Ministry of Finance
Postboks 8008 Dep.
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Date: 14.11.2017
Your ref.:
Our ref.:

Investment strategy for the Government Pension Fund Global

The Bank has advised the ministry since the fund's inception on how the investment strategy should be designed in order to achieve the objective of maximising return with moderate risk. The Bank's advice has largely been based on how changes to the investment strategy can be expected to affect risk and return for the fund in isolation. The relationship between the fund and other government wealth has been addressed first and foremost in the discussion on how much of the fund should be invested in equities – see, for example, the Bank's letter of 1 December 2016.

The fund now accounts for a much larger share of government wealth than before, and is an integral part of fiscal policy via the fiscal rule. In its strategy for Norges Bank Investment Management for 2017-2019, the Executive Board states that in future it will adopt a broader wealth perspective when advising the ministry. One question that has been discussed before is 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. In its letter of 1 December 2016, the Bank wrote that it may return to this issue.

In this letter, we conclude that the vulnerability of government wealth to a permanent drop in oil and gas prices will be reduced if the fund is not invested in oil and gas stocks, and advise removing these stocks from the fund's benchmark index. This advice is based exclusively on financial arguments. It does not reflect any particular view of future movements in oil prices or the profitability or sustainability of the oil and gas sector.

Oil exposure in government wealth

The value of Norwegian government wealth is sensitive to changes in oil prices. This applies

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primarily to future government oil and gas revenue, some of the fund's investments, and the government's holding in Statoil.

Based on estimates in the white paper *Long-term Perspectives on the Norwegian Economy 2017*, the present value of future government oil and gas revenue is around 4,000 billion kroner. The extent to which this expected revenue materialises will depend on developments in oil prices, production costs and production levels. All of these components are uncertain. According to the ministry's calculations, a permanent drop in oil prices of 100 kroner per barrel would more than halve the present value of future oil and gas revenue.[1] The net present value of future oil and gas revenue could also be affected by changes in one of the other components.

The value of the fund is currently around twice the present value of future government oil and gas revenue. Some of the fund's investments are exposed to movements in oil prices, most notably investments in oil and gas stocks. These investments currently make up around 4 percent of the fund. Exposure to oil and gas stocks is expected to rise as a result of the decision to increase the allocation to equities to 70 percent. Exposure to these companies will also be affected by changes to the benchmark index for equities.[2]

The market value of the government's holding in Statoil is currently around the same as the market value of the fund's investments in oil and gas companies. When the fund's investments and the holding in Statoil are taken together, we find that exposure to oil and gas stocks in the government's overall equity portfolio is around twice what it would have been had this portfolio been invested in line with a broad global stock index.[3] If this perspective is extended to include the value of future oil and gas revenue, the government's exposure to the oil and gas sector multiplies.

Oil exposure in the fund

In this section, we look at whether the government can reduce oil price risk in its wealth by making changes to the investment strategy for the fund. Our analysis confirms the findings of previous studies that the return on oil and gas stocks largely mirrors general movements in the stock market.[4] Prices for shares in oil companies have normally gone up when the broad equity market rises, and down when it falls. There have, however, also been periods when prices for oil and gas stocks have moved contrary to the broad market. As shown in the enclosure, the total return on oil and gas stocks has not been significantly different to the total return on a broad equity index.

The interesting question for the fund is to what extent investments in oil and gas stocks provide exposure to factors other than the broad equity market. We show in the enclosure that oil and gas stocks are much more sensitive to movements in oil prices than shares in

[1] See https://www.regjeringen.no/no/tema/okonomi-og-budsjett/norsk_okonomi/beregning-av-norges-nasjonalformue-til-perspektivmeldingen-2017/id2548710/ for further details.
[2] One example of such changes is when new countries are included in the benchmark index. It is expected that Saudi Arabia will be added to the benchmark index during the course of 2018. If the IPO at Saudi Aramco, the world's largest oil company, goes ahead, oil exposure in the benchmark index will therefore increase.
[3] There are also oil and gas-related investments in the Government Pension Fund Norway.
[4] See, for example, Report to the Storting No. 19 (2013-2014).

other sectors are.[5] Oil and gas stocks' exposure to oil price movements is considerable, and consistent with the market perceiving oil price shocks as persistent.

