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"Introducing The EMU Financial Conditions Index by UniCredit"

– We have developed a proprietary financial conditions index for the eurozone and major member states.
– Our indicator consists of a total of 56 variables including the trade weighted euro exchange rate, the ECB bank lending survey, interest rates, spreads and asset prices.
– After hitting an (expansionary) all-time high in summer 2015, financial conditions have tightened significantly in recent months, mainly due to renewed euro appreciation.
– Further monetary policy easing will help to make financial conditions more favorable again and support bank lending and investment activity.

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I. Executive Summary

EMU Financial Conditions Index by UniCredit

We have developed a proprietary indicator that reflects overall financial conditions in the eurozone and major member states. The EMU Financial Conditions Index by UniCredit consists of the following key variables as well as further subcomponents: the trade-weighted euro exchange rate, the bank lending survey, interest rates, spreads and asset prices such as share and residential property prices (collateral).

Motivation and backdrop

Since the global financial crisis, loan growth in the overall eurozone and especially in some crisis-countries, notably Spain, have been very subdued (see charts 1 and 2). Tight financial conditions have often been viewed as one of the major obstacles to bank lending and investment activity. Differing conditions among eurozone-crisis countries have led to a strong divergence in recovery with the risk of associated economic and political tensions.

SUBDUED LOAN GROWTH AFTER THE GLOBAL FINANCIAL CRISIS IN EUROPE

Chart 1: Eurozone loans to NFCs and households, yoy growth rate

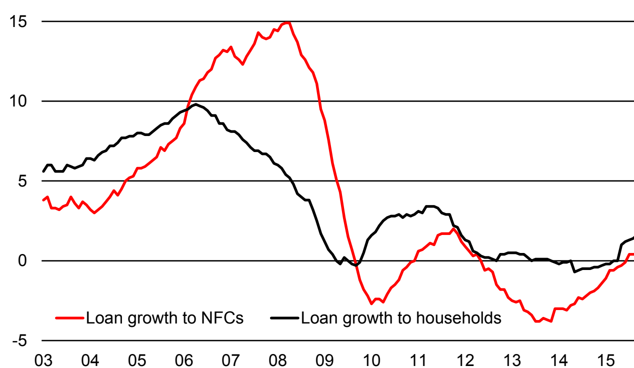
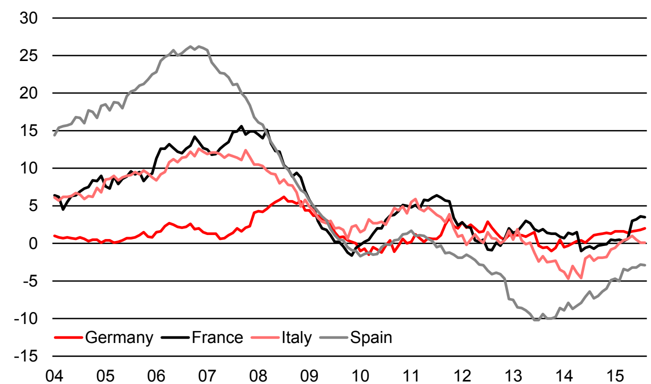


Chart 2: County-specific loans to non-MFIs excluding government, yoy growth rate.



Source: ECB, Bloomberg, UniCredit Research

Major results

Our analysis shows that financial conditions in the eurozone were indeed very tight after the Lehman collapse (2008-09) and during the eurozone debt crisis (2010-12). Since 2014, however, they have become significantly looser and even hit an all-time high this summer. However, in recent months, a renewed marked tightening has kicked in, mainly caused by the appreciating euro exchange rate. Country-specific analysis shows that this pattern holds true for Germany, France, Italy and Spain, albeit to varying degrees.

QE2

Further monetary easing will help to make financial conditions more favorable for companies and private households again after the recent setback. In combination with the ongoing recovery in the eurozone, looser financial conditions will support bank lending and investment activity.

Course of study

In the next section, we present our definition and data selection. In chapter 3, we outline and discuss our eurozone-related findings, followed by country-specific results. Finally, we draw conclusions from the financial conditions index and discuss their impact on ECB policy.

II. Definition and Data Composition

Measuring financial conditions and access to capital

The term financial conditions describes the current state of financial variables influencing the behavior of companies and consumers and, as a result, future economic developments. Financial conditions indices (FCIs) aim to summarize the state of financial conditions in a sector or geographical area by analyzing a broad set of data and condensing it into a single headline figure or a small set of indicators. The broad interpretation is common to most studies: tighter conditions hinder loan activity while looser ones promote it. However, the narrower interpretation varies, based on the specific topic to be discussed (see for instance Angelopoulou et al. 2013 or Paries et al. 2014). There are few indicators that explicitly measure the financial conditions of companies and households in the eurozone as a whole and for the major eurozone countries separately. Our index closes this information gap by providing an indicator that gives some guidance about potential loan growth (in the corporate and household sectors) and ultimately future GDP changes. We have identified five major groups of variables that provide information on financial conditions.[1]

1. Bank lending survey data

Bank lending survey data. This consists of time series taken from the ECB bank lending survey. The bank lending survey is based on a questionnaire regularly sent to European banks in which they are asked about their view on lending-relevant characteristics. These are, for instance, collateral requirements, margin changes, and overall credit conditions. Bank lending survey variables are a natural choice as input variables for our financial conditions index since the most important (re)financing sources for companies (and of course households) are bank loans. Chart 3 depicts the average amount of loans outstanding (of non-financial corporations) in comparison to debt securities issued by non-financial corporations. Chart 4 compares the share of loans in relation to debt securities in the eurozone with the situation in the US. The figures show the importance of bank loans as a source of funding within the euro area. Other sources of corporate financing are not as common in Europe as they are, for example, in the US. Although the share of loan financing has decreased slightly in recent years it is still about four times higher than financing by means of debt securities such as bonds.

