Global Macro Strategy
Focusing the Credit Lens on the US Economy

Strategy

Global

Stephen Caprio, CFA
Strategist
stephen.caprio@ubs.com
+1-203-719 6032

Matthew Mish, CFA
Strategist
matthew.mish@ubs.com
+1-203-719 1242

Investors should heed corporate credit trends

Our recent report on the tightness in non-bank corporate credit standards has prompted numerous follow-up questions from investors. At their core, the questions center on the aggregate economic implications of such a deterioration. Empirically, there has been a strong link between changes in corporate credit growth and overall US output, and that may be particularly amplified in this cycle. As households have de-levered post-crisis, US corporates have re-levered to near record highs, providing a key risk for macro investors to monitor. In addition, standard business cycle gauges, such as the output gap, may not be capturing growth risks fully this time, as a corporate re-leveraging cycle fuelled by financial engineering continues.

We introduce a credit-based gauge to assess US recession risks

We attempt to quantify the impact of corporate credit trends on US recession probabilities by isolating those credit variables that consistently turn in late cycle environments. This is done in a complementary fashion to research done by our US economics team. We find that changes in corporate leverage, interest coverage, bank NPLs and the Fed SLOS survey (C&I loans to small firms) have historically provided useful gauges of recession risks for investors. Our work suggests that the probability of a US recession from Q2'15-Q2'16 is 15%. This is slightly higher than much of the post-crisis period, due to an increase in corporate leverage.

Credit is not forecasting a 2016 recession

While our credit gauge is forecasting an uptick in recession probabilities, the overall likelihood still remains well below levels (~50%) seen prior to past recessions, and is only at levels consistent with what typical metrics would imply for this stage of the business cycle. This is consistent with the views of our US Economics team that no recession is likely in 2016. We think probabilities may remain elevated, especially if bank lending conditions do tighten in response to recent market volatility. Still, this would not be enough on its own to signal an imminent risk. Corporate interest coverage remains strong and is a key area to watch. While US high-yield funding costs have risen in recent months, the much larger investment grade universe is maintaining the benefits of low interest rates, as Treasury yields have fallen and debt loads have been termed out.

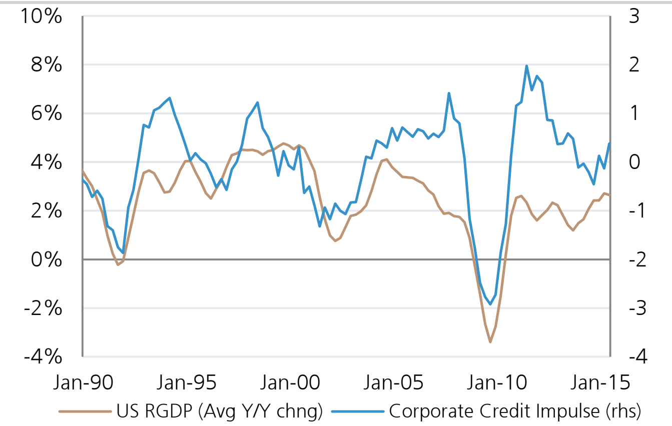
Our recent report on the emerging tightness in non-bank corporate credit standards has prompted numerous follow-up questions from investors[1]. At their core, the questions center on the aggregate economic implications of such a deterioration. Many have asked if the worsening trend in non-bank conditions is enough to signal a near-term US recession, particularly in the context of recent disappointing US growth data. In this piece, we introduce a credit-based gauge to assess US recession risks, in a complementary manner to those methods used by our economists. In our view, we come to two main conclusions:

1) Our credit gauge suggests that the chance of a 2016 US recession has ticked higher vs. post-crisis lows, given aggressive corporate re-leveraging and the expected flow-through of recent deterioration in non-bank lending standards.

2) With that said, our credit gauge does not suggest a 2016 US recession is likely. Overall probabilities remain well below levels that have signalled imminent danger in the past, as interest coverage remains solid and bank NPLs continue to head lower.

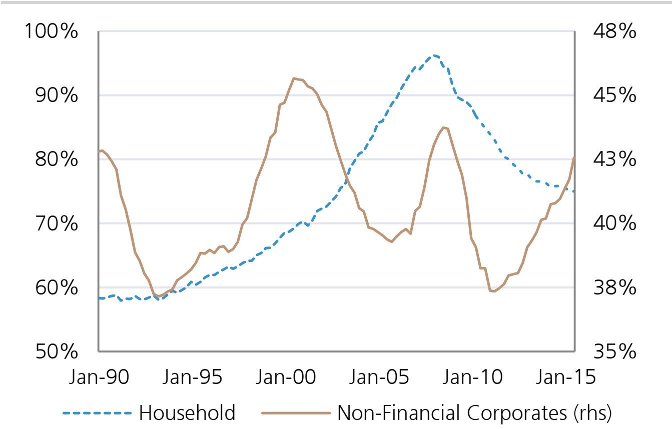
Taking a step back, why should credit variables be useful in predicting recessions, as opposed to more standard business cycle variables? First, there has historically been a strong link between the US corporate credit impulse (the rate of acceleration in US non-financial corporate credit growth) and overall US real GDP (correlation of 0.64 back to 1990) (Figure 1). There are exceptions, such as in 2007, when corporate re-leveraging was not enough to offset US household de-leveraging amidst a faltering domestic real-estate market. But this cycle should be different. Total US non-financial corporate debt to GDP levels are now near record highs as corporates have re-geared, while the US household sector continues to de-lever (Figure 2). In a sense, *corporate* credit growth has been a major support to the US economy in the post-crisis period. Even when accounting for corporate cash balances by looking at net debt to EBITDA ratios, the re-leveraging is plainly evident (Figure 3). In short, corporates are more likely to provide the leading indication of macro health in this cycle, absent a resurgence in household credit growth.

