index, MSCI BRIC, and NBIM BM from January 1998 to September 2017 (January 1998 = 100).

One reason why MSCI Emerging Markets Index and MSCI BRIC outperformed NBIM's Benchmark to a higher degree during the period 2005 to 2013 may be that the 2008 financial crisis hit the developed markets to a higher degree than the emerging markets included in the MSCI indices.

6. Emerging Market Equities

MSCI Emerging Markets Index

MSCI launched their Emerging Markets Index in 1988. Their objective is to capture the performance of large- and mid-cap securities in 24 Emerging Markets. As of December 2017, they covered approximately 85% of the free float-adjusted market capitalization in each country (MSCI, 2018a). MSCI's indices are all created using the Global Industry Classification Standard (GICS®), which is developed by MSCI and S&P Global (MSCI, 2018b). Even though they have developed this standard, MSCI Emerging and S&P Emerging BMI differ in which countries they categorize as emerging markets (see Table 1).
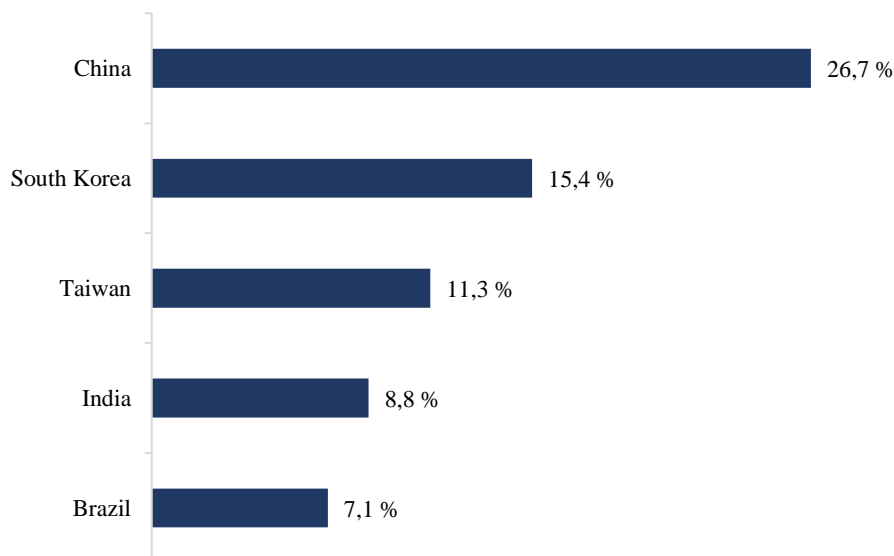
Figure 2: Top 5 MSCI Emerging Markets Index weights as of December 2017 (MSCI, 2018a)..

Most of the index (71%) consists of five countries (Figure 2); China, South Korea, Taiwan, India, and Brazil. The remaining 29% consists of the other 19 countries listed in Table 1. NBIM's Benchmark also has these five countries as the largest emerging markets investments as of 31st of December 2017, with a total weight of 8,72% (China: 3,08%, South Korea: 1,88%, Taiwan: 1,63%, India: 1,26%, and Brazil: 0,87%).

<u>MSCI BRIC</u>

MSCI BRIC Index was launched in 2005, which is why data prior to the launch is back-tested (MSCI, 2018d). As mentioned in the introduction, BRIC is short for the countries: Brazil, Russia, India, and China. China carries the largest weight at 61%. While Russia has the lowest weight at 7% (Figure 3).
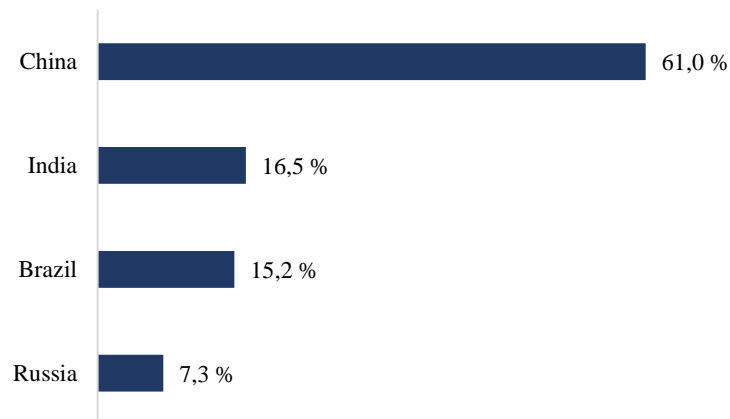
Figure 3: MSCI's country weights as of March 2018 (MSCI, 2018d).

7. Performance of Emerging Markets 1998 - 2017

This chapter will look at the performance of each Emerging Market Index compared to NBIM's Benchmark over the whole period from January 1998 to September 2017. Figure 1 in Chapter 5 illustrated that both MSCI Emerging Market Index and MSCI BRIC has performed better than NBIM's Benchmark during most of this period in terms of price development.

To evaluate in more detail how emerging markets has performed compared to NBIM's Benchmark, descriptive statistics are generated to see the annual performance over the period from 1998 to 2017. In addition, a least square regression is used to generate Jensens Alpha, Beta, and Adjusted R^2. Results from these analyses are presented in Table 6.

$$(r_{MSCI\ Index} - r_f) = \alpha_t + \beta_1(R_{NBIM\ BM} - r_f) + \varepsilon_t$$

$r_{MSCI\ Index} = MSCI\ Index\ return$
$r_f = risk\ free\ rate\ given\ by\ one\ month\ U.S.Treasury\ Bill$

Table 6: Annualized excess return (in excess of the risk-free rate), volatility (measured by standard deviation), skewness, kurtosis, alpha, beta, adjusted R^2, and Sharpe Ratio over the period 1998-2017 for NBIM Benchmark, MSCI Emerging Markets Index, and MSCI BRIC. The annual returns and alphas are significantly above zero on a 5% level. B_1 is significantly above 1 on a 5% level for both MSCI EM and MSCI BRIC. T-values are presented in parenthesis. Number of observations: 236

Index	Annual Return (%)	Annual Std.dev. (%)	Skewness	Kurtosis	Annual Alpha	β_1	Adj. R^2	Annual Sharpe Ratio
MSCI EM	8,9 (5,85)	23,4	-0,73	2,22	2,2 (2,71)	1,22 (4,44)	0,72	0,38
MSCI BRIC	10,6 (5,81)	27,9	-0,47	2,05	3,2 (2,80)	1,33 (4,82)	0,61	0,38
NBIM BM	5,5 (5,18)	16,4	-0,68	1,92				0,34

From the results presented in Table 6, both MSCI Emerging Markets Index and MSCI BRIC have performed better than NBIM's Benchmark. Even though they have an annual total rate of return greater than the NBIM's Benchmark, this also includes higher risk, represented by standard deviation. The sample is negatively skewed relative to a normal distribution for all indices. The kurtosis indicates that the distribution is leptokurtic, which means that there are fatter tails and greater risk of extreme outcomes.

Both MSCI EM and MSCI BRIC have a significantly annual alpha, indicating excess return over risk-free rate if investments were done in these two indices over the whole period. B_1 is higher than 1 for both indices, indicating higher market risk than NBIM's Benchmark. The Adjusted R^2 is also high which indicates that MSCI EM and MSCI BRIC have been affected by more of the same risk-factors during this period as NBIM's Benchmark.

The Sharpe Ratio indicates how the index has performed compared to the risk-free rate, higher number signals higher performance. Since the risk differs between the indices, they cannot be compared, but the Sharpe Ratio can be used to "rank" the performance. Both MSCI Emerging Markets Index and MSCI BRIC have a higher Sharpe Ratio than NBIM Benchmark, indicating that they have performed better during the period 1998 - 2017.

The volatility for these indices can be further illustrated through a 5-years rolling standard deviation window, presented in Figure 4. Here it is clear that NBIM's Benchmark has had a lower standard deviation than both MSCI EM and MSCI BRIC over the whole period from 1998 to 2017. MSCI BRIC has had the highest standard deviation over the whole period.
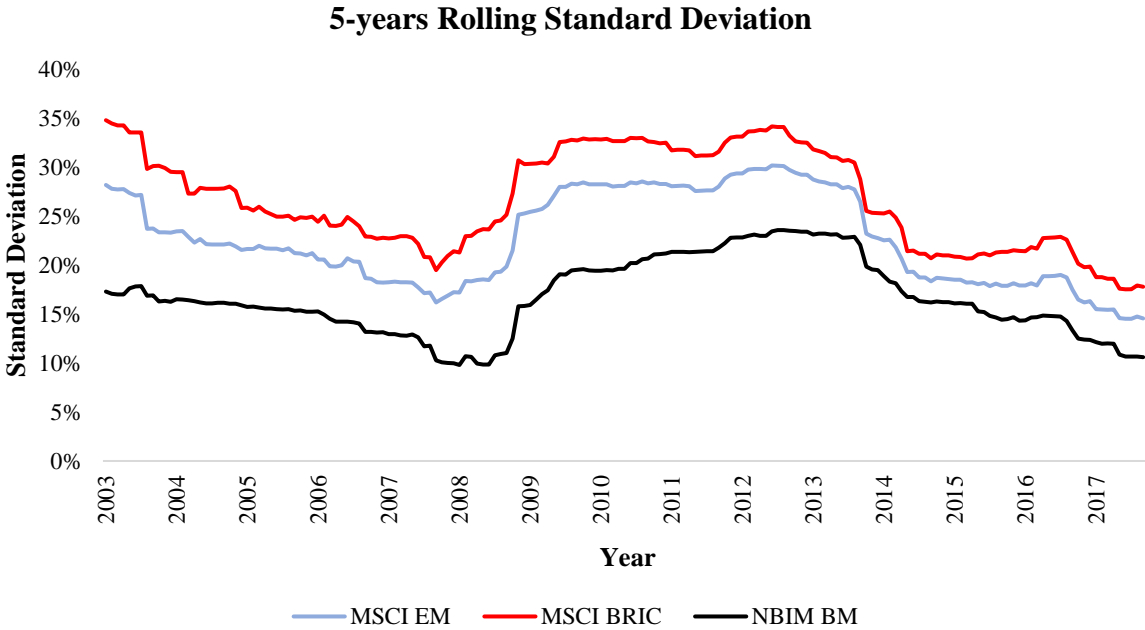
Figure 4: 5-years Rolling Standard Deviation over the period 1998-2017 for MSCI Emerging Market Index, MSCI BRIC, and NBIM Benchmark

At the end of 1990s and the beginning of 2000, multiple crises affected some emerging markets but only three events will be highlighted here. The first event was the 1997 Asian financial crisis, starting in Thailand (Euromoney, 1997). The countries which were most affected by the crises where Indonesia, South Korea, and Thailand. Hong Kong, Laos, Malaysia, Philippines, Brunei, China, Singapore, Taiwan, Vietnam, and Japan were also affect, although not as significant.

The other event during this period, was the Russian depression, starting in the mid-1990s. This originated from the transformation the county had from a communist dictatorship into a multiparty democracy with regular elections. This affected the Russian economy in various ways. Especially the way it was executed, associated with crime and corruption, affecting the perception economic agents had to the new, liberalized system, and therefore the trust they placed in it. New reforms were implemented, and during the 1996 political campaign, Boris Yeltsin agreed to a "loans-for-shares" program, which turned valuable natural resource enterprises into major businesses. This accelerated the consolidation of a few large financial groups. These companies performed extremely well, and were responsible for much of the dramatic increase in Russia's output, as well as the astonishing stock market boom (Aven, 2013).

The third major event affecting this period, was the Dotcom bubble occurring in the late 1990s. This affected both emerging and developed markets. This bubble is characterized by a rapid rise in equity market fueled by investments in Internet-based companies, which led to the value of equity markets growing exponentially (Investopedia, 2018b).

Figure 4 illustrates these crises with a higher standard deviation for the first five years. The risk increased again in the years before the financial crisis of 2008. In between these two periods, the risk has been lower indicating a more stable market. For the last years, all three indices are experiencing lower risk than the previous two decades.

The analysis done on the broad indices presented in Table 6, is also made for each of the individual MSCI Country Indices (Table 7). Figure 5 illustrates the annual return and standard deviation for the period 1998-2017.
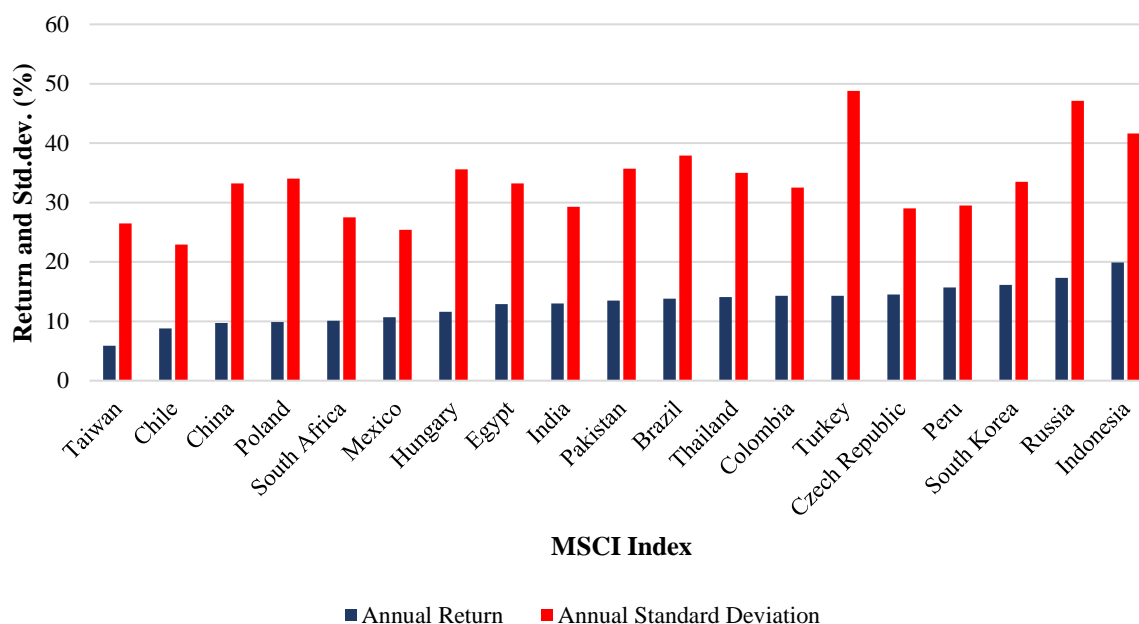
Figure 5: Annual excess return over risk-free rate and standard deviations for each individual country index over the period 1998-2017. Ranked after excess return.

Over the whole period Turkey, Russia, and Indonesia have had the highest standard deviation. All MSCI Country Indices have had a higher annual excess return over the whole period, compared to NBIM Benchmark. The results include the annualized excess return over the risk-free rate, annual standard deviation, skewness, kurtosis, annual alpha, market beta, Adjusted R^2, and annual Sharpe Ratio for the period 1998-2017 (Table7).