In the enclosure we also show how the accumulated relative return between oil and gas stocks and the broad equity market has varied with oil prices.[6] In periods with stable oil prices, the return on oil and gas stocks has largely moved in line with the broad equity market. However, oil and gas stocks have outperformed the broad market in periods with rising oil prices, and underperformed in periods with falling oil prices. The charts indicate that large and persistent oil price shocks have resulted in substantial and persistent accumulated return differences between oil and gas stocks and the broad market.[7]

The vulnerability of government wealth to a permanent drop in oil prices can therefore be reduced by not investing the fund in oil and gas stocks.[8] If the relationship between the long-term return on a broad equity index and oil and gas stocks persists, neither the expected return nor the market risk in the fund will be affected appreciably by whether or not the fund is invested in oil and gas stocks.

Oil prices also impact on returns in other equity sectors. The effect of oil price movements is much smaller than in the oil and gas sector, however, and so there is little reason to depart from the current index weights for these sectors if the aim is to reduce oil price risk. The value of some of the fund's bond investments will also be affected by changes in oil prices. This applies both to corporate bonds issued by oil and gas companies, and to bonds issued by governments with substantial oil and gas revenues.[9] In the markets where the fund has substantial investments in such bonds, prices are less affected by oil price movements. A decision not to invest the fund in such bonds would therefore have a lesser effect on oil price risk in government wealth.

The risk to government wealth from oil prices will be reduced if the fund is not invested in oil and gas stocks. The Bank proposes that this is achieved by removing companies classified as oil and gas companies by the index supplier FTSE from the benchmark index for equities.

The Bank recommends that oil and gas stocks are removed from the benchmark index. This will help reduce oil price risk in government wealth.

Yours faithfully

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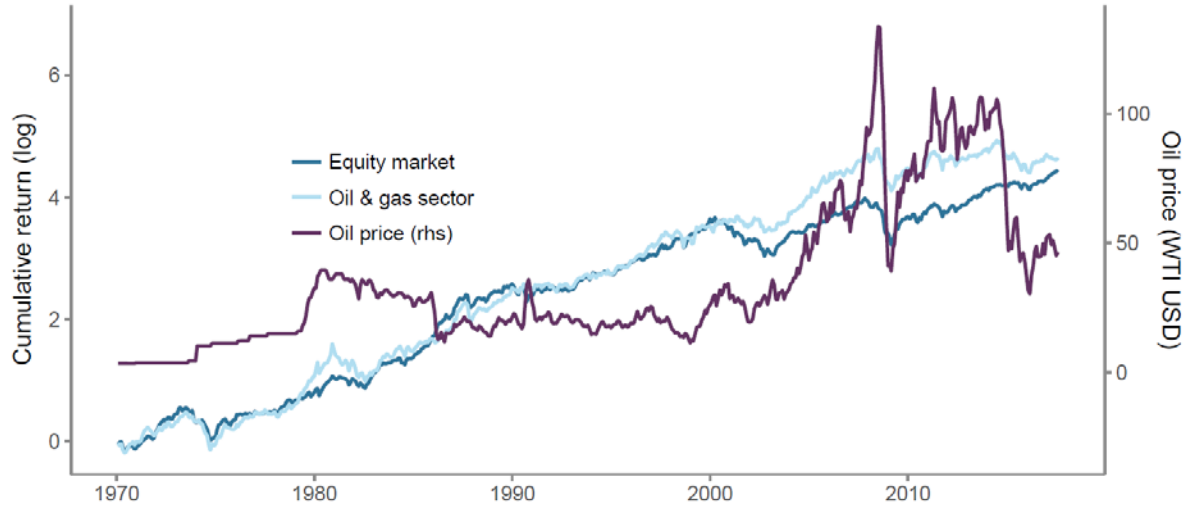
[5] The regression analyses in the enclosure are based on 12-month forward contracts. The length of the forward contracts used is not defining, and we obtain similar results using shorter contracts.
[6] For the charts in the enclosure, we have used oil spot prices in order to obtain the longest possible period of data.
[7] For a more detailed account of price formation in the oil market, see, for example, Alquist, Kilian and Vigfusson (2013), "Forecasting the Price of Oil", in *Handbook of Economic Forecasting*, vol. 2A.
[8] Besides oil prices, the value of both future government oil and gas revenue and the fund's oil and gas stocks will be affected by costs in the oil and gas sector. These may move differently to oil prices, which means that our analysis may underestimate the risk-mitigating effect of our recommendation on total oil risk in government wealth.
[9] In its letter of 1 September 2017, the Bank recommended removing corporate bonds from the fund's benchmark index.