Figure 1: US Corporate Credit Impulse vs. US RGDP



Source: UBS, Bloomberg, Federal Reserve

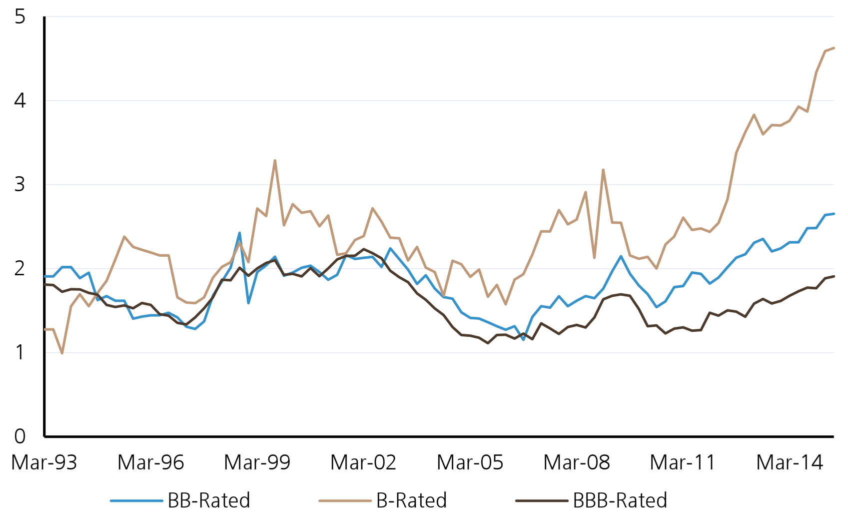
Figure 2: US Household vs. Corporate Debt % PGDP



Source: UBS, Bloomberg, Federal Reserve

[1] Credit Cycle Turning? Non-Bank Liquidity Hits Multi-Year Lows, S. Caprio, October 8, 2015

Figure 3: US Corporate Median Net Debt to EBITDA



Source: UBS, Worldscope

Second, there is sufficient academic research that links the corporate credit cycle with overall economic output. In particular, Stein (2015) demonstrates a clear link between frothy credit market sentiment (strong issuance at tight spreads) with declining net issuance 2 years later, and a drop in economic activity 2-4 years later[2]. Today, we are starting to see the decline in issuance phase play out. 2015 HY net issuance through Q3 ($19bn) is down considerably from 2012-2014 levels at the same point in the calendar ($100-160bn). Ex-energy, the drop-off is still very much evident (Figure 4). This is not just a commodities story. And as we discussed at length in our prior piece[3], the drop in net issuance is particularly stark among B-rated and lower issuers.

Figure 4: US HY Net Issuance (Q1-Q3), Total vs. Ex-Energy, ($bn)

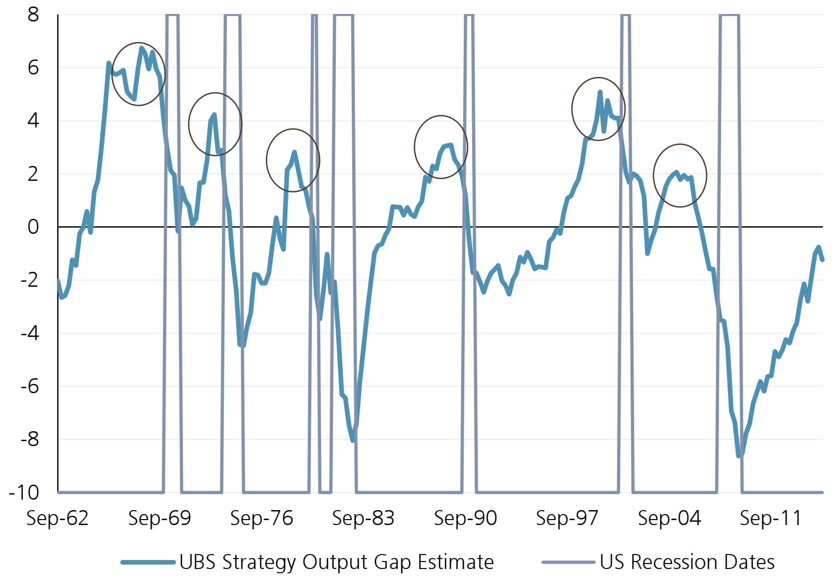
Date	Total	Ex-Energy
2015	19.0	8.2
2014	101.9	62.1
2013	159.5	133.2
2012	125.8	96.3

Source: UBS, Bloomberg

Lastly, there is a risk that this credit cycle evolves in a different manner from historical norms. Typically, the credit cycle evolves with the business cycle, and hence estimated measures of economic slack can often provide useful guides to where the credit cycle may head. For example, our estimate for the US output gap has been a solid leading indicator of future recessions roughly 2-3 years out, with values of +2 or higher signifying heightened risk (Figure 5).