Indonesia has had an annual return almost four times the return generated for NBIM's Benchmark, however this also includes more than twice the risk. After Indonesia, follows Russia with an annual excess return of 17% despite having gone through a depression in the beginning of the period. As for all indices, the higher return also indicates higher risk, where Russia has the second highest standard deviation of 47%, following Turkey with a volatility of 49% (three times the risk generated for NBIM Benchmark for the same period).

The countries generating the lowest return for this period are Taiwan, Chile, China, and Poland. The last three countries have generated a higher Sharpe Ratio than NBIM Benchmark, even though they carry a higher risk.

Table 7: Annualized excess return (in excess of the risk-free rate), volatility, skewness, kurtosis, alpha, beta, adjusted R^2, and Sharpe Ratio over the period 1998-2017 for each MSCI country index. T-values are presented in parenthesis, and are tested on a 5% level. Beta are tested for different than 1, and return, std.dev., and alpha is tested for different than 0. Ranked after highest to lowest Sharpe Ratio. Number of observations: 236

MSCI Country Index	Annual Return (%)	Annual Std.dev. (%)	Skewness	Kurtosis	Annual Alpha	B_1	Adj. R^2	Annual Sharpe Ratio
Peru	15,7 (8,16)	29,5	-0,49	2,10	0,11 (6,38)	0,91 (-0,85)	0,25	0,53
Czech Republic	14,5 (7,67)	29,0	-0,12	1,74	0,09 (5,66)	1,06 (0,65)	0,36	0,50
South Korea	16,1 (7,36)	33,5	0,50	1,45	0,09 (5,20)	1,38 (3,81)	0,45	0,48
Indonesia	19,9 (7,33)	41,6	0,63	3,50	0,13 (5,43)	1,28 (1,95)	0,25	0,48
Colombia	14,3 (6,78)	32,5	-0,04	0,64	0,09 (4,95)	0,89 (-0,99)	0,20	0,44
India	13,0 (6,83)	29,3	0,00	1,17	0,07 (4,62)	1,08 (0,86)	0,36	0,44
Mexico	10,7 (6,49)	25,4	-0,76	2,96	0,04 (3,91)	1,16 (2,30)	0,55	0,42
Thailand	14,1 (6,20)	35,0	0,26	3,04	0,08 (3,96)	1,19 (1,62)	0,31	0,40
Egypt	12,9 (5,99)	33,2	0,08	1,59	0,08 (4,16)	0,86 (-0,17)	0,18	0,39
Chile	8,8 (5,93)	22,9	-0,60	2,60	0,04 (3,35)	0,91 (-1,31)	0,42	0,39
Pakistan	13,5 (5,83)	35,7	-0,38	4,28	0,12 (4,97)	0,38 (-4,44)	0,03	0,38
Russia	17,3 (5,63)	47,1	-0,16	6,94	0,10 (3,65)	1,31 (1,83)	0,20	0,37
South Africa	10,1 (5,65)	27,5	-0,54	1,04	0,04 (2,78)	1,19 (2,49)	0,50	0,37
Brazil	13,8 (5,61)	37,9	-0,20	1,17	0,05 (2,77)	1,61 (5,56)	0,48	0,36
Hungary	11,6 (5,02)	35,6	-0,62	2,26	0,04 (2,14)	1,42 (3,91)	0,42	0,33
Turkey	14,3 (4,50)	48,8	0,48	3,05	0,05 (1,93)	1,67 (4,12)	0,31	0,29
China	9,7 (4,53)	33,2	0,66	3,99	0,03 (1,84)	1,17 (1,61)	0,34	0,29
Poland	9,9 (4,47)	34,0	-0,22	1,09	0,02 (1,00)	1,52 (5,54)	0,53	0,29
Taiwan	5,9 (3,40)	26,5	0,20	0,84	0,00 (0,19)	1,01 (0,17)	0,39	0,22

All indices have achieved a significant annual return in excess of the risk-free rate, except China, Turkey, Poland, and Taiwan. The market beta is significantly different than 1 for Brazil, Mexico, South Africa, South Korea, Turkey, Pakistan, Hungary, and Poland. All have a beta higher than one, except Pakistan, indicating a higher risk than NBIM's Benchmark. The highest

Adjusted R^2 are generated for Mexico, Poland, and South Africa. All indices have generally a low Adjusted R^2 indicating that these markets are affected by large country-specific risk.

Because the beginning of the period was affected by the Asian financial crisis, Russian Depression, and the Dotcom bubble, the selected period (from January 1998 to September 2017) will be divided into five. The first period (1998-2001) will represent a period where the market is under stress, the same case applies for the period 2006-2009, which includes another financial crisis that adversely affects developed markets more than emerging markets. The period in between, from 2003-2005, and the last two periods; 2010-2013 and 2014-2017, will represent a more distressed market. The reason the period is divided instead of excluding stressed periods, is to compare them to each other to see if some investments are better during different turbulences. In addition, crises are inevitable, so removing them will in the long-run not represent an appropriate image of reality. These periods will be in parts of the thesis be referred to as: Period 1 (1998-2001), Period 2 (2002-2005), Period 3 (2006-2009), Period 4 (2010-2013), and Period 5 (2014-2017).

Table 8 presents the annualized excess return over risk-free rate, standard deviation, and Sharpe Ratio for each MSCI index and NBIM BM over the five sub-periods. The MSCI World is presented in the table to facilitate comparison to developed markets. The volatility (represented by the standard deviation) is highest during the two stressed periods, 1998-2001 and 2006-2009. For emerging markets, the first period is represented by low and mostly negative Sharpe Ratio's. The returns are also low for this period, except for Russia, which experienced substantial growth during this period, although with an annual standard deviation of 83,1%. The second period from 2002 to 2005 is generally represented by higher Sharpe Ratio's than the other four periods. Egypt, Colombia, and Czech Republic generated the highest Sharpe Ratio for this period.

The last period is the most representative when evaluating future returns for these markets. Not because past data can be used to predict future returns, but because this is the latest period meaning it will more accurately represent today's characteristics of these markets compared to older periods. During this period, most countries have generated a lower annual excess return over risk-free rate than NBIM's Benchmark, in addition to higher volatility. The countries that have outperformed NBIM's Benchmark, represented by Sharpe Ratio, are India, Thailand, and Taiwan.

*Table 8: Annualized excess return over risk-free rate (standard deviation in parenthesis) and Sharpe Ratio over each sub-period. *indicates significant returns different than zero on a 5% level (t-values are listed in Appendix 4)*

MSCI Index and NBIM BM	Return and Std.dev. (%)	Sharpe Ratio	Return and Std.dev. (%)	Sharpe Ratio	Return and Std.dev. (%)	Sharpe Ratio	Return and Std.dev. (%)	Sharpe Ratio	Return and Std.dev. (%)	Sharpe Ratio
	1998 – 2001		2002 – 2005		2006 – 2009		2010 – 2013		2014 – 2017	
EM	-2,4 (30,0)	-0,08	23,0* (18,1)	1,27	12,8* (29,8)	0,43	4,9 (19,7)	0,25	5,8* (15,4)	0,38
BRIC	-3,8 (36,8)	-0,10	27,2* (22,5)	1,21	20,3* (34,6)	0,58	0,9 (22,2)	0,04	7,8* (18,6)	0,42
World	-0,8 (17,0)	-0,05	7,1* (13,5)	0,52	-0,1 (19,3)	-0,01	12,7* (15,4)	0,82	7,9* (10,1)	0,77
Russia	34,5* (83,1)	0,42	36,2* (30,2)	1,20	7,4 (42,9)	0,17	6,9 (28,3)	0,24	0,6 (27,4)	0,02
Brazil	0,7 (46,1)	0,02	36,1* (40,4)	0,89	29,3* (38,7)	0,76	-5,3 (26,3)	-0,20	7,7 (35,3)	0,22
India	1,8 (33,8)	0,05	30,3* (23,9)	1,27	20,7* (39,4)	0,52	1,5 (27,2)	0,05	10,6* (16,7)	0,63
China	-11,6 (53,5)	-0,22	17,7 (21,8)	0,81	26,0* (35,4)	0,73	4,3 (20,4)	0,21	11,7* (20,1)	0,58
Egypt	-18,9* (29,8)	-0,63	65,3* (30,5)	2,14	10,1 (38,8)	0,26	3,4 (31,0)	0,11	3,4 (31,1)	0,11
Indonesia	9,1 (71,2)	0,13	41,3* (31,9)	1,30	31,3* (41,6)	0,75	6,4 (23,3)	0,27	10,5* (19,1)	0,55
Mexico	8,8 (35,6)	0,25	24,1* (21,0)	1,15	10,3* (28,7)	0,34	11,3* (20,2)	0,56	-1,7 (17,0)	-0,10
South Africa	-5,7 (35,3)	-0,16	32,5* (22,9)	1,42	10,6* (31,7)	0,33	8,8* (22,4)	0,39	3,6 (22,1)	0,16
South Korea	27,1* (54,2)	0,50	28,2* (25,9)	1,09	7,1 (35,5)	0,20	11,3* (23,0)	0,49	6,3* (16,6)	0,38
Turkey	10,4 (75,0)	0,14	39,9* (49,4)	0,81	13,6 (47,1)	0,29	3,7 (31,8)	0,12	3,3 (26,6)	0,12
Pakistan	-10,2 (51,7)	-0,20	52,8* (31,4)	1,68	-1,2 (41,7)	-0,03	20,2* (20,6)	0,98	5,0 (20,3)	0,25
Chile	-1,6 (28,3)	-0,06	21,7* (20,8)	1,04	16,7* (24,2)	0,69	2,2 (22,7)	0,09	4,8 (17,1)	0,28
Colombia	-14,9* (43,0)	-0,35	61,5* (28,7)	2,14	18,1* (34,6)	0,52	11,3* (19,3)	0,58	-6,4 (28,5)	-0,22
Hungary	-3,5 (40,4)	-0,09	36,7* (25,9)	1,41	9,1 (44,1)	0,21	-1,3 (39,0)	-0,03	17,3* (23,3)	0,74
Peru	-8,1 (29,5)	-0,27	33,4* (25,3)	1,32	35,8* (41,1)	0,87	3,6 (25,4)	0,14	13,1* (21,1)	0,62
Poland	1,0 (43,0)	0,02	28,1* (28,9)	0,97	9,6 (41,2)	0,23	9,1* (31,2)	0,29	0,9 (21,5)	0,04
Thailand	-2,3 (60,0)	-0,04	32,2* (26,0)	1,24	12,9* (32,5)	0,40	17,3* (25,1)	0,69	9,8* (13,7)	0,72
Taiwan	-3,6 (39,8)	-0,09	7,0* (23,3)	0,30	7,8 (29,4)	0,26	7,7* (19,2)	0,40	10,6* (13,2)	0,80
Czech Republic	6,5 (39,4)	0,16	48,9* (22,0)	2,22	13,4* (32,5)	0,41	0,2 (25,1)	0,01	2,4 (20,1)	0,12
NBIM BM	-1,2 (16,7)	-0,07	9,0* (14,0)	0,64	1,8 (21,2)	0,09	11,3* (17,5)	0,65	6,6* (10,7)	0,62

25

To see how the standard deviation has evolved over time, a 5-years rolling window is created for six selected countries (Figure 6). These are selected because they deviate in results during the last period.

5-years Rolling Standard Deviation
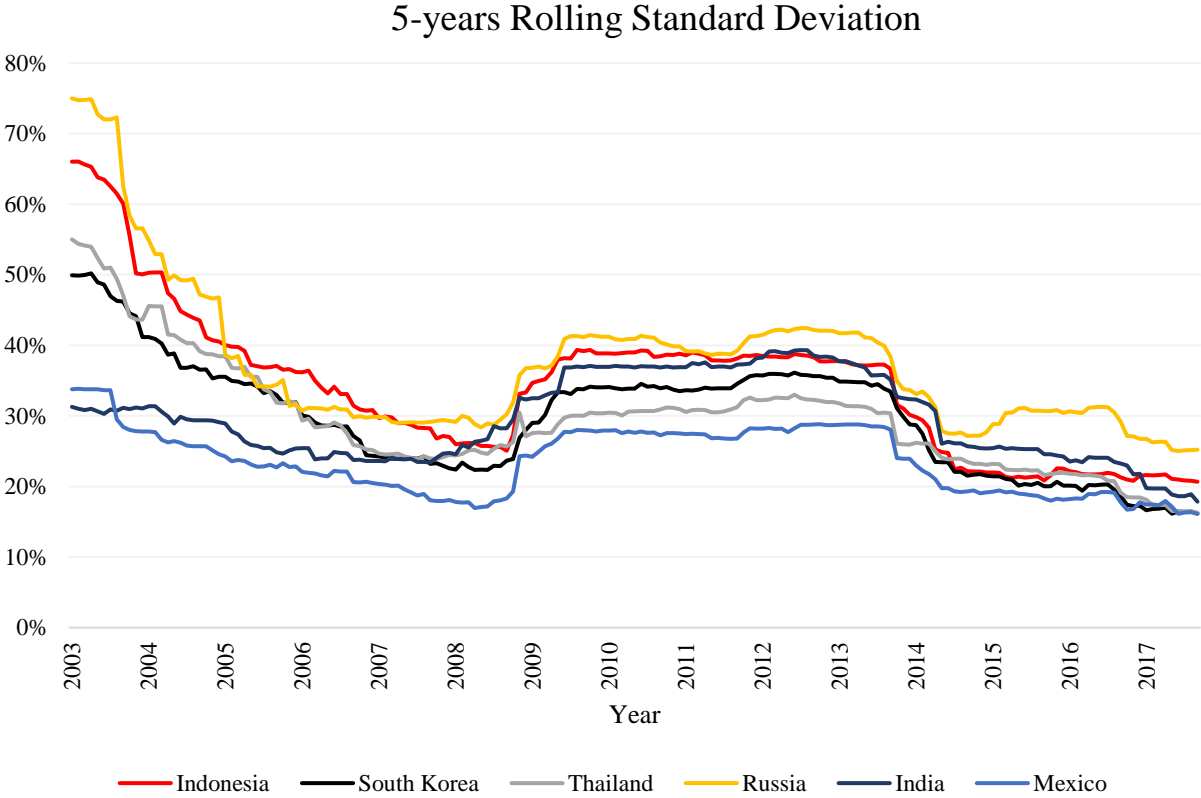
Figure 6: 5-years Rolling Standard Deviation over the period 1998 to 2017 for MSCI Index: Indonesia, Korea, Thailand, Russia, India and Mexico

As Figure 6 illustrates, the highest standard deviation was during the beginning of the period. This corresponds to the results presented in Table 8, and the expectations regarding the crises that affected come of the emerging markets. Russia has had the highest standard deviation during most of the period, followed by Indonesia. All indices experienced a higher degree of standard deviation during the U.S. financial crisis. The annual standard deviation for NBIM's Benchmark was 16,4% during the period 1998-2017 (Table 6).

