

Stress Testing Market Report

Risk On, Risk Off in a Multifactor World

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Introduction

“Risk on, risk off” has become a common way to describe market behavior. In the “risk on” scenario, investors display a greater appetite to buy “risky” assets, causing equity prices to increase. Alternatively, during periods of “risk off” behavior, risk aversion increases and can push equity prices lower, while “safe haven” assets outperform. In this binary world, asset prices move in tandem and have high correlations, presenting additional challenges to investors.

In this paper, we examine how factors in the Barra Integrated Model (BIM 301) have behaved under “risk on, risk off” conditions. We describe typical factor movements under a “risk off” scenario and specify a stress test in BarraOne that models factor changes when risk aversion is high. In the Appendix, we also provide insights to factor movements in the “risk on” scenario.

Three States of the Market

Under a “risk on, risk off” scenario, markets can be in one of the following three states: (1) “risk on,” (2) “risk off,” or (3) the “neutral” state where neither “risk on” nor “risk off” characteristics dominate.

Table 1: Characteristics of the three market states.

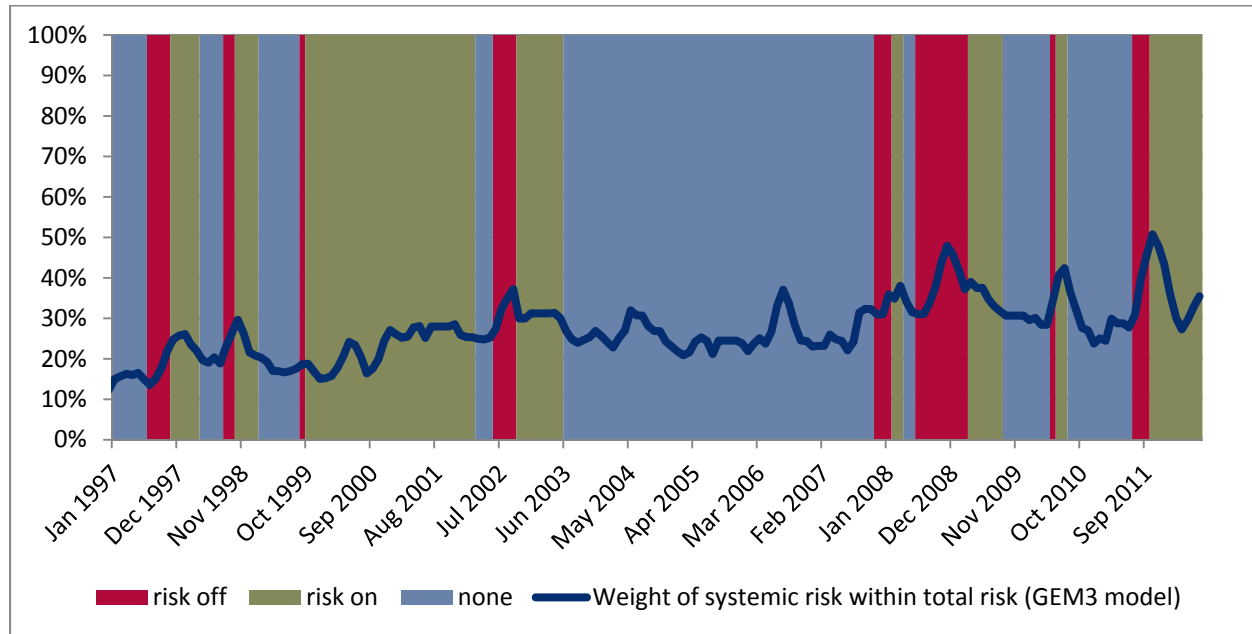
“Neutral”	Base case
“Risk on”	Investors are more willing to take risks Increasing equity prices Decreasing bond prices, increasing rates Higher volatility and higher correlation among assets
“Risk off”	Investors avoid risk-taking Decreasing equity prices Decreasing rates Increasing prices for safe haven assets like gold Higher volatility and higher correlation among assets

Risk On, Risk Off Regimes

To begin our analysis, we first identified historical regimes by applying a regime switching model.¹ This model considers our three possible states: (1) “risk on,” (2) “risk off,” and (3) the “neutral” state.

