QuantitativeStrategy
North America United States

Deutsche Bank

18 March 2011

Emerging Issues

# Global Macro - Quant Equity (GMQE) Model

**Research summary**
In this research, we attempt to integrate global macro prediction with bottom-up factor model stock selection. We call the new strategy Global Macro - Quant Equity (GMQE) model.

**Proactively adjust alpha models for Japan and oil crises**

**Natural disaster and political uncertainty**
Two weeks ago, the Middle East/North Africa political unrest dominated the headline news and the oil price skyrocketed within weeks. Now, the attention has shifted to the earthquake and tsunami in Japan and the nuclear meltdown aftermath.

We can either wait and complain or we can proactively position our portfolios. Our recent research has repeatedly proven that currently more opportunities are likely from top-down economic indicators than from pure bottom-up stock selection.

**Economic relationships do not exist in isolation**
Even a temporary shock in market sentiment or oil price may have a prolonged impact on the underlying economy and then factor performance. In this research, we build a VAR-based macroeconomic model to simulate three VIX/oil price scenarios, to study their long-term impact on the economy and then the implied factor, industry, and stock performance.

**Conclusion**
Value and quality factors are likely to outperform in a crisis, while growth, reversal, and momentum are likely to struggle. We expect the automobiles & components, health care equipment & services, household & personal products, and diversified financials & REITs industries to perform well in the coming 12 months.
In the end, we provide three lists of top-performing stocks and model portfolios that are expected to outperform for the three economic scenarios.

*Source: gettyimages.com*

**Team Contacts**

**Yin Luo, CFA**
Strategist
(+1) 212 250-8983
yin.luo@db.com

**Rochester Cahan, CFA**
Strategist
(+1) 212 250-8983
rochester.cahan@db.com

**Miguel-A Alvarez**
Strategist
(+1) 212 250-8983
miguel-a.alvarez@db.com

**Javed Jussa**
Strategist
(+1) 212 250-4117
javed.jussa@db.com

**Zongye Chen**
Strategist
(+1) 212 250-2293
john.chen@db.com

# A letter to our readers

## A new research series that deals with emerging issues

We are introducing a new periodic research series that deals with current and emerging issues. The goal of this series is to provide more timely coverage on these issues. In this first issue, we want to develop a stock-selection model that proactively deals with crises like the recent Japan earthquake/tsunami/nuclear meltdown and oil shocks.

Faced with crises, we can either wait and complain or we can proactively position our portfolios[1]. Our recent research has repeatedly proven more opportunities are likely from top-down economics than from pure bottom-up stock selection[2]. In Luo, Cahan, Alvarez, Jussa, and Chen [2011], we discuss how we can incorporate macroeconomic information, especially the market risk sentiment (proxyed by the VIX index), in our factor risk prediction, which further improves our alpha model performance. In this research, we study another alternative to proactively incorporate our economic views into our stock-selection models.

A common question is why we can't simply short volatility or buy energy stocks – that will save us all the trouble. The problem with only shorting volatility or buying energy stocks is that it depends too much on the risk regime and oil price prediction. If the Japan or oil crisis resolves favorably and quickly, VIX and oil price are likely come down significantly, which would improve investors' risk appetite and cause energy stocks to fall sharply. More importantly, even a temporary shock in VIX and/or oil price will have a more lasting impact on not only future VIX and/or oil price, but also on the overall economy; which will further influence future factor/industry/stock performance. Our economy and capital markets are integrated.

We want our alpha model to incorporate our VIX and oil price forecasts. If VIX (oil price) remains high, our portfolio will benefit from the high risk aversion (price of oil). However, if the VIX (oil price) plunges, our portfolios should be diversified enough to avoid too much suffering, and are still expect to produce positive alpha. Our proposed model also incorporates the overall impact on the economy.

In this research, we simulate and stress test the impact on the overall economy based on three crisis scenarios: current economic model prediction, temporary shock, and a more significant/permanent shock. Based on these three scenarios, we further forecast factor and industry returns. In the end, we calculate the expected alpha for all stocks in our universe based on the expected factor/industry returns. To conclude, we provide three lists of top-performing stocks and model portfolios for the three scenarios.

Yin, Rocky, Miguel, Javed, and John

Deutsche Bank US/Global Quantitative Strategy Team

[1] As stated in Luo, Y., Alvarez, M., Cahan, R., Jussa, J., and Chen, J. [2011]. "Quant Crisis? What Crisis?", Deutsche Bank Quantitative Strategy, January 28, 2011, we prefer finding solutions to simply stating what has happened.

[2] See Alvarez, M., Chen, J., Luo, Y., Cahan, Jussa, J. [2010], "Correlation and Opportunity", Deutsche Bank Quantitative Strategy, December 2, 2010.

# Japan crisis and oil shock

During the past four months, the price of Brent Crude Oil has increased by approximately 30%. Oil prices have surged due to socioeconomic and political unrest in Northern Africa and the Middle East. Civil protests have been fueled by high unemployment, government corruption, poverty, poor economic conditions, and a lack of free elections. In particular, regions such as Yemen, Libya, Algeria, Egypt, and Saudi Arabia have been affected by public demonstrations. These regions represent approximately 13% of global oil production and therefore, unrest in these regions will undoubtedly raise concerns about potential oil supply disruptions.

Deutsche Bank's chief energy economist, Adam Sieminski, currently forecasts Brent to stabilize at approximately $102/bbl by 2012. Deutsche Bank's chief economist, Peter Hooper, forecasts the economic impact of oil supply disruption based on two alternative scenarios. The first scenario assumes a moderate oil disruption where the Brent price could potentially reach $110 to $115/bbl. He forecasts that global GDP growth would slow by approximately 0.4% in this scenario. The second scenario assumes a more severe oil disruption where the Brent price could potentially reach $150/bbl. In this scenario, he forecasts global GDP growth slowing by approximately 2%. He states that the second scenario would likely reduce global growth to recessionary levels.

More recently, the catastrophic events in Japan have caused shock waves throughout the global economy. The tragic earthquake has caused severe damage to several nuclear reactors. Thus far eleven nuclear reactors have been shutdown. Although the International Atomic Energy Agency (IAEA), has stated that it is "unlikely" that the damage to Japan's nuclear power plants will turn into another Chernobyl, the widespread effects of Japan's 8.9 magnitude earthquake have impacted every facet of the Japanese and global economy.

The Japanese Yen has been at the strongest level since April 1995, when Japan experienced the devastating Kobe earthquake. The strength is likely due to investors unwinding Japanese carry trade positions. Currently, approximately 15.2 gigawatts or 7% of the electricity supply is off-line in Japan. This has caused rolling blackouts on Japan's electricity gird.

The impact to Japan’s oil refining capacity is also severe. Japan is a consumer (not producer) of oil. Japan has lost about 1.4 million barrels a day in oil refining capacity. Since the capacity is similar to the oil production capacity halted in Libya, many economists do not foresee a significant oil supply shortfall. However, assuming nuclear power remains hampered, economists foresee Japan's demand for oil to increase to meet new electricity demands. During a recovery, many analysts estimate that Japan's nuclear power plants will be replaced by thermal coal, natural gas, and petroleum products.

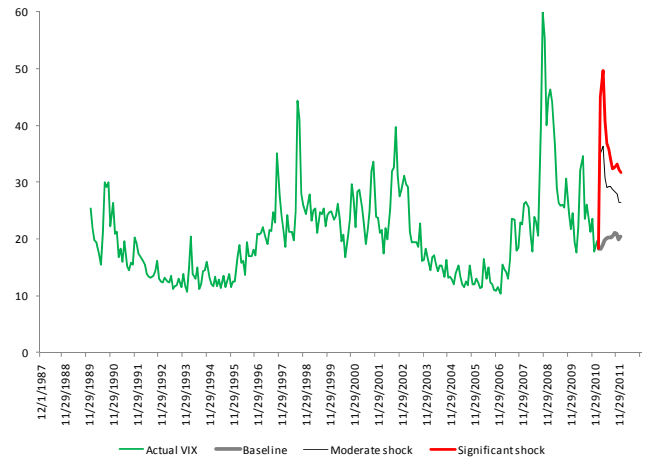
The foreseeable effects of the events in Japan on the US economy appear to be not as dire. Japan accounts for approximately 6.2% of total US imports. The largest component of imports is machinery and transportation for motor vehicles and parts. Analysts foresee that these components will be potentially sourced within the US. In terms of exports, Japan accounts for approximately 4.7% of total US exports. Certain components of US exports to Japan may increase as a result of recovery efforts in Japan. Although the impact to the US economy may not appear as alarming, analyst forecast that Global GDP growth could be reduced by 0.25%.

In our opinion, the most immediate and direct impacts of the series of catastrophic events in Japan and Middle East/North Africa oil crisis on the US economy are likely to be on the VIX index and oil price, which will further influence the domestic economy through inflation, consumer behavior, employment, and be reflected in the equity market.

In this research, we perform our analysis on three VIX and oil scenarios (see Figure 1 and Figure 2).

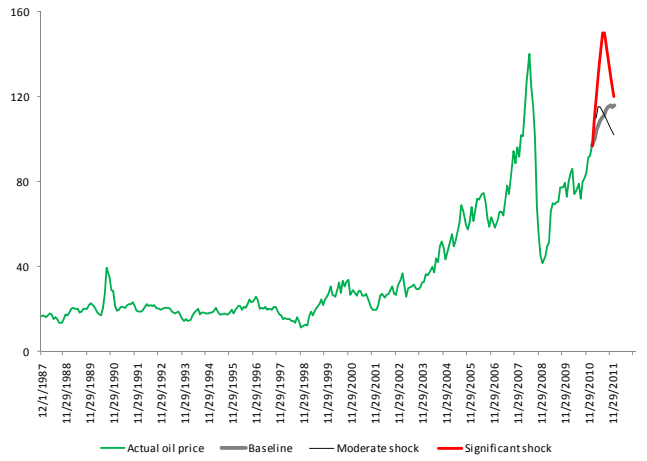
- The first scenario is based on the current reading of all major economic variables. It assumes all shocks are temporary. Because the model is mostly based on the relationship implied by historical data, it suggests a moderate increase in VIX and oil price in the next 12 months.
- The second scenario assumes the Japan crisis will cause temporary market panic, but it will be favorably resolved in the near term. In this scenario, we assume there will be a temporary positive shock to the VIX, reflecting the heightened market risk sentiment. In this scenario, investors' attention on oil price is likely to be distracted. The temporary reduction in oil refining demand in Japan is likely to balance the shortage in supply from Middle East/North Africa. However, once concerns revolving around Japan are over, investors' attention is likely to shift back on oil and oil price is likely to rise significantly again; therefore, we assume there will be a more lasting and gradual impact on oil price.
- The third scenario is more akin to a stress testing. We assume that both the Japan and Middle East/North Africa crises will significantly escalate. In this scenario, there will be a more significant shock on the VIX index. In the longer term, Japan is likely to demand more oil to replace nuclear power plants, consequently raising the price of oil.

**Figure 1: Three VIX scenarios**




*Source: Deutsche Bank*

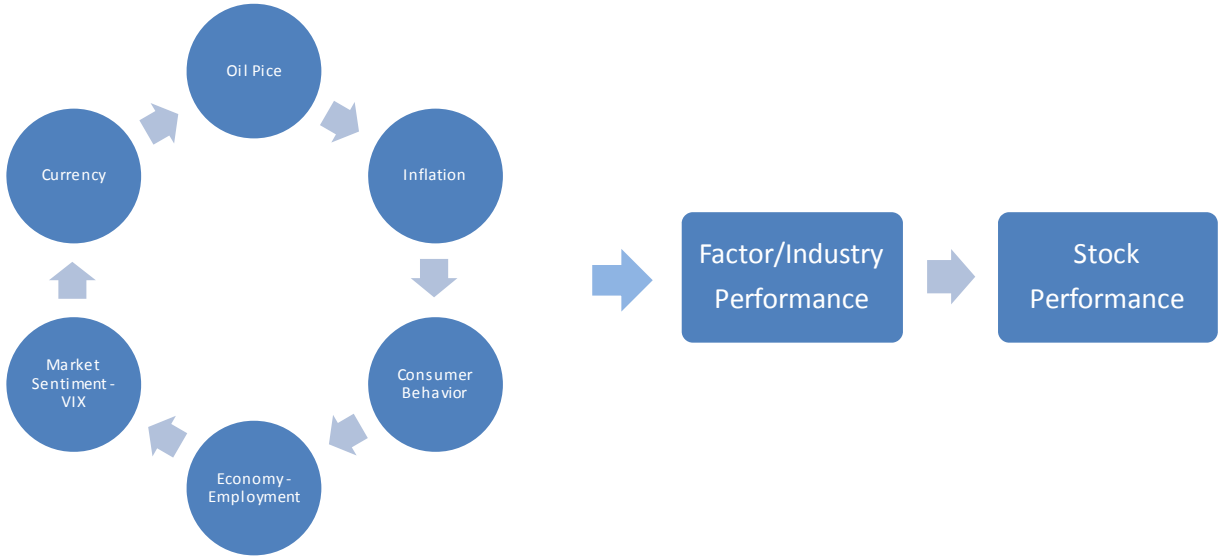
**Figure 2: Three oil price scenarios**




*Source: Deutsche Bank*

As shown in Figure 3, a one-time shock of almost any important economic variable is likely to affect not only the future value of the same economic variable, but also other economic variables, which would further influence factor/industry/stock performance. A temporary shock that lasts for a few months could therefore have a more lasting impact.