Table 9 presents the annual return in excess of NBIM's Benchmark (with corresponding t-values) for the MSCI Indices over the period 1998-2017. The excess return for Taiwan is the lowest and the only one that is not significantly different than zero on a 5% level. Indonesia, Russia, and South Korea achieves the highest excess return for this period.

MSCI Index	Annual Return in Excess of NBIM BM (%)	t-value
Indonesia	14,4	6,09
Russia	11,7	4,27
South Korea	10,6	6,35
Peru	10,2	6,14
Czech Republic	9,0	5,93
Turkey	8,8	3,23
Colombia	8,8	4,65
Thailand	8,6	4,52
Brazil	8,3	4,40
Pakistan	8,0	3,37
India	7,5	4,94
Egypt	7,4	3,79
Hungary	6,1	3,38
Mexico	5,2	4,68
BRIC	5,0	4,25
South Africa	4,6	3,61
Poland	4,4	2,72
China	4,2	2,39
EM	3,4	4,08
Chile	3,3	2,92
Taiwan	0,3	0,25

Deviations between the actual portfolio and the benchmark for the Government Pension Fund Global are measured through tracking error constraints. The tracking error limit has been 125 basis points since February 2016 (Norges Bank Investment Management, 2017d). When NBIM evaluates which investments to include in the Fund, they must keep the tracking error below this limit. This limit is made to reduce the market risk of the Fund.

Tracking Error (TE) has been used for a long time as a measurement of how much the fund (or here the index) deviates from its benchmark (NBIM's Benchmark).

$$Tracking\ Error = Stdev(R_{MSCI\ Index} - R_{NBIM\ BM})$$

$R_{MSCI\ Index} = the\ return\ of\ the\ MSCI\ Index$
$R_{NBIM\ BM} = the\ return\ of\ the\ NBIM\ Benchmark$

A low tracking error indicates that the fund is following NBIM's Benchmark tightly, whereas a high tracking error indicates a higher deviation from the benchmark. Since a higher tracking error often entails that NBIM takes on more risk, the measurement is often referred to as *active risk*.

Table 10: Annualized Tracking Error for each MSCI Index over sub-periods and the total period from 1998 to 2017. Ranked from highest to lowest TE for the period 1998-2017

MSCI Index	ANNUAL TRACKING ERROR (%)					
	1998 - 2001	2002 - 2005	2006 - 2009	2010 - 2013	2014 - 2017	1998 - 2017
Russia	81,3	27,1	29,4	16,1	23,4	42,3
South Korea	46,2	19,3	21,2	13,5	11,8	42,0
Turkey	67,5	42,8	34,9	26,0	24,1	36,6
Pakistan	52,3	34,7	43,7	19,8	19,6	36,3
Egypt	31,5	30,9	26,9	27,5	30,2	30,1
Thailand	53,0	22,9	21,3	19,0	12,6	29,2
Colombia	43,4	25,9	23,3	18,2	25,2	29,1
Brazil	37,4	31,8	24,8	14,5	30,6	29,0
Hungary	37,9	22,2	28,3	26,3	20,6	27,8
China	48,6	16,6	23,8	12,8	15,0	26,8
South Africa	27,6	18,6	17,3	14,1	17,5	25,6
Peru	29,5	23,0	29,7	23,9	18,0	25,5
Poland	35,2	22,3	27,0	17,4	17,7	24,8
India	32,4	21,8	24,5	19,7	14,3	23,4
Czech Republic	36,8	19,9	17,5	16,4	17,3	23,3
Taiwan	35,2	18,7	17,8	12,0	10,1	20,6
Mexico	27,2	14,4	13,6	11,0	14,4	19,6
BRIC	28,3	14,2	19,2	10,4	12,5	18,3
Chile	21,8	14,0	18,5	17,7	13,9	17,5
Indonesia	65,2	30,6	26,3	20,3	18,0	17,1
EM	19,8	9,6	12,8	8,2	9,5	12,8

Two of the periods are defined in this thesis as more "stressed". These are periods represented by higher volatility (Table 8). It may be expected that the TE in these periods are higher, than the periods with less fluctuation. The reason for this is that TE measure the difference in volatility, and in periods where the two indices are moving in the same direction, this will lead to a lower TE. This is one of the reasons why generally the TE for the first period is higher than for the third period for most countries. The first period represents crises which affected emerging markets more than developed ones, whereas the U.S. financial crisis during period 3 affected more both markets.

During the whole period (1998-2017) Russia, South Korea, and Turkey had the highest TE. For the individual emerging countries, the lowest TE are for Indonesia, Chile, and Mexico. Because the TE for the first period are markedly higher than the rest, the TE for 1998-2017 are higher than the general level during more calm periods. For this reason, TE for 2014-2017 may be more representative, even though it is shorter. The TE for the individual markets are between

10-30% per year, where Taiwan, South Korea, Thailand, and Chile have the lowest values, whereas the highest are for Egypt and Brazil.

Adding emerging markets with a high TE to the Fund will increase the total TE of the portfolio. The TE presented in Table 10 are generally high. This cause difficulties regarding NBIM's constraints regarding keeping the deviation between the actual portfolio and the benchmark under 125 basis points.

8. Diversification Benefits from Emerging Market Investments

Diversification benefits are one of the motivations to potentially expand NBIM's investments in emerging markets. These benefits may occur since NBIM's Benchmark is weighted more in developed markets, which generates a higher correlation.

MSCI Emerging Market Index will here represent emerging markets (EM), whereas developed markets (DM) are represented by MSCI World. During the five sub-periods, the correlation between NBIM's Benchmark and developed markets has been approximately 1 (Table 11). This means that investing in developed markets does not add a diversification benefit to the portfolio.

Table 11: Correlation coefficients between emerging markets (MSCI Emerging Market Index), developed markets (MSCI World), and NBIM BM during five sup-periods. EM: emerging markets, DM: developed markets.

PERIOD	CORRELATION	
	EM vs. DM	EM vs. NBIM BM
1998 - 2001	0,78	0,78
2002 - 2005	0,85	0,85
2006 - 2009	0,91	0,93
2010 - 2013	0,87	0,91
2014 - 2017	0,73	0,79

As shown in Table 11, there are diversification effects when investing in emerging markets, since the correlation between EM and NBIM's Benchmark is less than 1. One of NBIM's concerns regarding diversification effects generated from investing in emerging markets, is that the correlation between EM and DM are at its highest during stressed periods (Norges Bank Investment Management, 2017a). In other words, when the Fund needs the diversification benefits the most, the diversification effect is at its lowest. This is confirmed by looking at the correlation coefficient between EM and DM during the period 2006-2009, where it is at its highest. The correlation coefficient is not as high for the first period, which is also defined as a stressed period. As mentioned earlier, the crises in this period mostly affect emerging markets. Whereas the second stressed period affected developed markets. This makes the period from 2006 to 2009, the most representative when discussing where the diversification effect for the Fund is most needed.

Mentioned in Chapter 4, earlier work has emphasized that the correlation between emerging and developed markets has increased, which reduce the diversification benefits from investing

in both markets. This is the argument given by NBIM earlier, in addition to academic literature presented in chapter 4. However, through the results presented in Table 11 and through a 5-years rolling correlation window between emerging and developed markets (Figure 7), the correlation between these two markets has decreased after 2013/2014. This is one argument for why NBIM should expand their investments in emerging markets.

5-years rolling correlation between EM and DM
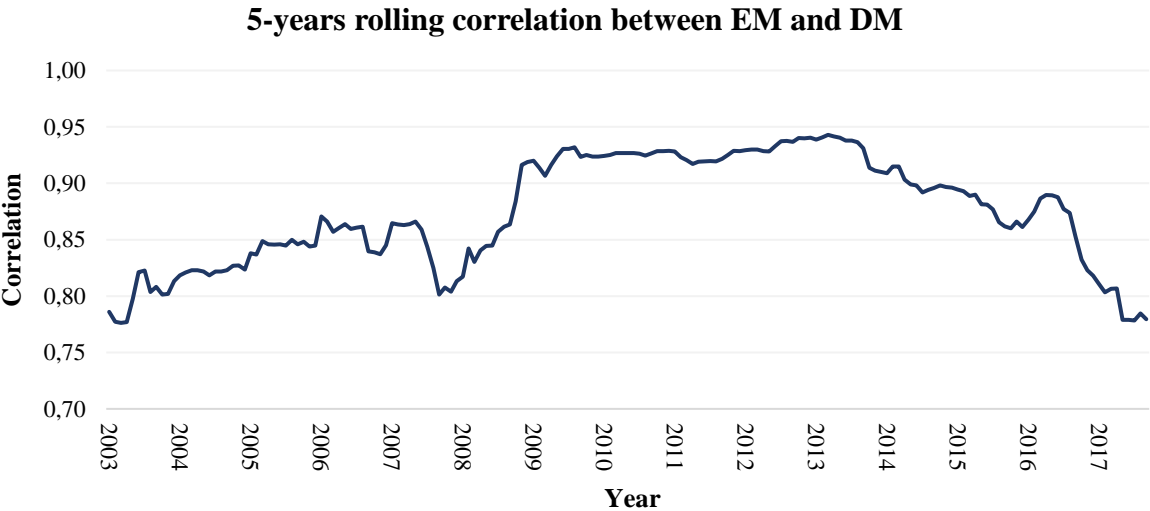
Figure 7: 5-years rolling correlation between Emerging and Developed markets, represented by MSCI Emerging Market Index and MSCI World, for the period 1998-2017

As mentioned in Chapter 6, a least square regression was generated to evaluate the relationship between MSCI Emerging Market Index and NBIM's Benchmark. This analysis is done also for each sub period (Table 12).

The beta is higher than 1 for all period, however only significantly different than one on a 5% level during the two stressed periods. A beta-value higher than 1 indicates that MSCI EM carries a higher risk than NBIM's Benchmark. Even though the beta-value for the first period is higher than from Period 3, it also has a lower Adjusted R^2. This emphasizes the argument presented earlier that the third period is more representative when discussing the investment benefits in emerging markets. During this period, MSCI EM and NBIM's Benchmark where affected by more of the same risk-factors represented by a higher Adjusted R^2. The lower Adjusted R^2 for the first period may emphasize the crises that mostly affected the emerging markets.

Table 12: Beta (t-values in parenthesis) and Adjusted R² for the five sub-periods from monthly excess returns. N: number of observations. Alpha tested for different than 0, and beta is tested for different than 1. Both on a 5% level.

$(R_{MSCI\,EM} - r_f) = \alpha_i + \beta_1(R_{NBIM\,BM} - r_f) + \varepsilon_i$				
Period	*α*	*β₁*	*Adj. R²*	*N*
1998 - 2001	-0,01	**1,42**	0,61	46
	(-0,29)	(2,51)		
2002 - 2005	**0,13**	1,10	0,72	47
	(9,34)	(1,02)		
2006 - 2009	0,10	**1,31**	0,86	47
	(6,50)	(4,05)		
2010 - 2013	-0,07	1,02	0,82	47
	(-5,46)	(0,35)		
2014 - 2017	-0,02	1,13	0,61	44
	(-1,14)	(0,97)		

For the last period, the Adjusted R^2 are generally low, which indicates that MSCI EM and NBIM's Benchmark are affected by different risk-factors to a higher degree than the previous three periods. This argues for diversification benefits from expanding their investments in emerging markets.

Based on historical data and results presented in this chapter, there are diversification benefits from investing in emerging markets. Therefore, it is interesting to see which countries generate the most benefit. To do this, the correlation between NBIM BM and a the individual MSCI emerging market indices are presented in Figure 8 for the whole period from January 1998 to September 2017.
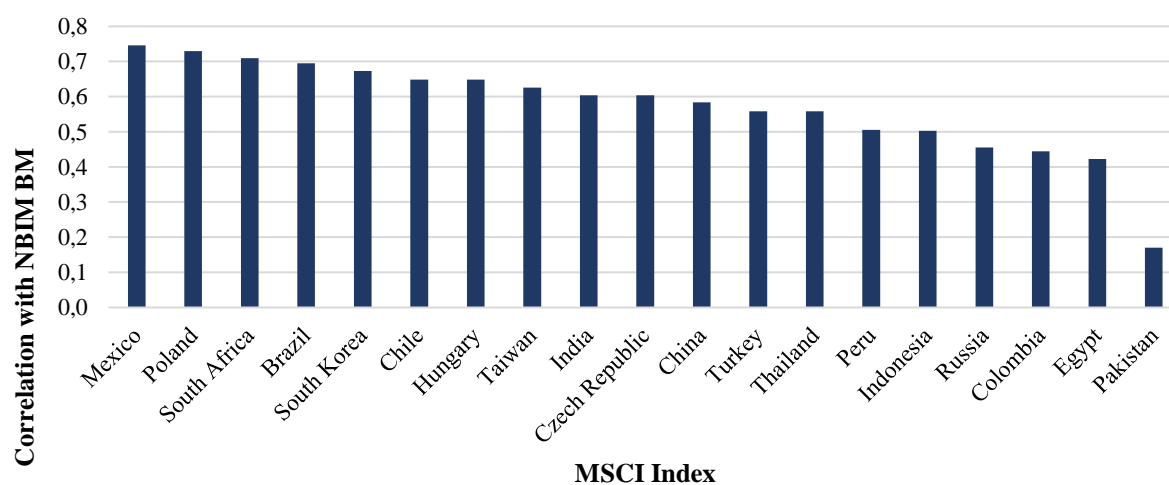
Figure 8: Correlations between NBIM's Benchmark and the MSCI country indices for the whole period (1998-2017)

During the whole period, all 19 countries had a correlation less than 1. This indicates that investing in these countries have, based on history, generated a diversification effect. The countries that generated the least diversification benefits are some of the countries that the Fund is most invested in. These include South Africa, Brazil, South Korea, and Taiwan. Still, they have a lower correlation than 1, and will reduce the risk of the total portfolio. Pakistan stands out with the lowest correlation. The low correlation indicates that just a small part shown in MSCI Pakistan corresponds to the variability in NBIM's Benchmark. This may be one of the reasons why Pakistan was added to the benchmark index in 2017.

As stated earlier, the diversification effect is mostly needed during crises, especially crises that affect developed markets, represented by Period 3 from 2006 to 2009. The correlation coefficients for each country, during each sub-period, are presented in Table 13.

Table 13: Correlation coefficients vs. NBIM BM (excess return over risk-free rate) for MSCI emerging market indices. Ranked after highest to lowest correlation for the period 1998-2017.

