Using a Leading Credit Index to Predict Turning Points in the U.S. Business Cycle[1]

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Abstract

Financial indicators such as yield curves and stock prices have been extensively used as leading indicators of economic activity due to their forward looking content. Indeed, the Leading Economic Index (LEI) for the United States, a widely used forecasting tool for business cycle turning points, includes several financial components. However, we argue that the coverage of financial and credit market activity in the LEI can be improved to account for some of the structural changes in the U.S. economy (especially in financial markets) and we present evidence that at least one of the existing components, namely real money supply does not perform as well as it used to as a leading indicator in the past several decades. Over the past three decades, many new financial indicators, such as interest rate swaps, credit default swaps, certain corporate-treasury spreads, the Federal Reserve's senior loan officer survey, etc. have become available, but, since most of these new indicators have not been available for a long enough period, very little research has been conducted to evaluate their utility as leading indicators. In this paper we evaluate the usefulness of a large number of financial indicators according to their ability to predict recessions (i.e. peaks in the business cycle). First, we establish the criteria which are helpful for assessing whether and when such financial indicators generate signals of recessions. We then choose the best ones and aggregate them into a single composite index of financial indicators which we name the Leading Credit Index (LCI). Our approach differs from others in the literature in that we focus on a small, carefully selected set of indicators as index components and, additionally, in our selection criteria we target business cycle turning points rather than financial stability. We argue that this leading credit index can be helpful to estimate recession probabilities better than individual indicators, including some of the existing components of the LEI, especially real money supply. As opposed to other recent financial indexes created to measure financial instability or volatility, the purpose of ours is to signal recessions in the US economy, and as such it could serve as an appropriate new component for the U.S. LEI.

Keywords: business cycles, turning points, forecasting, financial conditions, money and credit

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1. Introduction

The latest global recession highlighted the importance of the link between the financial sector and the real economy. Moreover, there are complex interactions between financial cycles and economic cycles. The relationship between the two sectors has not been very well understood and incorporated into macroeconomic models. The indicator approach which is focused on measuring and analyzing the business cycle can help to improve the understanding of how the financial and economic cycles evolve over time.[2]

In this paper we review some of the available financial, monetary, credit market indicators from the perspective of their relationship with the general business cycle of the U.S. economy. We find that it is possible to identify some new financial indicators that are useful in predicting recessions and recoveries. We argue that aggregating our selected indicators into a composite index offers advantages over relying on them individually. These advantages come from the ability of the simple, easy to calculate and transparent methodology of the composite index approach to generate reliable and smooth estimates of an unobserved business cycle variable.

The current ten leading index components each attempt to measure a different aspect of general economic activity including contractual relationships (i.e. orders, permits, etc.) and expectations or sentiment (i.e., consumer expectations and stock market prices). The leading index has three financial variables: real money supply, index of stock prices, and the interest rate spread. In this paper we argue that these indicators don't fully capture the complex and changing nature of the interactions and impact of the financial sectors and real economic activity and propose a new financial activity index that attempts to remedy this shortfall. We show that a new composition of the leading economic index (LEI) which uses the resulting composite index of financial indicators performs better than the current composition of the LEI.

There is a growing literature on indexes of financial conditions and stability. Recent research such as Hatzius et. al. (2010)[3] and Brave and Butters (2011)[4] among others also explores some of these issues. A number of new indexes of financial conditions and financial stability have been proposed in the recent literature. In contrast to most of the recent literature on financial instability, in this paper, we propose a new composite leading index of financial indicators, following the indicator approach of relying on a small set of carefully selected components. Our aim is to focus on financial indicators that can help predict turning points in general economic activity broadly defined. In our approach, the business cycle chronology determined by NBER and a composite index of current economic condition given by The Conference Board Coincident Economic Index (CEI) are key components of the evaluation

[2] The indicator approach to business cycle research is just one of many ways to study and analyze business cycle. It was first introduced by Mitchell and Burns (1938) and since then it has figured prominently in the NBER business cycle program. The timing and chronologies of business cycles and the classifications of economic indicators have been useful over the years. Currently, The Conference Board continues this tradition in its indicators program.

[3] Jan Hatzius, Peter Hooper, Frederic Mishkin, Kermit L. Schoenholtz and Mark W. Watson (April 2010) "Financial Conditions Indexes: A Fresh Look after the Financial Crisis"

[4] Scott Brave, R. Andrew Butters (2011) "Gathering Insights on the Forest from the Trees: A New Metric for Financial Conditions "

and scoring of the leading indicators from the financial sector. In this paper we also evaluate some of the other new indexes of financial conditions and ask how they compare with our proposed index in capturing business cycle movements. Finally, we are interested in finding out whether such financial indexes can serve well as leading indicators of economic activity and whether they could help improve the composite index of leading economic indicators (LEI) published by The Conference Board.

A further motivation for this study comes from the one of the existing components of the LEI, namely real money supply measured by the monetary aggregate M2 (deflated by the deflator for personal consumption expenditures). We present empirical evidence showing that real money supply as measured by the monetary aggregate M2, one of the ten components of the LEI, has ceased to be a good leading indicator in the United States. As an important indicator of monetary and credit conditions, real money supply, has been a component of the LEI for the US since the 1970s. However, empirical evidence over the last two decades suggests that the relationship between general economic activity and monetary aggregates such as M2 adjusted for inflation has undergone a major change, at least in the US economy. More specifically, real M2 performed well as leading indicator until the late1980s, but its relationship with business cycles has weakened and become unstable since. In fact, in the most recent decade it appears to be inversely related to current economic activity. For example, real M2 remained on an uptrend in the period prior to the start of the recession in December 2007. Indeed, continued increases in real M2 had provided the largest positive contributions to the index at that time, which helped keep the LEI generally flat from January 2006 to the middle of 2007 and prevented a sharper decline in the second half of 2007.[5]

Since the late 1970s when real M2 was added to the LEI as a component, the U.S. economy and the banking and financial sectors have gone through deregulation and structural changes in the subsequent decades. The earlier observed relationship between real M2 and general economic conditions is no longer observed in the data[6]. Real M2 began to lag the CEI, our preferred monthly measure of current economic conditions, in the mid-1990s. Levanon (2010) shows that, compared to other leading indicators and the LEI itself, real M2 has performed poorly as a leading indicator since 1989.[7]

Given the importance of the financial sector developments for the economy it is crucial to capture the impact of this activity on the business cycle. The turning point analysis used in the development and evaluation of composite indexes by The Conference Board as well as the non-linear methods of indicator evaluation and selection proposed by Levanon (2010) is used to score the new financial indicators (the latter evaluate and compare the ability of individual leading indicators to signal recession probabilities while the former evaluate the relationship between the turning points of the individual indicators with those of the business cycle).

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[5] See Tanchua, Jennelyn, "The Conference Board Leading Economic Index® for the United States in the 2007 Recession," *Business Cycle Indicators*, February 2010.
[6] See Levanon, Gad, et.al., "Real M2 and Its Impact on The Conference Board Leading Economic Index® (LEI) for the United States," *Business Cycle Indicators*, March 2010.
[7] Levanon, Gad "Evaluating and Comparing Leading and Coincident Economic Indicators," *Business Economics,* Vol. 45, No. 1, 2010, pp. 16–27.