To identify these states, we observed the monthly behavior of the following four factors that are part of BIM 301: World, Volatility, Precious Metals, and US Government curve.² Figure 1 shows the resulting historical “risk-on” (green) and “risk-off” (red) periods.³

Figure 1: Idiosyncratic risk decreases, systemic risk increases during “risk on, risk off” periods.



One notable takeaway from our historical analysis is that “risk on, risk off” behavior has not been strictly a post-financial crisis behavior. Figure 1 clearly identifies the Asian currency crisis (1997), the Russian financial crisis (1998), the dot-com bubble (1999-2001), the credit crunch of 2008, and the US sovereign debt downgrade (2011) as periods characterized by these regimes.

During “risk on, risk off” periods in Figure 1, assets tended to move together with a decreased proportion of idiosyncratic risk relative to total risk. These assets showed a higher weighting of risk attributable to common factors. In Figure 1, we can see that the “risk on, risk off” periods coincided with high values of the R-squared statistic for the Global Equity Model (GEM3). This is represented by the

¹ We fitted the three-state Gaussian regime switching model on the factor returns with no autocorrelation in the return series. The means of the factors and their covariance matrix differed for the three states. The movement across states was specified by a first-order Markov chain. We considered the process to be in a given state if the estimated conditional probability was the highest for that state. The applied estimation procedure is described in: James D. Hamilton (1990): Analysis of Time Series Subject to Changes in Regime. *Journal of Econometrics* (5), p39-70.

² The World factor is a Barra Integrated Model (BIM 301) global factor which stems from the Barra Global Equity Model 2 (GEM2) and measures the overall performance of global equity markets. The Volatility factor, another BIM 301 global factor, can be considered a proxy for risk aversion (see Solares-Moya: *The Volatility Factor and Risk Aversion*. Barra Investment Insight, MSCI. February, 2012). The Precious Metals Factor, a global factor from the COM2 model, is made up of mostly gold. Our fixed income factor, US Government_SHIFT, describes parallel movements of the US government yield curve.

³ Note that “risk on, risk off” periods shown in Figure 1 can depend on the selected factor set, the time window of estimation, and the frequency of the data used.

During the period shown in Figure 1, our analysis reveals that “risk off” was always followed by “risk on.” After the flight-to-safety phenomenon of a “risk off” period, there followed a consolidation period when risky assets reverted in value. Our historical results agree with a recent *Financial Times* article asserting that valuations tend to revert after a risk adverse period ends.⁴

Based on the identified historical “risk on, risk off” regimes, we designed two separate stress scenarios in BarraOne. In this section, we discuss how we calculated the factor shocks with the scenario shocks listed in the Appendix.

In BarraOne, we applied equity shocks to equity *indices*. We analyzed the average changes of MSCI single-country indices during “risk on” and “risk off” months, including 49 markets in the analysis. The index changes are shown in Figure 2, where the countries are labeled with their currency codes (or the code of their former currencies in the case of the Eurozone).

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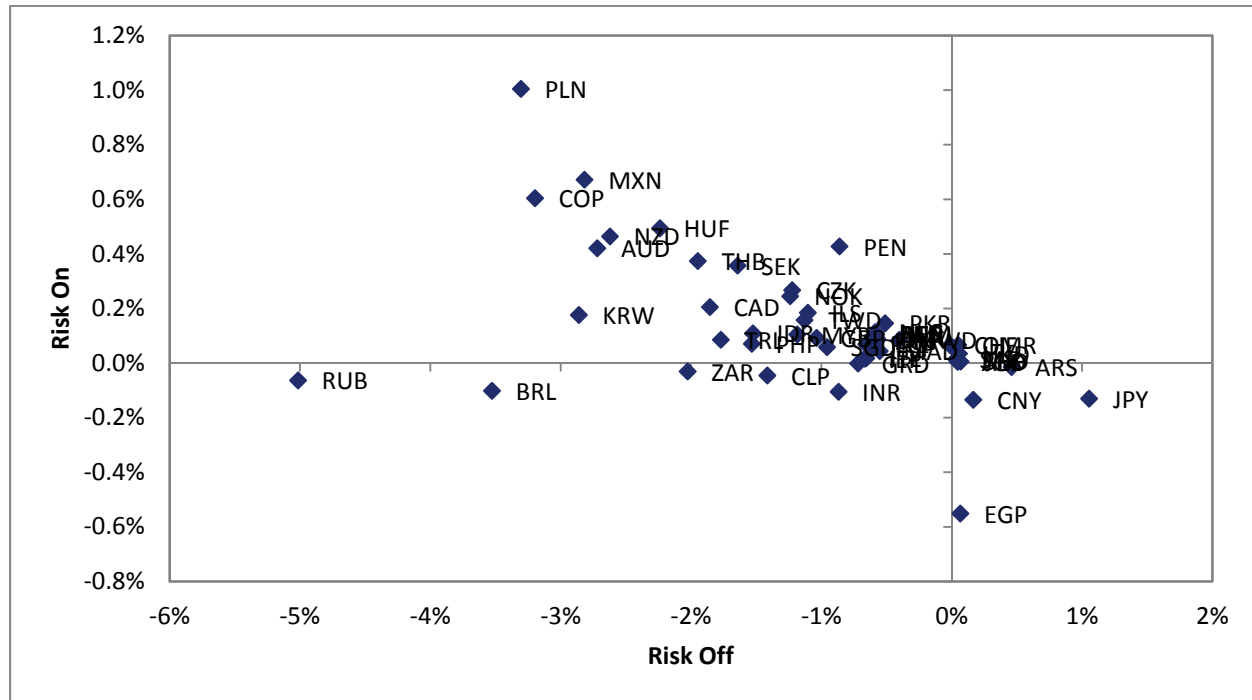
Currencies