MSCI Index	Correlation with NBIM BM					
	1998 – 2001	*2002 – 2005*	*2006 – 2009*	*2010 – 2013*	*2014 – 2017*	*1998 – 2017*
Mexico	0,68	0,73	0,89	0,85	0,54	0,75
Poland	0,62	0,66	0,81	0,90	0,57	0,73
South Africa	0,65	0,58	0,86	0,78	0,63	0,71
Brazil	0,65	0,72	0,81	0,85	0,55	0,69
South Korea	0,60	0,68	0,84	0,81	0,71	0,67
Chile	0,64	0,74	0,68	0,64	0,59	0,65
Hungary	0,35	0,49	0,86	0,84	0,47	0,65
Taiwan	0,47	0,59	0,80	0,79	0,66	0,63
Czech Republic	0,36	0,46	0,87	0,76	0,50	0,60
India	0,33	0,43	0,84	0,69	0,53	0,60
China	0,44	0,65	0,76	0,78	0,68	0,58
Turkey	0,54	0,58	0,73	0,58	0,43	0,56
Thailand	0,53	0,48	0,76	0,65	0,49	0,56
Peru	0,28	0,43	0,72	0,42	0,52	0,51
Colombia	0,17	0,43	0,75	0,52	0,48	0,45
Russia	0,21	0,44	0,78	0,86	0,54	0,45
Egypt	0,18	0,20	0,75	0,47	0,26	0,42
Indonesia	0,46	0,31	0,84	0,54	0,38	0,50
Pakistan	0,12	-0,02	0,16	0,47	0,33	0,17

The correlation has been generally higher during the U.S. financial crisis, affecting both emerging and developed markets. The first period represents, as mentioned earlier, crises which affects emerging countries more, represented by smaller correlations.

All countries, except Chile, experience a higher correlation during the period from 2006 to 2009 compared to other periods. Comparing Period 2 and 5, not all countries are back to the same low correlation as before the financial crisis. The countries which are at the same level or lower as before Period 3 are: Brazil, Mexico, Turkey, Chile, Hungary, and Poland. The other countries generate a higher correlation with NBIM's Benchmark than before the 2008 financial crisis.

Pakistan stands out as an appropriate candidate for diversification, as it has a low correlation with NBIM's Benchmark during the third period. For the second period, the correlation is in fact negative, indicating that for this period Pakistan and NBIM's Benchmark has moved in the opposite direction. However, all indices have correlation coefficients under 1 and will add diversification benefits to the Fund.

Figure 9 illustrates a 5-year rolling correlation window between NBIM's Benchmark and six selected indices. These includes the BRICs, Pakistan, and Indonesia. Here it can be observed that Pakistan generates a lower correlation during the time leading up to the 2008 financial crisis, and experienced a decreasing correlation during Period 3. This is opposite of what happened to the other five countries.
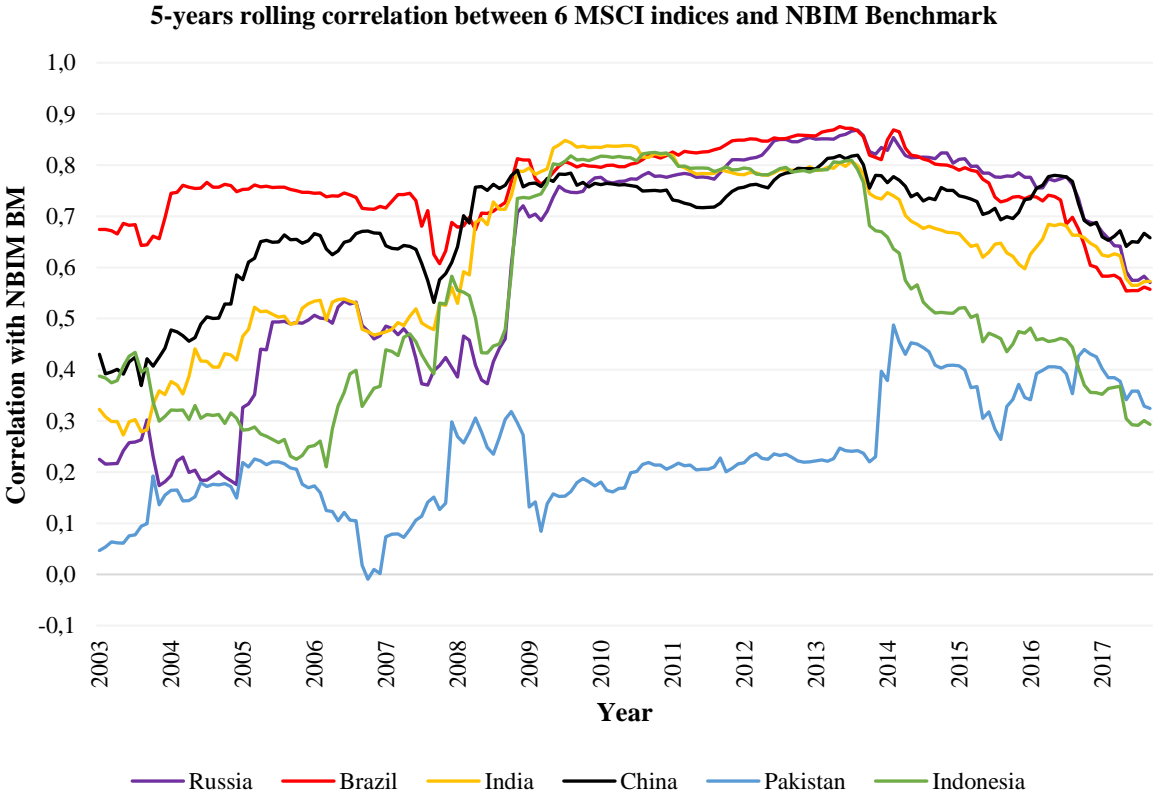

Figure 9: 5-year rolling correlation window between MSCI Pakistan and NBIM BM for the period from 1998 to 2017

Since the correlations between NBIM's Benchmark and the individual country MSCI Indices are low, it is expected that the Adjusted R^2 will be low as well. The single index model is performed on each individual country index. The results are presented in Table 14. An important relation is 1-Adjusted R^2. This measure represents the risk that are not explained in the market, called country-specific risk in this thesis.

For the total period from 1998 to 2017, most of the countries have a beta above 1 The exceptions are Chile, Peru, Colombia, Egypt, and Pakistan. The country that has the lowest country-specific risk is Mexico, followed by Poland, South Africa, and Brazil.

Table 14: Beta (t-values in parenthesis, tested for H0: Beta=1 on a 5% level) and country specific risk (represented by 1-Adjusted R2) for the five sub-periods and the whole period, from monthly excess returns. Raked after lowest to highest country risk for the whole period 1998-2017. Monthly alpha-values (with corresponding t-values) are presented in Appendix 5.

	1998 – 2001		2002 – 2005		2006 – 2009		2010 – 2013		2014 – 2017		1998 – 2017	
MSCI Index	*β1*	*1-Adj. R²*	*β1*	*1-Adj. R²*	*β1*	*1-Adj. R²*	*β1*	*1-Adj. R²*	*β1*	*1-Adj. R²*	*β1*	*1-Adj. R²*
Mexico	1,45 (-1,95)	0,55	1,10 (-0,62)	0,48	1,21 **(-2,38)**	0,21	0,97 (-0,34)	0,30	0,85 (-0,73)	0,73	1,16 **(-2,30)**	0,46
Poland	1,58 (1,93)	0,64	1,37 (-1,60)	0,57	1,58 **(-3,49)**	0,35	1,60 **(-5,14)**	0,20	1,14 (-0,56)	0,69	1,52 **(-5,54)**	0,47
South Africa	1,37 (-1,53)	0,59	0,95 (-0,25)	0,68	1,29 **(-2,56)**	0,27	1,00 (-0,02)	0,40	1,30 (-1,21)	0,62	1,19 **(-2,49)**	0,50
Brazil	1,80 **(-2,56)**	0,59	2,07 **(-3,64)**	0,49	1,48 **(-3,07)**	0,35	1,28 **(-2,47)**	0,28	1,82 **(-1,98)**	0,71	1,61 **(-5,56)**	0,52
South Korea	1,93 **(-2,41)**	0,66	1,26 (-1,28)	0,55	1,40 **(-2,98)**	0,31	1,07 (-0,60)	0,35	1,10 (-0,59)	0,51	1,38 **(-3,81)**	0,55
Chile	1,08 (-0,41)	0,61	1,10 (-0,70)	0,46	0,78 (-1,81)	0,55	0,83 (-1,14)	0,60	0,94 (-0,30)	0,67	0,91 (-1,31)	0,58
Hungary	0,85 (-0,44)	0,90	0,90 (-0,43)	0,78	1,79 **(-5,05)**	0,27	1,87 **(-4,82)**	0,31	1,02 (-0,06)	0,80	1,42 **(-3,91)**	0,58
Taiwan	1,12 (-0,37)	0,80	0,99 (-0,66)	0,66	1,12 (-0,94)	0,37	0,87 (-1,31)	0,38	0,82 (-1,29)	0,57	1,01 (-0,17)	0,61
India	0,67 (1,15)	0,91	0,74 (-1,16)	0,83	1,56 **(-3,74)**	0,30	1,08 (-0,45)	0,53	0,83 (-0,86)	0,74	1,08 (-0,86)	0,64
Czech Republic	0,86 (-0,43)	0,89	0,73 (-1,33)	0,80	1,34 **(-3,04)**	0,24	1,10 (-0,70)	0,43	0,95 (-0,22)	0,76	1,06 (-0,65)	0,65
China	1,40 (-0,93)	0,83	1,00 (-0,04)	0,59	1,27 (-1,66)	0,44	0,91 (-0,80)	0,40	1,27 (-1,30)	0,55	1,17 (-1,61)	0,66
Turkey	2,46 **(-2,55)**	0,72	2,04 **(-2,47)**	0,68	1,62 **(-2,77)**	0,48	1,05 (-0,23)	0,68	1,06 (-0,17)	0,84	1,67 **(-4,12)**	0,69
Thailand	1,92 **(-2,03)**	0,73	0,89 (-0,46)	0,79	1,17 (-1,17)	0,43	0,94 (-0,40)	0,59	0,62 **(-2,22)**	0,78	1,19 (-1,62)	0,69
Peru	0,50 **(1,98)**	0,94	0,78 (-0,92)	0,83	1,41 **(-2,05)**	0,49	0,62 **(-1,98)**	0,84	1,02 (-0,09)	0,75	0,91 (-0,85)	0,75
Indonesia	1,98 (-1,74)	0,80	0,71 (-0,91)	0,92	1,66 **(-4,21)**	0,30	0,72 (-1,68)	0,73	0,68 (-1,28)	0,88	1,28 (-1,95)	0,75
Russia	1,05 (-0,07)	0,98	0,94 (-0,20)	0,83	1,59 **(-3,07)**	0,39	1,34 **(-3,15)**	0,27	1,39 (-1,19)	0,72	1,31 (-1,83)	0,80
Colombia	0,45 (-1,46)	0,99	0,89 (-0,41)	0,83	1,23 (-1,48)	0,44	0,57 **(-3,06)**	0,75	1,26 (-0,74)	0,79	0,89 (-0,99)	0,80
Egypt	0,31 **(-2,62)**	0,99	0,44 (-1,79)	0,98	1,37 **(-2,08)**	0,45	0,84 (-0,69)	0,79	0,74 (-0,60)	0,96	0,86 (-1,17)	0,82
Pakistan	0,39 (-1,34)	1,34	-0,05 **(-3,17)**	1,02	0,31 **(-2,40)**	1,00	0,55 **(-2,90)**	0,80	0,63 (-1,36)	0,91	0,38 **(-4,44)**	0,97

Examining the individual sub-periods, the country-specific risk decreases for most of these countries during the stressed period from 2006 to 2009, except for Chile. This corresponds to the correlation coefficients presented in Table 13. Chile and Taiwan are the only countries from Table 14 generating a beta under 1 for the same period, but it is not significantly different than 1.

The last period is represented by high country-specific risk factors. This will cause difficulties for NBIM when investing in them; since the risk factors are different than the once they are already exposed to. This generate a diversification effect, but also makes it difficult to categorize what other risk-factor these countries are exposed to. During Period 2 and Period 4, the countries experienced a lower country-specific risk, indicating that the risk incorporated in NBIM are more representative for the exposure each of these countries experienced in more destressed periods.

Pakistan generated a very low correlation, and has a country-specific risk of approximately 1 during the period from 2006 to 2009. Investing in Pakistan will add almost exclusively risk factors to the fund which are different than those already incorporated. Also represented with a low beta of 0,31 that are significantly different than 1.

China does not have betas significantly different than 1 for any period. This is the emerging country where the Fund is most heavily invested in (Table 3). China generates the lowest country-specific risk during the last period, but also has the highest correlation compared to the other countries for the same period (Table 13). Thailand is the only country with a significant beta for the last period, in addition to a beta less than 1 and a country-specific risk that may be acceptable compared to others. It also generates a low correlation with NBIM's Benchmark during the last two periods, in addition to one of the lowest correlation through Period 3 (Table 13). During Period 4 Peru and Colombia generate a significant lower beta, and a country-specific risk at the same level as Thailand. These two countries are among those with a lower correlation with NBIM's Benchmark, both for sub-periods and for the total period (Table 13).

Following the discussions and evidence presented above, the first hypothesis is confirmed:

H1: Investing in emerging markets generates diversification benefits to the Fund

This applies to all MSCI Indices during each period. The chapter demonstrates how the correlation between emerging and developed markets have decreased lately, generating higher diversification opportunities in these markets. However, it is emphasized that these benefits are smallest during the most important period; the financial crisis affecting developed markets in a higher degree. It must be highlighted that all the individual countries have a potential for diversification effect to the portfolio, it depends of how much country-specific risk NBIM is willing to include in the Fund.

9. Do Emerging Market Offer a Hedge Against Falling Oil Prices?

In the letter to the Norwegian Ministry of Finance in November 2017, NBIM recommended that the fund extract investments related to the oil and gas market from the benchmark index (Norges Bank Investment Management, 2017b). NBIM's strategy for 2017-2019 includes a broader wealth perspective when advising the ministry. They have previously discussed whether the Norwegian economy's vulnerability to a permanent drop in oil prices can be reduced by adjusting the composition of the Fund away from investments where returns move in line with oil prices. Because of this, they recommended that the fund should not invest stocks related to the oil and gas market. As of 31st of December 2017, oil and gas companies accounted for 5,6% of the fund's equity holdings (Norges Bank Investment Management, 2017d). This chapter will evaluate if some of these investments should be diverted to investments in emerging markets, through analyzing their dependence on changes in oil price.