Our proposed index has six components and it aggregates different types of quantitative and qualitative survey indicators using principal component analysis[8]. We argue that this new index can reasonably capture important channels through which the financial sector can impact the real economy. The components of our proposed index are 1) 2-year Swap Spread, 2) LIBOR 3 month less 3 month Treasury-Bill yield spread, 3) Debit balances at margin account at broker dealer, 4) AAII Investors Sentiment Bullish (%) less Bearish (%), 5) Senior Loan Officers C&I loan survey – Bank tightening Credit to Large and Medium Firms, 6) Total Finance: Liabilities – Security Repurchase. We also show that the forecasting performance of the leading index can be improved upon if our new index of financial conditions is used as a component of the LEI replacing the money supply measure currently used as a component. It's important to note that the forecasting tests are constructed with the real time performance of the LEI in mind (tests use unrevised data and compared out of sample forecasts) and that they were not used in the indicator selection process (the selection process avoids explicit statistical model fitting).

The paper is organized as follows. Section 2 discusses the relationship between financial activity and real economic activity to help identify the conceptual and theoretical underpinnings for identifying financial indicators. Section 3 briefly discusses the changing relationship between real monetary aggregates (namely real M2) and economic activity. Section 4 is on existing financial conditions indexes and section 5 describes our proposed index and its components as well as the basis for their selection. Section 6 reports the evidence on real time forecasting performance of the proposed index and the impact it has on the real time forecasting performance of the LEI. Section 7 concludes.

2. The relationship between financial markets and the real economy

In a world with perfectly functioning and complete financial markets, the transmission channels between financial markets and the real economy – which are sometime called neoclassical channels[9] – are mainly price related channels. Indeed in such an ideal economy, interest rates, foreign exchange rates and asset prices are the main channels through which monetary policy and overall financial conditions interact with the real economy.[10] The structures of balance-sheets have no effect on the economy.[11]

However, financial markets do not function perfectly. Among others, asymmetric information and incomplete contracts[12] lead to frictions, credit rationing and incomplete markets. In a context where the different sources of funding are not completely

[8] The principal component method can be used for the Leading Credit Index because it includes only six components. Forni, Hallin, Lippi and Reichlin (2004) argue that while the principal component methodology is useful for extracting common factors from a small number of time series, dynamic factor models are more effective in extracting common factors when a large number of series are used.

[9] See Jean Boivin, Michael T. Kiley, Frederic Mishkin , "How has Monetary Transmission Mechanism evolved over Time?", NBER Working Paper Series, Working Paper 15879, April 2010

[10] For example, financial conditions influence the real economy via investments channels (cost of capital and Tobin'q), consumption channels (wealth effect and intertemporal substitution effect) and international trade channels (see Boivin and All for more details)

[11] As in the Monetarist view of Friedman or the Irrelevance view of Modigliani and Miller.

[12] Both problems favor adverse selection and moral hazard.

substitutable,[13] the structures of economic agents' balance-sheets are keys and banks have a specific role to play in the allocation of capital. The corresponding transmission channels between financial markets and the real economy – that are some times called non-neoclassical channels – are the balance-sheets channels and the bank based channels.[14]

The main balance-sheets channel is the financial accelerator[15] which is concerned by borrowers' balance-sheets - more specifically their net worth – and their ability to use it as collateral. As implied by the name, the underlying mechanism involves a feedback loop between credit conditions and the real economy that tends to be pro-cyclical.[16]

The bank based channels focuses on the balance-sheets of lenders, e.g. banks and other financial institutions, as their structures influence their lending policies. More specifically, their ability and willingness to lend can be affected by a duration mismatch[17] - a shortage of liquid asset or a problem of funding – or a capitalization effect – where the capital ratio is too low given assets risk.

Some authors consider the existence of an additional transmission channel, the risk channel,[18] which is independent from other real or financial variables. It may be related to the so-called "greed and fear" cycles[19] and to the "animal spirits"[20] that are of particular importance in an incomplete market context.[21] It may also play a growing role in market based banking sector. However empirical evidence tends to be model dependent and of little use. Moreover, this channel may already be taken into account by stock prices. Overall, we tend to see it as an additional support for the inclusion of financial indicators in LEIs.

The importance of the different transmission channels depends on the source of shocks. A detailed knowledge of the transmission channels is important because the sources of the shocks that affect financial conditions are not always the same and because the relative importance of the different channels depends on the nature of the shock. The most common source of shocks is monetary policy. But shocks also originate in the real economy – e.g. productivity shocks – or on financial markets – e.g. assets prices shocks. Of course all these

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[13] Especially for Small and Medium Enterprises (SMEs) and consumers.

[14] We use the terminology of Boivin and All 2010.

[15] See Bernanke, Ben and Mark Gertler, "Agency Costs, Net Worth, and Business Fluctuations", American Economic Review, volume 79(1), page 14-31, March 1989 and Bernanke Ben, Mark Gertler, Simon Gilchrist, "the Financial Accelerator in Quantitative Business Cycle Framework" in John B. Taylor and Micheal Woodford, Editors, "Hanbook of Macroeconomics", Elsevier, volume 1, part 3, pages 1341 – 1393, 1999.

[16] Note that a tightening of financial conditions due to higher interest rate may reduce cash-flows and increase the need for external funding, leading to similar constraints – this latter effect highlight the fact even nominal interest rates can have an effect of the real economy.

[17] Here, we use the terminology of Jürgen Antony and Peter Broer, "Linkage between the Financial and the Real Sector of the Economy, A Litterature Survey", CPB Documents, No 216, December 2010.

[18] Here, we use the terminology of Antony and Broer 2010.

[19] These are a type of liquidity cycles.

[20] This is our interpretation.

[21] In the work of Minsky 1978, financial instability and credit bubbles are endogeneous and largely due to wave of euphoria and anxiety. Economic Historians – like Kindleberger – have been sympathetic to that view by pointing out recurrent episodes of credit-driven financial instability.

shocks tend to interact, highlighting among other the interactive nature of the relationship between the real and the financial economies. The neoclassical channels or prices channels always play an important role. Moreover, a majority of these shocks can be detected by the existing set of components of the LEI. However, the relative importance of non neoclassical channels – i.e. of balance-sheets – tends to increase in case of financial stress as highlighted by the financial crisis. As it is likely affect the pattern of recession and recovery, it lends support to the idea to include indicators specifically related to these transmission channels.[22]

The evolving nature of the relationship between financial markets and the real economy

Looking for indicators related to the non neoclassical channels brings us to a discussion on the relationship between monetary aggregates (represented by real M2 as a component of the LEI) and business cycles. The potential causes of the break of the relationship between the two help to identify new indicators. The purpose is to deepen the analysis of the two main causes identified earlier[23] in order to assess their robustness and the likelihood of other changes.

Changes in the monetary policy transmission channel[24]

The changes of the goals and the strategy of the Federal Reserve (Fed) that took place during the last two or three decades went beyond the shift from targeting monetary aggregates to targeting the Federal Funds rate (Fed fund). In spite or because of its dual mandates – which can be interpreted as minimizing the unemployment rate subject to a constraint of prices stability – the Fed has put more emphasis on inflation[25] and the anchoring of inflation expectations. As a result, interest rates expectations and their "management" have seen their influence on the monetary policy transmission channel growing over time. The successful anchoring of inflation expectations[26] has been achieved by relying on an approach focused on the deviations from trend growth and from targeted inflation. Empirical evidence is mixed, but it seems that the success of this strategy has reduced the influence of monetary policy on growth while making its effects more persistent.