Enclosure

Figure 1: Cumulative total return

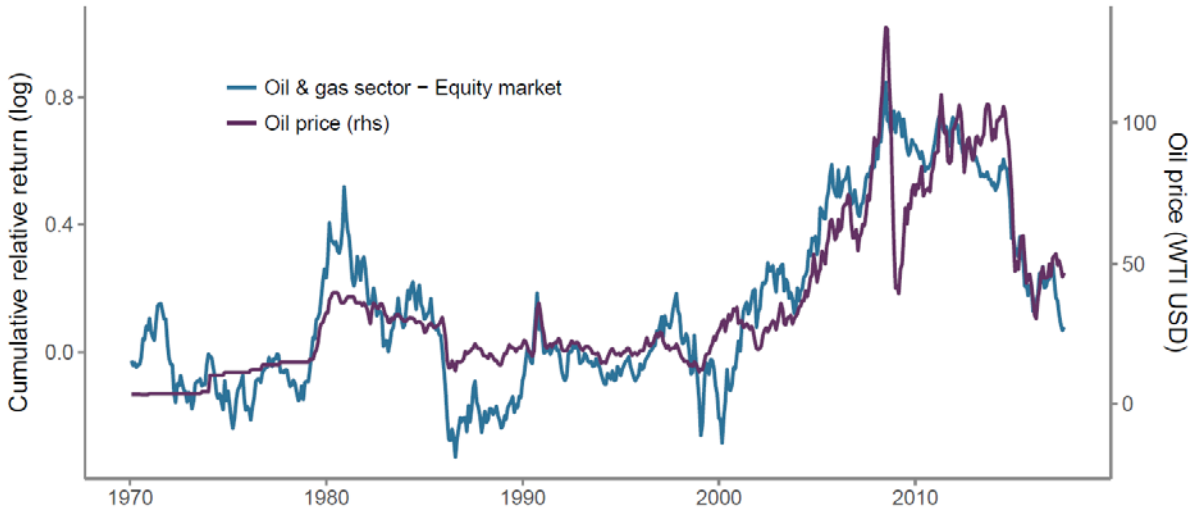
"Equity market" refers to the MSCI World index (mid- and large-cap companies in developed markets), "Oil & gas sector" refers to energy companies in the MSCI World index and "Oil price" refers to the spot WTI oil price. Monthly observations from January 1970 to July 2017, with all series measured in USD. All time-series in nominal terms. Results are unchanged if measured in real terms.



Source: MSCI, St. Louis FRED, Factset and NBIM

Figure 2: Cumulative relative return

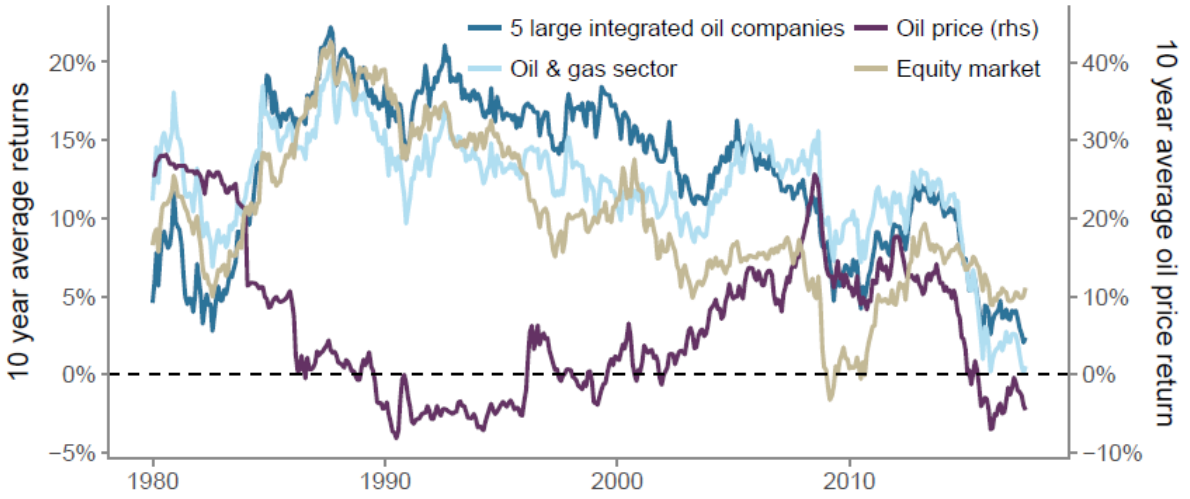
"Equity market" refers to the MSCI World index (mid- and large-cap companies in developed markets), "Oil & gas sector" refers to energy companies in the MSCI World index and "Oil price" refers to the spot WTI oil price. Relative return is calculated as the sector return in excess of the equity market return. Monthly observations from January 1970 to July 2017, with all series measured in USD. All time-series in nominal terms. Results are unchanged if measured in real terms.