IMPORTANCE OF LOANS IN THE EURO AREA

Chart 3: Sources of funding

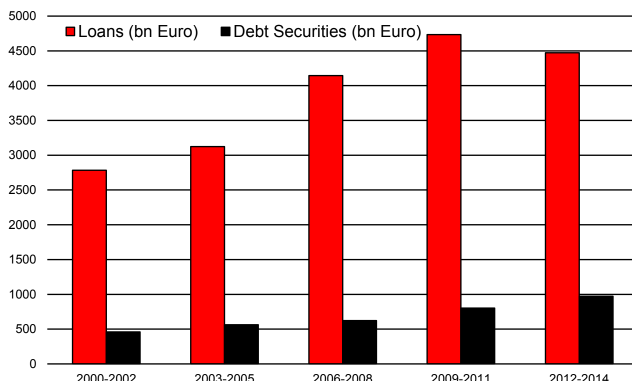
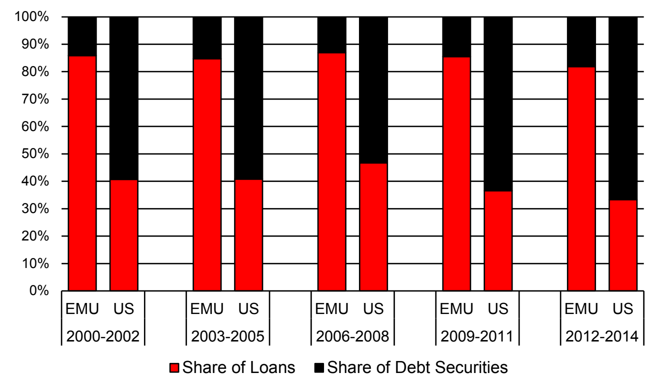


Chart 4: Compared to US



Source: ECB, Federal Reserve Bank of St. Louis, Bloomberg, UniCredit Research

[1] A list of variables used in this study can be found in table A1 of the appendix.

Changes in the conditions for bank loans will therefore have huge consequences for debt financing and financial conditions overall. Additionally, survey data contains the most timely information about fundamental condition changes in this area, since experts in the banking industry will recognize them first. Chart 5 displays the bank lending survey time series for the eurozone aggregate utilized in our euro-area indicator. Note that all variables are used in a way that an increase is associated with easing financial conditions while a decrease signals the opposite.[2] Two properties are directly observable at a glance. All variables of the bank lending survey are highly correlated and a huge downturn associated with the global financial crisis occurred in 2008 in all of the time series used. The implications will be discussed and interpreted in the "Eurozone results" section of this paper in more detail.

BANK LENDING SURVEY AND INTEREST RATES

Chart 5: Bank lending survey data for the eurozone (standardized)

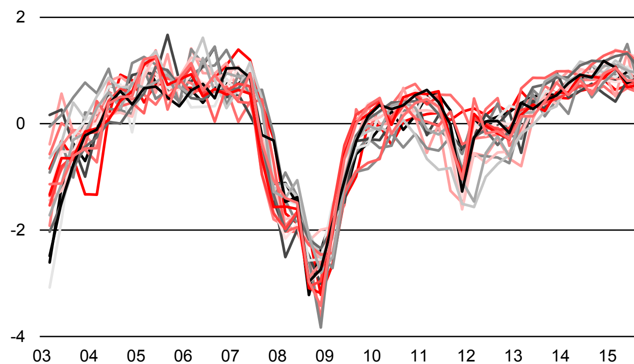
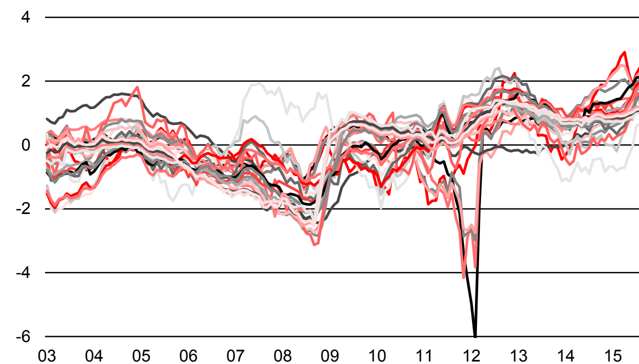


Chart 6: Interest rates for the eurozone aggregate (standardized)



Source: ECB, Bloomberg, UniCredit Research

2. Interest-rate data

Interest rates. In this study we use money-market rates as well as interest rates on credit to and deposits of non-financial corporations (NFCs) and households. Additionally, we work with series on government bond interest rates. The reasoning behind using interest rates in a financial conditions index is straightforward. The lower interest rates are, the more profitable investment opportunities become and vice versa. Therefore, lower interest rates positively affect financial conditions.

Central bank refinancing rates are a core monetary-policy instrument used to reduce or increase financing costs for banks. These normally trickle down to company and household loans, influencing growth activity and ultimately price stability. As measures for bank refinancing costs, Euribor time series with maturities between one week and twelve months are included.

To measure the easing or tightening of interest rates for households and companies, different series for consumption, company, and house-building loan interest rates, as well as for deposit rates, are included.

Additionally, interest-rate series on short, medium and long-term government debt are used. For the eurozone analysis these series are generic and aggregated, combining all eurozone government-bond interest rates. However, the interest to be paid by different governments has varied dramatically, especially at the peak of the eurozone crisis. Therefore it is crucial to conduct a country-specific analysis as well.

[2] We have changed the sign in the bank lending survey, interest rate and spread series. Usually an increase in interest rate, bank lending and spread series indicates tightening financial conditions. We have changed the sign in these series so that they are now positively defined, meaning that an increase signals easing financial conditions. Additionally, note that all data is standardized, i.e. de-meaned and divided by the standard deviation of the respective series. This procedure makes it possible to compare time series of different scaling, which is necessary for our later calculations.

All interest-rate series used are in real terms, i.e. we have applied three-month moving-average core-CPI data to deduct the inflation rate from the nominal interest rate series. This ensures that we are measuring real changes in the cost of financing.

Chart 6 shows the development of the eurozone interest rate series over time. Note that the time series are again standardized and their signs reversed so that more positive values indicate lower interest rates and vice versa. One can observe overall strong co-movements in the series, with the exception of a major outlier in 2Y government debt interest rates during the 2011/12 peak of the eurozone debt crisis. However, this is not a problem in our analysis, since single outliers do not have a significant impact on the index when PCA is used.

3. Spread data

Spreads. These consist of loan-to-deposit spreads. Loan-to-deposit spreads are interest rates for loans to households and companies minus interest rates on deposits. Higher loan-to-deposit spreads indicate higher risk premiums demanded by banks and higher credit financing costs, i.e. tighter financial conditions. It can be interpreted as a distress indicator for the banking system as well, measuring the overall willingness to provide loans compared to the payment for deposits. Note that spreads are reversely defined as well since an increase in spreads is an indicator of worsening financial conditions.