How emerging markets are affected by changes in oil price will be analyzed using monthly observations through a finite distributed-lag model (DLM), augmented by a factor representing NBIM's Benchmark. The chosen lag-length for the model is three. A longer lag length increases the possibility of problems related to multicollinearity. The model is given by the formula:

$$\left(r_t^{EM} - r_f\right) = \alpha_0 + B_M\left(r_t^{NBIM\ BM} - r_f\right) + \sum_{i=0}^{4} \beta_i r_{t-i}^{OIL} + \varepsilon_t$$

$r_t^{EM} = MSCI\ Index\ return$
$r_f = risk\ free\ rate, here\ one\ month\ U.S.Treasury\ Bill$
$r_t^{NBIM\ BM} = return\ NBIM\ Benchmark$
$\beta_{t-i}^{OIL} = oil\ price\ change\ t-i, represented\ by\ Brent$

This model is conducted for the total period 1998-2017, in addition to each of the sub-periods used throughout this thesis. Table 15-19, illustrates the results generating a significant oil beta different than zero for each period. Appendix 2 presents the full results from this analysis for all indices.

To see how the long-run oil effect for emerging markets for the whole period, long-run oil beta is calculated:

$$\hat{\beta} = \frac{\sum_{i=0}^{4} \beta_i}{(1 - \alpha_0)}$$

$1-\alpha_0$ is *the speed of adjustment*. The long-run beta, or the long-run multiplier gives lesser weight to distant β's (Gujarati & Porter, 2009). This is why it may be a more representative value of the markets sensitivity to changes in the oil price. However, in this thesis the long-run beta is not tested for significance. Table 15 illustrated the results of significant oil-betas on all three lags, in addition to the market beta, Adjusted R^2, and alpha for the period 1998-2017. The long-run oil beta for these indices are also presented in this table.

Table 15: Significant oil-betas, including market beta, alpha, and Adjusted R^2 from the DLM for the period 1998-2017. T-values in parenthesis. Market beta tested for H0: Beta=1, for oil-betas: H0: Beta=0, and for alpha: H0: alpha=0. All on a 5% level. The long-run Oil Beta is not tested for significance. Number of observations: 233

	1998 – 2017						
MSCI Index	NBIM BM	Brent (t)	Brent (t-1)	Brent (t-2)	Brent (t-3)	Alpha	Adj. R^2	Long-run Oil Beta
EM	**1,18**	**0,08**	0,00	0,01	**-0,05**	0,001	0,74	0,04
	3,68	3,63	0,23	0,43	-2,57	0,63		
BRIC	**1,27**	**0,12**	0,01	0,05	**-0,08**	0,002	0,64	0,11
	3,89	4,11	0,34	1,85	-2,61	0,47		
Brazil	**1,55**	**0,12**	0,03	**0,11**	**-0,12**	0,003	0,51	0,14
	4,93	2,59	0,56	2,42	-2,62	0,55		
India	1,01	**0,12**	-0,03	0,01	-0,01	0,005	0,37	0,09
	0,10	2,88	-0,64	0,24	-0,27	1,06		
China	1,09	**0,12**	-0,01	0,05	-0,07	0,002	0,36	0,09
	0,81	2,62	-0,31	1,23	-1,65	0,31		
Mexico	1,11	**0,08**	0,01	0,02	-0,01	0,003	0,56	0,10
	1,61	2,75	0,33	0,60	-0,47	0,84		
South Africa	**1,16**	**0,09**	0,06	-0,04	-0,05	0,002	0,52	0,05
	2,08	2,65	1,79	-1,16	-1,68	0,56		
Pakistan	0,32	0,10	-0,01	**0,13**	-0,06	0,008	0,04	0,16
	-4,67	1,64	-0,16	2,10	-1,01	1,22		
Chile	0,88	**0,07**	0,00	0,01	-0,06	0,003	0,43	0,02
	-1,70	2,23	-0,04	0,40	-1,98	0,91		
Hungary	1,42	0,00	**0,10**	0,01	-0,01	0,002	0,43	0,09
	3,75	-0,03	2,13	0,13	-0,32	0,38		
Peru	0,89	0,09	0,02	0,02	**-0,10**	0,008	0,27	0,03
	-1,01	1,93	0,55	0,43	-2,21	1,73		

Based on the long-run oil beta Pakistan and Brazil are most sensitive to changes in the oil price. For a full overview of the long-run oil betas see Appendix 3. Nine of the MSCI country indices generates significant oil-betas for this period, in addition the two broad emerging market

indices. MSCI EM, BRIC, and Brazil generates more than one significant oil beta for this period. Only four indices have a significant market beta, where the highest is generated by Brazil. MSCI EM have a low dependence on changes in oil price, however the index experience effects both on time t and t-3. The market beta indicates that MSCI EM generates a higher market risk. In addition to the significant number appearing from this analysis, it is interesting to also compare the Adjusted R^2 to the results from the single index model from chapter 7 (Figure 10). Adding changes in oil price and the lagged values have increased the Adjusted R^2 with 0,03 for both MSCI EM and MSCI BRIC. This may indicate that some of the risks affecting emerging markets may be associated with changes in oil price, however the impact is small. This is also represented by the long-run oil beta which is small for MSCI EM and higher for MSCI BRIC. This is expected since all countries in the BRICs (except Russia) generates significant oil-betas for this period.

Change in Adjusted R² when adding oil price change

Change in Adjusted R²
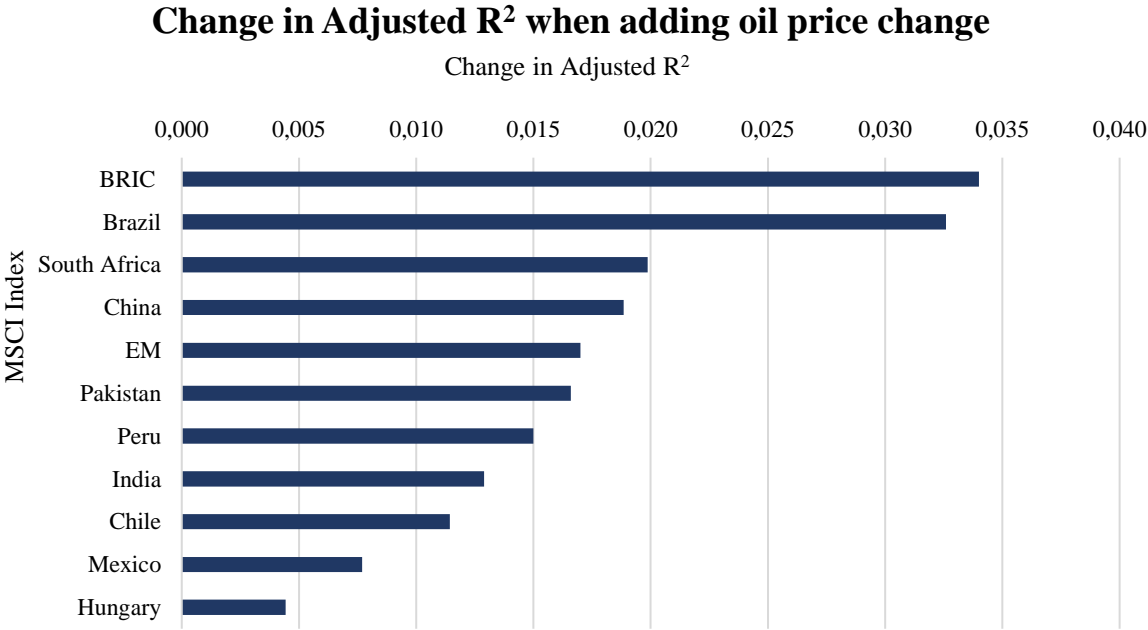
Figure 10: Changes in Adjusted R-square between Single Index Model and Distributed Lag Model for the period 1998-2017. The Adjusted R^2 from the single index model deviate some from the results presented in chapter 7, since three observations were removed to represent the same number of observations as in the DLM.

Of the nine MSCI emerging market indices, Brazil and Pakistan are the countries generating the highest long-run beta for this period. The countries which are least affected by changes in the oil-price over time (three month) are Chile and Peru. All long-run betas are under 0,16,

indicating that emerging markets may be an attractive investment for the issues related to Norway's exposure to falling oil prices.

The results from Table 15 indicates that all indices except Chile have a positive oil-beta for the first two lags, in addition to the oil-beta at time t. Oil-betas at lag 3, are all negative and therefore deviates from the results generated for the other oil-betas for the same period. This may indicate that the significant numbers generated for t-3 may not be representative when analyzing the effect oil-prices have on these indices.

Results from the period 1998-2001 are presented in Table 16. This period was affected by several crises, mentioned earlier in this thesis. None of the alpha values are significant. The low Adjusted R^2 illustrates that the emerging markets experienced risk factors which does not correspond to the market risk represented by NBIM's Benchmark. However, it is important to emphasize that these sub-periods are over a four-year period, which entail that there are fewer observations that will affect the results.

Table 16: Significant oil-betas, including market beta, alpha, and adjusted R2 from the DLM for the period 1998-2001. T-values in parenthesis. Market beta tested for H0: Beta=1, for oil-betas: H0: Beta=0, and for alpha: H0: alpha=0. All on a 5% level. The long-run Oil Beta is not tested for significance. Number of observations: 43

1998 – 2001								
MSCI Index	NBIM BM	Brent (t)	Brent (t-1)	Brent (t-2)	Brent (t-3)	Alpha	Adj. R^2	Long-run Oil Beta
EM	**1,38**	**0,13**	0,02	0,06	-0,05	-0,004	0,61	0,16
	2,13	2,15	0,39	0,95	-0,75	-0,40		
BRIC	1,42	0,17	0,08	**0,18**	-0,03	-0,009	0,48	0,39
	1,65	1,95	0,89	2,04	-0,33	-0,75		
India	0,49	**0,25**	0,04	0,04	0,01	-0,008	0,13	0,35
	-1,69	2,48	0,42	0,41	0,14	-0,52		
Mexico	**1,48**	**0,24**	0,08	0,09	-0,11	0,005	0,54	0,30
	2,02	3,00	1,00	1,15	-1,35	0,42		
South Africa	1,34	**0,22**	0,16	0,02	-0,04	-0,012	0,46	0,36
	1,37	2,71	1,87	0,19	-0,43	-0,96		
Chile	1,02	**0,14**	0,00	0,05	-0,06	-0,003	0,39	0,14
	0,09	1,98	0,03	0,72	-0,78	-0,28		

Also for this period MSCI EM and MSCI BRIC have significant oil-betas. MSCI EM have a significant positive oil beta at time t, indicating that it moves in the same direction as the oil price. The Adjusted R^2 is the same as from the single index model (Table 12). MSCI BRIC

have a positive oil beta at t-2, indicating that these countries are affected by changes in the oil price 2 month after. The Adjusted R^2 is low, which may be a result of the Russia Depression in the mid-1990s.

Four MSCI country indices have significant positive oil betas for this period, all at time t. This includes India, Mexico, South Africa, and Chile. These results indicate that they move in the same direction as the market. These had also significant oil betas at time t for the whole period presented in Table 16. India has the lowest Adjusted R^2 for this period, indicating that this country was affected by different risk factors than the model includes. This is also represented by the low market beta, although this is not significantly different than 1. Chile is the only country of these four that does not experience a higher Adjusted R^2 in this model, compared to the single index model (Table 14). India, South Africa, and Mexico experience an increase in Adjusted R^2 of 0,04, 0,05, and 0,09 respectively.

Mexico is the index with the highest market risk at 1,48. It has the second highest Adjusted R^2 for this period, which is still low and indicates that Mexico are affected by risk factors not represented in this model. South Africa has the highest long-run Oil beta for this period, and the country least affected by changes in the oil price over a three-month period is Chile. Also for this period, most of the oil-betas at time t-3 are negative, however not significant.

Unlike the results presented in the previous two tables, the period from 2002-2005 is represented by significant alpha values different than zero (Table 17). Of the ten country indices generating significant oil-betas, China and Taiwan are the only two which does not generate a significant alpha for this period. Even though these monthly alphas are low, they are positive, indicating excess return over risk-free rate for these emerging markets.

In this period, South Africa, Chile, and India do not generate significant oil betas whereas Mexico does. However, Mexico does not generate a positive significant oil beta at time t as for the first period, but instead generates a significant negative oil beta at time t-2. Indicating that if the oil price fall, ceteris paribus, the return for MSCI Mexico will go up. Mexico also have a significant alpha for this period indicating a monthly excess return over the risk-free rate of 1,6%.

Pakistan is the only country with a significant market beta different than 1. The market beta is negative and low, and the oil beta at time t-2 is negative. In addition, the long-run Oil Beta for

this period is -0,94 (however, not tested for significance). This is a period where MSCI Pakistan generated an annual return of 52% (standard deviation of 31,4%), referring to the results presented in Table 8. The low Adjusted R^2 underlines other analysis done in this thesis stating that this market is highly affected by country-specific risk. This is not exclusive for Pakistan, also the other countries have high country-specific risk.

Table 17: Significant oil-betas, including market beta, alpha, and adjusted R2 from the DLM for the period 2002-2005. T-values in parenthesis. Market beta is tested against H0: Beta=1, for oil-betas: H0: Beta=0, and for alpha: H0: alpha=0. All on a 5% level. The long-run Oil Beta is not tested for significance. Number of observations: 47

			2002 – 2005					
MSCI Index	NBIM BM	Brent (t)	Brent (t-1)	Brent (t-2)	Brent (t-3)	Alpha	Adj. R^2	Long-run Oil Beta
EM	1,13	0,01	0,03	**-0,10**	-0,07	**0,014**	0,75	-0,13
	1,25	0,23	0,72	-2,33	-1,65	2,822		
China	1,13	**0,18**	0,08	-0,03	-0,04	0,001	0,46	0,19
	0,72	2,24	0,95	-0,43	-0,49	0,133		
Egypt	0,48	0,13	-0,15	-0,18	0,11	**0,053**	0,04	-0,09
	-1,54	0,88	-1,01	-1,26	0,73	3,168		
Mexico	1,11	-0,05	0,02	**-0,14**	0,00	**0,016**	0,53	-0,17
	0,66	-0,63	0,31	-2,01	-0,05	2,015		
Korea	1,18	-0,10	-0,03	-0,16	**-0,20**	**0,028**	0,49	-0,51
	0,88	-1,03	-0,36	-1,86	-2,16	2,672		
Pakistan	**-0,15**	-0,05	-0,20	**-0,37**	-0,25	**0,068**	0,10	-0,94
	-3,43	-0,31	-1,38	-2,62	-1,68	4,072		
Indonesia	0,65	0,08	-0,21	-0,09	-0,06	**0,037**	0,06	-0,28
	-1,00	0,53	-1,38	-0,62	-0,37	2,116		
Colombia	0,84	0,01	-0,08	-0,05	-0,09	**0,051**	0,11	-0,23
	-0,51	0,04	-0,64	-0,43	-0,63	3,338		
Thailand	0,81	-0,06	-0,05	-0,14	**-0,25**	**0,034**	0,25	-0,52
	-0,74	-0,53	-0,47	-1,31	-2,20	2,683		
Taiwan	1,01	-0,08	0,09	**-0,24**	-0,13	0,008	0,44	-0,36
	0,05	-0,89	1,04	-2,88	-1,46	0,797		
Czech Republic	0,84	0,19	0,05	0,10	0,08	**0,023**	0,20	0,44
	-0,72	1,92	0,49	1,11	0,84	2,086		

The period 2006-2009 is not as representative when trying to predict how countries are affected by changes in the oil price. This is a stressed period used in this thesis to compare different market conditions. The correlation with NBIM's Benchmark increased for most of these countries during this period (Table 13). This may also be the reason why Adjusted R^2 is higher, and especially for MSCI EM with a value of 0,91 (Table 18).