Source: MSCI, St. Louis FRED, Factset and NBIM

Figure 3: Rolling 10 year total returns

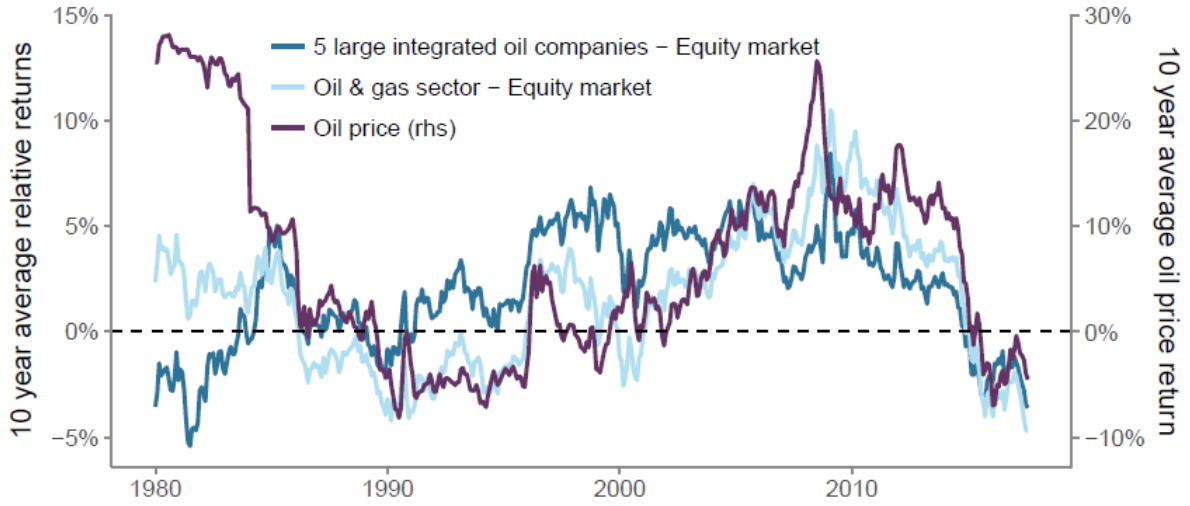
"5 large integrated oil companies" refers to a value-weighted portfolio of Exxon Mobil, BP, Royal Dutch Shell, Chevron and ConocoPhillips. "Equity market" refers to the MSCI World index (mid- and large-cap companies in developed markets), "Oil & gas sector" refers to energy companies in the MSCI World index and "Oil price" refers to the spot WTI oil price. Monthly observations from January 1970 to July 2017, with all series measured in USD. All time-series in nominal terms. Results are unchanged if measured in real terms.



Source: Bloomberg, St. Louis FRED, MSCI, Factset and NBIM

Figure 4: Rolling 10 year relative returns

"5 large integrated oil companies" refers to a value-weighted portfolio of Exxon Mobil, BP, Royal Dutch Shell, Chevron and ConocoPhillips. "Equity market" refers to the MSCI World index (mid- and large-cap companies in developed markets), "Oil & gas sector" refers to energy companies in the MSCI World index and "Oil price" refers to the spot WTI oil price. Relative return is calculated as the sector return in excess of the equity market return. Monthly observations from January 1970 to July 2017, with all series measured in USD. All time-series in nominal terms. Results are unchanged if measured in real terms.



Source: Bloomberg, St. Louis FRED, MSCI, Factset and NBIM

Table 1: Descriptive statistics

"5 large integrated oil companies" refers to a value-weighted portfolio of Exxon Mobil, BP, Royal Dutch Shell, Chevron and ConocoPhillips. "Equity market" refers to the MSCI World index (mid- and large-cap companies in developed markets), "Oil & gas sector" refers to energy companies in the MSCI World index and "Oil price" refers to the spot WTI oil price. Relative return is calculated as the sector return in excess of the equity market return. "t-stat" is the test statistic from the test $H_0: \mu = 0$ versus $H_1: \mu \neq 0$, where μ is the average return. "ρ-oil" is the average correlation between the respective return series and the change in oil price. Monthly observations from January 1970 to July 2017, with all series measured in USD.