In Figure 3, we calculated the average monthly currency *factor* returns during “risk on, risk off” months.

Based on the average currency shock results of Figure 3, the “risk on” scenario contains currency shocks that were higher than 0.6 percent.

For the “risk off” scenario, currency factors with changes higher than an absolute value of 1.5 percent were added to the scenario.

Figure 3: Average currency factor returns during “risk on, risk off” periods.



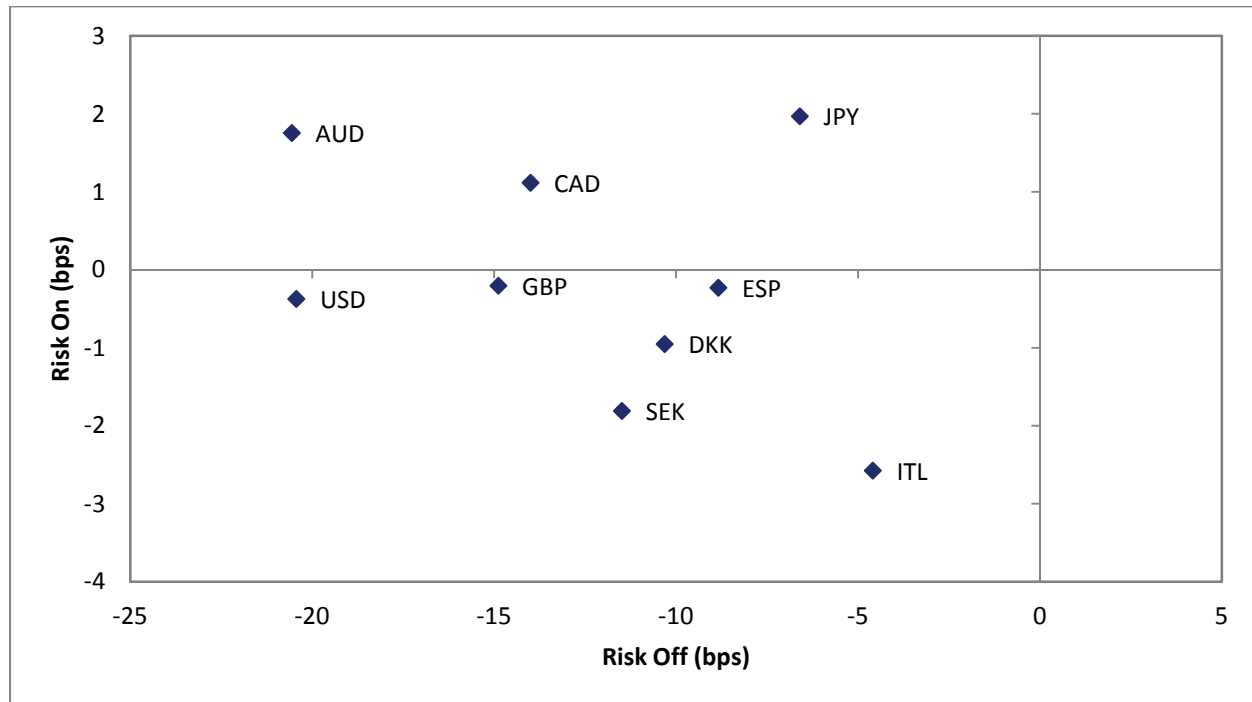
Interest Rates

We calculated the average parallel shifts of selected yield curves⁵ during “risk on” and “risk off” periods with the results presented in Figure 4. The countries are labeled with their currency codes, or the code of their former currencies in the case of the Eurozone.