[2] Credit-market sentiment and the Business Cycle, D. Lopez-Salido, J. Stein, E. Zakrajsek, 2015
[3] Credit Cycle Turning? Non-Bank Liquidity Hits Multi-Year Lows, S. Caprio, October 8, 2015

Figure 5: US Output Gap vs. Recessions

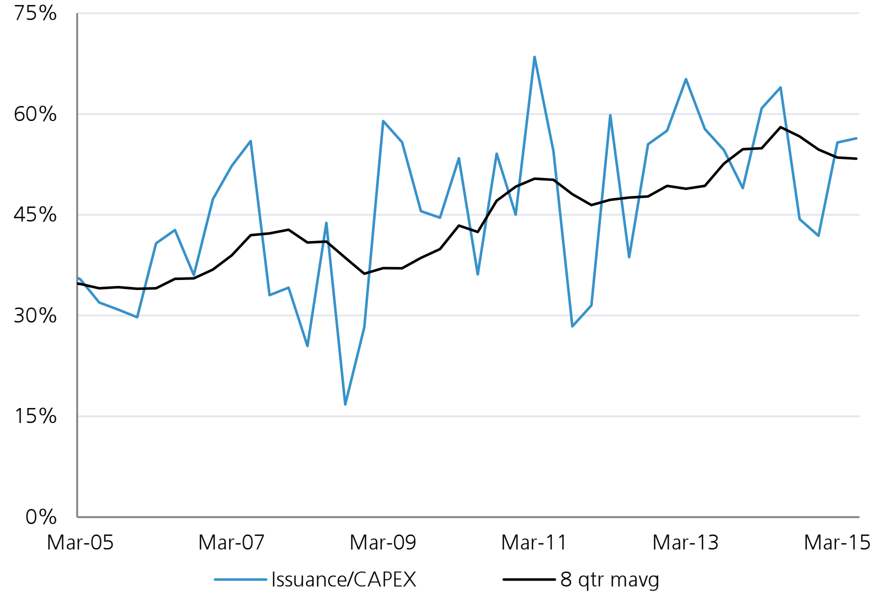


Source: UBS, Bloomberg

An economy with little slack can set in motion the latter phases of the corporate re-leveraging process, as companies borrow more and hire more to meet increased demand, pushing up interest rates and wages. Along with tighter Fed policy, this helps to compress profit margins, weaken earnings, and ultimately increase leverage and default risks.

Today's output gap of -1.2 would seem to suggest the business cycle has a fair amount of runway left before reaching more dangerous levels. But does this necessarily imply the credit cycle will stay well-anchored? We have our concerns. Our most pressing concern is the extent to which this credit cycle has been driven by financial engineering, through share buybacks and M&A activity, rather than real economic capex. The amount of corporate bond and loan issuance relative to capex (56%) is running at levels significantly higher than during the mid-2000s (mid 30% range, Figure 6). Hence we worry that this credit cycle has the potential to run ahead of economic fundamentals, in a break from past cycles and how the normal re-leveraging process works.

Figure 6: Total US Issuance (Bonds + Loans) Relative to Capex



Source: UBS, Bloomberg, Haver, S&P LCD

Given that we believe credit provides a unique lens to view US recession risks, is there a way to quantify this? We set out to do this by trying to construct a credit gauge that ideally leads US recessions by up to one year, but at worst at least signals periods coincident with US recessions. (This is still useful information for investors, given that recession dates are only known ex-post). The credit concepts we test include non-financial leverage, non-financial interest coverage, BBB credit spreads, HY default rates, the Fed Senior Loan Officer Survey for C&I Loans to Small Firms, and Bank NPLs. We chose these concepts based on their fundamental importance to the credit cycle and their long back-history, which allows us to test the robustness of these variables across multiple cycles (back to the 1960s in most cases). The appendix of this piece lists our data sources and methodology in more detail.

On this note, we find four key credit concepts that have been reliable indicators of past US recessions.

1) Rising Corporate Leverage

2) Deteriorating Interest Coverage

3) Bank Lending Standards Tightening for C&I Loans to Small Firms

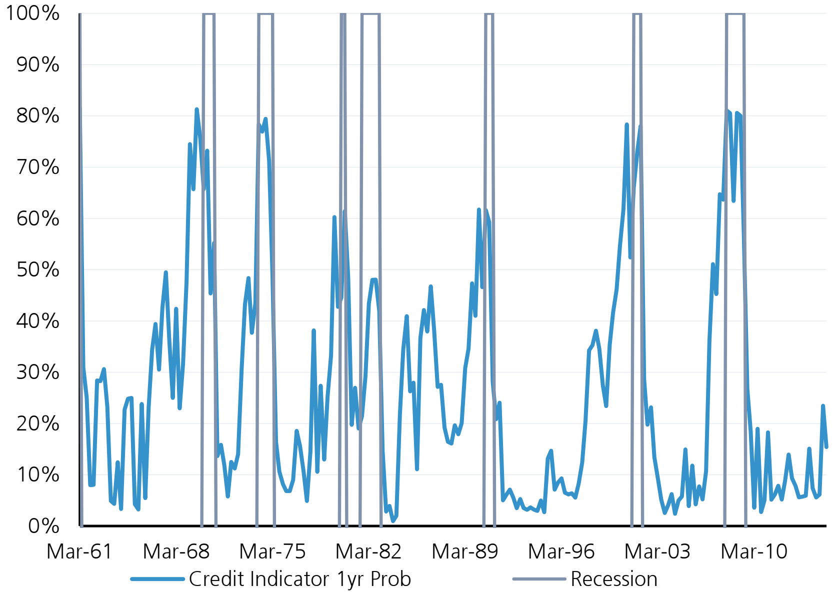
4) Rising Bank NPLs

It is most interesting to note that all variables selected were change variables (remember that SLOS levels are actually a change concept); levels were not especially powerful in helping to predict business cycle turns. In addition, BBB credit spreads were not significant, which is surprising at first glance. However, this finding is backed by academic research such as Gilchrist (2011) and Levanon (2011), which find that widening credit spreads are not a great predictor of future