Table 18: Significant oil-betas, including market beta, alpha, and adjusted R2 from the DLM for the period 2006-2009. T-values in parenthesis. Market beta is tested against H0: Beta=1, for oil-betas: H0: Beta=0, and for alpha: H0: alpha=0. All on a 5% level. The long-run Oil Beta is not tested for significance. Number of observations: 47

MSCI Index	2006 – 2009							
	NBIM BM	Brent (t)	Brent (t-1)	Brent (t-2)	Brent (t-3)	Alpha	Adj. R^2	Long-run Oil Beta
EM	**1,30**	**0,11**	0,00	**-0,07**	**-0,10**	**0,009**	0,91	-0,06
	4,12	3,04	0,04	-2,15	-2,96	2,332		
BRIC	**1,37**	**0,21**	0,00	-0,09	**-0,14**	**0,015**	0,84	-0,03
	3,39	3,83	-0,06	-1,89	-2,82	2,504		
Brazil	**1,34**	**0,32**	0,00	**-0,14**	-0,12	**0,021**	0,78	0,07
	2,34	4,56	-0,01	-2,08	-1,84	2,707		
China	**1,37**	0,05	-0,04	-0,08	**-0,18**	**0,022**	0,60	-0,26
	2,09	0,58	-0,48	-1,02	-2,29	2,362		
South Africa	**1,39**	0,03	0,01	**-0,15**	-0,10	0,009	0,78	-0,22
	3,30	0,52	0,11	-2,85	-1,82	1,460		
Chile	0,76	**0,13**	0,04	-0,10	**-0,13**	0,013	0,55	-0,06
	-1,83	2,09	0,64	-1,73	-2,25	1,880		
Hungary	**1,68**	0,01	**0,21**	-0,13	**0,18**	0,002	0,79	0,27
	4,22	0,08	2,83	-1,74	2,43	0,182		
Peru	**1,51**	0,07	-0,08	-0,18	-0,07	**0,031**	0,53	-0,27
	2,29	0,65	-0,80	-1,77	-0,71	2,591		
Thailand	1,18	0,11	0,00	**-0,20**	0,04	0,010	0,62	-0,06
	1,10	1,36	0,01	-2,79	0,54	1,152		

During this period, some of the countries experience significant excess return over risk-free rate. This includes Brazil, China, and Peru. These three have also generated a significant market risk over NBIM's Benchmark. Brazil appear to be the country which is most affected by changes in the oil price, represented by significant oil-betas at time t and t-2. In addition, this is one of two countries presented in Table 18, experiencing a positive long-run oil beta.

The next period from 2010-2013 is calmer, where after-effects from the financial crisis may appear. None of the indices generated any significant oil-betas in this period, which is why results are not presented in this chapter. As mentioned earlier, all results from these analyses are found in Appendix 2 and 3.

Table 19: Significant oil-betas, including market beta, alpha, and adjusted R2 from the DLM for the period 2010-2013. T-values in parenthesis. Market beta is tested against H0: Beta=1, for oil-betas: H0: Beta=0, and for alpha: H0: alpha=0. All on a 5% level. The long-run Oil Betas are not tested for significance. Number of observations: 44

MSCI Index	NBIM BM	Brent (t)	Brent (t-1)	Brent (t-2)	Brent (t-3)	Alpha	Adj. R^2	Long-run Oil Beta
2014 – 2017								
EM	1,15	-0,01	0,01	0,06	**-0,09**	-0,002	0,66	-0,04
	1,03	-0,34	0,29	1,66	-2,56	-0,518		
BRIC	1,29	0,02	0,01	0,11	**-0,13**	-0,001	0,66	0,01
	1,65	0,43	0,27	2,41	-2,79	-0,165		
Russia	0,64	**0,46**	0,02	0,01	-0,10	0,000	0,60	0,39
	-1,30	5,88	0,26	0,17	-1,38	0,011		
Brazil	1,73	0,05	0,04	**0,35**	**-0,29**	-0,002	0,49	0,15
	1,81	0,41	0,41	3,43	-2,76	-0,211		
China	1,30	-0,02	0,00	0,08	**-0,14**	0,001	0,49	-0,08
	1,31	-0,26	0,02	1,39	-2,42	0,224		
South Africa	1,49	-0,12	0,02	0,04	**-0,17**	-0,008	0,44	-0,23
	1,84	-1,63	0,26	0,65	-2,48	-1,044		
Korea	1,19	-0,06	0,00	0,04	**-0,10**	-0,003	0,51	-0,12
	1,04	-1,09	-0,05	0,78	-2,03	-0,531		
Pakistan	0,63	0,03	-0,11	**0,17**	0,05	0,002	0,16	0,15
	-1,26	0,35	-1,40	2,28	0,69	0,273		
Colombia	0,96	0,20	-0,04	**0,19**	-0,15	-0,009	0,33	0,19
	-0,11	1,89	-0,42	1,97	-1,61	-0,886		
Hungary	0,83	0,10	0,06	0,00	**-0,19**	0,009	0,26	-0,03
	-0,54	1,11	0,77	-0,04	-2,27	0,980		
Peru	0,85	0,11	0,00	0,12	**-0,14**	0,007	0,34	0,09
	-0,54	1,36	0,05	1,76	-1,96	0,860		

The last period from 2014 to 2017 is the most representative period for making conclusions regarding the characteristics of these markets since this is the latest period (Table 19). None of the market betas are significantly different than one for this period, and only Russia has a significant oil beta at time t. This is a high beta of 0,46 indicating that the Russian market is highly dependent on changes in the oil price. The long-run oil beta is also highest for Russia. This is to be expected sine Russia is a large producer of oil. This characteristic of the Russian market makes them less ideal for NBIM to invest in since this will add a higher oil dependence to the portfolio compared to other emerging markets. Based on the long-run oil betas for this period, only Russia and Brazil are observed to be sensitive to changes in the oil price.

China, South Africa, and South Korea have a negative oil-beta at time t, although it is not significant, it may however indicate in which direction this market is moving related to changes

in the oil price. This can be further emphasized by the significant negative oil betas at time t-3. However, as highlighted earlier in this chapter, the significant values at time t-3 may appear even though these markets are not affected three months after changes in the oil price. Even though the oil betas are not significant, the oil betas are rather low for multiple countries, making them more attractive investments for the Fund. Figure 11 illustrates how the Adjusted R^2 has changed from the single index model presented in chapter 8. As mentioned earlier in this chapter, this may be interpreted as the affect changes in oil prices have on these emerging markets. Russia, Brazil, and Colombia are the countries which are most sensitive to changing oil prices for this period (Table 19 and Figure 11). All three are net exporters of oil.

Change in Adjusted R^2 when adding oil price change
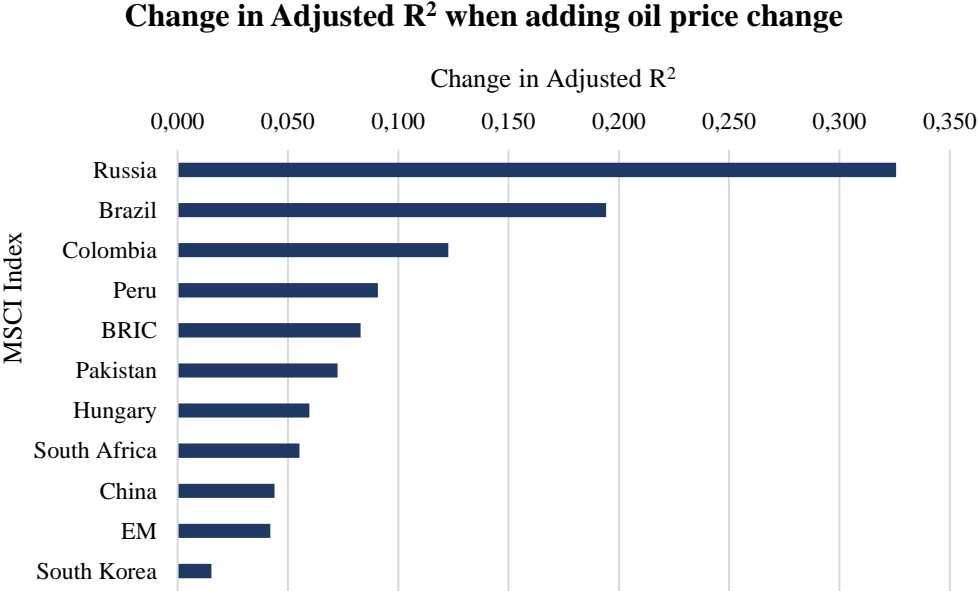
Figure 11: Changes in Adjusted R-square between Single Index Model and Distributed Lag Model for the period 2014-2017. The Adjusted R^2 from the single index model deviate some from the results presented in chapter 7, since three observations were removed to represent the same number of observations as the DLM.

It is also important to emphasize that if emerging markets are expanding, this generally involve being more oil dependent.

Following the discussion presented in this chapter the second hypothesis is not confirmed:

H2: Investments in emerging markets can be used to "hedge" against falling oil prices.

The results indicate that some countries are more heavily dependent on changes in oil prices than other. These are mainly net exporters like Russia, Brazil, and Colombia. Countries that are net exporters will not add characteristics to the Fund's which will reduce Norway's exposure to falling oil prices, rather the opposite. Even though emerging markets may not generate significant negative oil-betas, they can be attractive investments because they are less affected by falling oil prices. Looking at the last period from 2014 to 2017 as a reference, 9 out of 19 country indices generates a negative oil beta at time t (Appendix 2). This number reduces to 4 at time t-1 and 3 at time t-2. However, none of these are significant, and for that reason the conclusion is that none of the emerging markets can be used to "hedge" against falling oil prices. The significant negative oil betas at lag 3 is not accounted for, since the betas are markedly small. However, most of the countries, excluding the net exporters mentioned earlier, generate small oil betas which are attractive characteristics for the Fund when evaluating expansion of the equity portfolio.

10. Summary and Concluding Remarks

This thesis contributes to the discussion on whether the Government Pension Fund Global should increase their investments in emerging markets. The Fund is already invested in these markets, but with an objective to expand their equity portfolio to 70%, this thesis has focused on a possible expansion in these markets. At the end of 2017, the equity shares of the portfolio accounted for 66,6%. The Norwegian economy is vulnerable to a permanent drop in oil prices. A possible disinvestment from shares related to the oil and gas section will reduce the equity shares of the portfolio with 5,6% (Norges Bank Investment Management, 2017d).

Emerging markets have been good investment regions because of characteristics that differ from the ones found in developed markets. These differences create possible diversification effects to a portfolio. The motivation for this thesis is to analyze potential diversification effects in emerging markets, in addition the relationship between these markets and oil price changes.

To evaluate emerging markets, 19 MSCI country indices have been analyzed over the period from January 1998 to September 2017. Two broad indices (MSCI Emerging Market Index and MSCI BRIC) have been used to facilitate emerging market behavior collectively. The dataset is not tested for stationarity and autocorrelation since it is anticipated that these markets are efficient and follow a random walk.

The performance analysis shows that the annual returns achieved in these markets have been higher than what has been attained for the NBIM's Benchmark. However, this additional return also includes a higher volatility. NBIM are restricted to keep the tracking error between the actual portfolio and the benchmark under 125 basis points. This creates difficulties when evaluating emerging markets as an increased part of the portfolio because of the high tracking error between emerging markets and NBIM's Benchmark. This entails that for investments in emerging markets to significantly increase, the benchmark index must change.

Previously, NBIM and other academic literature have stated that the increased correlations between emerging and developed markets reduce the diversification benefit including both markets in a portfolio. However, this thesis has shown that this is not the case for the years after 2013. Indicating that the diversification benefits are instead increasing. All countries have

generated a lower correlation than 1, and for this reason adds diversification benefits to the Fund. However, the correlation between emerging and developed markets are highest during stressed periods, where the diversification effect is most needed. The period from 2014 to 2017 are represented by a low Adjusted R^2 from the single index model, which emphasize the benefits from higher investments in emerging markets. All emerging markets have a high country-specific risk that may add characteristics to the Fund which are unknown. It is also important to highlight that the world CAPM model may not hold in all countries (Basher & Sadorsky, 2006).

Investments in emerging markets cannot be used to "hedge" against falling oil prices. This conclusion is drawn from the results from the Distributed Lag Model. There are limitations to the distributed lag model used. When extending beta pricing models there are some assumptions which includes integrated capital markets, purchasing power parity, and no informational or transactions costs and taxes. Even though this is the conclusion on the second hypothesis in this thesis, it is important to emphasize that multiple emerging markets have some negative oil betas, but these are not significantly different than zero. In addition, most emerging markets analyzed have a low sensitivity to oil price changes, which is why they are attractive to investments in. This is not the case for the larger net exporter countries like China, Brazil, and Colombia. Analyzing the change in Adjusted R^2 between the single index model and distributed lag model, the result can also be interpreted as emerging markets not being sensitive to changes in the oil price. Although, it is known that when these markets grow, they are usually becoming more oil-dependent. The long-run oil beta is not tested for significance, however confirms that most countries examined in this paper are not sensitive to changes in the oil price.

Since the Fund does not invest in country indices, which are used in this paper, further analysis on a company level is recommended. The selection of indices used in this report is based on MSCI standards of emerging markets, not FTSE Russel who provides the benchmark that NBIM use. Norges Bank have emphasized that issues related to corporate governance in emerging markets are a part of the risk valuation made at company and sector level. Further analysis on a company level are recommended to investigate these issues further than what is presented in this paper.

Investing more in emerging markets will be beneficial in terms of diversification benefits generated by low correlations. The low sensitivity to changes in the oil price, is valuable for the

Norwegian economy, that are highly sensitive to these changes. On the other hand, these countries are affected by high country-specific risk that can be difficult to monitor. Some of these markets are small, making it problematic for larger investments. The tracking errors between emerging markets and NBIM's Benchmark are high. This makes it difficult for the Fund to keep within the 125 basis point limit determined by the Norwegian Ministry of Finance, if additional investments in these markets are added to the portfolio. Even though there are significant risk factors associated with investing in emerging market, it is recommended to investigate these markets on a company level and take advantage of the diversification benefits associated with including them in the Fund. Large investments in emerging markets does also contribute to making them more efficient.