4. Asset data

Assets. These consist of asset price series, i.e. annual stock price growth rates, measured by the respective benchmarking index (i.e. Euro Stoxx 50 for the eurozone) and market capitalization, as well as real estate indices (residential property price index for the eurozone). Assets can be used as collateral in refinancing operations and rising asset prices automatically increase the nominal amount that can be used as collateral, easing credit refinancing and therefore financial conditions.

5. Exchange rates

Exchange rates. These consist of only one rate per calculated financial conditions index, namely the real effective exchange rate. It is already an aggregated measure since it is an average of the individual exchange rates of a particular country weighted by the importance of each partner country’s share of trade. A decrease in the exchange rate can be interpreted as a windfall gain in the competitiveness of export goods, making investment decisions of exporting companies more promising, leading to easier credit approval.

Quantities for benchmarking purposes

As a benchmark, we used quantities, i.e. loan growth to households and NFCs. Note that the time series of this category is not included as explaining variables since quantities can be seen as intermediate or endogenous. Subdued credit financing growth rates (especially in eurozone periphery countries) are watched by policymakers in order to assess possible recovery potential in the near future. They either front-run investment-driven growth acceleration or follow a pickup in GDP growth. This occurs if spare capacity is decreasing and companies see room for further sales growth in the future, which leads to a reacceleration of recovery. Either way, loan growth is affected by the access of companies and households to credit and financial conditions in general. Therefore, we do not use it as part of our index but rather for benchmarking purposes.

Loan growth rates for the eurozone (charts 1 and 2) have been subdued since the onset of the financial crisis. Low and even negative growth rates may have been an essential trigger for the ECB launching its QE program. This proposal, its implications and whether the program can help tackle the issue of low credit growth will be discussed in the “Eurozone results” section.

III. The Eurozone Financial Conditions Index by UniCredit

Index construction

Index construction

Our Index is constructed as a weighted average of the subgroup indices, which are calculated using principal component analysis (PCA). PCA is basically a variable reduction method that extracts the common fundamental movement/factor from a set of highly correlated variables. The mutual underlying factor in our set of data is the financial conditions.

The exact index construction procedure is described more extensively in the box below. Details about the methodology can be found in the technical appendix and weightings for all index calculations are given in Table A2 in the appendix.

Deriving the Financial Conditions Index by UniCredit:

The statistical method used in this study is called principal component analysis (PCA), a common method in this area of study, applied, for instance, by Hatzius et al. (2010) and Matheson (2010). PCA is basically a variable reduction method which extracts the common fundamental movement in a set of highly correlated variables. This is conducted using redundancy in variances across a number of variables to identify a smaller number of artificial variables (called principal components). In this context, redundancy means that variables are correlated with each other, since they are measuring the same underlying changes in fundamentals. In other words, PCA identifies joint variations in observed variables in order to build unobserved latent variables. Technically, a principal component can be defined as a linear combination of optimally-weighted observed variables. Examples of PCA in an economic environment can be found where variables of multivariate statistics move together and might, therefore, be measuring the same driving principle governing the behavior of a system. PCA analysis is, for example, able to replace a group of economic indicators, e.g. interest rate series of different maturity or bank lending survey data, that are highly correlated or spreads that move closely together, by one single variable.

The series included in the first four subgroups discussed in the previous section (excluding exchange rate, since this group consists only of one series per country) constitute the sample of four subgroup PCAs (one for each group). Depending on the overall explained variance, the first two or three principal components in each group are used to construct sub-indices and the overall index finally consists of these sub-indices and the exchange rate. The extent to which all five subgroups are equally important in determining the financial conditions and whether there should be some kind of weighting procedure may be arguable. There is no single superior weighting structure discussed in the FCI literature and sometimes a simple equally weighted average is used to construct a headline FCI (IMF 2008, ECB 2009). However, we think that the weightings in our financial conditions index should represent the importance of the subgroups in quantifying the overall financial conditions. Since GDP growth is the variable of interest that should be affected by better financial conditions in the long run (for example through higher loan growth and investment activity) we construct the sub index weights based on their explanatory power on GDP growth in the following way:

1. A benchmark regression is constructed by identifying the most appropriate autoregressive structure for GDP-growth (based on the significance of the included lags, the Akaike information criterion and adjusted R-squared).

2. The structure identified in 1. is used in five regressions (one for each sub indicator) which additionally include the respective contemporary and lagged sub index. The lag structure is based on the Akaike information criterion (the maximum lag is limited to 4 quarters).

3. The difference between the explanatory power (adjusted R-squared) of the benchmark regression and the explanatory power of the respective regression including the sub indicator is calculated.

4. These values are finally divided by the total sum of the five differences to construct the weighting for each sub-indicator.

The final index is then simply the weighted sum of the five sub-indicators[3]

To give additional information and get further insight on why the overall financial conditions moved in the way they did over time, the sub-indices are presented in the following results sections as well.

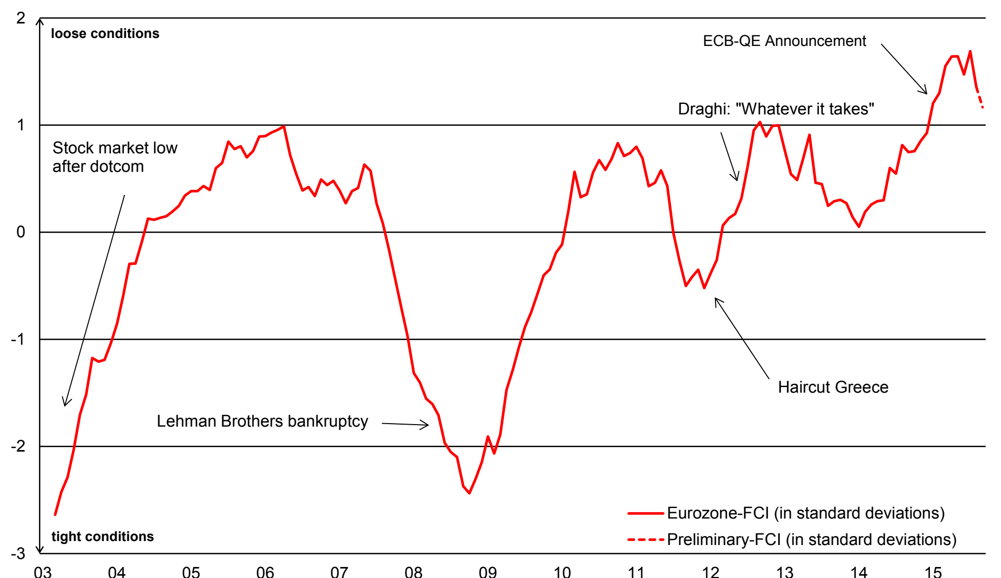
Note that we are using monthly and quarterly data, since the bank lending survey is only published on a quarterly basis. To get to the same frequency we linearly interpolate the bank lending survey data. The sample starts in 2003 for the eurozone aggregate and in 2004 for the country specific analysis, since some series are not available for the earlier period.