Overall, the change of emphasis of monetary policy that took place in between the 1980s and 1990s seems to have weakened the link between real economic activity and credit on the one hand and monetary aggregate on the other. As a result, tracking the stance of monetary policy and its expected impact on economic activity[27] with interest rates related indicators, like the yield spread - which provides an indirect view on the term structure of interest rate and

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[23] See "The Conference Board Leading Economic Index® for the United States in the 2007 Recession," *Business Cycle Indicators*, February 2010.

[24] We use the terminology and the analysis of Boivin and All 2010.

[25] It does not mean that Fed ignored inflation before, but it relied on different approach. For example, it used an intermediary target – a monetary aggregate – during the Volker's era. Note that the Fed has still not a formal inflation target – e.g. as the Bank of England – even if it has moved closer to that approach recently.

[26] And the resulting credibility.

[27] The term premium – i.e. the difference between 10 year Treasury yield and Fed Funds – depends on the level of official rates which are targeted by the Fed and the 10 year yield which results from investors expectations. Of course, nominal yields do not allow disentangling the effect of expected inflation.

therefore on investors' expectations– seems sufficient from a business cycle tracking point of view.

Of course, one can wonder in which direction the conduct of monetary policy will evolve in the future and if the increased volatility of the short term velocity of money is permanent. Among the factors that may influence the choices of policymakers in the futures, three related factors deserve some attention: the long term inflation outlook, the zero-bound for nominal interest rate and the potential broadening of the scope of monetary policy to prevent bubbles. Looking forward, one can wonder if the current ultra-loose policy-mix will not lead to a structurally higher inflation rate.[28] Bordo and Filardo (2006)[29] show a relationship between the inflation regime, the behaviour of the velocity of money and the interest of the information provided by monetary aggregates. They suggest the existence of a U –shaped curve where the importance of monetary aggregates grows at the extremes – i.e. deflation or high inflation. Of course, their aim is to make the case for the use of monetary aggregates in the conduct of monetary policy,[30] not to suggest that the relationship between monetary aggregates and the business cycles may become more stable in some inflation regimes. They also highlight the issue of the zero bound for interest rates whose importance was illustrated by the non-orthodox strategies implemented by the Federal Reserve.[31] It should also be noted that the zero-bound may also affect the signal provided by the yield spread. In any case, the crisis is likely to have lasting effect on the way monetary policy is viewed and implemented. There is therefore a potential case for completing the yield spread – and stock prices – with non-price indicators to track developments on credit markets and the stance of monetary policy.

2.3 Indicators of the price and the availability of credit

The business model of banks started to change well before the shift in monetary policy and the structural reforms in the 1980s. Indeed, the post WWII period saw a trend increase in the leverage of banks and in the riskiness of their assets.[32] It reinforced the need for funding and the importance of assets as collateral and weakened the relationship between money and credit.[33] The deregulation, the financial innovations – in particular the development of securitization – and the globalisation that started or accelerated during the 1980s mainly reinforced that trend and contributed to completing the move toward a market based financial system.[34]

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[28] In a provocative note, Blanchard, the Chief Economist of the IMF, suggested to increase the inflation target in advanced economies.

[29] Michael D. Bordo and Andrew Filardo, "Money Still makes the World Go Round: the Zonal View", paper prepared for the 21st Congress of the European Economic Association held in Vienna in August 2006.

[30] Indeed they vindicate a two pillars policy, like the strategy of the ECB.

[31] Of course, the key role played by broker dealers in a market based credit market, in particular in the securitization process, also explains why the Fed used its balance-sheet to backstop the markets that froze at the worst of the crisis.

[32] See Moritz Schularick and Alan M.Taylor, "Credit Booms go Bust: Monetary Policy, Leverage Cycles and Financial Crisis, 1870 – 2008", NBER Working Papers Series, Working Paper 15512, November2009.

[33] i.e. as long as credit was mainly based on deposit, the relationship was stable and monetary aggregate were good proxies of credit.

[34] See for example Tobias Adrian and Hyun Song Shin, "The Changing Nature of the Financila Intermediation and the Financial Crisis of 2007-09", Federal Reserve Bank of New York Staff Reports, Staff Reports no. 439, March 2010.

Adrian and Shin (2010) provide a detailed description and analysis of what is meant by a market based financial system. One of its main features is the growing importance of three related phenomenon: securitization, the so-called shadow-banking system and broker dealers. Securitization has broadened the access to credit and reinforced the role financial market based interest rates – e.g. mortgages rates are closely related to Treasury yields. But it has not reduced the importance of non-neoclassical or balance-sheets transmission channels, it has just changed their nature.

As a result, a specific case can be made to maintain or add credit related indicators in the LEI for the US. Long term historical evidence also supports that view. Bordo and Haubrich (2009)[35] suggest a close relationship between corporate credit spreads and the business cycle. They also insist on the importance of credit crunches – i.e. non price related credit rationing – reinforcing the case for non-price related indicators. However, their econometric analysis shows that the average duration (and asymmetry) of credit cycles doesn't correspond to the average duration of business cycle.

Overall, theoretical, historical and statistical evidence supports the inclusion of credit related and non-price credit related indicators – i.e. quantity and survey based indicators – in the LEI for the US.

3. The Changing Relationship between Real M2 and Economic Activity

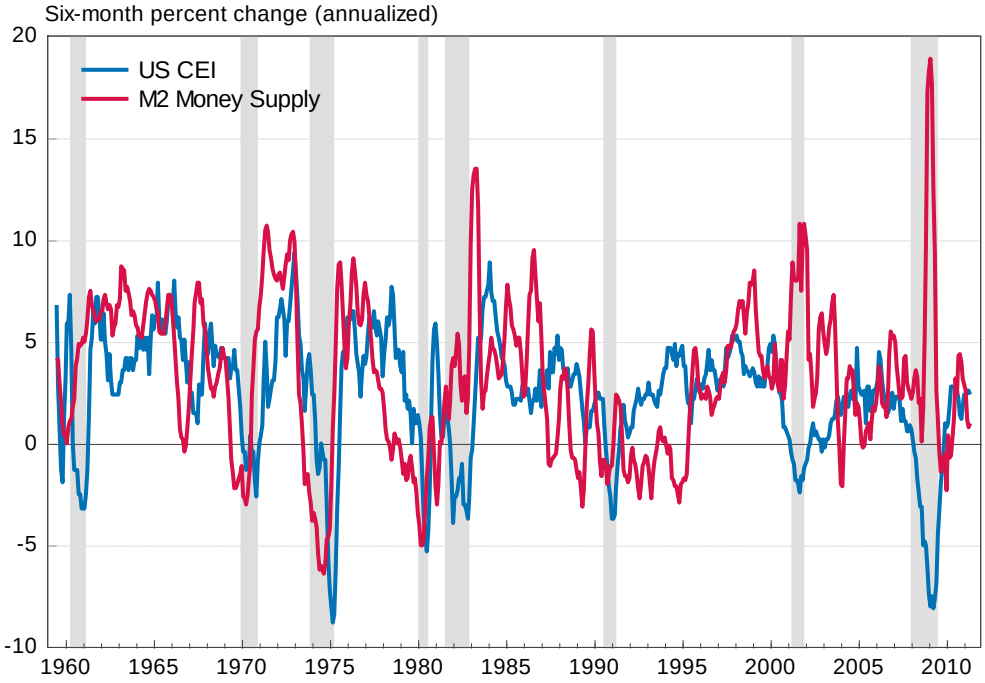
Until the mid-1980s, real M2 performed well as a leading indicator. It could be argued perhaps that it was able to capture, at least imperfectly, various channels through which financial and credit activity could impact real economic activity in the short term. It was procyclical and anticipated turning points in general economic activity. The leading relationship and usefulness of broad monetary aggregates was documented by Victor Zarnowitz and Charlotte Boschan in the 1970s.[36] When monetary aggregates were deflated with an appropriate price index, they tended to show consistent leads ahead of business cycle turning points. This is because late in an economic expansion, nominal money growth tends to fall as banks become increasingly restrained in their ability to create deposits by the availability of reserves. At the same time, the increase in prices usually picks up late in the cycle. Thus, real money balances would typically decline ahead of an economic downturn.