	Return	Volatility	Max DD	t-stat	ρ-oil
Panel A: Total return					
5 large integrated oil companies	11.6%	19.0%	-61.1%	4.24	18.9%
Oil & gas sector	11.5%	18.6%	-50.1%	4.27	22.0%
Equity market	10.5%	14.8%	-53.6%	4.89	3.7%
Oil price	10.0%	32.5%	-77.4%	2.11	100.0%
Panel B: Relative return					
5 large integrated oil companies – Equity market	1.2%	15.0%	-61.7%	0.54	20.4%
Oil & gas sector – Equity market	1.1%	13.4%	-57.2%	0.54	26.6%

Source: Bloomberg, St. Louis FRED, MSCI, Factset and NBIM

Table 2: Factor regressions – oil & gas sector

Monthly relative returns for the global oil & gas sector from FTSE (sector returns in excess of equity market returns). "MKT" is the equity market as given by FTSE (FTSE World index until September 2003, FTSE Global All Cap thereafter), while "SMB", "HML", "RMW" and "CMA" are sourced from Ken French's data library. "ΔOil" is the monthly percentage change in price for WTI futures contracts with 12 months to expiration. Robust standard errors in parentheses calculated using the Newey-West (1987) methodology (with 3-month lag length). Model 1 evaluates whether the relative return of the oil & gas sector is exposed to the overall market, whereas Models 2 to 4 adjust for additional exposures. "Intercept" is annualised and expressed in percentage points. Monthly observations from January 1994 to July 2017, with all series measured in USD.

	Model 1	Model 2	Model 3	Model 4
Intercept	1.84	-3.42	0.30	-4.13*
	(2.62)	(2.55)	(1.97)	(2.10)
MKT	-0.08	0.04	-0.29*	-0.15*
	(0.06)	(0.06)	(0.05)	(0.06)
SMB		0.34*		0.07
		(0.10)		(0.09)
HML		0.47*		0.22
		(0.18)		(0.14)
RMW		0.57*		0.49*
		(0.21)		(0.16)
CMA		-0.07		0.21
		(0.22)		(0.17)
ΔOil			0.41*	0.40*
			(0.04)	(0.04)
N	283	283	283	283
R2	0.01	0.14	0.37	0.45

* indicates significance at the 5 percent level

Source: Bloomberg, FTSE, Ken French and NBIM

Table 3: Factor regressions – relative returns

Monthly relative returns for FTSE sectors (sector returns in excess of equity market returns). "MKT" is the equity market as given by FTSE (FTSE World index until September 2003, FTSE Global All Cap thereafter), while "SMB", "HML", "RMW" and "CMA" are sourced from Ken French's data library. "ΔOil" is the monthly percentage change in price for WTI futures contracts with 12 months to expiration. Robust standard in parentheses calculated using the Newey-West (1987) methodology (with 3-month lag length). Monthly observations from January 1994 to July 2017, with all series measured in USD.

	Oil & Gas	Basic Materials	Industrials	Consumer Goods	Health Care	Consumer Services	Telecom	Utilities	Financials	Tech
MKT	−0.15*	0.22*	0.13*	−0.07*	−0.28*	−0.02	−0.14*	−0.29*	0.16*	0.06
	(0.06)	(0.06)	(0.02)	(0.03)	(0.05)	(0.02)	(0.05)	(0.05)	(0.03)	(0.06)
SMB	0.07	0.46*	0.25*	0.14*	−0.23*	0.10*	−0.46*	0.16	−0.16*	−0.19
	(0.09)	(0.10)	(0.05)	(0.05)	(0.09)	(0.04)	(0.15)	(0.09)	(0.05)	(0.13)
HML	0.22	0.43*	0.14*	0.11	−0.30*	−0.09	−0.63*	0.02	0.72*	−0.69*
	(0.14)	(0.12)	(0.06)	(0.08)	(0.11)	(0.05)	(0.13)	(0.13)	(0.09)	(0.14)
RMW	0.49*	0.45*	0.02	0.62*	0.33*	0.11	−0.09	0.57*	−0.33*	−0.71*
	(0.16)	(0.16)	(0.06)	(0.08)	(0.13)	(0.07)	(0.17)	(0.16)	(0.07)	(0.20)
CMA	0.21	−0.07	0.05	0.22*	0.62*	0.12	0.19	0.49*	−0.19	−0.61*
	(0.17)	(0.15)	(0.08)	(0.09)	(0.18)	(0.08)	(0.19)	(0.18)	(0.12)	(0.23)
ΔOil	0.40*	0.14*	−0.01	−0.06*	−0.04	−0.10*	−0.03	0.04	−0.08*	−0.06
	(0.04)	(0.04)	(0.01)	(0.02)	(0.02)	(0.01)	(0.03)	(0.03)	(0.02)	(0.03)
N	283	283	283	283	283	283	283	283	283	283
*R*2	0.45	0.32	0.25	0.57	0.42	0.24	0.28	0.48	0.56	0.53