**Figure 3: A global macro – quantitative equity model**

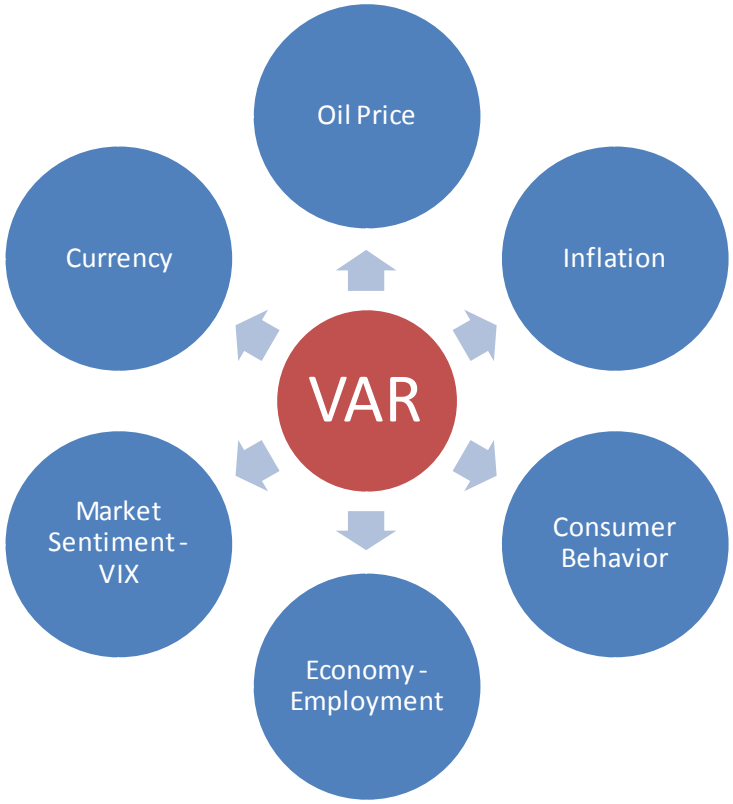



*Source: Deutsche Bank Quantitative Strategy*

# Modeling the economy – a multivariate exercise

As shown in Figure 4, a one-time shock to almost any important economic variable is likely to affect not only the future value of the same economic variable, but also other economic variables. A temporary shock that lasts for a few months could therefore have a more lasting impact. We need an integrated and dynamic macroeconomic model to link the different components together[3].

**Figure 4: A VAR model**




*Source: Deutsche Bank Quantitative Strategy*

## VAR model – intuition and technical introduction

In this research, we build a simple VAR or vector autoregressive model to link the six important economic variables together. In a VAR model, one economic variable can be explained by the contemporaneous and lagged values of the same and other economic variables.

The VAR model is one of the most successful, flexible, and easy to use models for the analysis of multivariate time series and empirical economics. The VAR model has proven to be especially useful for describing the dynamic behavior of economic and financial time series and for forecasting.

[3] As shown in Luo, Y., Cahan, R., Jussa, J., and Alvarez, M. [2010b], it is critical to use point-in-time as-reported economic data, rather than re-stated economic time series in any predictive modeling research.

The VAR model is a statistical description of the dynamic interrelations between $K$ different variables without making use of prior theoretical structural econometric models. Sims [1980] advocates the use of VAR models as a theory-free method to estimate economic relationships, thus being an alternative to the more complex structural econometric models. Empirical research tends to find that simpler VAR models often predict future economic conditions better than more complex structural econometric models.

Following Hamilton [1994], let $y_t$ be an $(K \times 1)$ vector containing the values of $K$ macroeconomic variables at date $t$. The dynamics of $y_t$ are presumed to be governed by a *p*th order Gaussian vector autoregression:

$$y_t = c + \Phi_1 y_{t-1} + \Phi_2 y_{t-2} + \ldots + \Phi_p y_{t-p} + \varepsilon_t$$

where,

$$\varepsilon_t \sim IID(0, \Omega).$$

The parameters, $\Phi_{1\ldots p}$ and $\Omega$ can be estimated via maximum likelihood. The number of parameter tends to increase exponentially with the order of $p$; therefore, in practice, we typically choose a small $p$.

## Impulse-response function

Based on the VAR model developed in the previous section, we can quantify the impact of a one-time shock (or impulse) in the *j*th variable at time $t$ to the *i*th variable at time $t+s$.

Mathematically, the VAR system can be written in vector $MA(\infty)$ form as:

$$y_t = \mu + \varepsilon_t + \Psi_1 \varepsilon_{t-1} + \Psi_2 \varepsilon_{t-2} + \ldots$$

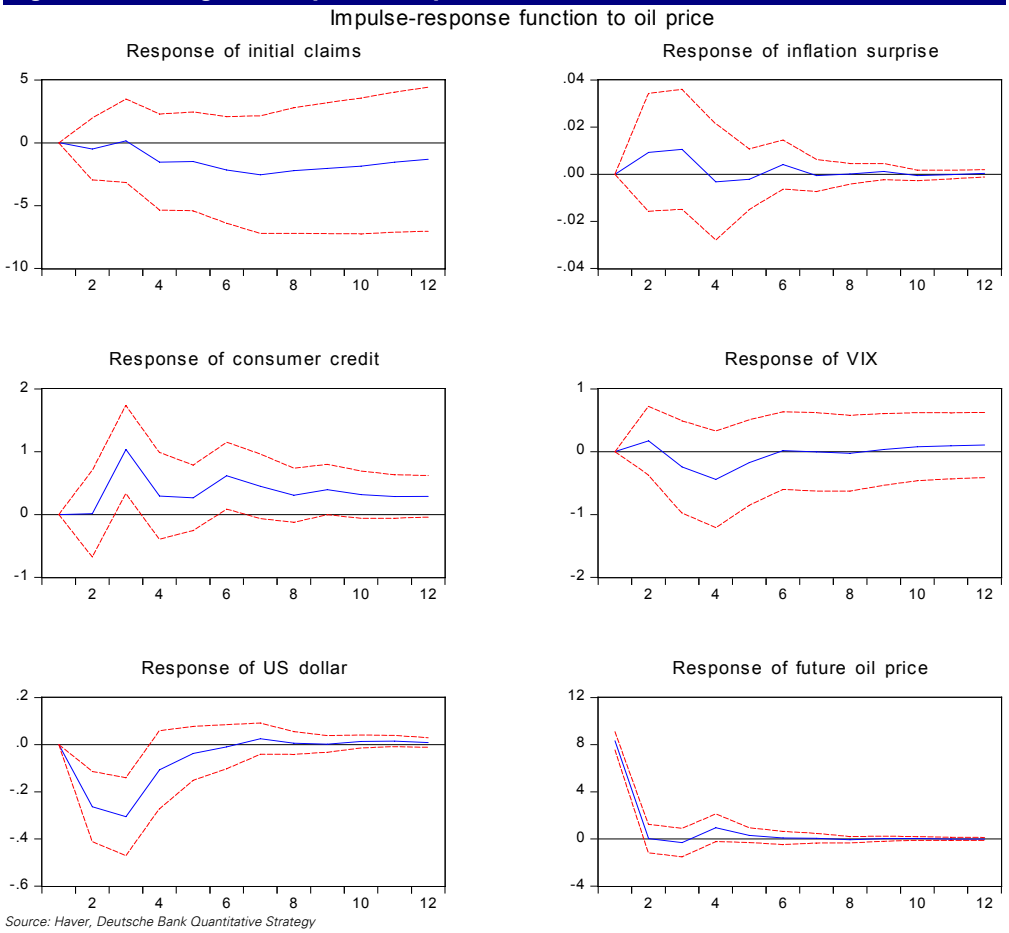
The matrix $\Psi_s$ has the interpretation of:

$$\Psi_s = \frac{\partial y_{t+s}}{\partial \varepsilon_t'}$$

A plot of the row $i$, column $j$ element of $\Psi_s$, $\frac{\partial y_{i,t+s}}{\partial \varepsilon_{jt}}$, as a function of $s$ is called the impulse-response function. It describes the response of $y_{i,t+s}$ to a one-time impulse in $y_{jt}$ with all other variables dated $t$ or earlier held constant.

Figure 5 shows the impact of oil price on other economic variables, using the impulse-response function. A one-time shock (impulse) in oil price is likely to have a negative impact on inflation (for up to three months), require consumers to borrow more (in the next 12 months), depreciate the US dollar (for up to four months), and it takes about one month for oil price to settle down to the original level.

**Figure 5: The long-term impact of oil price on other economic variables**

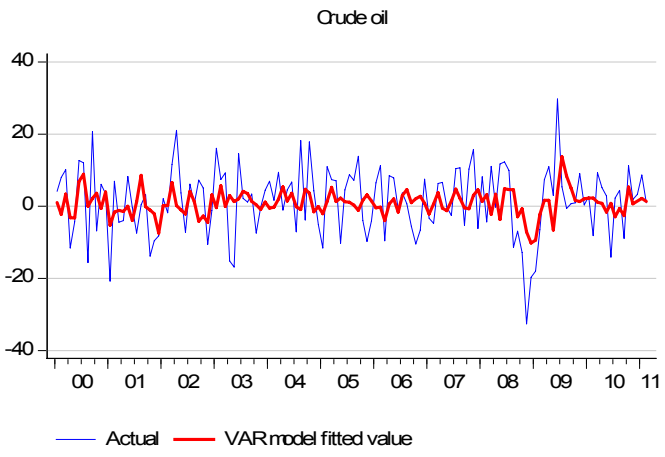



Source: Haver, Deutsche Bank Quantitative Strategy

## Model fitting

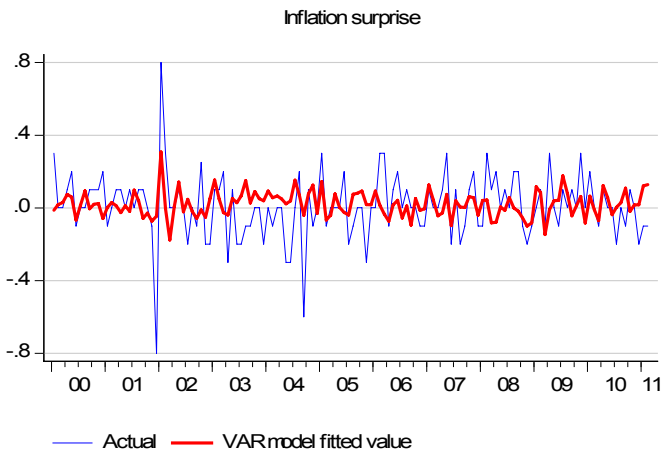
Figure 6 to Figure 11 show the actual and predicted economic variables. The simple VAR model seems to be able to capture the main features of most economic dynamics reasonably well.