However, this relationship broke down over the past couple of decades as a result of structural changes in the U.S. economy and the banking and financial sectors (Chart 1). The 10-year correlation between the six-month growth rates in real M2 and the CEI, a measure of current economic activity, was fairly stable and high at 0.8 during the 1960s and 1970s. However, this relationship deteriorated in the following decades, and it eventually became negative during the past decade.

[35] Michael D. Bordo and Joseph G. Haubrich, "Credit Crisis, Money and Contractions: an Historical View", NBER Working Paper Series, Working Paper 15389, September 2009.

[36] Victor Zarnowitz and Charlotte Boschan, "Cyclical Indicators: An Evaluation and New Leading Indexes", 1977, pp 170-184.

Chart 1, Real M2 and the U.S. CEI



Levanon (2010) provides further evidence of the changing relationship between real M2 and economic activity[37] and shows that, compared to other leading indicators and the LEI itself, real M2 has performed poorly as a leading indicator since 1989. For every indicator studied, the quarters in the sample were ranked by the likelihood of being recession quarters and then compared with the timing of the actual recessions. For the 1989–2009 period, 10 of real M2's 12 recession signals were produced in quarters when a well-performing leading indicator should not have signalled a recession.

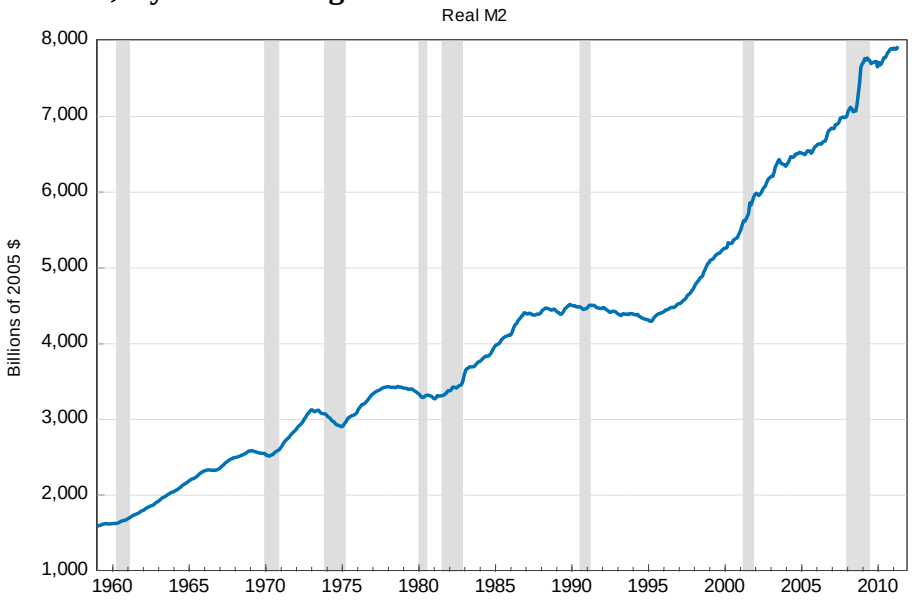
The breakdown in the procyclical relationship between real M2 and the CEI can be attributed to several factors. As suggested above, examples include the shift in the conduct of monetary policy in the 1980s, when the Federal Reserve abandoned targeting monetary aggregates in favor of targeting interest rates, weakened the positive link between real M2 and economic activity. In addition, the innovations that resulted from financial market deregulation— e.g. the creation of interest-bearing checking accounts and money market funds—spurred safe-haven demand for real M2. In periods of high risk aversion, such as those that occur before or during recessions, investors would shift away from risky assets to money, thereby raising M2 balances and creating a negative relationship between real M2 and economic activity. During these periods, inflation could also fall, which would push real M2 higher and possibly magnify its negative relationship to economic activity. The downtrend in inflation since the 1980s could also have contributed to the poor performance of real M2, since it was the interaction between nominal money balances and inflation that was believed to be important in making real M2 a suitable leading indicator. A negative relationship between real money supply and economic activity could occur when nominal M2 is rising faster than the price level.

[37] Gad Levanon, "Evaluating and Comparing Leading and Coincident Economic Indicators," *Business Economics*, Vol. 45, No. 1, 2010, pp. 16–27.

3.1 The Impact of Real M2 on the LEI in 2007

Until the 1990s, real M2 had performed fairly well in signalling in advance the peaks and troughs in economic activity. Since then, real M2 has not conformed well to the business cycle, missing the 2001 and 2007 recessions (Chart 2). The propensity of real M2 to miss turning points was also mentioned in Zarnowitz (1992) and documented in the *Business Conditions Digest* (December 1989, p. 104). According to these sources real M2 missed six of the turning points in the business cycles that occurred during 1953 and 1982. Despite this record, real M2 had fewer false signals and an acceptable leads at peaks and troughs. According to Zarnowitz (1992) the misses were given less weight than false signals. Thus, real M2 qualified as a component of the LEI at that time. However, the experience of the last two decades and the last two or three recessions suggests there may be a potential cost to including real M2 among the LEI components.

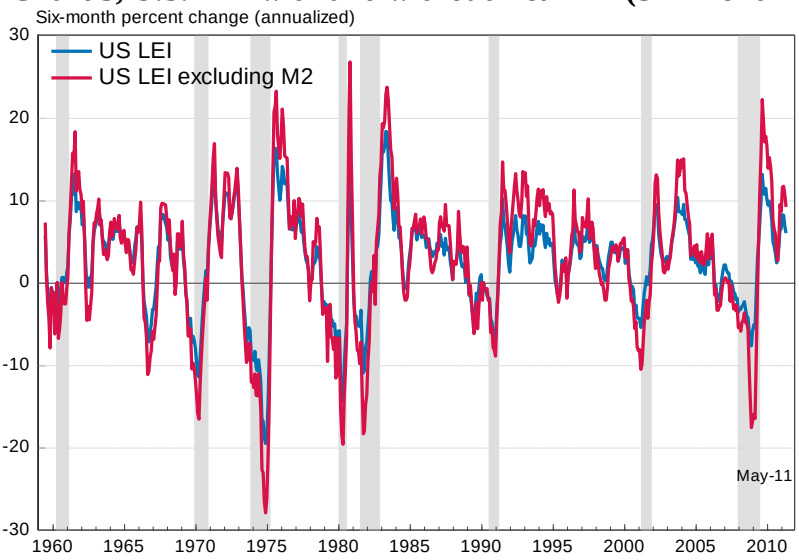
Chart 2, Cyclical Timing of Real M2



From 2007 to 2008, the correlation between the monthly changes in real M2 and the CEI was −0.6, while that for real M2 and real GDP was −0.7. Since real M2 continued to increase from 2007 to 2008, the declines in the LEI during this period were smaller compared to what they would have been had M2 not been in the index (Chart 3).[38] Without real M2, the six-month declines in the LEI would have exceeded 5.0 percent (annual rate) at the beginning of 2008, which, according to the Three Ds criteria, would have been a stronger recession signal than the one the present LEI (including real M2) produced.[39] Recall that real GDP did not contract severely until the second half of 2008. (According to revised data in December 2011, real GDP was negative already in 2008Q1 at -1.8 although 2008Q2 was 1.3. Third and fourth quarters of 2008 saw deeper contractions in real GDP -- -3.7 and -8.9, respectively)

[38] In general, the amplitude in the LEI is smaller than if real M2 were excluded from the index.
[39] According to the "Three-Ds" rule**,** a recession usually follows when the (annualized) six-month decline in the LEI reaches at least 4.5 percent and the six-month diffusion index falls below 50 percent.