* indicates significance at the 5 percent level

Source: Bloomberg, FTSE, Ken French, Factset and NBIM

Table 4: Oil exposure – selected financial assets

"RUB", "AUD", "CAD", "MXN", "MYR", "IDR" is the return to treasury bonds in respective currencies, "Corporate bonds – Energy sector" is the excess return (duration adjusted) relative to a broad index of corporate bonds (Bloomberg Barclays Global Aggregate Corporate Bonds). "Statoil" and "Oil & gas sector" refer to the return to the stock and FTSE's global oil & gas sector respectively. "EQ" is the equity market return from FTSE (FTSE World before September 2003, and FTSE Global All Cap thereafter), "FI" is the return from the Bloomberg Barclays Global Aggregate Index and "Oil" is the monthly percentage change in price for WTI futures contracts with 12 months to expiration. Our model estimates the exposure of assets to innovations in oil prices and is given by $y_{i,t} = \alpha_i + \beta_{EQ} EQ_t + \beta_{FI} FI_t + \beta_{Oil} Oil_t + \epsilon_{i,t}$ for fixed income and $y_{i,t} = \alpha_i + \beta_{EQ} EQ_t + \beta_{Oil} Oil_t + \epsilon_{i,t}$ for equities. Monthly USD excess returns (relative to 3-month U.S. T-bills) for all series except "Corporate bonds – Energy sector" and WTI futures contracts. Robust standard errors in parentheses calculated using the Newey-West (1987) methodology (with 3-month lag length). Monthly observations until July 2017, with all series measured in USD.

	Entire history				Data from July 2008			
	β_{EQ}	β_{FI}	β_{Oil}	# obs	β_{EQ}	β_{FI}	β_{Oil}	# obs
Panel A: Fixed income								
RUB	0.20	0.36	0.49*	109	0.20	0.36	0.49*	109
	(0.17)	(0.20)	(0.14)		(0.17)	(0.20)	(0.14)	
AUD	0.34*	0.94*	0.09*	283	0.36*	1.09*	0.05	109
	(0.03)	(0.08)	(0.02)		(0.05)	(0.09)	(0.04)	
CAD	0.23*	0.58*	0.08*	283	0.26*	0.61*	0.05*	109
	(0.02)	(0.06)	(0.02)		(0.04)	(0.08)	(0.03)	
MXN	0.49*	0.55*	0.03	151	0.51*	0.64*	0.04	109
	(0.07)	(0.15)	(0.04)		(0.09)	(0.18)	(0.06)	
MYR	0.24*	0.60*	-0.03	139	0.21*	0.69*	-0.02	109
	(0.07)	(0.11)	(0.03)		(0.08)	(0.13)	(0.05)	
IDR	0.64*	0.94*	-0.11	109	0.64*	0.94*	-0.11	109
	(0.14)	(0.22)	(0.06)		(0.14)	(0.22)	(0.06)	
Corporate bonds – Energy sector	0.00	-0.02	0.04*	283	-0.01	-0.06	0.08*	109
	(0.01)	(0.03)	(0.01)		(0.03)	(0.06)	(0.02)	
Panel B: Equities								
Statoil	0.66*		0.61*	194	0.52*		0.65*	109
	(0.12)		(0.08)		(0.16)		(0.11)	
Oil & gas sector	0.71*		0.41*	283	0.69*		0.40*	109
	(0.05)		(0.04)		(0.07)		(0.05)	

* indicates significance at the 5 percent level

Source: Bloomberg, FTSE, Ken French, Factset and NBIM