US recessions[4,5]. Gilchrist (2011) does find that excess credit spreads (i.e., the additional spread compensation above that required for expected defaults) lead significant declines in economic activity, but we do not have enough historical data to test this concept in our view.

Our credit gauge recession probability forecast over time is shown in Figure 7. This indicator illustrates the credit-based probability of being in a recession now or within 1 year at any date. Currently, our indicator suggests a 15% probability of being in a recession between Q2'15-Q2'16, though this number was at 25% in Q1. This probability is the highest in the post-crisis period, and also above that seen in the mid-1990s and mid-2000s (7-10%). Hence, credit variables suggest the recent up-tick in investor recession inquiries is warranted to some extent.

Figure 7: Credit Recession Gauge (Q2'15-Q2'16)



Source: UBS, Bloomberg

But much more importantly, we are still far below warning levels that a recession is imminent, given the information we have today. The unconditional probability of being within one year of a recession is 19% back to 1983 and 27% back to 1961. Hence, while our credit gauge is detailing a *relative* increase in risk from low levels, the *absolute* risk is far from elevated. In particular, our indicator has typically reached the 50% level before US recessions have occurred (Figure 8). This level has a consistent track record, providing a leading signal for every recession, except Sept 1981, while also highlighting elevated risks in the mid-1980s and 1997-1998 that our economists believe were legitimate risks. Our indicator also compares favorably to other widely used leading indicators, such as changes in the S&P 500 and the Conference Board's Leading Economic Index (Figures 9 & 10).

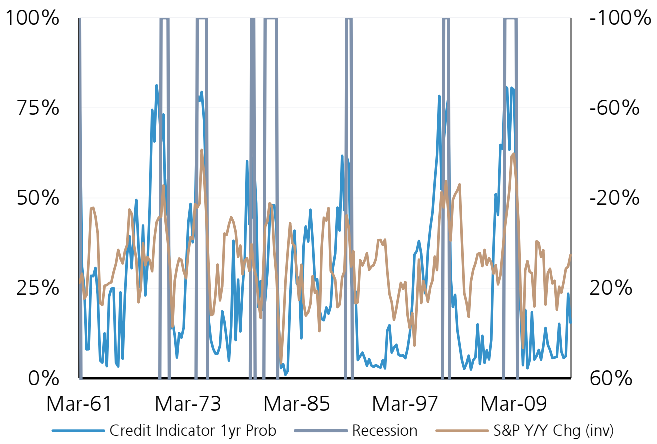
[4] Credit spreads and business cycle fluctuations, S. Gilchrist and E. Zakrajsek, May 2011
[5] Using a Leading Credit Index to Predict Turning Points in the US Business Cycle, Dec 2011

Figure 8: Indicator Warning Levels and Subsequent Recession Start Dates

Indicator Near 50% Threshold	Indicator Probability	Recession Starts
Jun-1967	49%	33 months later
Dec-1968	48%	15 months later
Jun-1973	48%	9 months later
Sept-1979	60%	6 months later
Sept-1986	47%	48 months later
Sept-1989	47%	12 months later
Jun-2000	55%	12 months later
Mar-2007	51%	12 months later

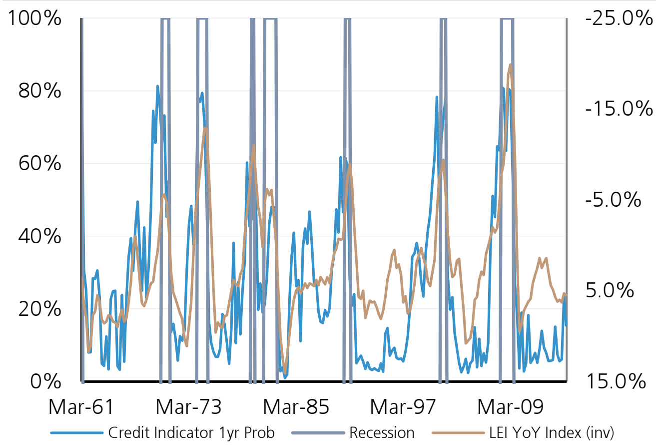
Source: UBS, Bloomberg

Figure 9: Credit Recession Gauge vs. S&P 500 Y/Y Chg



Source: UBS, Bloomberg

Figure 10: Credit Recession Gauge vs. Conf Board Leading Econ Index (Y/Y Chg)



Source: UBS, Bloomberg

Could credit signal a different story as we obtain more data in 2015? The individual signals behind our current estimate provide a starting point (Figure 11). For most variables, recession probabilities are very subdued. However, it must be noted that corporate re-leveraging is occurring at a fast and furious pace, in a similar manner to prior dangerous periods for the US economy. On US corporate bank lending standards (SLOS), we do expect this probability to tick up given recent market volatility and tightness in non-bank corporate lending standards. However, even if US banks were to tighten aggressively as per our non-bank proxy suggests (13.8% of banks tightening), this would only take aggregate recession risks into the 20-25% range per our credit gauge.