Certain variables used in our analysis are only available after a time lag. Therefore, the latest month for which we have all the relevant input variables is August. However, to give a first impression of how the most recent month might have affected the index, we calculate a preliminary index as well, which is based on the currently available data, holding all other input parameters constant.

Eurozone results

EUROZONE FINANCIAL CONDITIONS INDEX BY UNICREDIT

Chart 7: Eurozone Financial Conditions Index over time



Source: ECB, Bloomberg, UniCredit Research

[3] As an alternative weighting procedure we also used loan growth as dependent variable in the weighting regression. However, the results do not differ qualitatively.

Most favorable financial conditions in summer 2015

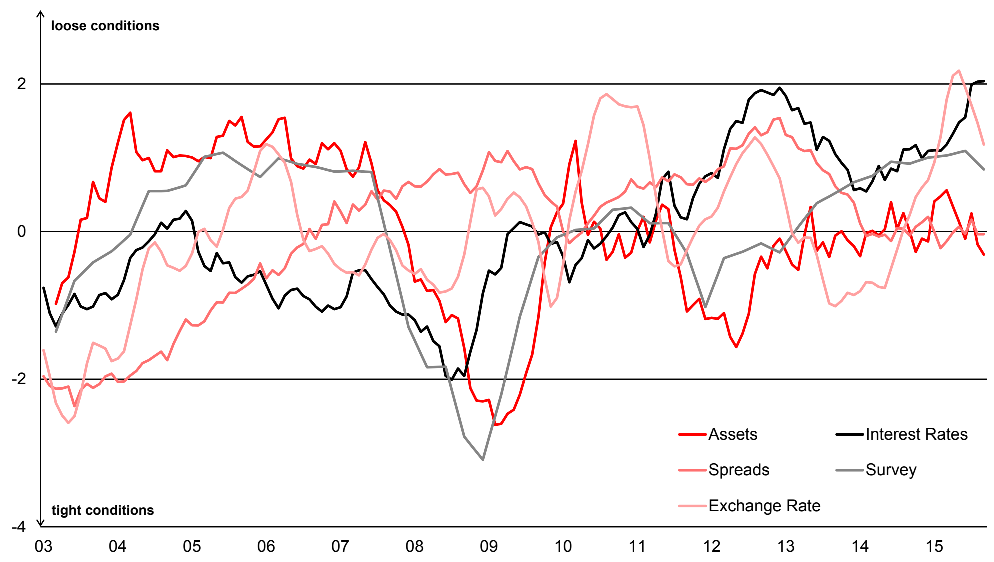
The eurozone index (chart 7) reveals that financial conditions in the EMU peaked in summer 2015. The index started to increase at the end of 2013, when it was slightly above its long-term average. (Note that since the data is de-meaned and standardized, the zero line indicates the series' long term average over the sample period and the y-axis is defined in standard deviations. This means that plus/minus one indicates a divergence of one standard deviation in relation to the mean). It is interesting to note that the index has not dropped below its long-term average since Mario Draghi's "Whatever it takes" statement. After the QE-announcement, financial conditions reached their all-time high in July 2015 – even higher than prior to the global financial crises or during the recovery period afterwards (before the eurozone debt crisis kicked in).

Although current financial conditions are currently still elevated at one standard deviation above the mean, our indicator started losing ground again after the summer break. Between July and the end of September, it declined by more than 0.5 standard deviations. Key drivers were the drop in asset prices and especially the appreciating euro exchange rate.

Historically, the indicator shows six major phases in financial conditions since 2003, namely the recovery in the aftermath of the dotcom bubble, the strong decrease due to the financial crisis followed by a recovery period, a similar but less pronounced movement surrounding the peak of the euro crisis and finally the improvement phase until mid-2015.

SUB-INDICATORS OF THE EUROZONE FINANCIAL CONDITIONS INDEX BY UNICREDIT

Chart 8: Index constituents for the eurozone



Source: ECB, Bloomberg, UniCredit Research

Subcomponents indicate that the peak in summer 2015 was broad based

Our sub-indicator analysis (chart 8) can be used to shed more light on the underlying driving forces behind these movements. It is clear that the sub-indicators behave differently over time, although some similarities can be identified.

At the beginning of our sample, all indicators were at subdued levels. During the financial crisis as well as during the eurozone crisis the asset market and the bank lending data (survey) were most influential in depressing the headline indicator figure.

During the latest phase of improvement, it is remarkable that we do not see any component weighing substantially on financial conditions.

The factors that led to the rise in the headline figure beginning in early 2014 are clearly the bank lending survey and interest rates, indicating very good refinancing conditions in the market. Additionally, the sharp increase in the exchange rate component (signaling a strong depreciation of the trade-weighted exchange rate) obviously contributed to the increase in the headline-index figure in 2014 and early 2015 as well. All of these advantageous factors were at least partially driven by the support of very expansive monetary policy.

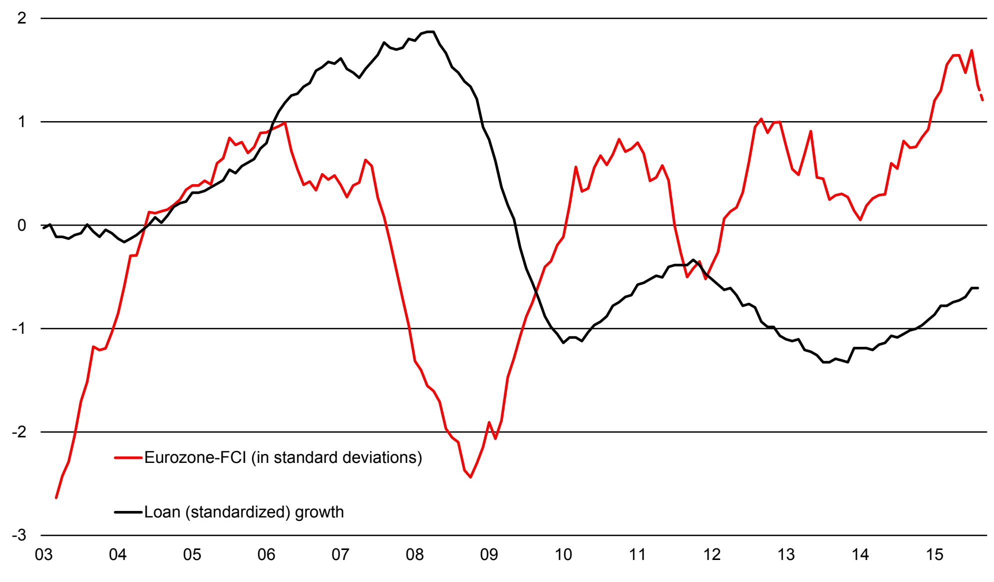
Economic outlook and policy implications