**Figure 6: Actual vs fitted – oil price**



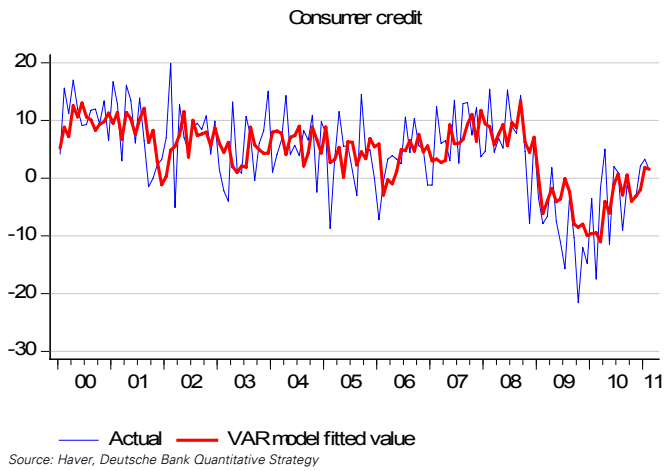

Source: Haver, Deutsche Bank Quantitative Strategy

**Figure 7: Actual vs fitted – inflation surprise**



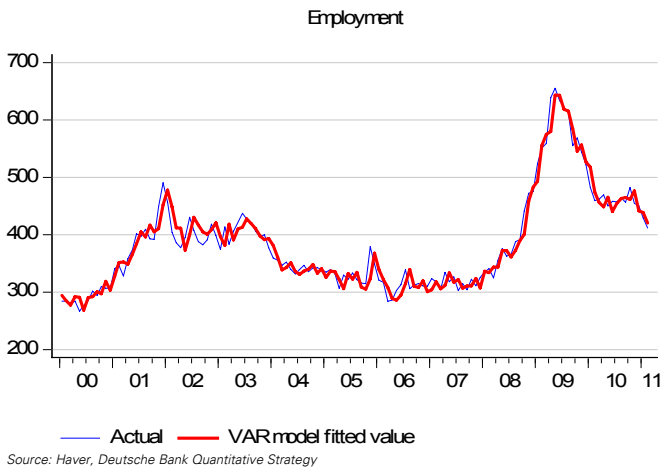

Source: Haver, Deutsche Bank Quantitative Strategy

**Figure 8: Actual vs fitted – consumer credit**



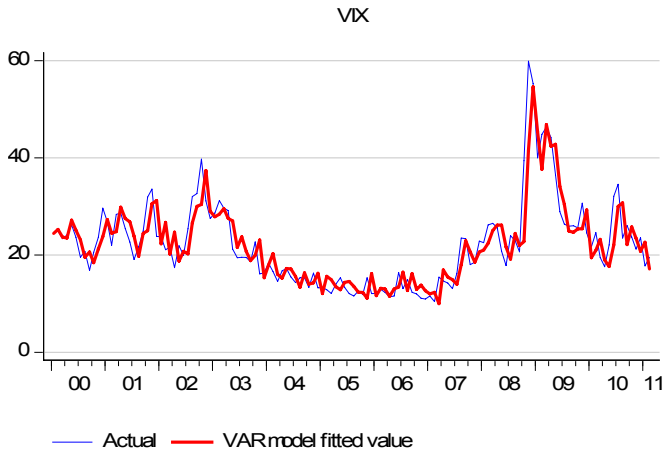

Source: Haver, Deutsche Bank Quantitative Strategy

**Figure 9: Actual vs fitted – employment**



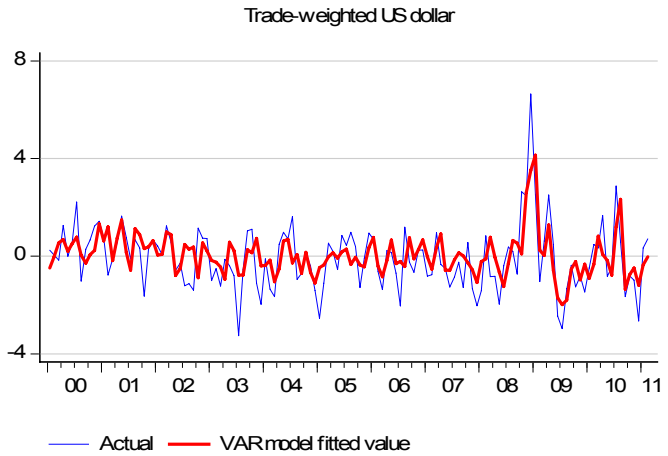

Source: Haver, Deutsche Bank Quantitative Strategy

**Figure 10: Actual vs fitted – VIX**




Source: Haver, Deutsche Bank Quantitative Strategy

**Figure 11: Actual vs fitted – Currency**




Source: Haver, Deutsche Bank Quantitative Strategy

# Multi-period economic simulation and forecasting

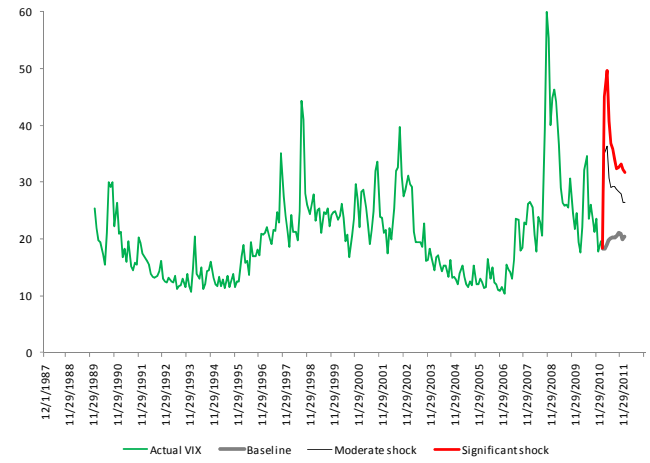
The nice thing about the VAR model we build in the previous session is that it allows us to perform multi-period forecasting. Furthermore, it allows us to perform scenario analysis, i.e., we can override the model projection with additional shocks.

## Three VIX and oil price scenarios

In this research, we perform our analysis on three VIX/oil price scenarios (see Figure 12 and Figure 13).

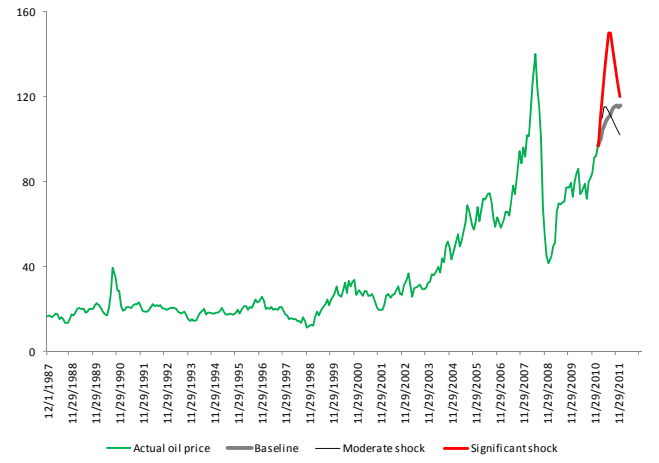
- Model prediction based on current economic readings (i.e., insignificant and temporary shock)
- Moderate and temporary shock
- Significant and more permanent shock

**Figure 12: Three VIX scenarios**




*Source: Deutsche Bank*

**Figure 13: Three oil price scenarios**




*Source: Deutsche Bank*

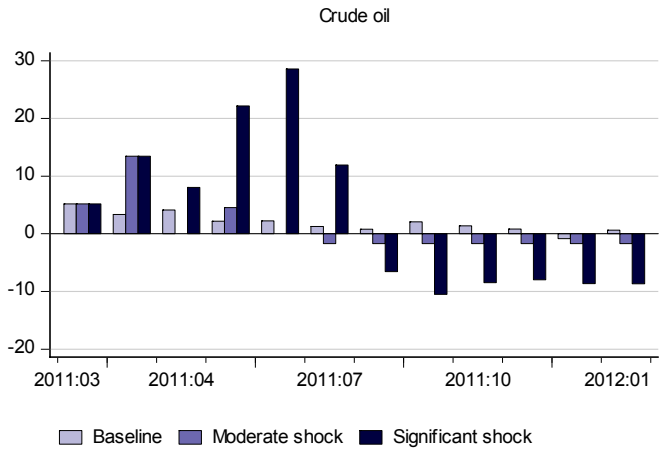
## Economic forecast

Based on our VAR model, we can estimate the impact of oil price on other economic variables. The best linear predictor of a $h$ period ahead forecast, $y_{t+h|t}$ is

$$\hat{y}_{t+h|t} = \hat{c} + \hat{\Phi}_1 \hat{y}_{t+h-1|t} + \hat{\Phi}_2 \hat{y}_{t+h-2|t} + \ldots + \hat{\Phi}_p \hat{y}_{t+h-p|t}$$

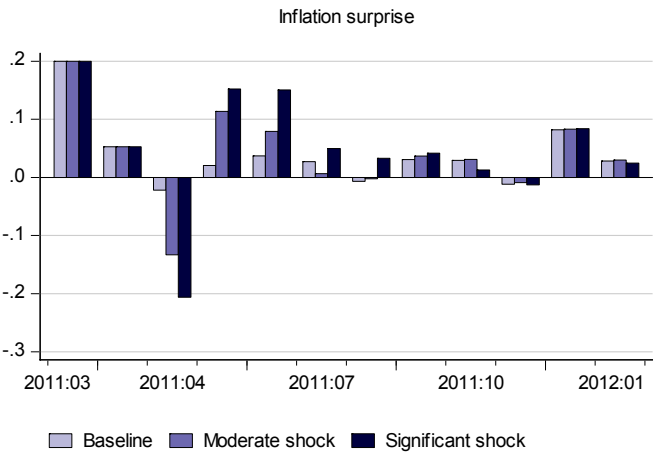
Figure 14 to Figure 19 show the predicted economic variables under the three scenarios. A more significant VIX/oil shock is likely to cause higher inflation surprise, more consumer credit, more unemployment, and a weakening US dollar.

**Figure 14: Predicted oil price**



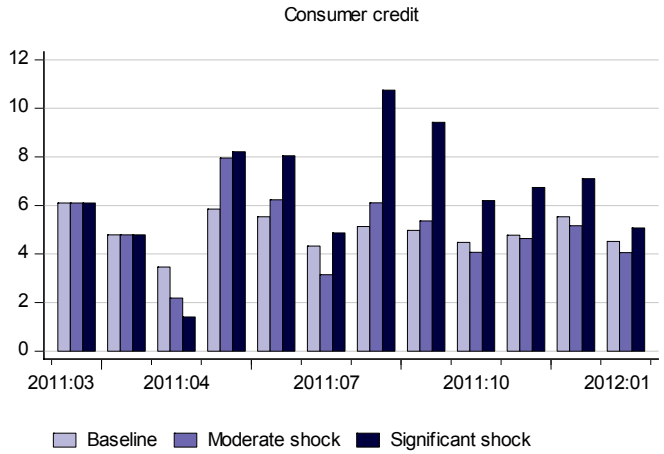

Source: Haver, Deutsche Bank Quantitative Strategy

**Figure 15: Predicted inflation surprise**



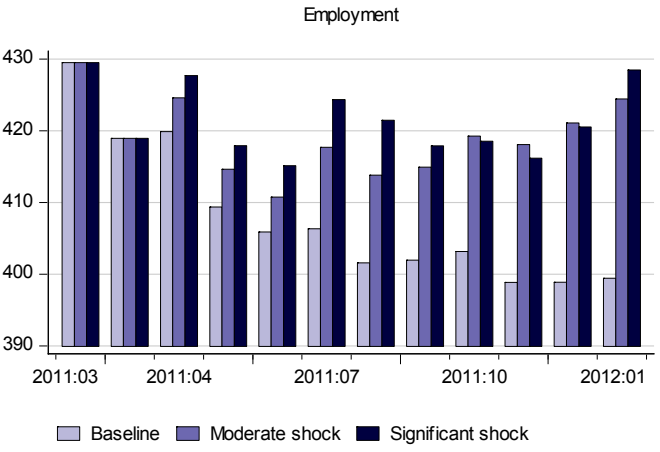

Source: Haver, Deutsche Bank Quantitative Strategy

**Figure 16: Predicted consumer credit**



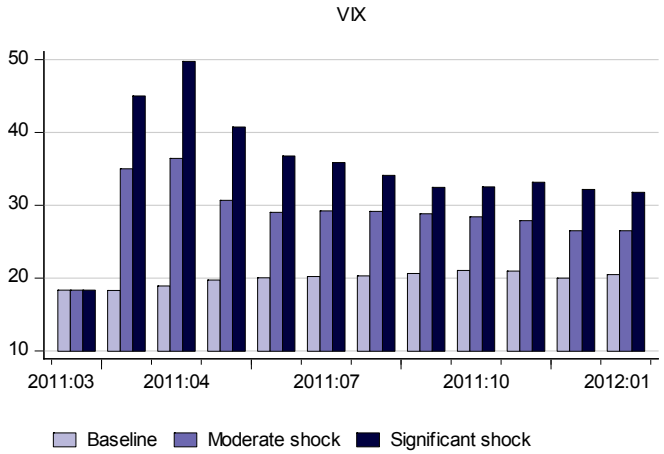

Source: Haver, Deutsche Bank Quantitative Strategy

**Figure 17: Predicted employment**



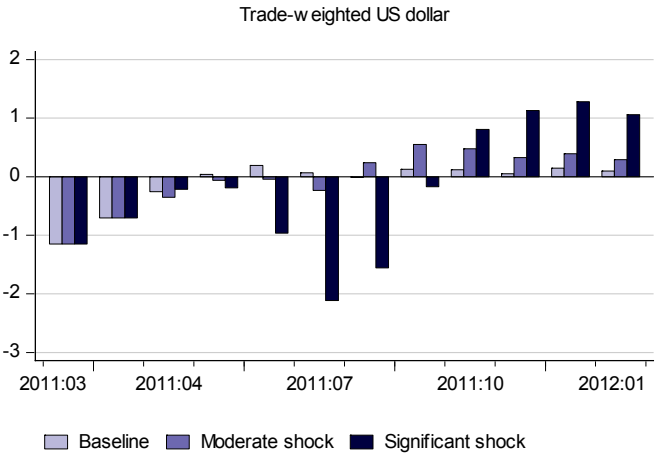

Source: Haver, Deutsche Bank Quantitative Strategy

**Figure 18: Predicted VIX**




Source: Haver, Deutsche Bank Quantitative Strategy

**Figure 19: Predicted Currency**




Source: Haver, Deutsche Bank Quantitative Strategy

# A Global Macro – Quantitative Equity (GMQE) model

In our Style Rotation model (Luo, Cahan, Jussa, and Alvarez [2010b]), we find VIX and oil price are among the key drivers of factor (and industry) returns.

In this section, we build an alpha model that explicitly takes into account the macroeconomic environment. In order to keep it simple, we use the same 12 factors as in our style rotation research[4].