Figure 11: Credit Gauge Recession Probabilities (Q2'15-Q2'16) By Indicator

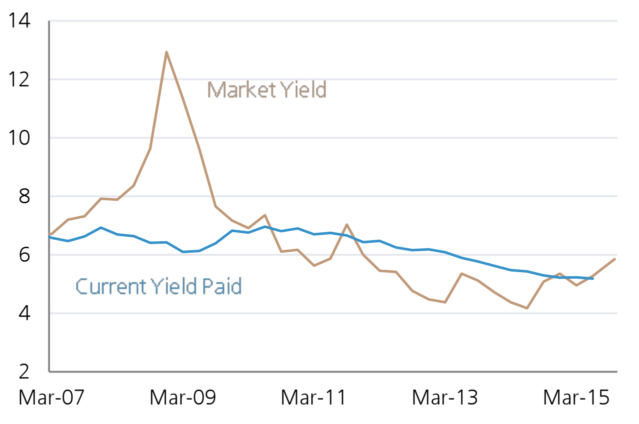
Non-Financial Leverage (Chng)	Interest Coverage (Chng)	Bank NPLs (Chng)	SLOS
50%	2%	0%	10%

Source: UBS

In our view, it would take a deterioration in interest coverage ratios, from both weaker earnings and higher interest rates, to become more concerned. To be clear, this is starting to play out for US high-yield firms as current market rates have surged beyond that currently paid by most HY firms on prior borrowings (Figures 12 & 13). But the HY universe is only 20% of the total corporate bond market; it won't be enough to tip the scale from a broader economy point of view. We

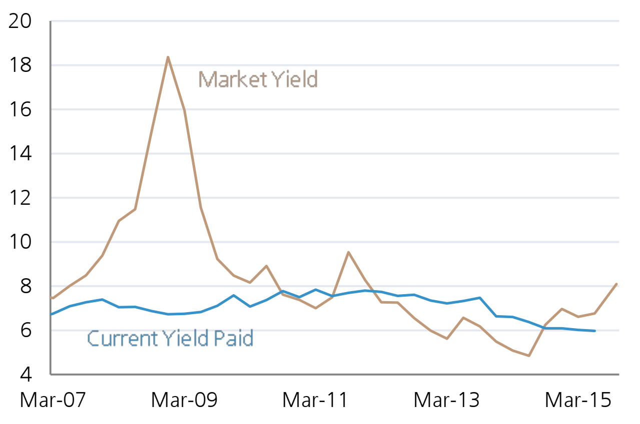
would need to see some spillover to investment-grade firms, and while this has occurred in recent weeks, the increase has been far less subdued due to falling longer term Treasury yields and more termed out maturities (Figure 14). In sum, we do believe that recent corporate credit trends are an important US growth risk for investors to monitor. However, there is a higher bar to meet to extrapolate that potential downside risk to US growth into outright recessionary conditions. Based on the information we have today, our credit gauge is suggesting that a 2016 US recession is unlikely.

Figure 12: Current Yield Paid vs. Market Yield: BB Credits



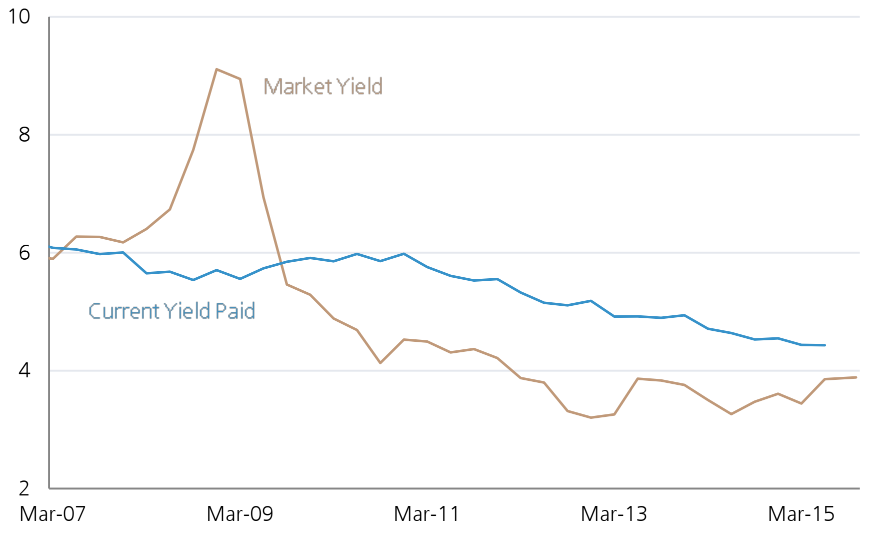
Source: UBS, Worldscope, Yieldbook

Figure 13: Current Yield Paid vs. Market Yield: B Credits



Source: UBS, Worldscope, Yieldbook

Figure 14: Current Yield Paid vs. Market Yield: BBB Credits



Source: UBS, Worldscope, Yieldbook

Appendix

The general methodology behind the construction of our credit-based recession probability forecast was to build an early warning signal that highlighted rising recession risks given the divergence between credit and economic/interest rate cycles. We use recession dates per the NBER, where recessionary quarters are defined as having a minimum of at least 2 out of 3 months in a recession. We test below both variable levels and changes, where changes = current value – average of prior 4 quarters. This is done to better capture trends in the underlying time series.