Chart 3, U.S. LEI with and without Real M2 (Six-Month Annual Rate of Change)



On the other hand, the peak of the LEI ahead of the latest recession without real M2 would have been much earlier and far less credible. If real M2 is excluded, the leading index would have reached a turning point in January 2006, which is 23 months ahead of the cyclical peak. The turning point in the current leading index is 5 months (Table 1). An earlier peak would have also eliminated the essentially flat period from January 2006 to July 2007—a pattern that was generally consistent with economic conditions prevailing at that time. All previous peaks of the LEI are unaffected by the omission of real M2. However, excluding real M2 from the LEI would change some of its troughs, and reduce the median lead at troughs from 7 months to 2 months and the average lead from 3.9 months to 2.9 months.

Table 1, Leads/Lags of the LEI with and without Real M2

Business Cycle Peaks		
	Current LEI	LEI ex M2
Apr-60	-10	-10
Dec-69	-8	-8
Nov-73	-9	-9
Jan-80	-14	-14
Jul-81	-8	-8
Jul-90	-18	-18
Mar-01	-11	-11
Dec-07	-5	-23
Mean	-10.4	-12.6
Median	-9.5	-10.5
St. Deviation	4.0	5.4
Business Cycle Troughs		
	Current LEI	LEI ex M2
Feb-61	-3	-2
Nov-70	-7	0
Mar-75	-2	-2
Jul-80	-2	-2
Nov-82	-10	-10
Mar-91	-2	-2
Nov-01	-2	-2
Jun-09	-3	-3
Mean	-3.9	-2.9
Median	-2.5	-2.0
St. Deviation	3.0	3.0

Note: Negative numbers denote number of months of leads.

3.2 The Future of Real M2 as an Indicator

In addition to an unstable relationship with business cycles, our analysis suggests that real M2 is adding noise, rather than relevant information about the economic cycle, to the LEI for the United States. We are therefore proposing to remove real M2. However, this removal raises some questions. Firstly, just omitting M2 do not necessarily improve the behaviour of the LEI for the United States at turning points – see above the impact on the lead time before the last peak – and therefore this could lead to an increase in the difficulty of interpreting the signals from the LEI.

It should be noted that the problems of real M2 apply to all the available monetary aggregates[40] which have been evaluated with the approach proposed by Levanon (2010). Of course, M3 was not tested as it is not published anymore. We could have tested a proxy of M3 but historical and theoretical researches – see below – suggest that other financial and credit indicators may be more appropriate and that monetary aggregates have ceased to be good proxies of credits in a market-based financial system.

Secondly, the removal of a leading indicator that has failed to perform during recent turning points raises the concern of missing signals in the future. Indeed, as business cycles have different causes and follow different patterns, this leading indicator may prove once again

[40] i.e. M0 and M1 as well as the difference between these aggregates.

useful in signalling future turning points. However, the above and below mentioned explanations for the lack of performance of real M2 since the beginning of 1990s suggest that a structural shift has taken place and that it is unlikely to be reversed. As a result, there are good reasons to think the real M2 or other monetary aggregates are unlikely to perform as reliable leading indicators again in the future.

At the same time, the financial crisis has highlighted the importance of the credit cycle and of the related indicators, which were previously incorporated via real M2. So, on top of the yield spread and stock prices, a case can be made for credit related financial indicators.

4. Existing financial conditions indexes

Given the lack of detailed knowledge and the apparent changing nature of the relationship between credit markets and the real economy – due to innovation, the importance of the shadow banking system or difficulty to monitor over-the-counter (OTC) derivatives – one can be tempted to favour broad financial conditions indicators which incorporate as many indicators as possible to avoid missing signal provided by different market segments. This is the approach taken by Hatzius et. al. (2010)[41] and Brave and Butters (2010).[42] However, the apparent lack of a stable relationship between the credit cycle and the business cycle and the reliance of such indexes on econometric estimation given the available data suggests that such indexes could add noise to the LEI, especially in a real time setting.

There are numerous indicators intended to track financial conditions in the United States. They can be pooled into two main categories. The first category focuses on financial instability. As implied by their name, their purpose is to provide early signals of financial crisis. Financial crises are often related to recessions, either as causes or as consequences, but they don't appear to have a consistent relationship with business cycles defined as expansions and contractions in the level of real economic activity. As a consequence, these indicators are generally unfit as components of a composite business cycle index such as the LEI for United States.[43]

The second category of financial indicators is made of financial condition indexes. These indexes build on the tradition of monetary conditions indexes that were developed in the early 1990s to gauge the stance of monetary policy in some countries (e.g. Bank of Canada (BoC)).[44] LEIs are indicators of the business cycle, but financial condition indexes are more closely related to the growth cycle concept.[45] Financial conditions indexes have evolved since their inception, but they remain related to growth cycle defined as fluctuations in the

[41] Jan Hatzius, Peter Hooper, Frederic Mishkin, Kermit L. Schoenholtz and Mark W. Watson (April 2010) "Financial Conditions Indexes: A Fresh Look after the Financial Crisis"

[42] Scott Brave, R. Andrew Butters (2010) "Gathering Insights on the Forest from the Trees: A New Metric for Financial Conditions "

[43] Note that professional investors use risk-appetite indicators which are close to financial instability indexes but which purpose it to be used as market timing indicators.

[44] These indicators – which included foreign exchange related indicators – seemed better for monetary policy purpose than the Taylor-Rule for export oriented economies like Canada.

[45] Business cycles are defined as expansions and contractions in the level of real economic activity while growth cycle while growth cycles are defined as deviation from the trend level of activity, a concept that is used in the conduct of monetary policy as explained above.

deviations from the long run growth of the economy– instead of business cycles– and are also often related to monetary policy assessment and forecasting. In addition, a majority of them are constrained by the short history of their components.

5. The Proposed Leading Credit Index

Given the need to complement the yield spread and stock prices with non-price and credit related indicators, and given the lack of a satisfying index that targets the level of general economic activity (rather than its growth rate or deviations from trend), we develop a Leading Credit Index (LCI) and argue that this index can be a useful component of the LEI for United States. The purpose is to construct a composite index whose specific aim is to provide early signals of turning points of the business cycle. Because of the unique features of the financial indicators and data availability, we take an approach that is closely related to developing earlier versions of the LEI, but also take advantage of other methods in our selection and evaluation of the components as well as the index construction.