Based on the results of Figure 4, the yield curve movements were not significant during a “risk on” month. Therefore, interest rate shocks were added only to the “risk off” scenario. We used the average shifts for the government yield curves of Australia, Canada, the United Kingdom, and the US.

⁵ We selected the yield curves of the countries where the shift factor of the government yield curve is a global factor of the BIM301 model.

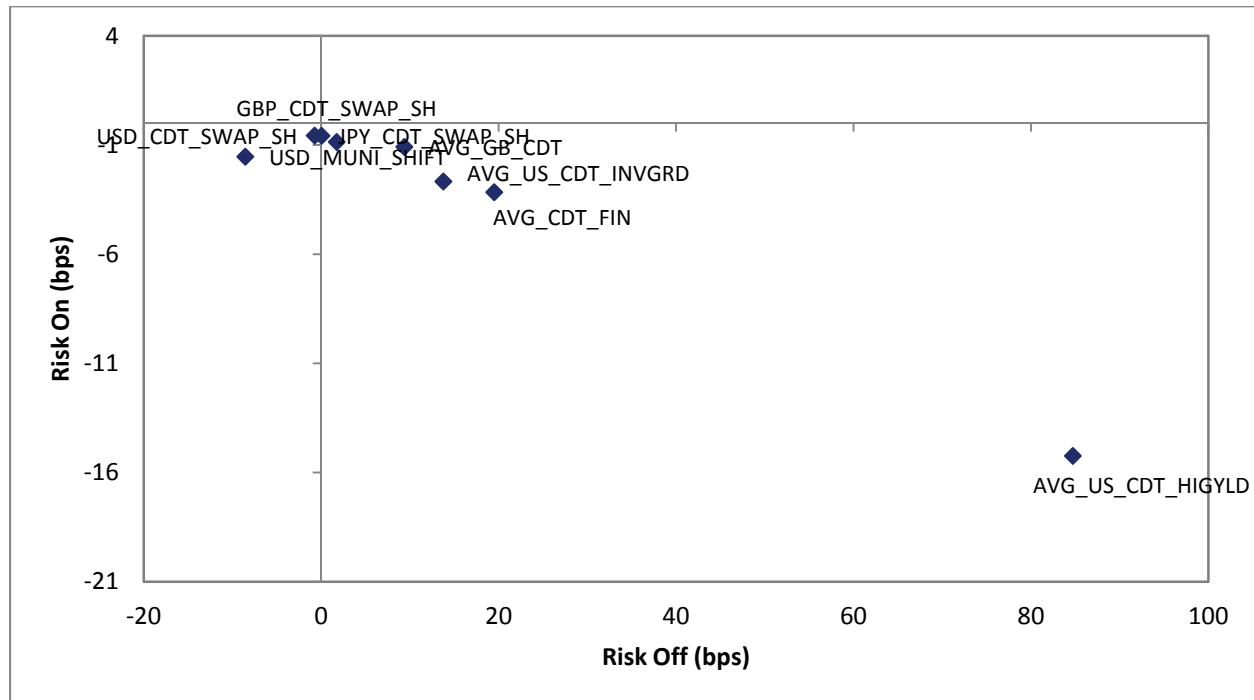
Figure 4: Average yield curve shift during “risk on, risk off” periods.



Spreads

We analyzed the average monthly changes in the global spread *factors* of the BIM301 model for “risk on” and “risk off” periods. Based on the average spread changes shown in Figure 5, we shocked US high-yield spreads in both the “risk on” and “risk off” scenarios. US investment grade spreads and spreads of financials were shocked in the “risk off” scenario.