We then calculate the average value of each variable below within 1 year of a US recession. We compare the conditional probability of that average being within 1 year of a recession start date, including being in a recession itself, to the unconditional probability for each variable. We chose this method to find variables that consistently either lead recessions, or at worst, provide a coincident signal that a recession is occurring.

Because we cannot directly take the conditional probability of a continuous variable, we use intervals surrounding the average that encompass roughly 10% of the distribution as a proxy (though other measures such as medians or larger distributions of up to 20% around the average do not change the results in any meaningful sense). The results for each variable (both levels and changes) are below. The variables selected are the ones with the greatest signal of a near-term recession risk, with conditional probabilities more than 20% above unconditional probabilities. (The only reason for variation in unconditional probabilities is the different time series history for each variable). The aggregate signal finally constructed is simply the average of the individual conditional probabilities through time.

Figure 15: UBS Credit Variables Tested For Recession Indicator

	Conditional Probability	Unconditional Probability
Interest Coverage (chng)	**57%**	**27%**
Total Bank NPLs (chng)	**50%**	**20%**
Non-Financial Leverage (chng)	**50%**	**27%**
SLOS	**50%**	**30%**
Interest Coverage	41%	28%
Total Bank NPLs	25%	20%
BBB Spreads (chng)	30%	27%
Non-Financial Leverage	30%	28%
BBB Spreads	27%	28%
HY Default Rate (chng)	17%	28%
HY Default Rate (Trailing 12m lvl)	11%	30%

Source: UBS

Data Concepts:

- **US Non-Financial Leverage**: Average leverage of non-financial corporate sector (Nonfinancial Corp Debt/ (US Nonfinancial + Rest of World Corp Profits) (i.e. earnings earned both domestically and abroad)

  Sources: Nonfinancial Corporate Debt - Federal Reserve, Z1 release: Tables D.3, line 1 and US Nonfinancial + Rest of World Corp Profits - Bureau of Economic Analysis: Table 6.16D lines 4 and 5).

- **US Non-Financial Interest Coverage:** (US Nonfinancial Profits + US Nonfinancial Consumption of Fixed Capital + US Nonfinancial Net Interest & Misc Payments)/ US Nonfinancial Net Interest & Misc Payments

  *Source: Haver Tickers: a) **YCPDN@USNA** - Nonfinancial Corporate Business: Profits with IVA & CCAdj (SAAR,Bil.$); b) **BNALO@USNA** - Nonfinancial Corp Business: Consumption of Fixed Capital (SAAR, Bil.$); c) **BNNI@USNA** - Nonfinancial Corporate Business: Net Interest & Misc Payments (SAAR, Bil.$)*

- **US Bank NPLs:** Nonperforming loans (past due 90+ days plus nonaccrual) to total loans for all US Banks

  Source: FDIC, Federal Reserve of St. Louis (FRED) Ticker: USNPTL Index

- **Fed Senior Loan Officer Survey**: Senior Loan Officer Survey of 60 large domestic US banks and 24 US branches and agencies of foreign banks. We have used the net percentage of banks tightening standards for commercial and industrial loans to small firms. Note: Since 1990 banks have been asked about "standards to approve commercial and industrial loans or credit lines" to firms according to size. By contrast, from 1978 to 1983, banks were asked about "standards to qualify for the prime rate," and between 1967 and 1977, about "standards for loans to nonfinancial businesses." The questions asked between 1978 and 1983 were considerably more narrow than the earlier, more general standards question. From 1984 through 1989 this question was not asked in any manner.

  Source: Federal Reserve, Bloomberg Ticker: SLDETGTS Index

- **BBB Spreads:** 30yr BBB Spreads

  Source: Moody's until Jan-2013, Citi BBB Index thereafter

- **HY Default Rate**: Trailing 12m HY Default Rate (issuer-weighted)

  Source: Moody's

We would like to thank Pavan Komanduru, Sridhar Sure, and Bunny Badal employees of Cognizant Group, for their assistance in preparing this research report. Cognizant staff provides research support services to UBS.

Statement of Risk

Risks of multi-asset investing include but are not limited to market risk, credit risk, interest rate risk, and foreign exchange risk. Correlations of returns among different asset classes may deviate from historical patterns. Geopolitical events and policy shocks pose risks that can reduce asset returns. Valuations may be adversely affected during times of high market volatility, thin liquidity, and economic dislocation.

Required Disclosures

This report has been prepared by UBS Securities LLC, an affiliate of UBS AG. UBS AG, its subsidiaries, branches and affiliates are referred to herein as UBS.

For information on the ways in which UBS manages conflicts and maintains independence of its research product; historical performance information; and certain additional disclosures concerning UBS research recommendations, please visit www.ubs.com/disclosures. The figures contained in performance charts refer to the past; past performance is not a reliable indicator of future results. Additional information will be made available upon request. UBS Securities Co. Limited is licensed to conduct securities investment consultancy businesses by the China Securities Regulatory Commission.