The first step is to select a "small" number of financial indicators that fulfils TCB's requirements for LEIs' components and that include non-price and/or credit related data. While there is a growing literature in using large datasets to extract common factors in an economy and use these in forecasting, we follow the more traditional approach of carefully selecting a subset of components. There are a number of papers on the advantages of large vs. small data sets and the latter come out favourably (see Inklaar et. al.).

We use several methods to determine which financial indicators are the best leading indicators of turning points in economic activity. As components of the LCI we select those financial indicators that receive the highest rankings. We also compared the financial indicators that we considered with the existing components of the LEI. We used three approaches to evaluate the indicators. The first is the turning point analysis that was traditionally done when the set of leading indicators were first selected. The second is based on a regime switching model where the variables are modeled using a Markov switching model. Lastly, the third approach was based on generating recession probabilities using a probit model.

We complement the traditional approach of turning point analysis with the two latter because there are only three business cycle peaks and troughs in the sample since 1990. And, many indicators considered do not have turning points that can be matched to business cycle turning points but they nevertheless contain useful information on the state of the business cycle and whether the economy is in expansion or contraction. In addition, we don't want to use traditional model fitting exercises (i.e. econometric) so we specifically focus on matching turning points in short sample using the other methods.

3.1 Selecting Indicators Based on Their Ability to Signal Turning Points: The Markov Switching Method

Since the seminal work of Hamilton (1989) a large body of literature has applied regime switching to various empirical settings. The idea behind regime switching has been that the parameters of an econometric model are not constant over time. Allowing them to switch between several regimes is thought to improve the fit of a model and its forecasting ability. A byproduct of this method has been regime-switching probabilities, which are the

probabilities that a given indicator is in a low-mean regime. This method simultaneously estimates the parameters for each regime and the probability of being in the low-regime in every period. In our approach, the way this method is used for evaluating leading indicators compares the timing of the periods with the highest low-regime probabilities with the timing of recessions[46]. For example, in the 1989-2011 period, there were 12 quarters that are considered recessions (1990 Q3-1991Q1, 2001Q1-2001Q4, 2007Q4 – 2009Q2, according to the NBER). During that time, we compare the timing of the 12 quarters with the highest low-regime probabilities for each indicator with the timing of the recession quarters. We choose the same number of recession signal quarters, 12, as the number of quarters in recessions, because if we demand that leading indicators signal both peaks and troughs, then the duration of the recession signal needs to start before the peak and end before the trough. That means that the duration of the recession signal is roughly the same as the recession itself. We divide the sample into "good zones" and "bad zones." The good zone is a period where we would want a good leading indicator to signal a recession. In this method we defined the good zone as the zone that includes the three quarters prior to the beginning of the recession and quarters during the recession except for the last two quarters of the recession. The bad zone is a period between the last quarter of a recession and four quarters prior to the next recession. One quarter before the last quarter of the recession is a neutral zone because it is not clear if a good leading indicator should signal a recession during that quarter.

Table 2 summarizes the recession signals generated using this method by the ten components of the LEI and the financial indicators we considered for the LCI. In the first seven columns it shows where the 12 low-regime quarters are located for each indicator across the business cycles in our sample. The score at the last column is the number of quarters in the good zone (columns one, two, and three) minus the number of quarters in the bad zone (columns 5, 6, and 7). The indicators are ranked according to the score in the last column, from highest to lowest. A higher score indicates that the indicator gives good recession signals with appropriate timing before recessions.

This table also provides additional evidence for omitting the money supply component of the LEI. Out of the 12 recession signals of this indicator, only two occurred in the good zone. Some of the indicators we considered for the LCI were ranked the highest in Table 2. The top two were the two-year swap spread and the senior loan officer survey. The LIBOR spread and the bull-bear sentiment index were also ranked better than the existing components of the LEI.

[46] For a more detailed description of the method, please see Levanon (2010).

Table 2 – Markov Switching Model Results

Ranking Financial Indicators Based on Their Ability to Signal Recession Using a Markov Switching Model, 1989Q3 - 2011Q1

			Recession Signal observed: P-3	P (Peak)	Other recession quarters	T(Trough)	T+3	Expansions
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	VARIABLE	Score	3 before first	first	other recession	last	3 after last	other
1	**2-years Swap Spread**	7	4	2	3	0	0	2
2	**Senior Loan Officers C&I loan survey – Bank tightening Credit to Large and Medium Firms**	5	3	1	3	1	1	0
3	Average Weekly Initial Claims Unemployment Insurance (SA, Thous)	3	2	1	3	2	0	1
4	**LIBOR 3 month less 3 month Treasury-Bill yield spread**	2	2	1	3	1	0	3
5	Building Permits: New Private Housing Units (SAAR, Thous)	2	3	1	2	1	0	3
6	Interest Rate Spread: 10-Year Treasury Bonds Less Federal Funds (%)	2	7	0	0	0	0	5
7	**WILSHIRE 5000 Index**	1	1	2	2	1	1	2
8	**AAII Investors Sentiment Bullish (%) les Bearish (%)**	0	1	2	2	1	1	3
9	Average Weekly Hours: Manufacturing (SA, Hours)	0	2	1	2	1	0	4
10	Manufacturers New Orders: Consumer Goods & Materials (SA, Mil. 1982$)	0	1	1	3	2	0	3
11	Manufacturers New Orders: Nondefense Capital Goods (SA, Mil. 1982$)	0	2	1	2	2	2	1
12	S&P 500 Composite Price Index (1941-43=10)	0	1	2	1	2	2	3
13	**Debit balances at margin account at broker dealer**	-1	2	1	1	2	2	1
14	**Total Finance: Liabilities – Security Repurchase**	-1	1	1	3	1	0	5
15	**Consumer Confidence 12M Exp: Stock Prices will Decline (TCB)**	-2	0	1	3	2	1	3
16	Michigan Consumer Expectations (Q1-66=100)	-2	0	1	3	0	1	5
17	**RUSSSEL 2000 Index**	-3	1	2	1	0	1	6
18	**High Yield Spread**	-4	1	1	1	3	2	2
19	Money Supply: M2 (SA, Bil.Chn.2005$)	-6	0	1	1	1	1	6
20	**MOODY'S Baa - Treasury Spread**	-7	0	0	2	2	4	3
21	**VIX Volatility Index**	-8	0	0	1	2	2	5
22	NAPM Vendor Performance Deliveries Diffusion Index (SA, 50+=Slower Deliveries)	-9	0	0	1	1	0	9

Except where indicated, the series are all used in first differences rather than levels. Note: The variables are ranked according to the score they received in column 1. The score is calculated by adding the number of signals that occur before or during recessions and subtracting the number of signals that occur during expansions. That is, cols. 2+3+4-6-7-8. A signal occurs if the Markov switching model indicates a switch in the regime. For a more detailed description of the method, please see Levanon (2010).

On the other hand, some well-known financial indicators we considered ranked very low, especially the corporate spreads and the VIX. These indicators ranked low mostly because they were lagging rather than leading indicators. The corporate spreads in particular are highly correlated with default rates, which tend to lag the business cycle. Among the indicators we considered we chose the highest ranked five or six for the construction of the LCI.[47]

The results from the regime switching analysis are largely confirmed by the probit model analysis. In this method we define a binary variable with the value of one during quarters when there was a recession. We used lags of the indicators to forecast the binary variable one or two quarters ahead using a probit model. We then calculate the quadratic probability

[47] Note this analysis shows that there are other components of the LEI that rank poorly such as the ISM supplier delivery index and the consumer expectations component. In this paper, our focus is on the financial indicators and real money supply only.

scores and use that as a measure for evaluating the leading indicators. In most cases, the results in Table 3 confirm the regime switching analysis.