Financial conditions lead loan growth

As outlined earlier, favorable financial conditions should at some point affect loan growth rates. Chart 9 displays a comparison of the eurozone index and standardized loan growth over the past 12 years. At the beginning of the sample the index increased rapidly. Loan growth reacted with a lag of a few quarters. Early in 2007 a strong downturn in financial conditions occurred and again loan growth followed about a year afterwards. In general, the indicator turning points precede loan growth reversals by between four and six quarters. Therefore, from the financial conditions side, everything is set for a decent recovery in loan growth activity as long as other burdensome factors do not interfere and financial conditions do not drop further. However, one major factor that weighed on loan growth in the aftermath of the financial and the eurozone crises has subsided, namely the missing support from the business cycle.

EUROZONE INDEX COMPARISON

Chart 9: Financial conditions compared to standardized loan growth



Source: ECB, Bloomberg, UniCredit Research

Subdued public and private investment activity

After bottoming out during the global crisis, financial conditions recovered substantially and crossed the neutral line at the beginning of 2010. It seems that there was not enough time for loan growth to pick up substantially before the debt crisis kicked in and investors became nervous about the future growth outlook again. The austerity policies of many European countries took their toll from then onwards. Europe-wide cuts to public spending led to declining direct and indirect demand for goods and services and without the opportunity to sell their products, companies obviously refrained from investing in new subsidiaries, machinery, and production capacity. Furthermore, the budget consolidation in Europe has been achieved not just by reducing public consumption but, to a large extent, through public investment cuts. Subdued public and private investment in Europe has been a burden to short and medium-term acceleration in growth (and will depress long-term growth prospects as well).

Subdued credit growth: mainly a demand-side problem

Altogether, this provides an interesting insight. Former talk of the unwillingness of banks to extend credit to companies and households might have been right two or three years ago, but the picture is different today. The subdued credit growth levels seem to be a demand side rather than a supply side problem nowadays. The bank lending survey indicates that the financial industry stands ready (and stood ready in 2010 before the onset of the debt crisis) to provide credit. However, there is (and was) simply less demand for loans and therefore loan growth has so far been unable to pick up to pre-crisis levels. Or to put it differentially, it has simply been a lack of support from the business cycle that has prevented a substantial pick up in loan growth.

Recovery in credit growth is in the pipeline

However, the current brightening economic outlook for the eurozone overall is the game-changer now, signaling increasing support from the business cycle. Together with our index, which indicates a bottoming out and that a turnaround in quantities was reached at the end of 2013, it is likely that at least a modest acceleration in credit growth is in the pipeline for the upcoming months. This, in turn, leads to a further improvement in economic activity by adding the pick-up in private investment as another pillar to the current eurozone recovery.

Financial conditions consistent with solid medium-term growth

Having discussed the background, it is interesting to evaluate the implications of current financial conditions for eurozone GDP development in the upcoming quarters and years. Financial conditions affect loan and GDP growth with a certain lag. To estimate what current financial conditions imply for future GDP growth, we performed a regression of our index on quarterly yoy GDP growth rates[4] $GDP_yoy_t = 0.58 + 0.85 * UFCI_{t-1} + 1.40 * UFCI_{t-4} - 0.69 * UFCI_{t-8}$. Accordingly, a one standard deviation increase in the financial conditions index would lead to an overall increase in the yoy growth rates of 1.56 percentage points over the next two years, holding all other potential influencing factors equal. Taken at face value, the current financial conditions would be consistent with a GDP growth rate of about 2.8% by the end of 2015. Of course this calculation should to be interpreted with caution. Other factors, such as the aforementioned lack of public investment, the drop in global trade and headwinds from emerging markets in general will probably weigh on growth and this is not reflected in the univariate regression-based forecast.

This can also be seen from chart 10, which depicts the eurozone GDP growth rates compared to the index, and chart 11, which shows our financial-conditions based forecast. Historically, turning points in the business cycle seem to be preceded by a turnaround in the financial conditions. Since the onset of the eurozone crises, however, the connection between financial conditions and GDP growth has deteriorated and consequently the forecast overestimates actual GDP growth during this period. However, this can be explained by the strong austerity policy and in general the forecast series and eurozone GDP follow, at least loosely, a common path. It indicates that the upward momentum in the eurozone economy is still intact and, provided the financial conditions do not drop significantly, further growth acceleration is in the pipeline.

[4] The specification with a one-quarter, four-quarter and eight-quarter lag as explanatory variables performed best, based on the Akaike information criterion and the R-squared value [0.65]. All variables are statistically significant at least at the 5% level.)

FINANCIAL CONDITIONS AND GDP

Chart 10: Financial conditions compared to GDP growth

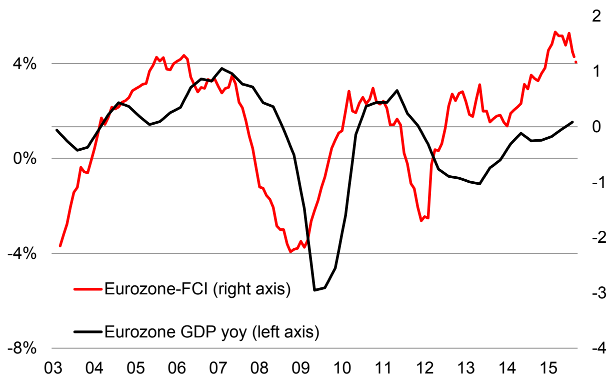
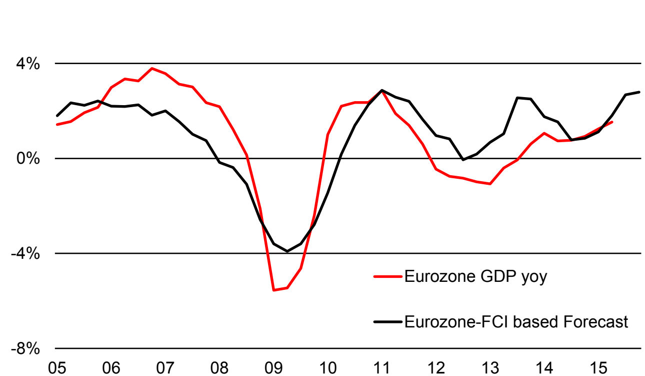


Chart 11 FCI-GDP forecast compared to GDP growth



Source: ECB, Bloomberg, UniCredit Research

QE keeps conditions advantageous

So what is the outlook on the development of financial conditions in the next months and quarters? Obviously, it is difficult to predict how leading indicators will develop in the future. However, our subcomponent analysis can give some ideas. It has shown that interest rates, exchange rates and bank lending sentiment were the predominant driving factors behind the all-time high. The first two subcomponents, in particular, are directly and straightforwardly affected by monetary policy and the historically low central bank rates are certainly a factor that led to the good situation.