Analyst Certification: Each research analyst primarily responsible for the content of this research report, in whole or in part, certifies that with respect to each security or issuer that the analyst covered in this report: (1) all of the views expressed accurately reflect his or her personal views about those securities or issuers and were prepared in an independent manner, including with respect to UBS, and (2) no part of his or her compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed by that research analyst in the research report.

UBS Investment Research: Global Equity Rating Definitions

12-Month Rating	Definition	Coverage[1]	IB Services[2]
Buy	FSR is > 6% above the MRA.	49%	33%
Neutral	FSR is between -6% and 6% of the MRA.	40%	26%
Sell	FSR is > 6% below the MRA.	12%	18%
Short-Term Rating	**Definition**	**Coverage[3]**	**IB Services[4]**
Buy	Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.	less than 1%	less than 1%
Sell	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	less than 1%	less than 1%

Source: UBS. Rating allocations are as of 30 September 2015.
1:Percentage of companies under coverage globally within the 12-month rating category. 2:Percentage of companies within the 12-month rating category for which investment banking (IB) services were provided within the past 12 months.
3:Percentage of companies under coverage globally within the Short-Term rating category. 4:Percentage of companies within the Short-Term rating category for which investment banking (IB) services were provided within the past 12 months.

KEY DEFINITIONS: Forecast Stock Return (FSR) is defined as expected percentage price appreciation plus gross dividend yield over the next 12 months. **Market Return Assumption (MRA)** is defined as the one-year local market interest rate plus 5% (a proxy for, and not a forecast of, the equity risk premium). **Under Review (UR)** Stocks may be flagged as UR by the analyst, indicating that the stock's price target and/or rating are subject to possible change in the near term, usually in response to an event that may affect the investment case or valuation. **Short-Term Ratings** reflect the expected near-term (up to three months) performance of the stock and do not reflect any change in the fundamental view or investment case. **Equity Price Targets** have an investment horizon of 12 months.

EXCEPTIONS AND SPECIAL CASES: UK and European Investment Fund ratings and definitions are: Buy: Positive on factors such as structure, management, performance record, discount; **Neutral:** Neutral on factors such as structure, management, performance record, discount; **Sell:** Negative on factors such as structure, management, performance record, discount. **Core Banding Exceptions (CBE):** Exceptions to the standard +/-6% bands may be granted by the Investment Review Committee (IRC). Factors considered by the IRC include the stock's volatility and the credit spread of the respective company's debt. As a result, stocks deemed to be very high or low risk may be subject to higher or lower bands as they relate to the rating. When such exceptions apply, they will be identified in the Company Disclosures table in the relevant research piece.

Unless otherwise indicated, please refer to the Valuation and Risk sections within the body of this report.

Global Disclaimer

This document has been prepared by UBS Securities LLC, an affiliate of UBS AG. UBS AG, its subsidiaries, branches and affiliates are referred to herein as UBS.

Global Research is provided to our clients through UBS Neo, the UBS Client Portal and UBS.com (each a "System"). It may also be made available through third party vendors and distributed by UBS and/or third parties via e-mail or alternative electronic means. The level and types of services provided by Global Research to a client may vary depending upon various factors such as a client's individual preferences as to the frequency and manner of receiving communications, a client's risk profile and investment focus and perspective (e.g. market wide, sector specific, long-term, short-term, etc.), the size and scope of the overall client relationship with UBS and legal and regulatory constraints.

When you receive Global Research through a System, your access and/or use of such Global Research is subject to this Global Research Disclaimer and to the terms of use governing the applicable System.

When you receive Global Research via a third party vendor, e-mail or other electronic means, your use shall be subject to this Global Research Disclaimer and to UBS's Terms of Use/Disclaimer (http://www.ubs.com/global/en/legalinfo2/disclaimer.html). By accessing and/or using Global Research in this manner, you are indicating that you have read and agree to be bound by our Terms of Use/Disclaimer. In addition, you consent to UBS processing your personal data and using cookies in accordance with our Privacy Statement (http://www.ubs.com/global/en/legalinfo2/privacy.html) and cookie notice (http://www.ubs.com/global/en/homepage/cookies/cookie-management.html).

If you receive Global Research, whether through a System or by any other means, you agree that you shall not copy, revise, amend, create a derivative work, transfer to any third party, or in any way commercially exploit any UBS research provided via Global Research or otherwise, and that you shall not extract data from any research or estimates provided to you via Global Research or otherwise, without the prior written consent of UBS.

For access to all available Global Research on UBS Neo and the Client Portal, please contact your UBS sales representative.

This document is for distribution only as may be permitted by law. It is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation or would subject UBS to any registration or licensing requirement within such jurisdiction. It is published solely for information purposes; it is not an advertisement nor is it a solicitation or an offer to buy or sell any financial instruments or to participate in any particular trading strategy. No representation or warranty, either expressed or implied, is provided in relation to the accuracy, completeness or reliability of the information contained in this document ('the Information'), except with respect to Information concerning UBS. The Information is not intended to be a complete statement or summary of the securities, markets or developments referred to in the document. UBS does not undertake to update or keep current the Information. Any opinions expressed in this document may change without notice and may differ or be contrary to opinions expressed by other business areas or groups of UBS. Any statements contained in this report attributed to a third party represent UBS's interpretation of the data, information and/or opinions provided by that third party either publicly or through a subscription service, and such use and interpretation have not been reviewed by the third party.