Table 3 – Quadratic Probability Scores

Earliest lead 1qrt & latest lead 2qrts	QPS 1989/Q3 to 2011/Q2
Financial Index Components	
Senior Loan Officers C&I loan survey – Bank tightening Credit to Large and Medium Firms	0.1145
Average Weekly Initial Claims Unemployment Insurance (SA, Thous)	0.1445
2-years Swap Spread	0.1509
Debit balances at margin account at broker dealer	0.1529
Building Permits: New Private Housing Units (SAAR, Thous)	0.1550
Total Finance: Liabilities – Security Repurchase	0.1557
Consumer Confidence 12M Exp: Stock Prices will Decline (TCB)	0.1571
WILSHIRE 5000 Index	0.1602
S&P 500 Composite Price Index (1941-43=10)	0.1686
Manufacturers New Orders: Consumer Goods & Materials (SA, Mil. 1982$)	0.1723
LIBOR 3 month less 3 month Treasury-Bill yield spread	0.1739
High Yield Spread	0.1824
MOODY'S Baa - Treasury Spread	0.1973
RUSSSEL 2000 Index	0.2013
AAII Investors Sentiment Bullish (%) les Bearish (%)	0.2059
Manufacturers New Orders: Nondefense Capital Goods (SA, Mil. 1982$)	0.2078
Interest Rate Spread: 10-Year Treasury Bonds Less Federal Funds (%)	0.2174
Average Weekly Hours: Manufacturing (SA, Hours)	0.2208
VIX Volatility Index	0.2245
Money Supply: M2 (SA, Bil.Chn.2005$)	0.2410
NAPM Vendor Performance Deliveries Diffusion Index (SA, 50+=Slower Deliveries)	0.2654

The indicators that have been selected with this strategy are (ranked according to their frequency – frequency and sources are shown in Table 4):

- 2-years Swap Spread (real time)
- LIBOR 3 month less 3 month Treasury-Bill yield spread (real time)
- Debit balances at margin account at broker dealer (monthly)
- AAII Investors Sentiment Bullish (%) less Bearish (%) (weekly[48])
- Senior Loan Officers C&I loan survey – Bank tightening Credit to Large and Medium Firms (quarterly)
- Total Finance: Liabilities – Security Repurchase (quarterly)

This selection of indicators is compatible with the model of financial intermediation described by Adrian and Shin (2010) and the historical evidence presented by Schularick and Taylor (2009). Our selected components are also found in broader financial conditions indexes like the one developed by Hatzius et. al. (2010). The two first are credit related price indicators. The 2-year Swap Spread is a standard measure of the creditworthiness of banks and by extension of corporate credit spread.[49] The LIBOR 3 month[50] less 3 month Treasury-Bill yield spread is a liquidity indicator of the funding conditions of banks[51] but also of other financial firms as the quest for quality collateral – i.e. Treasury-Bill – for liquidity purpose can signals stress in the system.

The four remaining indicators correspond to our non-price constraints. Debit balances at margin accounts[52] at broker dealer is an indicator of the willingness and the ability of speculators to leverage their bets on financial markets. As such, it depends on the balance-sheets of speculators and broker dealer alike and is mainly driven by the level of interest rates and risk appetite with a clear pro-cyclical nature. The AAII[53] Investors Sentiment Bullish (%) less Bearish (%) is an indicator of the risk appetite of retail investors. It is often considered as a contrarian indicator of the stock market – i.e. extreme optimism tends to lead markets' declines while extreme pessimism tends to lead markets' rebound.

The Senior Loan Officers C&I loan survey – Bank tightening Credit to Large and Medium Firms (quarterly) is a traditional non-price indicator of credit availability and by extension of

[48] Weekly data are averaged to give monthly observations.

[49] An interest rate swap is a derivative in which one party exchanges a stream of interest payments for another party's stream of cash flows. Interest rate swaps are used by hedgers and speculator to manage fixed or floating assets and liabilities. The swap spread is determined by the same factors that influence the spread over Treasuries of financial instruments with same characteristics. Swaps spread with maturities of less than five year depends on the cost of hedging in the Eurodollar CD futures market. For longer maturities, swap spreads depends on the credit spreads in the corporate bon market.

[50] The LIBOR is the London Interbank Offered Rates (see www.bbalibor.com for more details). is the primary benchmark for short term interest rates globally. It is used as the basis for settlement of interest rate contracts on many of the world's major futures and options exchanges and is often used as a barometer to measure the health of financial monetary markets.

[51] It also used as an indicator of risk aversion in financial markets.

[52] In a margin account, the broker lends the customer cash to purchase securities. The loan in the account is collateralized by the securities and cash. If the value of the stock drops sufficiently, the account holder will be required to deposit more cash or sell a portion of the stock.

[53] The American Association of Individual Investors. See www.aaii.com/sentimentsurvey for more details on the indicator.

non-price credit rationing – i.e. credit crunch.[54] Once again, that is an indicator that is closely related to balance-sheets, in the case of non-financial firms and (mainly commercial) banks. The Total Finance: Liabilities – Security Repurchase (repos) is particularly relevant in a market-based credit system as repos is the main source of funding for many financial firms and in particular broker dealers that are so central to the functioning of the system. As such, it also provides an indication on what is taking place in the shadow-banking system.

The second step is the aggregation of these indicators. Using the normalized values of the indicators, we used principal component analysis to create the index.[55] The two quarterly series were interpolated to the monthly frequency, using the Chow-Lin interpolation method using as an instrumental variable the National Financial Conditions Index (NFCI) published by the Federal Reserve Bank of Chicago.[56] Chart 4 shows the Leading Credit Index, with Top 5 referring to the index created from highest ranked five components and Top 6 referring to the index created from the Top 6 indicators in Table 6. The LCI is the first principal component of the selected indicators and its fluctuations match the major business cycle fluctuations in the available sample since 1990. The cumulated form of the LCI can be compared directly with the levels of LEI and CEI. The cumulation procedure is also useful in the interpretation of the LCI as a business cycle indicator.

Chart 4 – Leading Credit Index

[54] Asymmetric information and its consequences in terms of adverse selection and moral hazard explain why banks do not use the interest rate charged to borrowers to clear the credit market. The use of collateral and other credit enhancement techniques mitigate these problem but only partially Moreover, all borrowers are not equal with respect to the access to other sources of funding.

[55] Principal component analysis (see, Stock and Watson, 2002) helps to identify the common business cycle component of the selected variables. The variance structure of the set of selected index components is modeled using linear combinations of the variables. The coefficients or loadings serve as weights that combine the selected variables. The principal component was calculated in Eviews.

[56] See Chow and Lin (1971). NFCI is a coincident index of financial conditions published weekly by the Federal Reserve Bank of Chicago. We rely on the high correlation of this composite indicator with our selected variables and utilize it in the time disaggregation of the quarterly variables.