In January 2015 the ECB extended its expansive monetary policy even further by launching the QE program. It is too early to definitively evaluate whether or not this program has been a success, but the initial data and theoretical considerations based on our indicator point in this direction (at least regarding financial conditions). The program has helped accelerate the normalization of the credit channel and weaken the currency compared to the period before the market started to price-in a potential QE program. Additionally, it holds the interest rates low (even for longer maturities), and extends the expectation that there will be a high level of liquidity for a long time. That, in turn, should hold credit conditions at favorable levels and increase credit approval rates. Therefore QE constitutes a powerful tool that the ECB can use to buy the real economy sufficient time for the good financial conditions to trickle down to an acceleration of credit growth and investment activity.

During the ECB press conference on 22 October, Mario Draghi pointed explicitly to negative financial market developments (drop in asset prices) and the latest euro appreciation. These are the two components most recently dragging down our financial conditions index and during the press conference it became clear that the ECB is most likely going to apply further expansive monetary policy measures such as an extension to the QE program. This will probably stop the downturn in these subcomponents and improve the financial conditions for companies and private households again.

Country-specific indicators

Financial conditions favorable across eurozone countries

Finally, it is worth looking at the country specific FCIs and their subcomponents in charts 11 to 18. As noted in the introduction, it is important not just to focus on the eurozone aggregate, since developments and financial conditions in the different countries can vary dramatically. This is indeed the case when we compare the FCI of, for instance, Spain and Germany during the eurozone crisis. While we can observe a tightening in financial conditions to about -0.8 standard deviations in the case of Germany and to -0.6 in France, the effect has been much more pronounced for Italy. The FCI in Spain even tightened to levels similar to those seen at the peak of the global financial crisis. However, the most important insight here is that the improvement in financial conditions until the summer was broad based and took place in all major eurozone countries and not just in Germany. Even for Spain, the index increased to about 0.7 standard deviations above its long-term average. On the other hand, it can also be seen that the most recent tightening is broad based as well, mostly driven by the exchange rate and the asset component in all countries. This is further evidence that the ECB sees the urgent need to use more expansionary monetary policy tools, such as the extension of their QE program or even a further rate cut, to stabilize financial conditions.

GERMANY

Chart 12: Financial Conditions Index by UniCredit for Germany

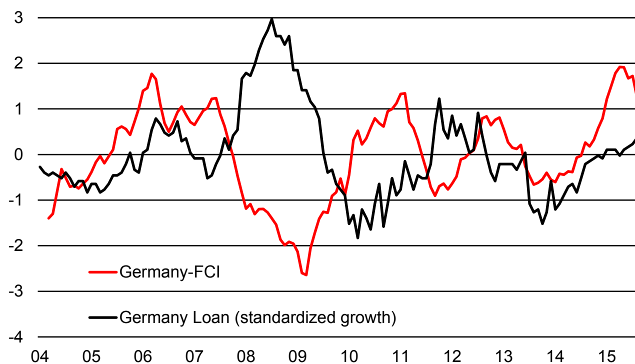
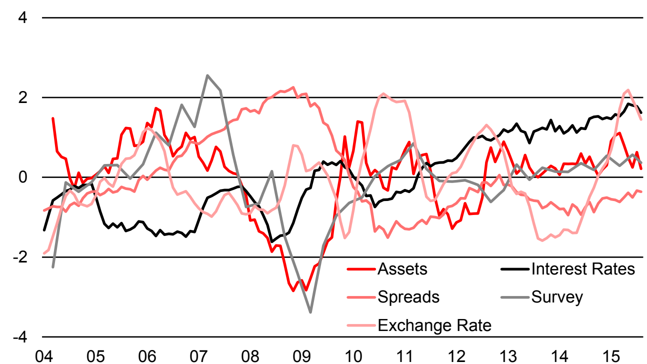


Chart 13: Sub-indicators of the German financial conditions



FRANCE

Chart 14: Financial Conditions Index by UniCredit for France

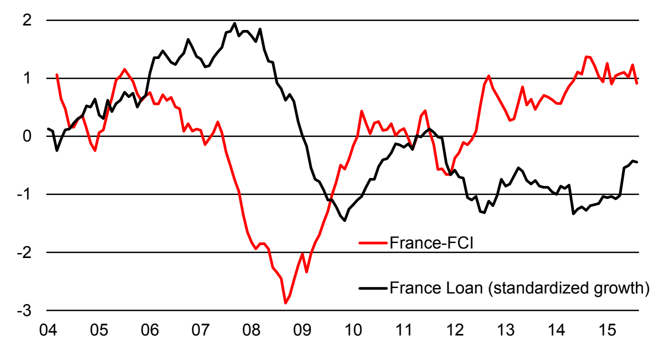
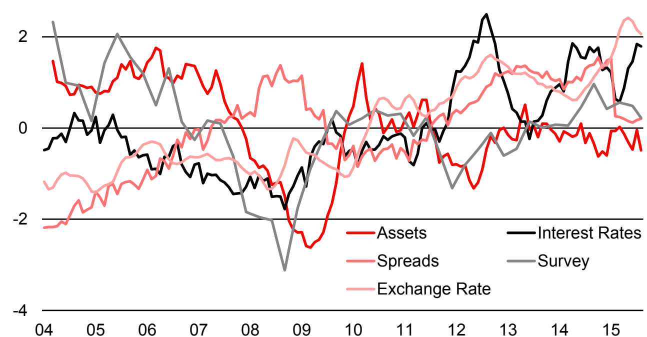