Figure 5: Average spread changes during “risk on, risk off” periods.



Commodities

We examined the behavior of the global commodity *factors* of the BIM301 model and found that the energy and the precious metals factors were the most relevant. For the stress testing scenarios, we included the average monthly factor returns of the Brent Crude Oil and Gold factors during “risk on” and “risk off” periods. The averages were calculated by using the Barra Commodity Model 2 (COM2).

Stress Testing Case Study

Our case study measures the regional effects of a “risk off” month on multi-asset class portfolios. We applied the “risk off” scenario on three regional portfolios: (1) US (2) Eurozone and (3) an emerging market portfolio constructed as 60 percent equity and 40 percent fixed income. The asset class proxies can be found in Table 2.

Table 2: Stress test sample portfolios.

Sample portfolios	Equities	Fixed income
Weight	60%	40%
Regional proxies		
USA	MSCI USA IMI Index	Bank of America Merrill Lynch US Domestic Master Index
Eurozone	MSCI EMU IMI Index	Bank of America Merrill Lynch EMU Broad Market Index
Emerging Markets	MSCI Emerging Markets IMI Index	50% Bank of America Merrill Lynch Global Emerging Market Sovereigns Index 50% Bank of America Merrill Lynch Global Emerging Market Credit Index

Stress Test Results

We shocked the portfolios from Table 2 with the “risk off” stress scenario. The results were calculated using the BIM301L model, for the analysis date of July 16, 2012. The results are presented in Table 3.

Table 3: Stress test results.

Sample portfolios	Equity portfolio	Fixed income portfolio	Total portfolio
USA	-5.56%	0.08%	-3.31%
Eurozone	-7.61%	-0.16%	-4.63%
Emerging Markets	-8.79%	-0.88%	-5.63%

The value of the US stock portfolio decreased by 5.56 percent. With nearly flat bond prices, the value of the total US portfolio decreased by 3.31 percent. This means that after a “risk off” month, 3.31 percent of the portfolio value disappeared.

The change in the total Eurozone portfolio was -4.63 percent. The emerging market portfolio lost 5.63 percent of its value.

Within the equity and fixed income asset classes, the emerging markets portfolio was the most sensitive to “risk off” stress. US stocks and bonds were the least sensitive. The slight increase in the US bond portfolio value may be attributed to the safe haven characteristics of US treasuries.

Conclusion

Changes in risk aversion continue to impact investors' portfolios whenever the market switches from a preference for safe haven assets to a riskier appetite (as shown in Figure1). We started our analysis by first defining "risk on, risk off" market conditions using four global factors taken from the Barra Integrated Model (BIM 301). Through the identification of historical "risk on, risk off" regimes, we calculated the average factor changes for three states: (1) "risk on" (2) "risk off" and (3) the "neutral" state.

The identification of these regimes allowed us to specify "risk on, risk off" stress tests in BarraOne that we applied to a multi-asset portfolio in a "risk off" case study. As illustrated in Table 3, our analysis shows important regional differences that offered potential portfolio diversification opportunities, particularly in the USA Index sample portfolio.

Index of Stress Testing Market Reports from 2012

“Stress Testing in RiskManager: Contemplating a Eurozone Breakup,” February 2012.

http://www.msci.com/resources/research_papers/product_insight_-_stress-testing_in_riskmanager_contemplating_a_eurozone_breakup_-_february_2012.html

“Hedging the Risk of \$200 per Barrel,” March 2012.

http://www.msci.com/resources/research_papers/multi-asset_class_market_report_hedging_the_risk_of_200_per_barrel.html

“Stress Testing in BarraOne: Contemplating a Eurozone Breakup,” April 2012.

http://www.msci.com/resources/research_papers/multi-asset_class_market_report_-_stress-testing_in_barraone_contemplating_a_eurozone_breakup_-_apri.html

“Enter the Dragon: Stress Testing for a Chinese Hard Landing,” May 2012.

http://www.msci.com/resources/research_papers/mac_market_report_-_enter_the_dragon_stress_testing_for_a_chinese_hard_landing.html

“Stress Testing Market Report: Testing for the End of the LTRO Effect,” June 2012.

http://www.msci.com/resources/research_papers/stress_testing_market_report_-_testing_for_the_end_of_the_ltro_effect_-_june_2012.html