**Figure 20: Selected style factors**

| Factor_Description | Style Category | Direction* | Three-year Avg IC | Long-term Avg IC | Long-term IC Vol | Long-term IR | Three-year - Long-term IC |
|---|---|---|---|---|---|---|---|
| Earnings yield, forecast FY1 mean | Value | Ascending | 0.90 | 4.43 | 12.76 | 0.35 | (3.53) |
| Price-to-book | Value | Ascending | 0.25 | 2.92 | 9.83 | 0.30 | (2.68) |
| IBES 5Y EPS growth | Growth | Ascending | 0.16 | 0.55 | 8.76 | 0.06 | (0.39) |
| Maximum daily return in last 1M (lottery factor) | Momentum/reversal | Descending | 3.85 | 5.07 | 14.95 | 0.34 | (1.22) |
| 12M-1M total return | Momentum/reversal | Ascending | 0.08 | 3.39 | 13.13 | 0.26 | (3.31) |
| IBES LTG Mean EPS Revision, 3M | Sentiment | Ascending | (0.52) | 0.84 | 3.97 | 0.21 | (1.36) |
| Sales to total assets (asset turnover) | Quality | Ascending | 1.99 | 1.40 | 8.90 | 0.16 | 0.59 |
| Long-term debt/equity | Quality | Ascending | (1.07) | 0.73 | 9.84 | 0.07 | (1.80) |
| Net external financing/net operating assets | Quality | Ascending | 1.20 | 2.91 | 10.39 | 0.28 | (1.72) |
| Accruals (Sloan 1996 def) | Quality | Descending | 0.75 | 0.54 | 4.54 | 0.12 | 0.21 |
| CAPM idosyncratic vol, 1Y daily | Technical | Descending | 3.07 | 4.75 | 17.96 | 0.26 | (1.67) |
| Log float-adj capitalization | Technical | Ascending | 1.66 | 2.85 | 10.91 | 0.26 | (1.19) |

* "Ascending" means higher factor scores are generally associated with higher subsequent stock returns.

*Source: Bloomberg Finance LLP, Compustat, IBES, Russell, Thomson Reuters, Deutsche Bank Quantitative Strategy*

## Factor/industry return estimation

Factor and industry returns are estimated using the following cross-sectional regression. Factor returns are "pure" returns after controlling for other common factors, while industry returns are unweighted "pure" returns after controlling for fundamental factors. This is similar to our QCD model methodology (Luo, Cahan, Jussa, and Alvarez [2010a]).

$$r_{i,t+1} = \sum_{j=1}^{J_t} \beta_{j,t} F_{j,i,t} + \sum_{k=1}^{K_t} \gamma_{k,t} S_{k,i,t} + \varepsilon_{i,t}$$

where,

$r_{i,t+1}$ is the forward one-period ahead return for stock *i* in period *t+1*;

$F_{j,i,t}$ is the *j*th factor score for stock *i* in period *t*, e.g., where the *j*th factor is PE, then $F_{j,i,t}$ is the PE for stock *i* in period *t*);

[4] More innovative and less crowded factors are less likely to be influenced by the economic environment. In recent months, we have introduced a series of innovative alpha factors based on securities lending data, high frequency data, industry-specific data, news sentiment/text mining, and options data. Please refer to the *Signal Processing* monthly research series for details.

$\beta_{j,t}$ is the estimated factor return for factor *j* in period *t*;

$S_{k,i,t}$ is a dummy variable indicating whether stock *i* belonged to sector *k* in period *t*;

$\gamma_{k,t}$ is the estimated sector *k* return in period *t*;

$\varepsilon_{i,t}$ is the regression residual, i.e., the random noise that can not be accounted for by the linear regression model;

*i* = 1 to $N_t$ indicating the number of stocks in period *t*;

*j* = 1 to $J_t$ indicating the number of factors in period *t*; and

*k* = 1 to $K_t$ indicating the number of industries in period *t*.

## Factor timing with macroeconomic data

Forward factor returns are assumed to be dependent on macroeconomic variables. This is similar to our QCD model (Luo, Cahan, Jussa, and Alvarez [2010a]) and style rotation model (Luo, Cahan, Jussa, and Alvarez [2010b]).

$$\beta_{j,t} = \sum_{g=1}^{G} \delta_{j,g} E_{g,t-1} + \sum_{h=1}^{H} \rho_{j,h} C_{h,t-1} + \sum_{p=1}^{P} \theta_{j,p} A_{p,t-1} + \sum_{l=1}^{L} \upsilon_{j,l} \beta_{j,t-l} + \varsigma_{j,t-1}$$

where,

$\beta_{j,t}$ (as defined in the previous section) is the estimated factor return for style factor *j* in period *t*;

$E_{g,t-1}$ is the *g*th macroeconomic variable at period *t-1*;

$\delta_{j,g}$ is the estimated coefficient for the *j*th style factor with regard to the *g*th macroeconomic variable at period *t-1*;

$C_{h,t-1}$ is the *h*th capital market variable at period *t-1*;

$\rho_{j,h}$ is the estimated coefficient for the *j*th style factor with regard to the *h*th capital market variable at period *t-1*;

$A_{p,t-1}$ is the *p*th seasonal dummy variable at period *t-1*;

$\upsilon_{j,t-l}$ is the estimated coefficient for the *j*th style factor with regard to the *l*th lagged factor;

$\theta_{j,p}$ is the estimated coefficient for the *j*th style factor with regard to the *p*th dummy variable at period *t-1*;

$\varsigma_{j,t-1}$ is the regression residual, i.e., the random noise that can not be accounted for by the linear regression model;

*j* = 1 to $J_t$ indicating the number of style factors in period *t*;

*g* = 1 to *G* indicating the number of macroeconomic variables;

*h* = 1 to *H* indicating the number of capital market variables;

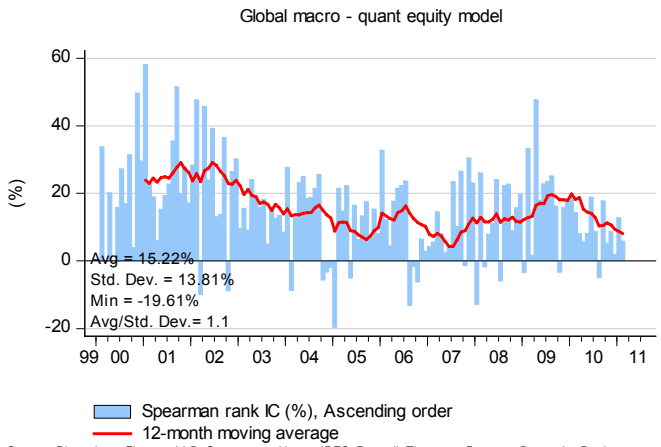
*p* = 1 to *P* indicating the number of seasonal dummy variables; and

*l* = 1 to *L* indicating the number of lags.

## Model backtesting

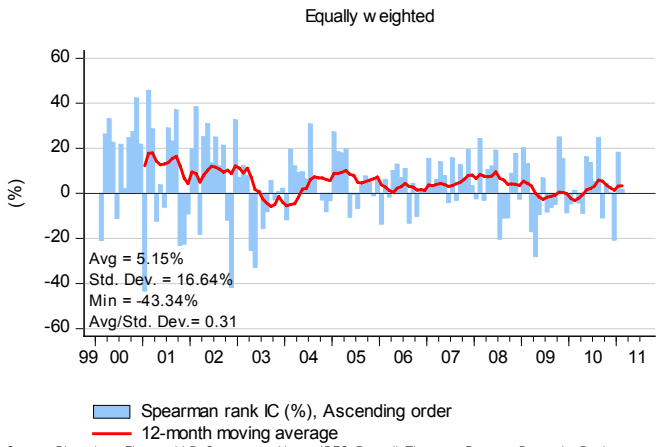
As shown in Figure 21 and Figure 22, the performance of our Global Macro – Quant Equity (GMQE) model that incorporates macro data improves substantially relative to our benchmark model, where we equally weight all 12 factors (EQW). The outperformance also persists in different VIX environment (Figure 23) and oil price scenarios (Figure 24).

**Figure 21: Global Macro – Quant Equity (GMQE) model**



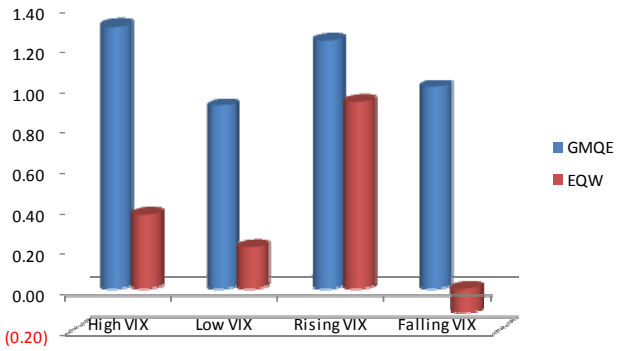

*Source: Bloomberg Finance LLP, Compustat, Haver, IBES, Russell, Thomson Reuters, Deutsche Bank Quantitative Strategy*

**Figure 22: Equally weight all factors**



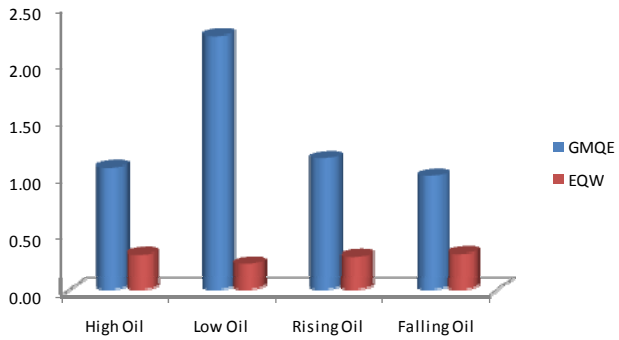

*Source: Bloomberg Finance LLP, Compustat, Haver, IBES, Russell, Thomson Reuters, Deutsche Bank Quantitative Strategy*

**Figure 23: Performance comparison in different market volatility regimes**




*Source: Bloomberg Finance LLP, Compustat, Haver, IBES, Russell, Thomson Reuters, Deutsche Bank Quantitative Strategy*

**Figure 24: Performance comparison in different oil price scenarios**




*Source: Bloomberg Finance LLP, Compustat, Haver, IBES, Russell, Thomson Reuters, Deutsche Bank Quantitative Strategy*

# Global macro – quantitative equity models

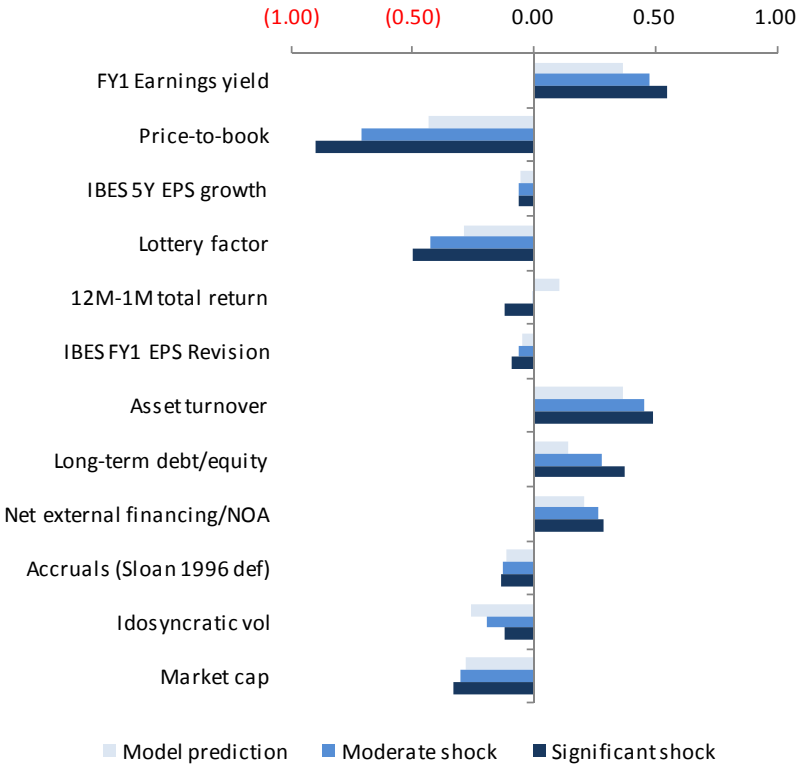
## Predicted factor performance

From our economic predictions, the $h$ period ahead forecast of the $j$th factor return is:

$$\hat{\beta}_{j,t+h|t} = \sum_{g=1}^{G} \hat{\delta}_{j,g} \hat{E}_{g,t+h-1|t} + \sum_{h=1}^{H} \hat{\rho}_{j,h} \hat{C}_{h,t+h-1|h} + \sum_{p=1}^{P} \hat{\theta}_{j,p} \hat{A}_{p,t+h-1|t} + \sum_{l=1}^{L} \hat{v}_{j,l} \hat{\beta}_{j,t+h-l|t}$$

Figure 25 shows the predicted performance of the 12 factors[5]. Relatively speaking, we expect earnings yield, price-to-book, asset turnover, debt/equity ratio, and net external financing factors to generate positive alpha in the next 12 months, especially in a bigger oil price shock scenario. In a more stressful economic environment associated with high VIX and oil price, investors would naturally look for value and quality factors to be more defensive.