Chart 15: Sub-indicators of the French financial conditions



Source: ECB, Bloomberg, UniCredit Research

ITALY

Chart 16: Financial Conditions Index by UniCredit for Italy

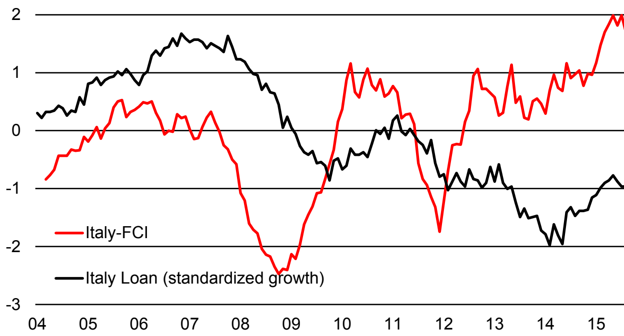
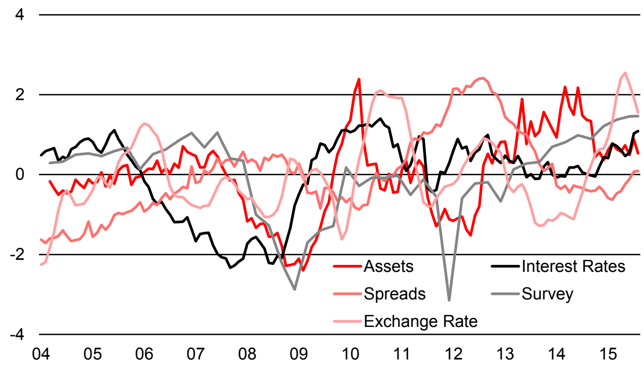


Chart 17: Sub-indicators of the Italian financial conditions



SPAIN

Chart 18: Financial Conditions Index by UniCredit for Spain

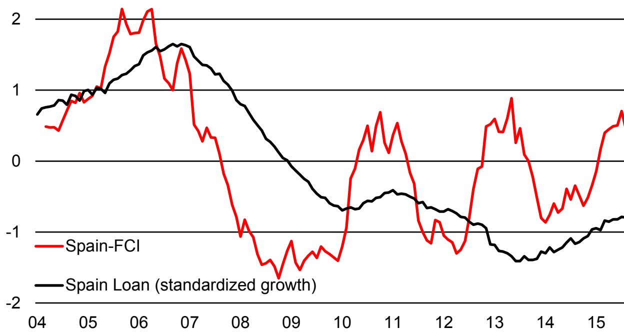
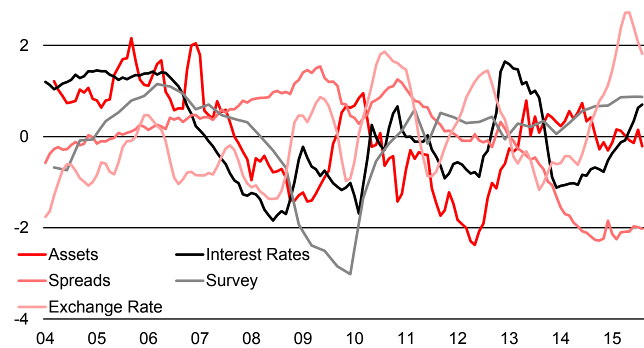


Chart 19: Sub-indicators of the Spanish financial conditions



Source: ECB, Bloomberg, UniCredit Research

IV. Conclusion

Conclusion

In this study we have introduced a proprietary index called the Financial Conditions Index by UniCredit, which depicts the financial conditions in the eurozone. The index can be used to assess the current debt financing conditions and gives guidance about future loan and GDP growth prospects.

Prolonged subdued loan growth cannot solely be explained by unfavorable financial conditions, as our study reveals. Over recent years it has become rather more of a demand-side problem. However, positive developments in the eurozone recovery and the historical track record of our index point towards a positive growth outlook for the eurozone. The extension of the QE program expected to be announced in December, will help to stop the most recent declines in financial conditions. All in all, our analysis suggests a decent near-to-medium-term economic outlook for the eurozone as long as headwinds from such factors as global trade do not increase. Future developments will be monitored closely, and we will provide quarterly updates on our financial conditions index.

V. Appendix

Principal component analysis:

Principle component analysis (PCA) is a widely used method to reduce the dimension of a dataset in order to identify a substantially smaller set of generic variables, the so called "principal components", that explain the bulk of the variance of all variables. The idea is the following: a dataset of highly correlated variables is driven by common fundamental factors – thus they can be represented by only one/a small number of series. In other words: PCA seeks to identify linear combinations of variables such that the maximum variance is extracted from those variables.

Before performing the actual PCA, the variables need to be standardized (de-meaned and divided by their own standard deviation) in order to avoid different scaling.

In a first step, the variance-covariance matrix of the standardized variables has to be calculated:

$$\sum = Cov(x) = \begin{pmatrix} Var(X_1) & Cov(X_2, X_1) & Cov(X_1, X_p) \\ Cov(X_2, X_1) & Var(X_2) & Cov(X_2, X_p) \\ Cov(X_p, X_1) & Cov(X_p, X_1) & Var(X_p) \end{pmatrix}$$

The first principal component should explain most of the variance. Therefore the eigenvalues of the matrix above are calculated in order to calculate the principal components such that their respective variance is maximized and they are uncorrelated with each other. The principal components $Y_1, \dots, Y_p$ are defined as linear combinations of the variables $X_1, \dots, X_p$

$$Y_1 = l_{11}X_1 + l_{12}X_2 + [\dots] + l_{1p}X_p$$

$$Y_2 = l_{21}X_1 + l_{22}X_2 + [\dots] + l_{2p}X_p$$

$$Y_p = l_{p1}X_1 + l_{p2}X_2 + [\dots] + l_{pp}X_p$$

where l' represents the respective coefficient vector.

The ith principal component is given by

$$Y_i = e_i'X = e_{i1}X_1 + e_iX_2 + [\dots] + e_{ip}X_p$$

Where $e_i' = (l_{1p}, [\dots], l_{ip})$ is the ith eigenvector of the variance-covariance matrix $\sum$, which belongs to the ith eigenvalue arranged in order of size. The variance of the ith principal component equals the ith eigenvalue of $\sum$.

Bear in mind that for symmetrical matrices, eigenvectors corresponding to different eigenvalues are always orthogonal. Hence the second principal component is orthogonal to the first and consequently explains the part of the variance that the first one doesn't include. The decision as to how many components are used afterwards depends on the dataset. There is a tradeoff between the loss of information and reduction of dimension, but for a system of highly correlated variables the first two or three principal components should already explain the bulk of the dataset's variance.