Appendix: Stress test scenario factors in BarraOne

Table A.1: "Risk off" scenario factor shocks

Equity(49)

Country	Index Portfolio	Market Data	Change	Edit	Delete
Argentina	MSCIARGM	Price	-7.3600 %	edit	×
Austria	MSCIAUTM	Price	-9.7100 %	edit	×
Australia	MSCIAUSM	Price	-7.4600 %	edit	×
Belgium	MSCIBELM	Price	-7.6600 %	edit	×
Brazil	MSFBRAM	Price	-10.6900 %	edit	×
Canada	MSCICANM	Price	-6.7500 %	edit	×
Switzerland	MSCISWIM	Price	-5.8700 %	edit	×
Chile	MSCICHIM	Price	-6.1700 %	edit	×
China	MSFCHNM	Price	-6.0800 %	edit	×

Foreign Exchange(16)

Foreign/Domestic Currency	Market Data	Change	Edit	Delete
AUD/USD	Rates	-2.7200 %	edit	×
BRL/USD	Rates	-3.5300 %	edit	×
CAD/USD	Rates	-1.8600 %	edit	×
COP/USD	Rates	-3.2000 %	edit	×
HUF/USD	Rates	-2.2400 %	edit	×
IDR/USD	Rates	-1.5300 %	edit	×
KRW/USD	Rates	-2.8600 %	edit	×
MXN/USD	Rates	-2.8200 %	edit	×
NZD/USD	Rates	-2.6200 %	edit	×

Interest Rate(4)

Currency	Market Data	Curve Type	Change	Edit	Delete
AUD	Shift	Treasury	-21.0000	edit	×
CAD	Shift	Treasury	-14.0000	edit	×
GBP	Shift	Treasury	-15.0000	edit	×
USD	Shift	Treasury	-20.0000	edit	×
Add Shock					

Credit Spreads(6)

Currency	Market Data	Issuer Type	Rating	Change	Edit	Delete
USD	Bond Spread	Corporate	AA+ to AA-	14.0000	edit	×
USD	Bond Spread	Corporate	A+ to A-	14.0000	edit	×
USD	Bond Spread	Corporate	BBB+ to BBB-	14.0000	edit	×
USD	Bond Spread	Corporate	BB+ to BB-	85.0000	edit	×
USD	Bond Spread	Corporate	B+ to B-	85.0000	edit	×
USD	Bond Spread	Corporate	CCC+ to D	85.0000	edit	×
Add Shock						

Detailed Spreads(1)

Attribute	Filter	Change	Edit	Delete
GICS Sector	distinct Financials	19.0000	edit	×
Add Shock				

Table A.2: "Risk on" scenario factor shocks

Equity(49)

Country	Index Portfolio	Market Data	Change	Edit	Delete
Argentina	MSCIARGM	Price	0.0500 % edit	×	
Austria	MSCIAUTM	Price	1.4900 % edit	×	
Australia	MSCIAUSM	Price	1.2400 % edit	×	
Belgium	MSCIBELM	Price	1.2900 % edit	×	
Brazil	MSFBRAM	Price	1.1400 % edit	×	
Canada	MSCICANM	Price	1.0200 % edit	×	
Switzerland	MSCISWIM	Price	0.7800 % edit	×	
Chile	MSCICHIM	Price	0.8700 % edit	×	
China	MSFCHNM	Price	-0.9500 % edit	×	

Foreign Exchange(3)

Foreign/Domestic Currency	Market Data	Change	Edit	Delete
COP/USD	Rates	0.6000 % edit	×	
MXN/USD	Rates	0.6700 % edit	×	
PLN/USD	Rates	1.0000 % edit	×	
Add Shock				

Credit Spreads(3)

Currency	Market Data	Issuer Type	Rating	Change	Edit	Delete
USD	Bond Spread	Corporate	BB+ to BB-	-15.0000 edit	×	
USD	Bond Spread	Corporate	B+ to B-	-15.0000 edit	×	
USD	Bond Spread	Corporate	CCC+ to D	-15.0000 edit	×	
Add Shock						

Commodity(2)

Commodity	Market Data	Change	Edit	Delete
Brent Crude	Price	-0.7400 % edit	×	
Gold	Price	-0.6500 % edit	×	
Add Shock				

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¹As of June 30, 2011, based on eVestment, Lipper and Bloomberg data.