**Figure 25: Predicted factor performance**




*Source: Bloomberg Finance LLP, Compustat, IBES, Russell, Thomson Reuters, Deutsche Bank Quantitative Strategy*

[5] Please note the significant negative expected returns for price-to-book factor. For the next 12 months, we expect price-to-book work in the "correct" direction, which means stocks with lower price-to-book multiples are likely to outperform. The reason that we reverse the sign of the factor is because we find, in the long term, stocks with lower price-to-book multiples actually underperform. In our factor library, the sign of the factor is always based on the factor's long term performance.

## Predicted industry performance

The industry return prediction is more involved than factor return prediction. The industry return $\gamma_{k,t}$ defined in the equation below is a "pure" industry return after controlling for other fundamental factors. It is also un-weighted by market capitalization, while most investors perfer the cap-weighted industry return term.

$$r_{i,t+1} = \sum_{j=1}^{J_t} \beta_{j,t} F_{j,i,t} + \sum_{k=1}^{K_t} \gamma_{k,t} S_{k,i,t} + \varepsilon_{i,t}$$

We can link our un-weighted pure industry return $\gamma_{k,t}$ to a weighted industry return in a simple manner. We need to estimate the expected alpha for all stocks in our universe first. Then, the cap-weighted industry return is simple the cap-weighted alpha of all stocks in that industry.

Figure 26 shows the expected relative performance of the 22 industries. Automobiles & components, household & personal products, healthcare equipment & services, and diversified financials and REITs are likely to outperform, especially in a more significant and long lasting crisis mode.

**Figure 26: Predicted industry performance**


*Source: Bloomberg Finance LLP, Compustat, IBES, Russell, Thomson Reuters, Deutsche Bank Quantitative Strategy*

## Predicted stock performance

Based on our economic forecast and factor/industry predictions, the $h$ period ahead forecast of the $i$th stock's alpha is:

$$\hat{r}_{i,t+h|t} = \sum_{j=1}^{J_t} \hat{\beta}_{j,t+h|h} F_{j,i,t} + \sum_{k=1}^{K_t} \hat{\gamma}_{k,t+h|t} S_{k,i,t}$$

In this section, we provide the top two stocks in each industry that may potentially benefit the most under the three economic scenarios (see Figure 27, Figure 28, and Figure 29). There is some overlap among the three lists, as our prediction reflects not only our economic scenarios, but also the underlying stock specific fundamentals.

**Figure 27: Top ranked stocks based on current economic forecast**

| Ticker | Company | Industry | Float-adj Market Cap | Avg Daily Trading Vol |
|---|---|---|---|---|
| GPRE | GREEN PLAINS RENEWABLE ENRGY | Energy | 223.6 | 265,900 |
| REX | REX AMERICAN RESOURCES CORP | Energy | 106.4 | 22,300 |
| BZ | BOISE INC | Materials | 629.5 | 2,258,700 |
| SXT | SENSIENT TECHNOLOGIES CORP | Materials | 1,652.7 | 326,700 |
| TPC | TUTOR PERINI CORP | Capital Goods | 635.6 | 182,900 |
| LLL | L-3 COMMUNICATIONS HLDGS INC | Capital Goods | 9,177.1 | 759,600 |
| VSEC | VSE CORP | Commercial & Professional Services | 112.3 | 14,300 |
| DNB | DUN & BRADSTREET CORP | Commercial & Professional Services | 4,071.4 | 282,900 |
| PNCL | PINNACLE AIRLINES CORP | Transportation | 112.4 | 64,900 |
| PTSI | P.A.M. TRANSPORTATION SVCS | Transportation | 54.4 | 5,100 |
| LEA | LEAR CORP | Automobiles & Components | 5,234.1 | 768,400 |
| TEN | TENNECO INC | Automobiles & Components | 2,382.2 | 1,171,400 |
| DLA | DELTA APPAREL INC | Consumer Durables & Apparel | 78.5 | 9,100 |
| JOUT | JOHNSON OUTDOORS INC -CL A | Consumer Durables & Apparel | 67.3 | 16,900 |
| COCO | CORINTHIAN COLLEGES INC | Consumer Services | 461.8 | 4,662,200 |
| DPZ | DOMINO'S PIZZA INC | Consumer Services | 623.9 | 965,000 |
| MDP | MEREDITH CORP | Media | 1,267.1 | 462,900 |
| VCI | VALASSIS COMMUNICATIONS INC | Media | 1,406.1 | 927,600 |
| SYX | SYSTEMAX INC | Retailing | 147.3 | 49,200 |
| GPI | GROUP 1 AUTOMOTIVE INC | Retailing | 1,036.7 | 385,600 |
| SUSS | SUSSER HOLDINGS CORP | Food & Staples Retailing | 103.1 | 31,300 |
| SPTN | SPARTAN STORES INC | Food & Staples Retailing | 339.3 | 104,100 |
| JBSS | SANFILIPPO JOHN B&SON | Food, Beverage & Tobacco | 95.2 | 16,600 |
| FDP | FRESH DEL MONTE PRODUCE INC | Food, Beverage & Tobacco | 1,133.8 | 194,500 |
| CENTA | CENTRAL GARDEN & PET CO | Household & Personal Products | 555.4 | 255,000 |
| USNA | USANA HEALTH SCIENCES INC | Household & Personal Products | 210.1 | 54,700 |
| ADPI | AMERICAN DENTAL PARTNERS INC | Health Care Equipment & Services | 202.1 | 33,400 |
| UAM | UNIVERSAL AMERICAN CORP | Health Care Equipment & Services | 658.4 | 185,300 |
| CRTX | CORNERSTONE THERAPEUTICS INC | Pharmaceuticals, Biotechnology & Life Scie | 42.4 | 23,700 |
| PRX | PAR PHARMACEUTICAL COS INC | Pharmaceuticals, Biotechnology & Life Scie | 1,082.7 | 299,000 |
| BOFI | BOFI HOLDING INC | Banks | 106.4 | 26,100 |
| PBIB | PORTER BANCORP INC | Banks | 33.4 | 16,200 |
| ARI | APOLLO COMMERCIAL RE FIN INC | Diversified Financials & REITs | 298.7 | 77,700 |
| CODI | COMPASS DIVERSIFIED HOLDINGS | Diversified Financials & REITs | 591.3 | 312,300 |
| AHL | ASPEN INSURANCE HOLDINGS LTD | Insurance | 2,284.7 | 964,600 |
| FSR | FLAGSTONE REINSURANCE HLD SA | Insurance | 593.7 | 186,400 |
| CSC | COMPUTER SCIENCES CORP | Software & Services | 7,423.6 | 2,484,100 |
| PLUS | EPLUS INC | Software & Services | 108.8 | 26,800 |
| SNX | SYNNEX CORP | Technology Hardware & Semiconductors | 791.8 | 176,300 |
| IM | INGRAM MICRO INC | Technology Hardware & Semiconductors | 3,122.8 | 1,889,500 |
| TDS | TELEPHONE & DATA SYSTEMS INC | Telecommunication Services | 2,842.2 | 318,500 |
| CBB | CINCINNATI BELL INC | Telecommunication Services | 531.0 | 1,732,100 |
| GXP | GREAT PLAINS ENERGY INC | Utilities | 2,602.4 | 795,400 |
| AEE | AMEREN CORP | Utilities | 6,662.5 | 1,926,800 |

*Source: Bloomberg Finance LLP, Compustat, Haver, IBES, Russell, Thomson Reuters, Deutsche Bank Quantitative Strategy*

**Figure 28: Top ranked stocks that may benefit from a moderate and temporary crisis**

| Ticker | Company | Industry | Float-adj Market Cap | Avg Daily Trading Vol |
|---|---|---|---|---|
| GPRE | GREEN PLAINS RENEWABLE ENRGY | Energy | 223.6 | 265,900 |
| REX | REX AMERICAN RESOURCES CORP | Energy | 106.4 | 22,300 |
| BZ | BOISE INC | Materials | 629.5 | 2,258,700 |
| OMN | OMNOVA SOLUTIONS INC | Materials | 314.3 | 368,200 |
| TPC | TUTOR PERINI CORP | Capital Goods | 635.6 | 182,900 |
| LLL | L-3 COMMUNICATIONS HLDGS INC | Capital Goods | 9,177.1 | 759,600 |
| VSEC | VSE CORP | Commercial & Professional Services | 112.3 | 14,300 |
| DNB | DUN & BRADSTREET CORP | Commercial & Professional Services | 4,071.4 | 282,900 |
| PNCL | PINNACLE AIRLINES CORP | Transportation | 112.4 | 64,900 |
| GNK | GENCO SHIPPING & TRADING | Transportation | 344.3 | 1,410,300 |
| LEA | LEAR CORP | Automobiles & Components | 5,234.1 | 768,400 |
| SHLO | SHILOH INDUSTRIES INC | Automobiles & Components | 62.1 | 13,200 |
| DLA | DELTA APPAREL INC | Consumer Durables & Apparel | 78.5 | 9,100 |
| CSS | CSS INDUSTRIES INC | Consumer Durables & Apparel | 130.3 | 19,400 |
| COCO | CORINTHIAN COLLEGES INC | Consumer Services | 461.8 | 4,662,200 |
| LINC | LINCOLN EDUCATIONAL SERVICES | Consumer Services | 217.1 | 235,500 |
| MNI | MCCLATCHY CO -CL A | Media | 239.1 | 1,133,900 |
| DEXO | DEX ONE CORP | Media | 263.6 | 330,300 |
| SYX | SYSTEMAX INC | Retailing | 147.3 | 49,200 |
| CONN | CONN'S INC | Retailing | 65.8 | 140,200 |
| SUSS | SUSSER HOLDINGS CORP | Food & Staples Retailing | 103.1 | 31,300 |
| SPTN | SPARTAN STORES INC | Food & Staples Retailing | 339.3 | 104,100 |
| JBSS | SANFILIPPO JOHN B&SON | Food, Beverage & Tobacco | 95.2 | 16,600 |
| AOI | ALLIANCE ONE INTL INC | Food, Beverage & Tobacco | 323.4 | 814,500 |
| CENTA | CENTRAL GARDEN & PET CO | Household & Personal Products | 555.4 | 255,000 |
| SPB | SPECTRUM BRANDS HOLDINGS INC | Household & Personal Products | 522.1 | 259,000 |
| ADPI | AMERICAN DENTAL PARTNERS INC | Health Care Equipment & Services | 202.1 | 33,400 |
| SUNH | SUN HEALTHCARE GROUP INC | Health Care Equipment & Services | 366.3 | 244,900 |
| CRTX | CORNERSTONE THERAPEUTICS INC | Pharmaceuticals, Biotechnology & Life Scie | 42.4 | 23,700 |
| CEPH | CEPHALON INC | Pharmaceuticals, Biotechnology & Life Scie | 4,234.1 | 1,877,400 |
| BOFI | BOFI HOLDING INC | Banks | 106.4 | 26,100 |
| PBIB | PORTER BANCORP INC | Banks | 33.4 | 16,200 |
| ARI | APOLLO COMMERCIAL RE FIN INC | Diversified Financials & REITs | 298.7 | 77,700 |
| NNI | NELNET INC | Diversified Financials & REITs | 589.4 | 90,500 |
| AHL | ASPEN INSURANCE HOLDINGS LTD | Insurance | 2,284.7 | 964,600 |
| FSR | FLAGSTONE REINSURANCE HLD SA | Insurance | 593.7 | 186,400 |
| CSC | COMPUTER SCIENCES CORP | Software & Services | 7,423.6 | 2,484,100 |
| CHINA | CDC CORP | Software & Services | 87.3 | 156,300 |
| SNX | SYNNEX CORP | Technology Hardware & Semiconductors | 791.8 | 176,300 |
| IM | INGRAM MICRO INC | Technology Hardware & Semiconductors | 3,122.8 | 1,889,500 |
| TDS | TELEPHONE & DATA SYSTEMS INC | Telecommunication Services | 2,842.2 | 318,500 |
| CBB | CINCINNATI BELL INC | Telecommunication Services | 531.0 | 1,732,100 |
| AEE | AMEREN CORP | Utilities | 6,662.5 | 1,926,800 |
| NRG | NRG ENERGY INC | Utilities | 5,103.7 | 2,616,700 |

*Source: Bloomberg Finance LLP, Compustat, Haver, IBES, Russell, Thomson Reuters, Deutsche Bank Quantitative Strategy*