Nothing in this document constitutes a representation that any investment strategy or recommendation is suitable or appropriate to an investor's individual circumstances or otherwise constitutes a personal recommendation. Investments involve risks, and investors should exercise prudence and their own judgement in making their investment decisions. The financial instruments described in the document may not be eligible for sale in all jurisdictions or to certain categories of investors. Options, derivative products and futures are not suitable for all investors, and trading in these instruments is considered risky. Mortgage and asset-backed securities may involve a high degree of risk and may be highly volatile in response to fluctuations in interest rates or other market conditions. Foreign currency rates of exchange may adversely affect the value, price or income of any security or related instrument referred to in the document. For investment advice, trade execution or other enquiries, clients should contact their local sales representative.

The value of any investment or income may go down as well as up, and investors may not get back the full (or any) amount invested. Past performance is not necessarily a guide to future performance. Neither UBS nor any of its directors, employees or agents accepts any liability for any loss (including investment loss) or damage arising out of the use of all or any of the Information.

Any prices stated in this document are for information purposes only and do not represent valuations for individual securities or other financial instruments. There is no representation that any transaction can or could have been effected at those prices, and any prices do not necessarily reflect UBS's internal books and records or theoretical model-based valuations and may be based on certain assumptions. Different assumptions by UBS or any other source may yield substantially different results.

This document and the Information are produced by UBS as part of its research function and are provided to you solely for general background information. UBS has no regard to the specific investment objectives, financial situation or particular needs of any specific recipient. In no circumstances may this document or any of the Information be used for any of the following purposes:

(i) valuation or accounting purposes;

(ii) to determine the amounts due or payable, the price or the value of any financial instrument or financial contract; or

(iii) to measure the performance of any financial instrument.

By receiving this document and the Information you will be deemed to represent and warrant to UBS that you will not use this document or any of the Information for any of the above purposes or otherwise rely upon this document or any of the Information.

Research will initiate, update and cease coverage solely at the discretion of UBS Investment Bank Research Management. The analysis contained in this document is based on numerous assumptions. Different assumptions could result in materially different results. The analyst(s) responsible for the preparation of this document may interact with trading desk personnel, sales personnel and other parties for the purpose of gathering, applying and interpreting market information. UBS relies on information barriers to control the flow of information contained in one or more areas within UBS into other areas, units, groups or affiliates of UBS. The compensation of the analyst who prepared this document is determined exclusively by research management and senior management (not including investment banking). Analyst compensation is not based on investment banking revenues; however, compensation may relate to the revenues of UBS Investment Bank as a whole, of which investment banking, sales and trading are a part.

For financial instruments admitted to trading on an EU regulated market: UBS AG, its affiliates or subsidiaries (excluding UBS Securities LLC) acts as a market maker or liquidity provider (in accordance with the interpretation of these terms in the UK) in the financial instruments of the issuer save that where the activity of liquidity provider is carried out in accordance with the definition given to it by the laws and regulations of any other EU jurisdictions, such information is separately disclosed in this document. For financial instruments admitted to trading on a non-EU regulated market: UBS may act as a market maker save that where this activity is carried out in the US in accordance with the definition given to it by the relevant laws and regulations, such activity will be specifically disclosed in this document. UBS may have issued a warrant the value of which is based on one or more of the financial instruments referred to in the document. UBS and its affiliates and employees may have long or short positions, trade as principal and buy and sell in instruments or derivatives identified herein; such transactions or positions may be inconsistent with the opinions expressed in this document.

United Kingdom and the rest of Europe: Except as otherwise specified herein, this material is distributed by UBS Limited to persons who are eligible counterparties or professional clients. UBS Limited is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. **France:** Prepared by UBS Limited and distributed by UBS Limited and UBS Securities France S.A. UBS Securities France S.A. is regulated by the ACPR (Autorité de Contrôle Prudentiel et de Résolution) and the Autorité des Marchés Financiers (AMF). Where an analyst of UBS Securities France S.A. has contributed to this document, the document is also deemed to have been prepared by UBS Securities France S.A. **Germany:** Prepared by UBS Limited and distributed by UBS Limited and UBS Deutschland AG. UBS Deutschland AG is regulated by the Bundesanstalt fur Finanzdienstleistungsaufsicht (BaFin). **Spain:** Prepared by UBS Limited and distributed by UBS Limited and UBS Securities España SV, SA. UBS Securities España SV, SA is regulated by the Comisión Nacional del Mercado de Valores (CNMV). **Turkey:** Distributed by UBS Limited. No information in this document is provided for the purpose of offering, marketing and sale by any means of any capital market instruments and services in the Republic of Turkey. Therefore, this document may not be considered as an offer made or to be made to residents of the Republic of Turkey. UBS AG is not licensed by the Turkish Capital Market Board under the provisions of the Capital Market Law (Law No. 6362). Accordingly, neither this document nor any other offering material related to the instruments/services may be utilized in connection with providing any capital market services to persons within the Republic of Turkey without the prior approval of the Capital Market Board. However, according to article 15 (d) (ii) of the Decree No. 32, there is no restriction on the purchase or sale of the securities abroad by residents of the Republic of Turkey. **Poland:** Distributed by UBS Limited (spolka z ograniczona odpowiedzialnoscia) Oddzial w Polsce regulated by the Polish Financial Supervision Authority. Where an analyst of UBS Limited (spolka z ograniczona odpowiedzialnoscia) Oddzial w Polsce has contributed to this

UBS