11.   Bibliography

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12. Appendices

Appendix 1: FTSE Russells' Quality of Markets Matrix

Figure 12: Quality of Market Matrix used by FTSE Russel to evaluate if countries should be categorized as Developed, Advanced Emerging, Secondary Emerging, or Frontier (FTSE Russell, 2018b).

Criteria	Developed	Advanced Emerging	Secondary Emerging	Frontier
World Bank GNI Per Capita Rating				
Credit Worthiness				
Market and Regulatory Environment				
Formal stock market regulatory authorities actively monitor market (e.g., SEC, FSA, SFC)	X	X	X	X
Fair and non-prejudicial treatment of minority shareholders	X	X		
No or selective incidence of foreign ownership restrictions	X	X		
No objection to or significant restrictions or penalties applied to the investment of capital or the repatriation of capital and income	X	X	X	X
Free and well-developed equity market	X	X		
Free and well-developed foreign exchange market	X	X		
No or simple registration process for foreign investors	X	X		
Custody and Settlement				
Settlement - Rare incidence of failed trades	X	X	X	X
Custody-Sufficient competition to ensure high quality custodian services	X	X	X	
Clearing & settlement - T+2 / T+3	X	X	X	X
Settlement - Free delivery available	X			
Custody - Omnibus and segregated account facilities available to international investors	X	X		
Dealing Landscape				
Brokerage - Sufficient competition to ensure high quality broker services	X	X	X	
Liquidity - Sufficient broad market liquidity to support sizeable global investment	X	X	X	
Transaction costs - implicit and explicit costs to be reasonable and competitive	X	X	X	
Stock Lending is permitted	X			
Short sales permitted	X			
Off-exchange transactions permitted	X			
Efficient trading mechanism	X			
Transparency - market depth information/visibility and timely trade reporting process	X	X	X	X
Derivatives				
Developed Derivatives Market	X			

Appendix 2: Results from Distributed Lag Model

Table 20: Results from Distributed Lag Model for period 1 from 1998 to 2001. Including Betas, Alpha, Adjusted R^2, and Long-run beta. Market beta: highlighted values are significantly different than 1, for oil-betas and alpha, different than zero, both at 5% level.

MSCI Index	NBIM BM	Brent (t)	Brent (t-1)	Brent (t-2)	Brent (t-3)	Alpha	Adj. R^2	Long Run Beta
EM	**1,38**	**0,13**	0,02	0,06	-0,05	-0,004	0,61	0,16
t-value	2,13	2,15	0,39	0,95	-0,75	-0,40		
BRIC	1,42	0,17	0,08	**0,18**	-0,03	-0,009	0,48	0,39
t-value	1,65	1,95	0,89	2,04	-0,33	-0,75		
Russia	0,94	-0,29	-0,03	0,30	0,25	0,025	-0,02	0,24
t-value	-0,08	-1,05	-0,12	1,06	0,90	0,62		
Brazil	**1,79**	0,16	0,09	0,21	-0,06	-0,004	0,42	0,39
t-value	2,33	1,38	0,81	1,77	-0,51	-0,22		
India	0,49	**0,25**	0,04	0,04	0,01	-0,008	0,13	0,35
t-value	-1,69	2,48	0,42	0,41	0,14	-0,52		
China	1,11	0,23	0,11	0,25	0,04	-0,024	0,16	0,62
t-value	0,24	1,55	0,72	1,64	0,29	-1,08		
Egypt	**0,27**	0,15	0,01	0,03	-0,05	-0,019	-0,03	0,13
t-value	-2,47	1,51	0,06	0,25	-0,47	-1,29		
Mexico	**1,48**	**0,24**	0,08	0,09	-0,11	0,005	0,54	0,30
t-value	2,02	3,00	1,00	1,15	-1,35	0,42		
South Africa	1,34	**0,22**	0,16	0,02	-0,04	-0,012	0,46	0,36
t-value	1,37	2,71	1,87	0,19	-0,43	-0,96		
South Korea	**2,02**	0,06	-0,20	-0,20	0,05	0,039	0,41	-0,30
t-value	2,52	0,46	-1,44	-1,43	0,35	1,95		
Turkey	**2,73**	0,00	-0,19	0,09	-0,18	0,023	0,31	-0,28
t-value	2,89	0,01	-0,94	0,45	-0,88	0,78		
Pakistan	0,45	0,05	0,01	0,22	-0,13	-0,009	-0,03	0,15
t-value	-1,07	0,30	0,05	1,24	-0,73	-0,38		
Indonesia	1,83	-0,27	0,23	0,29	0,37	-0,002	0,23	0,62
t-value	1,39	-1,35	1,13	1,42	1,81	-0,06		
Chile	1,02	0,14	0,00	0,05	-0,06	-0,003	0,39	0,14
t-value	0,09	1,98	0,03	0,72	-0,78	-0,28		
Colombia	0,62	-0,11	0,03	0,08	0,00	-0,008	-0,04	0,00
t-value	-0,89	-0,79	0,24	0,54	0,00	-0,38		
Hungary	0,94	-0,18	-0,04	-0,03	-0,05	0,002	0,06	-0,30
t-value	-0,16	-1,46	-0,32	-0,21	-0,35	0,09		
Peru	0,50	0,13	0,07	0,14	-0,09	-0,013	0,10	0,26
t-value	-1,86	1,48	0,80	1,58	-0,94	-1,00		
Poland	1,54	0,04	0,03	-0,08	-0,04	0,000	0,31	-0,05
t-value	1,67	0,40	0,31	-0,74	-0,38	0,00		
Thailand	1,85	0,22	0,06	0,03	0,00	-0,001	0,24	0,31
t-value	1,69	1,32	0,35	0,15	0,02	-0,05		
Taiwan	1,04	0,13	-0,09	0,06	-0,09	-0,001	0,19	0,01
t-value	0,11	1,18	-0,81	0,50	-0,80	-0,08		
Czech Republic	0,78	-0,07	0,01	0,07	0,12	0,001	0,04	0,12
	-0,60	-0,58	0,06	0,51	0,94	0,06		

Table 21: Results from Distributed Lag Model for period 1 from 2002 to 2005. Including Betas, Alpha, Adjusted R2, and Long-run beta. Market beta: highlighted values are significantly different than 1, for oil-betas and alpha, different than zero, both at 5% level.

	NBIM BM	Brent (t)	Brent (t-1)	Brent (t-2)	Brent (t-3)	Alpha	Adj. R²	Long Run Beta
EM	1,13	0,01	0,03	**-0,10**	-0,07	**0,014**	0,75	-0,13
t-value	1,25	0,23	0,72	-2,33	-1,65	2,822		
BRIC	**1,36**	0,10	0,06	-0,04	-0,04	0,010	0,63	0,09
t-value	2,34	1,50	0,93	-0,64	-0,55	1,322		
Russia	1,21	0,18	0,25	-0,17	0,12	0,011	0,24	0,38
t-value	0,69	1,31	1,95	-1,37	0,92	0,760		
Brazil	**2,10**	-0,01	0,10	0,05	-0,06	0,012	0,47	0,08
t-value	3,33	-0,04	0,68	0,37	-0,42	0,743		
India	0,73	0,13	-0,13	-0,10	-0,11	**0,025**	0,22	-0,21
t-value	-1,13	1,25	-1,28	-0,97	-1,09	2,127		
China	1,13	**0,18**	0,08	-0,03	-0,04	0,001	0,46	0,19
t-value	0,72	2,24	0,95	-0,43	-0,49	0,133		
Egypt	0,48	0,13	-0,15	-0,18	0,11	**0,053**	0,04	-0,09
t-value	-1,54	0,88	-1,01	-1,26	0,73	3,168		
Mexico	1,11	-0,05	0,02	**-0,14**	0,00	**0,016**	0,53	-0,17
t-value	0,66	-0,63	0,31	-2,01	-0,05	2,015		
South Africa	1,06	0,10	0,14	0,03	-0,02	0,013	0,32	0,25
t-value	0,27	1,04	1,47	0,31	-0,22	1,195		
South Korea	1,18	-0,10	-0,03	-0,16	**-0,20**	**0,028**	0,49	-0,51
t-value	0,88	-1,03	-0,36	-1,86	-2,16	2,672		
Turkey	**1,93**	-0,06	-0,24	-0,20	-0,02	0,033	0,29	-0,53
t-value	2,00	-0,28	-1,16	-1,00	-0,11	1,398		
Pakistan	**-0,15**	-0,05	-0,20	**-0,37**	-0,25	**0,068**	0,10	-0,94
t-value	-3,43	-0,31	-1,38	-2,62	-1,68	4,072		
Indonesia	0,65	0,08	-0,21	-0,09	-0,06	**0,037**	0,06	-0,28
t-value	-1,00	0,53	-1,38	-0,62	-0,37	2,116		
Chile	1,12	-0,01	0,05	-0,01	-0,01	0,009	0,51	0,02
t-value	0,76	-0,07	0,69	-0,19	-0,19	1,128		
Colombia	0,84	0,01	-0,08	-0,05	-0,09	**0,051**	0,11	-0,23
t-value	-0,51	0,04	-0,64	-0,43	-0,63	3,338		
Hungary	1,07	0,17	0,16	-0,01	0,07	0,012	0,21	0,40
t-value	0,28	1,46	1,42	-0,09	0,60	0,938		
Peru	0,88	0,02	0,15	-0,15	-0,03	0,022	0,18	-0,01
t-value	-0,45	0,14	1,36	-1,39	-0,25	1,686		
Poland	1,43	0,05	0,10	-0,04	-0,09	0,012	0,41	0,01
t-value	1,71	0,41	0,94	-0,40	-0,84	0,993		
Thailand	0,81	-0,06	-0,05	-0,14	**-0,25**	**0,034**	0,25	-0,52
t-value	-0,74	-0,53	-0,47	-1,31	-2,20	2,683		
Taiwan	1,01	-0,08	0,09	**-0,24**	-0,13	0,008	0,44	-0,36
t-value	0,05	-0,89	1,04	-2,88	-1,46	0,797		
Czech Republic	0,84	0,19	0,05	0,10	0,08	**0,023**	0,20	0,44
	-0,72	1,92	0,49	1,11	0,84	2,086		

Table 22: Results from Distributed Lag Model for period 1 from 2006 to 2009. Including Betas, Alpha, Adjusted R2, and Long-run beta. Market beta: highlighted values are significantly different than 1, for oil-betas and alpha, different than zero, both at 5% level.

	NBIM BM	Brent (t)	Brent (t-1)	Brent (t-2)	Brent (t-3)	Alpha	Adjusted R2	Long Run Beta
EM	**1,30**	**0,11**	0,00	**-0,07**	**-0,10**	**0,009**	0,91	-0,06
t-value	4,12	3,04	0,04	-2,15	-2,96	2,332		
BRIC	**1,37**	**0,21**	0,00	-0,09	**-0,14**	**0,015**	0,84	-0,03
t-value	3,39	3,83	-0,06	-1,89	-2,82	2,504		
Russia	1,30	0,36	0,14	-0,11	-0,06	-0,001	0,73	0,33
t-value	1,72	4,21	1,71	-1,33	-0,74	-0,108		
Brazil	**1,34**	**0,32**	0,00	**-0,14**	-0,12	**0,021**	0,78	0,07
t-value	2,34	4,56	-0,01	-2,08	-1,84	2,707		
India	**1,58**	0,08	-0,09	0,00	-0,12	0,016	0,70	-0,13
t-value	3,40	0,96	-1,10	0,03	-1,57	1,778		
China	**1,37**	0,05	-0,04	-0,08	**-0,18**	0,022	0,60	-0,26
t-value	2,09	0,58	-0,48	-1,02	-2,29	2,362		
Egypt	1,38	0,01	0,07	-0,09	0,00	0,006	0,52	-0,01
t-value	1,79	0,11	0,67	-0,95	0,05	0,556		
Mexico	1,18	0,05	0,01	-0,04	0,03	0,006	0,78	0,05
t-value	1,68	0,87	0,21	-0,77	0,58	1,101		
South Africa	**1,39**	0,03	0,01	**-0,15**	-0,10	0,009	0,78	-0,22
t-value	3,30	0,52	0,11	-2,85	-1,82	1,460		
South Korea	**1,52**	-0,04	-0,04	0,00	-0,13	0,006	0,70	-0,22
t-value	3,34	-0,54	-0,57	-0,01	-1,88	0,741		
Turkey	**1,63**	-0,04	0,03	0,08	-0,07	0,009	0,49	0,00
t-value	2,35	-0,33	0,22	0,66	-0,54	0,596		
Pakistan	**-0,01**	0,20	0,05	0,23	-0,02	-0,008	0,02	0,47
t-value	-3,06	1,25	0,36	1,56	-0,14	-0,430		
Indonesia	**1,68**	0,04	0,07	-0,10	-0,07	**0,024**	0,70	-0,06
t-value	3,73	0,50	0,84	-1,22	-0,91	2,471		
Chile	0,76	**0,13**	0,04	-0,10	**-0,13**	0,013	0,55	-0,06
t-value	-1,83	2,09	0,64	-1,73	-2,25	1,880		
Colombia	**1,36**	-0,09	0,09	-0,14	-0,03	0,015	0,57	-0,18
t-value	2,00	-1,02	1,08	-1,72	-0,39	1,552		
Hungary	**1,68**	0,01	**0,21**	-0,13	**0,18**	0,002	0,79	0,27
t-value	4,22	0,08	2,83	-1,74	2,43	0,182		
Peru	**1,51**	0,07	-0,08	-0,18	-0,07	**0,031**	0,53	-0,27
t-value	2,29	0,65	-0,80	-1,77	-0,71	2,591		
Poland	**1,46**	0,02	0,11	-0,01	0,14	0,003	0,66	0,25
t-value	2,41	0,19	1,26	-0,17	1,61	0,257		
Thailand	1,18	0,11	0,00	**-0,20**	0,04	0,010	0,62	-0,06
t-value	1,10	1,36	0,01	-2,79	0,54	1,152		
Taiwan	1,14	0,04	0,01	-0,04	-0,08	0,005	0,62	-0,08
t-value	0,96	0,57	0,10	-0,64	-1,24	0,709		
Czech Republic	1,25	0,06	0,06	-0,02	0,05	0,007	0,75	0,15
t-value	1,94	0,89	1,01	-0,37	0,83	1,065		

Table 23: Results from Distributed Lag Model for period 1 from 2010 to 2013. Including Betas, Alpha, Adjusted R2, and Long-run beta. Market beta: highlighted values are significantly different than 1, for oil-betas and alpha, different than zero, both at 5% level.