**Figure 29: Top ranked stocks that may benefit from a significant crisis and more permanent shock**

| Ticker | Company | Industry | Float-adj Market Cap | Avg Daily Trading Vol |
|---|---|---|---|---|
| GPRE | GREEN PLAINS RENEWABLE ENRGY | Energy | 223.6 | 265,900 |
| REX | REX AMERICAN RESOURCES CORP | Energy | 106.4 | 22,300 |
| BZ | BOISE INC | Materials | 629.5 | 2,258,700 |
| OMN | OMNOVA SOLUTIONS INC | Materials | 314.3 | 368,200 |
| TPC | TUTOR PERINI CORP | Capital Goods | 635.6 | 182,900 |
| GFF | GRIFFON CORP | Capital Goods | 540.0 | 291,800 |
| VSEC | VSE CORP | Commercial & Professional Services | 112.3 | 14,300 |
| CBZ | CBIZ INC | Commercial & Professional Services | 247.2 | 296,900 |
| PNCL | PINNACLE AIRLINES CORP | Transportation | 112.4 | 64,900 |
| GNK | GENCO SHIPPING & TRADING | Transportation | 344.3 | 1,410,300 |
| SHLO | SHILOH INDUSTRIES INC | Automobiles & Components | 62.1 | 13,200 |
| SPAR | SPARTAN MOTORS INC | Automobiles & Components | 208.8 | 201,900 |
| DLA | DELTA APPAREL INC | Consumer Durables & Apparel | 78.5 | 9,100 |
| CSS | CSS INDUSTRIES INC | Consumer Durables & Apparel | 130.3 | 19,400 |
| COCO | CORINTHIAN COLLEGES INC | Consumer Services | 461.8 | 4,662,200 |
| LINC | LINCOLN EDUCATIONAL SERVICES | Consumer Services | 217.1 | 235,500 |
| MNI | MCCLATCHY CO -CL A | Media | 239.1 | 1,133,900 |
| DEXO | DEX ONE CORP | Media | 263.6 | 330,300 |
| SYX | SYSTEMAX INC | Retailing | 147.3 | 49,200 |
| CONN | CONN'S INC | Retailing | 65.8 | 140,200 |
| SUSS | SUSSER HOLDINGS CORP | Food & Staples Retailing | 103.1 | 31,300 |
| SPTN | SPARTAN STORES INC | Food & Staples Retailing | 339.3 | 104,100 |
| JBSS | SANFILIPPO JOHN B&SON | Food, Beverage & Tobacco | 95.2 | 16,600 |
| AOI | ALLIANCE ONE INTL INC | Food, Beverage & Tobacco | 323.4 | 814,500 |
| CENTA | CENTRAL GARDEN & PET CO | Household & Personal Products | 555.4 | 255,000 |
| SPB | SPECTRUM BRANDS HOLDINGS INC | Household & Personal Products | 522.1 | 259,000 |
| ADPI | AMERICAN DENTAL PARTNERS INC | Health Care Equipment & Services | 202.1 | 33,400 |
| SUNH | SUN HEALTHCARE GROUP INC | Health Care Equipment & Services | 366.3 | 244,900 |
| CRTX | CORNERSTONE THERAPEUTICS INC | Pharmaceuticals, Biotechnology & Life Scie | 42.4 | 23,700 |
| AMRI | ALBANY MOLECULAR RESH INC | Pharmaceuticals, Biotechnology & Life Scie | 106.7 | 97,400 |
| BOFI | BOFI HOLDING INC | Banks | 106.4 | 26,100 |
| PBIB | PORTER BANCORP INC | Banks | 33.4 | 16,200 |
| ARI | APOLLO COMMERCIAL RE FIN INC | Diversified Financials & REITs | 298.7 | 77,700 |
| NNI | NELNET INC | Diversified Financials & REITs | 589.4 | 90,500 |
| AHL | ASPEN INSURANCE HOLDINGS LTD | Insurance | 2,284.7 | 964,600 |
| FSR | FLAGSTONE REINSURANCE HLD SA | Insurance | 593.7 | 186,400 |
| CSC | COMPUTER SCIENCES CORP | Software & Services | 7,423.6 | 2,484,100 |
| CHINA | CDC CORP | Software & Services | 87.3 | 156,300 |
| SNX | SYNNEX CORP | Technology Hardware & Semiconductors | 791.8 | 176,300 |
| IM | INGRAM MICRO INC | Technology Hardware & Semiconductors | 3,122.8 | 1,889,500 |
| TDS | TELEPHONE & DATA SYSTEMS INC | Telecommunication Services | 2,842.2 | 318,500 |
| CBB | CINCINNATI BELL INC | Telecommunication Services | 531.0 | 1,732,100 |
| NRG | NRG ENERGY INC | Utilities | 5,103.7 | 2,616,700 |
| CEG | CONSTELLATION ENERGY GRP INC | Utilities | 5,739.8 | 1,979,600 |

*Source: Bloomberg Finance LLP, Compustat, Haver, IBES, Russell, Thomson Reuters, Deutsche Bank Quantitative Strategy*

# Three well-diversified portfolios

Based on the three scenarios, we further build three long-only optimized portfolios[6]. We expect all three portfolios to outperform their respective benchmark, irrespective of investors' economic forecast. Investors can choose the best portfolio based on their macro views on VIX and the oil price. If the macro views turn out to be correct, we would expect even higher alpha.

**Figure 30: A model portfolio based on current economic environment**

| Symbol | Description | Industry | Wgt (%) | Active Wgt (%) | Symbol | Description | Industry | Wgt (%) | Active Wgt (%) |
|---|---|---|---|---|---|---|---|---|---|
| LEA | LEAR CORP | Auto & Components | 0.24% | 0.20% | OMI | OWENS & MINOR INC NEW | Health Care Equipment & Serv | 2.75% | 2.74% |
| NOC | NORTHROP GRUMMAN CORP | Capital Goods | 3.13% | 3.00% | HNT | HEALTH NET INC | Health Care Equipment & Serv | 2.48% | 2.46% |
| LLL | L-3 COMMUNICATIONS HLDGS INC | Capital Goods | 1.78% | 1.72% | WLP | WELLPOINT INC | Health Care Equipment & Serv | 2.30% | 2.12% |
| TPC | TUTOR PERINI CORPORATION | Capital Goods | 1.14% | 1.13% | ADPI | AMERICAN DENTAL PARTNERS | Health Care Equipment & Serv | 1.65% | 1.65% |
| OSK | OSHKOSH CORP | Capital Goods | 0.83% | 0.81% | TFX | TELEFLEX INC | Health Care Equipment & Serv | 1.46% | 1.44% |
| ACM | AECOM TECHNOLOGY CORP DELAWA | Capital Goods | 0.26% | 0.24% | ABC | AMERISOURCEBERGEN CORP | Health Care Equipment & Serv | 1.20% | 1.13% |
| DNB | DUN & BRADSTREET CORP DEL NEW | Commercial & Professional Serv | 3.03% | 3.00% | UAM | UNIVERSAL AMERICAN CORP | Health Care Equipment & Serv | 0.76% | 0.76% |
| VSEC | VSE CORP | Commercial & Professional Serv | 1.33% | 1.33% | IVC | INVACARE CORP | Health Care Equipment & Serv | 0.71% | 0.71% |
| DLA | DELTA APPAREL INC | Cons Durables & Apparel | 0.99% | 0.99% | UNH | UNITEDHEALTH GROUP INC | Health Care Equipment & Serv | 0.65% | 0.33% |
| DPZ | DOMINOS PIZZA INC | Consumer Services | 1.31% | 1.31% | MCK | MCKESSON CORP | Health Care Equipment & Serv | 0.40% | 0.27% |
| JACK | JACK IN THE BOX INC | Consumer Services | 0.27% | 0.26% | MGLN | MAGELLAN HEALTH SVCS INC | Health Care Equipment & Serv | 0.39% | 0.38% |
| COCO | CORINTHIAN COLLEGES INC | Consumer Services | 0.13% | 0.12% | SUNH | SUN HEALTHCARE GROUP INC NEW | Health Care Equipment & Serv | 0.20% | 0.20% |
| RCL | ROYAL CARIBBEAN CRUISES LTD | Consumer Services | 0.09% | 0.05% | AGP | AMERIGROUP CORP | Health Care Equipment & Serv | 0.12% | 0.10% |
| LINC | LINCOLN EDL SVCS CORP | Consumer Services | 0.03% | 0.03% | CVH | COVENTRY HEALTH CARE INC | Health Care Equipment & Serv | 0.04% | 0.01% |
| MFA | MFA FINANCIAL INC | Div Financials & REITs | 3.02% | 3.00% | SXT | SENSIENT TECHNOLOGIES CORP | Materials | 3.01% | 3.00% |
| HTS | HATTERAS FINL CORP | Div Financials & REITs | 3.01% | 3.00% | BZ | BOISE INC | Materials | 3.00% | 3.00% |
| PSEC | PROSPECT CAPITAL CORPORATION | Div Financials & REITs | 3.01% | 3.00% | UFS | DOMTAR CORP | Materials | 1.53% | 1.51% |
| NNI | NELNET INC | Div Financials & REITs | 2.97% | 2.97% | RS | RELIANCE STEEL & ALUMINUM CO | Materials | 1.33% | 1.31% |
| CODI | COMPASS DIVERSIFIED HOLDINGS | Div Financials & REITs | 2.97% | 2.96% | RKT | ROCK-TENN CO | Materials | 1.06% | 1.04% |
| C | CITIGROUP INC | Div Financials & REITs | 2.69% | 2.02% | SLGN | SILGAN HOLDINGS INC | Materials | 0.45% | 0.44% |
| ARI | APOLLO COML REAL EST FIN INC | Div Financials & REITs | 2.05% | 2.05% | SCHN | SCHNITZER STL INDS | Materials | 0.33% | 0.32% |
| DX | DYNEX CAP INC | Div Financials & REITs | 1.15% | 1.15% | BLL | BALL CORP | Materials | 0.21% | 0.17% |
| AEA | ADVANCE AMER CASH ADVANCE CT | Div Financials & REITs | 0.88% | 0.88% | TPCG | TPC GROUP INC | Materials | 0.12% | 0.12% |
| MS | MORGAN STANLEY | Div Financials & REITs | 0.33% | 0.03% | LLY | ELI LILLY & CO | Pharma, Biotech & Life Sciences | 1.63% | 1.39% |
| BKCC | BLACKROCK KELSO CAPITAL CORP | Div Financials & REITs | 0.11% | 0.11% | AZO | AUTOZONE INC | Retailing | 3.05% | 3.00% |
| BAC | BANK OF AMERICA CORPORATION | Div Financials & REITs | 0.09% | (0.86%) | BBY | BEST BUY INC | Retailing | 1.18% | 1.11% |
| COF | CAPITAL ONE FINL CORP | Div Financials & REITs | 0.02% | (0.13%) | GPI | GROUP 1 AUTOMOTIVE INC | Retailing | 1.16% | 1.16% |
| RODM | RODMAN & RENSHAW CAP GP INC | Div Financials & REITs | 0.01% | 0.01% | SYX | SYSTEMAX INC | Retailing | 0.96% | 0.96% |
| CVX | CHEVRON CORP NEW | Energy | 4.39% | 3.00% | GME | GAMESTOP CORP NEW | Retailing | 0.77% | 0.75% |
| COP | CONOCOPHILLIPS | Energy | 3.77% | 3.00% | CORE | CORE MARK HOLDING CO INC | Retailing | 0.70% | 0.70% |
| VLO | VALERO ENERGY CORP NEW | Energy | 2.35% | 2.24% | CSC | COMPUTER SCIENCES CORP | Software & Services | 2.27% | 2.22% |
| SUN | SUNOCO INC | Energy | 1.61% | 1.58% | UNTD | UNITED ONLINE INC | Software & Services | 0.20% | 0.20% |
| GPRE | GREEN PLAINS RENEWABLE ENERG | Energy | 1.12% | 1.12% | PLUS | EPLUS INC | Software & Services | 0.20% | 0.20% |
| XOM | EXXON MOBIL CORP | Energy | 0.64% | (2.27%) | IM | INGRAM MICRO INC | Tech Hardware & Semi | 3.02% | 3.00% |
| MRO | MARATHON OIL CORP | Energy | 0.60% | 0.36% | SNX | SYNNEX CORP | Tech Hardware & Semi | 3.01% | 3.00% |
| MUR | MURPHY OIL CORP | Energy | 0.47% | 0.38% | | | | | |
| TSO | TESORO CORP | Energy | 0.41% | 0.39% | | | | | |
| DK | DELEK US HLDGS INC | Energy | 0.10% | 0.10% | | | | | |
| SUSS | SUSSER HLDGS CORP | Food & Staples Retailing | 0.23% | 0.23% | | | | | |
| CAH | CARDINAL HEALTH INC | Health Care Equipment & Serv | 3.10% | 3.00% | | | | | |

*Source: Deutsche Bank*

[6] These portfolios are all benchmarked to the Russell 3000 index, with about 6% target tracking error, and beta/sector/size neutrality constrained.