TABLE A1: EUROZONE FINANCIAL CONDITIONS INDEX BY UNICREDIT CONSTITUENTS

Spread interest rates on convenience loans – deposits HH	Monthly	Spreads	Level	ECB/Bloomberg
Spread interest rates on consumption loans short term – deposits HH	Monthly	Spreads	Level	ECB/Bloomberg
Spread interest rates on cons. loans medium term – deposits HH	Monthly	Spreads	Level	ECB/Bloomberg
Spread interest rates on mortgage loans – deposits HH	Monthly	Spreads	Level	ECB/Bloomberg
Spread interest rates on other loans short term – deposits NFC	Monthly	Spreads	Level	ECB/Bloomberg
Spread interest rates on other loans medium term – deposits NFC	Monthly	Spreads	Level	ECB/Bloomberg
Spread interest rates on overdraft etc. – deposits to NFC	Monthly	Spreads	Level	ECB/Bloomberg
Deposits with agreed maturity, up to 2 years HH	Monthly	Interest rates	Level, real	ECB
Deposits with agreed maturity, over to 2 years HH	Monthly	Interest rates	Level, real	ECB
Deposits with agreed maturity, up to 2 years NFC	Monthly	Interest rates	Level, real	ECB
Deposits with agreed maturity, over to 2 years NFC	Monthly	Interest rates	Level, real	ECB
Euribor 1 Week	Monthly	Interest rates	Level, real	Bloomberg
Euribor 1 Month	Monthly	Interest rates	Level, real	Bloomberg
Euribor 3 Month	Monthly	Interest rates	Level, real	Bloomberg
Euribor 6 Month	Monthly	Interest rates	Level, real	Bloomberg
Euribor 12 Month	Monthly	Interest rates	Level, real	Bloomberg
Generic-2-year-gov-bond	Monthly	Interest rates	Level, real	ECB
Generic-3-year-gov-bond	Monthly	Interest rates	Level, real	ECB
Generic-5-year-gov-bond	Monthly	Interest rates	Level, real	ECB
Generic-7-year-gov-bond	Monthly	Interest rates	Level, real	ECB
Generic-10-year-gov-bond	Monthly	Interest rates	Level, real	ECB
Loans for house purchase with maturity of up to 1 year, HH	Monthly	Interest rates	Level, real	ECB
Loans for house purchase with maturity of o. 1 year up to 5 years, HH	Monthly	Interest rates	Level, real	ECB
Loans for house purchase with maturity over 5 years, HH	Monthly	Interest rates	Level, real	ECB
Loans for consumption with maturity of up to 1 year, HH	Monthly	Interest rates	Level, real	ECB
Loans for consumption with maturity of over 1 year up to 5 years, HH	Monthly	Interest rates	Level, real	ECB
Loans for consumption with maturity of over 5 years, HH	Monthly	Interest rates	Level, real	ECB
Loans for convenience, HH	Monthly	Interest rates	Level, real	ECB
Loans with maturity of up to 1 year, NFC	Monthly	Interest rates	Level, real	ECB
Loans with maturity of over 1 year and up to 5 years, NFC	Monthly	Interest rates	Level, real	ECB
Loans with maturity of over 5 years, NFC	Monthly	Interest rates	Level, real	ECB
Loans for convenience, NFC	Monthly	Interest rates	Level, real	ECB
FTSE EPRA/NAREIT Euro Zone Property Index	Monthly	Asset	Growth (yoy)	Bloomberg
Euro Stoxx 50	Monthly	Asset	Growth (yoy)	Bloomberg
Market Capitalization (Euro Stoxx 50)	Monthly	Asset	Growth (yoy)	Bloomberg
Residential Property Price Index	quarterly	Asset	Growth (yoy)	ECB
Enterprises Credit standards, Large enterprises	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Enterprises Credit standards, Long-term loans	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Enterprises Credit standards, Overall	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Enterprises Credit standards, Small- and medium-sized enterprises	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Enterprises Credit standards, Short-term loans	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Enterprises Terms and Conditions, Collateral requirements	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Enterprises Terms and Conditions, Loan covenants	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Enterprises Terms and Conditions, Margin on average loans	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Enterprises Terms and Conditions, Margin on riskier loans	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Enterprises Terms and Conditions, Size of loans	quarterly	Survey data	Level (Weighted diffusion index)	ECB
House purchase, Credit Standards	quarterly	Survey data	Level (Weighted diffusion index)	ECB
House purchase Terms and Conditions, Collateral requirements	quarterly	Survey data	Level (Weighted diffusion index)	ECB
House purchase Terms and Conditions, Impact of loan to value ratio	quarterly	Survey data	Level (Weighted diffusion index)	ECB
House purchase Terms and Conditions, Margin on average loans	quarterly	Survey data	Level (Weighted diffusion index)	ECB
House purchase Terms and Conditions, Margin on riskier loans	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Consumer Credit, Credit standards	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Consumer Credit Terms and Conditions, Collateral requirements	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Consumer Credit Terms and Conditions, Margin on average loans	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Consumer Credit Terms and Conditions, Margin on riskier loans	quarterly	Survey data	Level (Weighted diffusion index)	ECB
Euro area Real Effective Exchange Rate Broad	Monthly	Exchange rate	Growth (3M-yoy)	Bloomberg

Source: ECB, Bloomberg, UniCredit Research

TABLE A2: WEIGHTINGS OF SUB-INDICATORS

	Eurozone		Germany		France		Italy		Spain	
%	Weighting	Expl. var.	Weighting	Expl. var.	Weighting	Expl. var.	Weighting	Expl. var.	Weighting	Expl. var.
Survey data	23.6	92.5	25.4	75.7	29.7	73.8	28.0	74.9	20.7	89.3
Interest rates	17.4	89.6	10.0	97.1	15.3	90.3	9.9	91.7	22.9	91.0
Spread data	13.6	88.0	10.2	95.9	12.5	92.7	11.2	95.9	14.0	93.0
Asset data	26.1	95.1	27.1	99.0	28.1	94.3	28.4	88.3	29.3	99.0
Exchange rate	19.3	100.0	27.3	100.0	14.4	100.0	22.5	100.0	13.1	100.0

Note: Weightings and explained variance are calculated as described in the text. Weightings are capped at 30% on the upside and 10% on the downside:

Source: ECB, Bloomberg, UniCredit Research

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