	NBIM BM	Brent (t)	Brent (t-1)	Brent (t-2)	Brent (t-3)	Alpha	Adjusted R2	Long Run Beta
EM	1,03	0,00	-0,02	0,07	0,03	-0,006	0,81	0,08
t-value	0,36	0,01	-0,35	1,21	0,58	-1,720		
BRIC	1,13	0,00	-0,06	0,10	0,04	**-0,011**	0,78	0,08
t-value	1,27	-0,06	-0,83	1,41	0,61	-2,323		
Russia	**1,34**	0,07	-0,03	0,04	0,10	-0,009	0,71	0,19
t-value	2,38	0,63	-0,26	0,43	0,99	-1,338		
Brazil	**1,30**	-0,02	0,00	0,05	0,04	**-0,017**	0,70	0,06
t-value	2,19	-0,19	-0,02	0,50	0,40	-2,729		
India	1,23	-0,22	-0,17	0,26	-0,09	-0,008	0,52	-0,21
t-value	1,27	-1,50	-1,33	2,06	-0,72	-0,966		
China	0,90	0,03	-0,08	0,12	0,07	-0,007	0,60	0,15
t-value	-0,81	0,34	-0,92	1,43	0,89	-1,149		
Egypt	0,93	-0,13	0,01	0,02	-0,16	-0,003	0,15	-0,27
t-value	-0,26	-0,60	0,04	0,11	-0,88	-0,223		
Mexico	0,99	-0,04	-0,08	0,00	0,00	0,001	0,68	-0,11
t-value	-0,12	-0,42	-1,06	0,06	0,02	0,229		
South Africa	0,95	0,09	0,03	-0,03	0,03	-0,003	0,57	0,12
t-value	-0,39	0,80	0,30	-0,28	0,35	-0,443		
South Korea	1,02	0,11	0,04	0,12	0,04	-0,003	0,64	0,31
t-value	0,14	1,02	0,42	1,30	0,49	-0,528		
Turkey	1,22	-0,28	-0,05	0,04	0,05	-0,006	0,30	-0,23
t-value	0,84	-1,35	-0,28	0,21	0,31	-0,540		
Pakistan	**0,50**	0,07	-0,05	-0,11	0,03	0,013	0,15	-0,06
t-value	-2,78	0,46	-0,36	-0,86	0,22	1,500		
Indonesia	0,74	-0,02	-0,13	0,16	0,10	-0,003	0,27	0,11
t-value	-1,38	-0,10	-0,94	1,17	0,74	-0,342		
Chile	0,90	-0,07	-0,01	0,19	-0,01	-0,008	0,39	0,11
t-value	-0,61	-0,51	-0,04	1,57	-0,06	-0,967		
Colombia	**0,60**	-0,02	0,05	0,11	0,02	0,002	0,21	0,16
t-value	-2,43	-0,17	0,43	0,95	0,22	0,274		
Hungary	**1,93**	-0,10	-0,06	0,11	0,08	**-0,020**	0,68	0,03
t-value	4,42	-0,57	-0,38	0,75	0,54	-2,022		
Peru	0,64	-0,04	0,02	0,00	-0,04	-0,002	0,08	-0,05
t-value	-1,55	-0,20	0,11	0,01	-0,22	-0,227		
Poland	**1,67**	-0,12	0,08	-0,06	0,08	-0,008	0,79	-0,02
t-value	4,94	-1,13	0,79	-0,62	0,90	-1,300		
Thailand	0,93	0,02	-0,04	0,12	0,00	0,005	0,37	0,11
t-value	-0,35	0,15	-0,28	0,92	0,04	0,511		
Taiwan	0,88	-0,02	0,08	-0,01	-0,03	-0,002	0,59	0,02
t-value	-0,99	-0,17	1,00	-0,16	-0,38	-0,381		
Czech Republic	1,09	0,04	0,09	0,13	0,05	-0,013	0,56	0,31
t-value	0,57	0,31	0,78	1,18	0,46	-1,779		

Table 24: Results from Distributed Lag Model for period 1 from 2014 to 2017. Including Betas, Alpha, Adjusted R2, and Long-run beta. Market beta: highlighted values are significantly different than 1, for oil-betas and alpha, different than zero, both at 5% level.

	NBIM BM	Brent (t)	Brent (t-1)	Brent (t-2)	Brent (t-3)	Alpha	Adjusted R2	Long Run Beta
EM	1,15	-0,01	0,01	0,06	**-0,09**	-0,002	0,66	-0,04
t-value	1,03	-0,34	0,29	1,66	-2,56	-0,518		
BRIC	1,29	0,02	0,01	0,11	**-0,13**	-0,001	0,66	0,01
t-value	1,65	0,43	0,27	2,41	-2,79	-0,165		
Russia	0,64	**0,46**	0,02	0,01	-0,10	0,000	0,60	0,39
t-value	-1,30	5,88	0,26	0,17	-1,38	0,011		
Brazil	1,73	0,05	0,04	**0,35**	**-0,29**	-0,002	0,49	0,15
t-value	1,81	0,41	0,41	3,43	-2,76	-0,211		
India	1,00	-0,11	0,02	-0,02	0,05	0,003	0,28	-0,06
t-value	-0,02	-1,74	0,43	-0,41	0,92	0,479		
China	1,30	-0,02	0,00	0,08	**-0,14**	0,001	0,49	-0,08
t-value	1,31	-0,26	0,02	1,39	-2,42	0,224		
Egypt	0,95	-0,13	0,01	0,07	-0,10	-0,004	-0,01	-0,15
t-value	-0,10	-0,94	0,10	0,54	-0,75	-0,287		
Mexico	0,77	0,04	0,02	-0,01	-0,06	-0,006	0,23	0,00
t-value	-0,96	0,65	0,33	-0,14	-0,90	-0,870		
South Africa	1,49	-0,12	0,02	0,04	**-0,17**	-0,008	0,44	-0,23
t-value	1,84	-1,63	0,26	0,65	-2,48	-1,044		
South Korea	1,19	-0,06	0,00	0,04	**-0,10**	-0,003	0,51	-0,12
t-value	1,04	-1,09	-0,05	0,78	-2,03	-0,531		
Turkey	1,28	-0,13	-0,01	-0,03	-0,12	-0,007	0,14	-0,29
t-value	0,71	-1,20	-0,08	-0,26	-1,17	-0,665		
Pakistan	0,63	0,03	-0,11	**0,17**	0,05	0,002	0,16	0,15
t-value	-1,26	0,35	-1,40	2,28	0,69	0,273		
Indonesia	0,83	-0,11	0,06	-0,09	0,03	0,003	0,15	-0,12
t-value	-0,61	-1,36	0,86	-1,33	0,38	0,408		
Chile	0,91	0,01	0,02	0,04	-0,06	-0,001	0,29	0,01
t-value	-0,39	0,23	0,30	0,66	-1,00	-0,168		
Colombia	0,96	0,20	-0,04	**0,19**	-0,15	-0,009	0,33	0,19
t-value	-0,11	1,89	-0,42	1,97	-1,61	-0,886		
Hungary	0,83	0,10	0,06	0,00	**-0,19**	0,009	0,26	-0,03
t-value	-0,54	1,11	0,77	-0,04	-2,27	0,980		
Peru	0,85	0,11	0,00	0,12	**-0,14**	0,007	0,34	0,09
t-value	-0,54	1,36	0,05	1,76	-1,96	0,860		
Poland	1,12	0,01	0,01	0,03	-0,08	-0,006	0,26	-0,03
t-value	0,40	0,16	0,09	0,44	-1,02	-0,704		
Thailand	0,61	0,01	-0,01	0,02	-0,01	0,005	0,15	0,00
t-value	-1,94	0,21	-0,28	0,38	-0,24	0,839		
Taiwan	0,88	-0,04	0,02	0,02	-0,03	0,004	0,39	-0,04
t-value	-0,72	-0,95	0,46	0,45	-0,73	0,763		
Czech Republic	0,98	-0,04	0,06	0,09	-0,08	-0,003	0,23	0,04
t-value	-0,07	-0,46	0,89	1,30	-1,11	-0,396		

Appendix 3: Long-run Oil Betas

Table 25: Long-run oil beta from the distributed lag model. Ranked after the whole period from 1998 – 2017. Each sub-period is also presented. These betas are not tested for significance.

MSCI Index	Long-Run Oil Beta					
	1998 - 2017	**1998 - 2001**	**2002 - 2005**	**2006 - 2009**	**2010 - 2013**	**2014 - 2017**
Russia	0,29	0,24	0,38	0,33	0,19	0,39
Czech Republic	0,22	0,12	0,44	0,15	0,31	0,04
Pakistan	0,16	0,15	-0,94	0,47	-0,06	0,15
Brazil	0,14	0,39	0,08	0,07	0,06	0,15
Indonesia	0,13	0,62	-0,28	-0,06	0,11	-0,12
BRIC	0,11	0,39	0,09	-0,03	0,08	0,01
Poland	0,11	-0,05	0,01	0,25	-0,02	-0,03
Egypt	0,10	0,13	-0,09	-0,01	-0,27	-0,15
Mexico	0,10	0,30	-0,17	0,05	-0,11	0,00
India	0,09	0,35	-0,21	-0,13	-0,21	-0,06
China	0,09	0,62	0,19	-0,26	0,15	-0,08
Hungary	0,09	-0,30	0,40	0,27	0,03	-0,03
Colombia	0,06	0,00	-0,23	-0,18	0,16	0,19
South Africa	0,05	0,36	0,25	-0,22	0,12	-0,23
Thailand	0,05	0,31	-0,52	-0,06	0,11	0,00
EM	0,04	0,16	-0,13	-0,06	0,08	-0,04
Peru	0,03	0,26	-0,01	-0,27	-0,05	0,09
Chile	0,02	0,14	0,02	-0,06	0,11	0,01
Taiwan	-0,04	0,01	-0,36	-0,08	0,02	-0,04
South Korea	-0,07	-0,30	-0,51	-0,22	0,31	-0,12
Turkey	-0,14	-0,28	-0,53	0,00	-0,23	-0,29

Appendix 4: t-values for excess return presented in Table 8

Table 26: t-values for excess return presented in Table 8. Highlighted are values that are significantly different than zero on a 5% level

MSCI Index	1998 – 2001	2002 – 2005	2006 – 2009	2010 – 2013	2014 – 2017
EM	-0,56	**8,79**	**2,97**	1,73	**2,55**
BRIC	-0,71	**8,36**	**4,05**	0,28	**2,81**
World	-0,31	**3,61**	-0,05	**5,69**	**5,20**
Russia	**2,85**	**8,31**	1,20	1,68	0,15
Brazil	0,11	**6,19**	**5,24**	-1,40	1,46
India	0,36	**8,79**	**3,64**	0,37	**4,26**
China	-1,49	5,62	**5,08**	1,47	**3,92**
Egypt	**-4,34**	**14,85**	1,81	0,77	0,72
Indonesia	0,88	**8,98**	**5,21**	1,89	**3,70**
Mexico	1,69	**7,94**	**2,48**	**3,87**	-0,67
South Africa	-1,11	**9,85**	**2,32**	**2,70**	1,11
South Korea	**3,42**	**7,56**	1,39	**3,42**	**2,53**
Turkey	0,95	**5,59**	1,99	0,80	0,82
Pakistan	-1,35	**11,65**	-0,20	**6,78**	1,65
Chile	-0,39	**7,22**	**4,79**	0,66	1,87
Colombia	**-2,37**	**14,83**	**3,63**	**4,04**	-1,51
Hungary	-0,60	**9,80**	1,43	-0,22	**4,97**
Peru	-1,87	**9,17**	**6,03**	0,97	**4,17**
Poland	0,15	**6,74**	1,61	**2,03**	0,29
Thailand	-0,26	**8,58**	**2,74**	**4,78**	**4,81**
Taiwan	-0,63	**2,07**	1,83	**2,76**	**5,37**
NBIM BM	-0,48	**4,43**	0,59	**4,48**	**4,14**

Appendix 5: monthly alpha and t-values from the analysis presented in Table 13

Table 27: Alpha and t-values for the five-periods from monthly excess return over risk-free rate (corresponds to the analysis presented in Table 13). Significantly different alphas than zero are highlighted. Results for the whole period are presented in table 7.

	1998 – 2001		2002 – 2005		2006 – 2009		2010 – 2013		2014 – 2017	
MSCI Index	α	t-value	α	t-value	α	t-value	α	t-value	α	t-value
Russia	0,03	0,86	0,02	**1,99**	0,00	0,34	-0,01	-1,17	-0,01	-0,70
Brazil	0,00	0,16	0,01	1,21	0,02	**2,32**	-0,02	**-2,82**	0,00	-0,28
India	0,00	0,16	0,02	**2,14**	0,01	1,64	-0,01	-1,06	0,00	0,68
China	-0,01	-0,41	0,01	1,02	0,02	**2,03**	0,00	-0,92	0,00	0,43
Egypt	-0,02	-1,23	0,05	**4,00**	0,01	0,59	-0,01	-0,43	0,00	-0,10
Mexico	0,01	0,78	0,01	1,94	0,01	1,24	0,00	0,06	-0,01	-0,97
South Africa	0,00	-0,30	0,02	**2,51**	0,01	1,01	0,00	-0,36	0,00	-0,54
South Korea	0,02	1,32	0,01	1,74	0,00	0,47	0,00	-0,11	0,00	-0,16
Turkey	0,01	0,41	0,02	1,04	0,01	0,65	-0,01	-0,61	0,00	-0,29
Pakistan	-0,01	-0,37	0,04	**3,30**	0,00	-0,09	0,01	1,49	0,00	0,08
Indonesia	0,01	0,35	0,03	**2,24**	0,02	**2,50**	0,00	-0,18	0,01	0,64
Chile	0,00	-0,03	0,01	1,65	0,01	1,70	-0,01	-0,81	0,00	-0,20
Colombia	-0,01	-0,66	0,04	**4,02**	0,01	1,38	0,00	0,56	-0,01	-1,11
Hungary	0,00	-0,13	0,02	**2,46**	0,00	0,51	-0,02	**-2,04**	0,01	0,96
Peru	-0,01	-0,52	0,02	**2,26**	0,03	**2,31**	0,00	-0,29	0,01	0,66
Poland	0,00	0,16	0,01	1,43	0,01	0,55	-0,01	-1,26	-0,01	-0,71
Thailand	0,00	0,00	0,02	**2,07**	0,01	1,01	0,01	0,69	0,00	0,90
Taiwan	0,00	-0,13	0,00	-0,19	0,00	0,65	0,00	-0,36	0,00	0,99
Czech Republic	0,01	0,40	0,04	**4,22**	0,01	1,36	-0,01	-1,46	0,00	-0,42