## Figure 31: A model portfolio that may benefit from a moderate and temporary VIX/oil shock

| Symbol | Description | Industry | Wgt (%) | Active Wgt (%) | Symbol | Description | Industry | Wgt (%) | Active Wgt (%) |
|---|---|---|---|---|---|---|---|---|---|
| LEA | LEAR CORP | Auto & Components | 1.74% | 1.70% | TFX | TELEFLEX INC | Health Care Equipment & Serv | 1.95% | 1.94% |
| ALV | AUTOLIV INC | Auto & Components | 1.35% | 1.30% | ADPI | AMERICAN DENTAL PARTNERS | Health Care Equipment & Serv | 1.71% | 1.71% |
| F | FORD MTR CO DEL | Auto & Components | 0.69% | 0.32% | OMI | OWENS & MINOR INC NEW | Health Care Equipment & Serv | 1.54% | 1.53% |
| TEN | TENNECO INC | Auto & Components | 0.42% | 0.40% | UNH | UNITEDHEALTH GROUP INC | Health Care Equipment & Serv | 1.18% | 0.86% |
| TRW | TRW AUTOMOTIVE HLDGS CORP | Auto & Components | 0.04% | 0.02% | UAM | UNIVERSAL AMERICAN CORP | Health Care Equipment & Serv | 1.09% | 1.09% |
| TPC | TUTOR PERINI CORPORATION | Capital Goods | 1.00% | 1.00% | SUNH | SUN HEALTHCARE GROUP INC NEW | Health Care Equipment & Serv | 0.89% | 0.89% |
| LLL | L-3 COMMUNICATIONS HLDGS INC | Capital Goods | 0.80% | 0.73% | IVC | INVACARE CORP | Health Care Equipment & Serv | 0.81% | 0.81% |
| OSK | OSHKOSH CORP | Capital Goods | 0.29% | 0.27% | CVH | COVENTRY HEALTH CARE INC | Health Care Equipment & Serv | 0.26% | 0.23% |
| DNB | DUN & BRADSTREET CORP DEL NEW | Commercial & Professional Serv | 3.03% | 3.00% | AHCI | ALLIED HEALTHCARE INTL INC | Health Care Equipment & Serv | 0.11% | 0.11% |
| VSEC | VSE CORP | Commercial & Professional Serv | 0.83% | 0.83% | KMB | KIMBERLY CLARK CORP | Household & Personal Prod | 1.07% | 0.89% |
| DLA | DELTA APPAREL INC | Cons Durables & Apparel | 1.15% | 1.15% | CENTA | CENTRAL GARDEN & PET CO | Household & Personal Prod | 0.90% | 0.90% |
| DPZ | DOMINOS PIZZA INC | Consumer Services | 1.09% | 1.09% | BZ | BOISE INC | Materials | 2.41% | 2.41% |
| JACK | JACK IN THE BOX INC | Consumer Services | 0.56% | 0.55% | RS | RELIANCE STEEL & ALUMINUM CO | Materials | 1.27% | 1.24% |
| COCO | CORINTHIAN COLLEGES INC | Consumer Services | 0.43% | 0.43% | SXT | SENSIENT TECHNOLOGIES CORP | Materials | 0.98% | 0.96% |
| LINC | LINCOLN EDL SVCS CORP | Consumer Services | 0.40% | 0.40% | UFS | DOMTAR CORP | Materials | 0.42% | 0.40% |
| RCL | ROYAL CARIBBEAN CRUISES LTD | Consumer Services | 0.39% | 0.35% | RKT | ROCK-TENN CO | Materials | 0.29% | 0.27% |
| C | CITIGROUP INC | Div Financials & REITs | 3.66% | 3.00% | SCHN | SCHNITZER STL INDS | Materials | 0.00% | (0.01%) |
| HTS | HATTERAS FINL CORP | Div Financials & REITs | 3.01% | 3.00% | LLY | ELI LILLY & CO | Pharma, Biotech & Life Sciences | 3.23% | 3.00% |
| PSEC | PROSPECT CAPITAL CORPORATION | Div Financials & REITs | 3.01% | 3.00% | CRTX | CORNERSTONE THERAPEUTICS INC | Pharma, Biotech & Life Sciences | 0.10% | 0.10% |
| NNI | NELNET INC | Div Financials & REITs | 2.76% | 2.75% | AZO | AUTOZONE INC | Retailing | 2.56% | 2.52% |
| MFA | MFA FINANCIAL INC | Div Financials & REITs | 2.53% | 2.51% | CORE | CORE MARK HOLDING CO INC | Retailing | 1.61% | 1.61% |
| ARI | APOLLO COML REAL EST FIN INC | Div Financials & REITs | 2.01% | 2.01% | BBY | BEST BUY INC | Retailing | 1.50% | 1.43% |
| CODI | COMPASS DIVERSIFIED HOLDINGS | Div Financials & REITs | 1.74% | 1.74% | SYX | SYSTEMAX INC | Retailing | 1.23% | 1.23% |
| MS | MORGAN STANLEY | Div Financials & REITs | 1.41% | 1.11% | GME | GAMESTOP CORP NEW | Retailing | 1.14% | 1.12% |
| GS | GOLDMAN SACHS GROUP INC | Div Financials & REITs | 1.40% | 0.84% | GPI | GROUP 1 AUTOMOTIVE INC | Retailing | 0.81% | 0.80% |
| BAC | BANK OF AMERICA CORPORATION | Div Financials & REITs | 1.23% | 0.27% | CSC | COMPUTER SCIENCES CORP | Software & Services | 2.69% | 2.64% |
| DX | DYNEX CAP INC | Div Financials & REITs | 1.19% | 1.19% | UNTD | UNITED ONLINE INC | Software & Services | 0.40% | 0.39% |
| AEA | ADVANCE AMER CASH ADVANCE CT | Div Financials & REITs | 0.61% | 0.60% | PLUS | EPLUS INC | Software & Services | 0.02% | 0.02% |
| CXS | CREXUS INVT CORP | Div Financials & REITs | 0.42% | 0.42% | IM | INGRAM MICRO INC | Tech Hardware & Semi | 3.02% | 3.00% |
| JPM | JPMORGAN CHASE & CO | Div Financials & REITs | 0.32% | (0.92%) | SNX | SYNNEX CORP | Tech Hardware & Semi | 3.01% | 3.00% |
| COF | CAPITAL ONE FINL CORP | Div Financials & REITs | 0.17% | 0.01% | TECD | TECH DATA CORP | Tech Hardware & Semi | 1.54% | 1.52% |
| CVX | CHEVRON CORP NEW | Energy | 4.39% | 3.00% | AMKR | AMKOR TECHNOLOGY INC | Tech Hardware & Semi | 0.49% | 0.48% |
| COP | CONOCOPHILLIPS | Energy | 3.49% | 2.72% | XRX | XEROX CORP | Tech Hardware & Semi | 0.34% | 0.24% |
| VLO | VALERO ENERGY CORP NEW | Energy | 1.21% | 1.10% | XRTX | XYRATEX LTD | Tech Hardware & Semi | 0.08% | 0.08% |
| GPRE | GREEN PLAINS RENEWABLE ENERG | Energy | 1.19% | 1.19% | AVT | AVNET INC | Tech Hardware & Semi | 0.02% | (0.01%) |
| SUN | SUNOCO INC | Energy | 1.06% | 1.03% | PCCC | P C CONNECTION | Tech Hardware & Semi | 0.02% | 0.02% |
| REX | REX AMERICAN RESOURCES CORP | Energy | 0.11% | 0.10% | | | | | |
| WLP | WELLPOINT INC | Health Care Equipment & Serv | 3.18% | 3.00% | | | | | |
| CAH | CARDINAL HEALTH INC | Health Care Equipment & Serv | 2.95% | 2.85% | | | | | |
| HNT | HEALTH NET INC | Health Care Equipment & Serv | 2.05% | 2.03% | | | | | |

*Source: Deutsche Bank*

## Figure 32: A model portfolio that may benefit from a more significant and permanent VIX/oil shock

| Symbol | Description | Industry | Wgt (%) | Active Wgt (%) | Symbol | Description | Industry | Wgt (%) | Active Wgt (%) |
|---|---|---|---|---|---|---|---|---|---|
| ALV | AUTOLIV INC | Auto & Components | 2.19% | 2.15% | ADPI | AMERICAN DENTAL PARTNERS | Health Care Equipment & Serv | 1.54% | 1.54% |
| LEA | LEAR CORP | Auto & Components | 2.07% | 2.04% | SUNH | SUN HEALTHCARE GROUP INC NEW | Health Care Equipment & Serv | 1.21% | 1.21% |
| F | FORD MTR CO DEL | Auto & Components | 1.05% | 0.68% | UNH | UNITEDHEALTH GROUP INC | Health Care Equipment & Serv | 1.21% | 0.89% |
| TRW | TRW AUTOMOTIVE HLDGS CORP | Auto & Components | 0.83% | 0.80% | UAM | UNIVERSAL AMERICAN CORP | Health Care Equipment & Serv | 1.09% | 1.08% |
| TEN | TENNECO INC | Auto & Components | 0.67% | 0.66% | IVC | INVACARE CORP | Health Care Equipment & Serv | 0.64% | 0.64% |
| TPC | TUTOR PERINI CORPORATION | Capital Goods | 0.89% | 0.88% | OMI | OWENS & MINOR INC NEW | Health Care Equipment & Serv | 0.63% | 0.61% |
| DNB | DUN & BRADSTREET CORP DEL NEW | Commercial & Professional Serv | 1.81% | 1.79% | CVH | COVENTRY HEALTH CARE INC | Health Care Equipment & Serv | 0.26% | 0.23% |
| VSEC | VSE CORP | Commercial & Professional Serv | 0.56% | 0.56% | AHCI | ALLIED HEALTHCARE INTL INC | Health Care Equipment & Serv | 0.23% | 0.23% |
| DLA | DELTA APPAREL INC | Cons Durables & Apparel | 1.09% | 1.09% | BIOS | BIOSCRIP INC | Health Care Equipment & Serv | 0.10% | 0.10% |
| DPZ | DOMINOS PIZZA INC | Consumer Services | 0.73% | 0.72% | PMC | PHARMERICA CORP | Health Care Equipment & Serv | 0.06% | 0.06% |
| JACK | JACK IN THE BOX INC | Consumer Services | 0.57% | 0.56% | KMB | KIMBERLY CLARK CORP | Household & Personal Prod | 2.87% | 2.68% |
| COCO | CORINTHIAN COLLEGES INC | Consumer Services | 0.53% | 0.53% | CENTA | CENTRAL GARDEN & PET CO | Household & Personal Prod | 1.24% | 1.24% |
| LINC | LINCOLN EDL SVCS CORP | Consumer Services | 0.53% | 0.53% | AHL | ASPEN INSURANCE HOLDINGS LTD | Insurance | 0.15% | 0.13% |
| RCL | ROYAL CARIBBEAN CRUISES LTD | Consumer Services | 0.33% | 0.29% | BZ | BOISE INC | Materials | 1.52% | 1.52% |
| RGS | REGIS CORP MINN | Consumer Services | 0.28% | 0.27% | RS | RELIANCE STEEL & ALUMINUM CO | Materials | 1.21% | 1.19% |
| TRK | SPEEDWAY MOTORSPORTS INC | Consumer Services | 0.13% | 0.13% | DTV | DIRECTTV | Media | 1.32% | 1.07% |
| C | CITIGROUP INC | Div Financials & REITs | 3.66% | 3.00% | LLY | ELI LILLY & CO | Pharma, Biotech & Life Sciences | 3.23% | 3.00% |
| PSEC | PROSPECT CAPITAL CORPORATION | Div Financials & REITs | 3.01% | 3.00% | CEPH | CEPHALON INC | Pharma, Biotech & Life Sciences | 1.16% | 1.14% |
| HTS | HATTERAS FINL CORP | Div Financials & REITs | 2.72% | 2.70% | CRTX | CORNERSTONE THERAPEUTICS INC | Pharma, Biotech & Life Sciences | 0.38% | 0.38% |
| GS | GOLDMAN SACHS GROUP INC | Div Financials & REITs | 2.47% | 1.90% | ABT | ABBOTT LABS | Pharma, Biotech & Life Sciences | 0.37% | (0.13%) |
| NNI | NELNET INC | Div Financials & REITs | 2.32% | 2.32% | MRK | MERCK & CO INC | Pharma, Biotech & Life Sciences | 0.26% | (0.41%) |
| BAC | BANK OF AMERICA CORPORATION | Div Financials & REITs | 1.74% | 0.78% | FRX | FOREST LABS INC | Pharma, Biotech & Life Sciences | 0.17% | 0.11% |
| MFA | MFA FINANCIAL INC | Div Financials & REITs | 1.68% | 1.67% | JAZZ | JAZZ PHARMACEUTICALS INC | Pharma, Biotech & Life Sciences | 0.03% | 0.03% |
| ARI | APOLLO COML REAL EST FIN INC | Div Financials & REITs | 1.62% | 1.61% | AZO | AUTOZONE INC | Retailing | 2.09% | 2.04% |
| MS | MORGAN STANLEY | Div Financials & REITs | 1.61% | 1.31% | CORE | CORE MARK HOLDING CO INC | Retailing | 2.07% | 2.07% |
| CXS | CREXUS INVT CORP | Div Financials & REITs | 1.20% | 1.20% | BBY | BEST BUY INC | Retailing | 1.63% | 1.56% |
| JPM | JPMORGAN CHASE & CO | Div Financials & REITs | 0.97% | (0.27%) | SYX | SYSTEMAX INC | Retailing | 1.39% | 1.39% |
| DX | DYNEX CAP INC | Div Financials & REITs | 0.91% | 0.90% | GME | GAMESTOP CORP NEW | Retailing | 1.32% | 1.30% |
| CODI | COMPASS DIVERSIFIED HOLDINGS | Div Financials & REITs | 0.89% | 0.89% | GPI | GROUP 1 AUTOMOTIVE INC | Retailing | 0.58% | 0.57% |
| AEA | ADVANCE AMER CASH ADVANCE CT | Div Financials & REITs | 0.41% | 0.41% | CSC | COMPUTER SCIENCES CORP | Software & Services | 2.74% | 2.70% |
| CIM | CHIMERA INVT CORP | Div Financials & REITs | 0.31% | 0.28% | UNTD | UNITED ONLINE INC | Software & Services | 0.48% | 0.48% |
| COF | CAPITAL ONE FINL CORP | Div Financials & REITs | 0.01% | (0.14%) | IM | INGRAM MICRO INC | Tech Hardware & Semi | 3.02% | 3.00% |
| CVX | CHEVRON CORP NEW | Energy | 3.68% | 2.29% | SNX | SYNNEX CORP | Tech Hardware & Semi | 3.01% | 3.00% |
| COP | CONOCOPHILLIPS | Energy | 1.82% | 1.04% | TECD | TECH DATA CORP | Tech Hardware & Semi | 2.13% | 2.11% |
| GPRE | GREEN PLAINS RENEWABLE ENERG | Energy | 1.11% | 1.11% | XRX | XEROX CORP | Tech Hardware & Semi | 1.05% | 0.95% |
| SUN | SUNOCO INC | Energy | 0.45% | 0.42% | AMKR | AMKOR TECHNOLOGY INC | Tech Hardware & Semi | 0.69% | 0.69% |
| VLO | VALERO ENERGY CORP NEW | Energy | 0.27% | 0.16% | CSCO | CISCO SYS INC | Tech Hardware & Semi | 0.43% | (0.28%) |
| REX | REX AMERICAN RESOURCES CORP | Energy | 0.14% | 0.14% | AVT | AVNET INC | Tech Hardware & Semi | 0.29% | 0.25% |
| WLP | WELLPOINT INC | Health Care Equipment & Serv | 3.18% | 3.00% | XRTX | XYRATEX LTD | Tech Hardware & Semi | 0.28% | 0.27% |
| TFX | TELEFLEX INC | Health Care Equipment & Serv | 1.93% | 1.91% | HPQ | HEWLETT PACKARD CO | Tech Hardware & Semi | 0.15% | (0.49%) |
| CAH | CARDINAL HEALTH INC | Health Care Equipment & Serv | 1.80% | 1.70% | PCCC | P C CONNECTION | Tech Hardware & Semi | 0.04% | 0.04% |
| HNT | HEALTH NET INC | Health Care Equipment & Serv | 1.57% | 1.55% | | | | | |

*Source: Deutsche Bank*

# Bibliography

Alvarez, M., Chen, J., Luo, Y., Cahan, R., and Jussa, J. [2010]. "Correlation and Opportunity", Deutsche Bank Quantitative Strategy, December 2, 2010

Hamilton, J. [1994]. *Time Series Analysis*, Princeton University Press

Luo, Y., Cahan, R., Jussa, J., and Alvarez, M. [2010a]. "QCD Model – DB Quant Handbook", Deutsche Bank Quantitative Strategy, July 22, 2010

Luo, Y., Cahan, R., Jussa, J., and Alvarez, M. [2010b]. "GTAA/Signal Processing – Style Rotation", Deutsche Bank Quantitative Strategy, September 7, 2010

Luo, Y., Cahan, R., Alvarez, M., Jussa, J., and Chen, J. [2010b]. "Robust Factor Models", Deutsche Bank Quantitative Strategy, January 24, 2011

Sims, C.A. [1980]. "Macroeconomics and reality", *Econometrica* 48

# Appendix 1

## Important Disclosures

Additional information available upon request

**For disclosures pertaining to recommendations or estimates made on a security mentioned in this report, please see the most recently published company report or visit our global disclosure look-up page on our website at** http://gm.db.com/ger/disclosure/DisclosureDirectory.egsr**.**

## Analyst Certification

The views expressed in this report accurately reflect the personal views of the undersigned lead analyst(s). In addition, the undersigned lead analyst(s) has not and will not receive any compensation for providing a specific recommendation or view in this report. Yin Luo/Rochester Cahan/Miguel-A Alvarez/Javed Jussa/Zongye Chen

## Hypothetical Disclaimer

Backtested, hypothetical or simulated performance results discussed on page 10 herein and after have inherent limitations. Unlike an actual performance record based on trading actual client portfolios, simulated results are achieved by means of the retroactive application of a backtested model itself designed with the benefit of hindsight. Taking into account historical events the backtesting of performance also differs from actual account performance because an actual investment strategy may be adjusted any time, for any reason, including a response to material, economic or market factors. The backtested performance includes hypothetical results that do not reflect the reinvestment of dividends and other earnings or the deduction of advisory fees, brokerage or other commissions, and any other expenses that a client would have paid or actually paid. No representation is made that any trading strategy or account will or is likely to achieve profits or losses similar to those shown. Alternative modeling techniques or assumptions might produce significantly different results and prove to be more appropriate. Past hypothetical backtest results are neither an indicator nor guarantee of future returns. Actual results will vary, perhaps materially, from the analysis.

# Regulatory Disclosures

## 1. Important Additional Conflict Disclosures

Aside from within this report, important conflict disclosures can also be found at https://gm.db.com/equities under the "Disclosures Lookup" and "Legal" tabs. Investors are strongly encouraged to review this information before investing.

## 2. Short-Term Trade Ideas

Deutsche Bank equity research analysts sometimes have shorter-term trade ideas (known as SOLAR ideas) that are consistent or inconsistent with Deutsche Bank's existing longer term ratings. These trade ideas can be found at the SOLAR link at http://gm.db.com.

## 3. Country-Specific Disclosures

Australia: This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act.
EU countries: Disclosures relating to our obligations under MiFiD can be found at http://globalmarkets.db.com/riskdisclosures.
Japan: Disclosures under the Financial Instruments and Exchange Law: Company name - Deutsche Securities Inc. Registration number - Registered as a financial instruments dealer by the Head of the Kanto Local Finance Bureau (Kinsho) No. 117. Member of associations: JSDA, The Financial Futures Association of Japan. Commissions and risks involved in stock transactions - for stock transactions, we charge stock commissions and consumption tax by multiplying the transaction amount by the commission rate agreed with each customer. Stock transactions can lead to losses as a result of share price fluctuations and other factors. Transactions in foreign stocks can lead to additional losses stemming from foreign exchange fluctuations. "Moody's", "Standard & Poor's", and "Fitch" mentioned in this report are not registered as rating agency in Japan unless specifically indicated as Japan entities of such rating agencies.
New Zealand: This research is not intended for, and should not be given to, "members of the public" within the meaning of the New Zealand Securities Market Act 1988.
Russia: This information, interpretation and opinions submitted herein are not in the context of, and do not constitute, any appraisal or evaluation activity requiring a license in the Russian Federation.

## Deutsche Bank Securities Inc.

### North American location

**Deutsche Bank Securities Inc.**
60 Wall Street
New York, NY 10005
Tel: (212) 250 2500

**Deutsche Bank Securities Inc.**
One International Place
12th Floor
Boston, MA 02110
United States of America
Tel: (1) 617 217 6100

**Deutsche Bank Securities Inc.**
222 South Riverside Plaza
30th Floor
Chicago, IL 60606
Tel: (312) 537-3758

**Deutsche Bank Securities Inc.**
3033 East First Avenue
Suite 303, Third Floor
Denver, CO 80206
Tel: (303) 394 6800

**Deutsche Bank Securities Inc.**
1735 Market Street
24th Floor
Philadelphia, PA 19103
Tel: (215) 854 1546

**Deutsche Bank Securities Inc.**
101 California Street
46th Floor
San Francisco, CA 94111
Tel: (415) 617 2800

**Deutsche Bank Securities Inc.**
700 Louisiana Street
Houston, TX 77002
Tel: (832) 239-4600

### International Locations

**Deutsche Bank Securities Inc.**
60 Wall Street
New York, NY 10005
United States of America
Tel: (1) 212 250 2500

**Deutsche Bank AG London**
1 Great Winchester Street
London EC2N 2EQ
United Kingdom
Tel: (44) 20 7545 8000

**Deutsche Bank AG**
Große Gallusstraße 10-14
60272 Frankfurt am Main
Germany
Tel: (49) 69 910 00

**Deutsche Bank AG**
Deutsche Bank Place
Level 16
Corner of Hunter & Phillip Streets
Sydney, NSW 2000
Australia
Tel: (61) 2 8258 1234

**Deutsche Bank AG**
Filiale Hongkong
International Commerce Centre,
1 Austin Road West,Kowloon,
Hong Kong
Tel: (852) 2203 8888

**Deutsche Securities Inc.**
2-11-1 Nagatacho
Sanno Park Tower
Chiyoda-ku, Tokyo 100-6171
Japan
Tel: (81) 3 5156 6770

## Disclaimer

The information and opinions in this report were prepared by Deutsche Bank AG or one of its affiliates (collectively "Deutsche Bank"). The information herein is believed to be reliable and has been obtained from public sources believed to be reliable. Deutsche Bank makes no representation as to the accuracy or completeness of such information.

Deutsche Bank may engage in securities transactions, on a proprietary basis or otherwise, in a manner **inconsistent** with the view taken in this research report. In addition, others within Deutsche Bank, including strategists and sales staff, may take a view that is **inconsistent** with that taken in this research report.

Opinions, estimates and projections in this report constitute the current judgement of the author as of the date of this report. They do not necessarily reflect the opinions of Deutsche Bank and are subject to change without notice. Deutsche Bank has no obligation to update, modify or amend this report or to otherwise notify a recipient thereof in the event that any opinion, forecast or estimate set forth herein, changes or subsequently becomes inaccurate. Prices and availability of financial instruments are subject to change without notice. This report is provided for informational purposes only. It is not an offer or a solicitation of an offer to buy or sell any financial instruments or to participate in any particular trading strategy. Target prices are inherently imprecise and a product of the analyst judgement.

As a result of Deutsche Bank's recent acquisition of BHF-Bank AG, a security may be covered by more than one analyst within the Deutsche Bank group. Each of these analysts may use differing methodologies to value the security; as a result, the recommendations may differ and the price targets and estimates of each may vary widely.

Deutsche Bank has instituted a new policy whereby analysts may choose not to set or maintain a target price of certain issuers under coverage with a Hold rating. In particular, this will typically occur for "Hold" rated stocks having a market cap smaller than most other companies in its sector or region. We believe that such policy will allow us to make best use of our resources. Please visit our website at http://gm.db.com to determine the target price of any stock.

The financial instruments discussed in this report may not be suitable for all investors and investors must make their own informed investment decisions. Stock transactions can lead to losses as a result of price fluctuations and other factors. If a financial instrument is denominated in a currency other than an investor's currency, a change in exchange rates may adversely affect the investment.

All prices are those current at the end of the previous trading session unless otherwise indicated. Prices are sourced from local exchanges via Reuters, Bloomberg and other vendors. Data is sourced from Deutsche Bank and subject companies.

Past performance is not necessarily indicative of future results. Deutsche Bank may with respect to securities covered by this report, sell to or buy from customers on a principal basis, and consider this report in deciding to trade on a proprietary basis.

Derivative transactions involve numerous risks including, among others, market, counterparty default and illiquidity risk. The appropriateness or otherwise of these products for use by investors is dependent on the investors' own circumstances including their tax position, their regulatory environment and the nature of their other assets and liabilities and as such investors should take expert legal and financial advice before entering into any transaction similar to or inspired by the contents of this publication. Trading in options involves risk and is not suitable for all investors. Prior to buying or selling an option investors must review the "Characteristics and Risks of Standardized Options," at http://www.theocc.com/components/docs/riskstoc.pdf If you are unable to access the website please contact Deutsche Bank AG at +1 (212) 250-7994, for a copy of this important document.

The risk of loss in futures trading, foreign or domestic, can be substantial. As a result of the high degree of leverage obtainable in futures trading, losses may be incurred that are greater than the amount of funds initially deposited.

Unless governing law provides otherwise, all transactions should be executed through the Deutsche Bank entity in the investor's home jurisdiction. In the U.S. this report is approved and/or distributed by Deutsche Bank Securities Inc., a member of the NYSE, the NASD, NFA and SIPC. In Germany this report is approved and/or communicated by Deutsche Bank AG Frankfurt authorized by the BaFin. In the United Kingdom this report is approved and/or communicated by Deutsche Bank AG London, a member of the London Stock Exchange and regulated by the Financial Services Authority for the conduct of investment business in the UK and authorized by the BaFin. This report is distributed in Hong Kong by Deutsche Bank AG, Hong Kong Branch, in Korea by Deutsche Securities Korea Co. This report is distributed in Singapore by Deutsche Bank AG, Singapore Branch, and recipients in Singapore of this report are to contact Deutsche Bank AG, Singapore Branch in respect of any matters arising from, or in connection with, this report. Where this report is issued or promulgated in Singapore to a person who is not an accredited investor, expert investor or institutional investor (as defined in the applicable Singapore laws and regulations), Deutsche Bank AG, Singapore Branch accepts legal responsibility to such person for the contents of this report. In Japan this report is approved and/or distributed by Deutsche Securities Inc. The information contained in this report does not constitute the provision of investment advice. In Australia, retail clients should obtain a copy of a Product Disclosure Statement (PDS) relating to any financial product referred to in this report and consider the PDS before making any decision about whether to acquire the product. Deutsche Bank AG Johannesburg is incorporated in the Federal Republic of Germany (Branch Register Number in South Africa: 1998/003298/10). Additional information relative to securities, other financial products or issuers discussed in this report is available upon request. This report may not be reproduced, distributed or published by any person for any purpose without Deutsche Bank's prior written consent. Please cite source when quoting. 