Table 4, Selected Financial Indicators

TCB Financial Index Components

	Indicator	Frequency	Source
1)	Two-year Swap Spreads	monthly	Datastream
2)	Libor 3 month Less Treasury 3-month yield	monthly	ECB, Federal Reserve, Datastream
3)	Debit balances at margin accounts at broker dealers	monthly	New York Stock Exchange, Haver
4)	Senior Loan Officer C&I Loan Survey - Banks Tightening Credit to Large & Medium Firms	quarterly	Federal Reserve
5)	AAII Investor Sentiment: Bullish (%) Less Bearish (%)	monthly	American Association of Individual Investors, Haver
6)	Total Finance: Liabilities - Security Repurchases	quarterly	Federal Reserve, Bureau of Economic Analysis

The AAII Investor Sentiment Survey measures the percentage of individual investors who are bullish, bearish, and neutral on the stock market for the next six months; individuals are polled from the ranks of the AAII membership on a weekly basis. Only one vote per member is accepted in each weekly voting period.

Debit balances at margin accounts at broker dealers. Series refers to aggregate debits in securities margin accounts, as well as aggregate free credits in cash and margin accounts. Margin accounts cover stock, convertible bond, special subscription, and corporate and government bond accounts. This is reported by NYSE member organizations (and can be found in Federal Reserve Bulletin" Table 1.36). Deflated by PCE.

Security repurchases outstanding in financial companies. Deflated by PCE. From Flow of Funds Liabilities. (Table L.5 Total Liabilities and Its Relation to Total Financial Assets, item 11 – Security RPs.)

Chart 5 LEI and new LEI (replacing M2 with LCI)

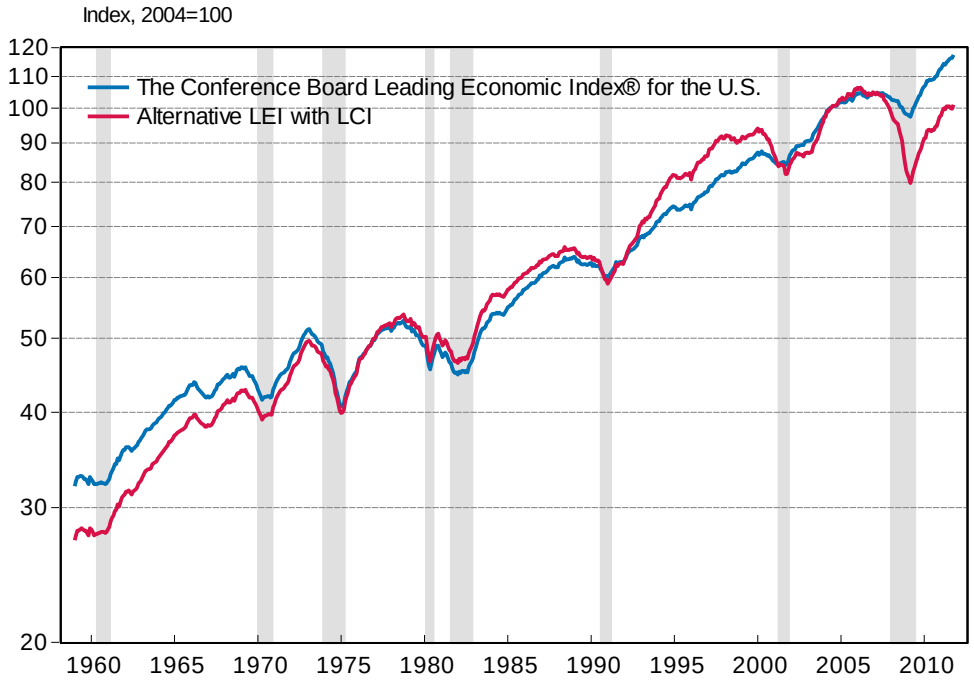


Chart 5 shows the current LEI and the alternative LEI which replaces the M2 component with our new Leading Credit Index (LCI). The history of the two indexes are very similar until 1990, as expected, because the new LCI only enters the LEI after May 1990 (given data availability for the selected financial indicators). The new LEI shows a more rapid expansion during the 1990s and a much deeper contraction ahead of and during the 2008-2009 recession. Following the end of the latest recession, the new LEI shows a rapid recovery, as does the old LEI, but the former has not recovered its previous peak (this is similar to the post recession behavior of the CEI, not shown). Table 5 below shows the turning points of the

alternative indexes with and without the M2 component, and with two versions of the LCI replacing the M2 component. The historical turning points and the average leads at peaks and troughs remain roughly the same. The lead ahead of the most recent business cycle peak in December 2007 increases to over 20 months compared with the 5 months lead in the current LEI. While an ex-post lead of 20 months is somewhat too long to be very useful in real time, the cyclical movements in the alternative LEI are not entirely inconsistent with the similar cyclical movements in the current LEI which also showed an essentially flat period in the index during 2006-2007 with a double peak configuration.[57]

Table 5, Cyclical Timing of LEI, LEIexM2, and LEI with LCI

Business Cycle Peaks

	NLEI_PC5		NLEI_PC6		LEI_EXM2		USLEAD
Apr-60	-3	*	-3	*	-4	*	-10
Dec-69	-8		-8		-8		-8
Nov-73	-9		-9		-9		-9
Jan-80	-15		-15		-15		-15
Jul-81	-8	*	-8	*	-8		-8
Jul-90	-6		-4		-18		-18
Mar-01	-11		-11		-14		-11
Dec-07	-21		-21		-23		-5
Mean	-10.1		-9.9		-12.4		-10.5
Median	-8.5		-8.5		-11.5		-9.5
St. Deviation	5.6		5.9		6.3		4.2

Business Cycle Troughs

	NLEI_PC5		NLEI_PC6		LEI_EXM		USLEAD
Feb-61	-11	*	-11	*	-3	*	-3
Nov-70	-7		-7		-7		-7
Mar-75	-2		-2		-2		-2
Jul-80	-2		-2		-2		-2
Nov-82	-10	*	-10	*	-10		-10
Mar-91	0		0		-2		-2
Nov-01	-1		-1		-2		-2
Jun-09	-3		-3		-3		-3
Mean	-4.5		-4.5		-3.9		-3.9
Median	-2.5		-2.5		-2.5		-2.5
St. Deviation	4.2		4.2		3.0		3.0

*manually selected

In Table 6 and 7, we compare LCI with other financial indicators described above. We find that in the 1990-2009 period, the two alternatives we considered were ranked higher than any other financial indicator or index.

[57] See footnote 47 on other components of the LEI. This exercise only discusses the marginal effect of omitting M2 and replacing it with LCI.

Table 6 – Quadratic Probability Scores

Earliest lead 1qrt & latest lead 2qrts	QPS 1990/Q3 to 2009/Q4
Financial Indexes Comparison	
LCI TCB TOP6	0.0678
LCI TCB TOP5	0.0781
Senior Loan Officers C&I loan survey – Bank tightening Credit to Large and Medium Firms	0.1298
Total Finance: Liabilities – Security Repurchase	0.1326
FCI Deutsche Bank	0.1463
FCI Chicago FED	0.1484
2-years Swap Spread	0.1509
Debit balances at margin account at broker dealer	0.1543
Average Weekly Initial Claims Unemployment Insurance (SA, Thous)	0.1573
FCI Kansas City FED	0.1681
Building Permits: New Private Housing Units (SAAR, Thous)	0.1690
LIBOR 3 month less 3 month Treasury-Bill yield spread	0.1796
S&P 500 Composite Price Index (1941-43=10)	0.1832
Manufacturers New Orders: Consumer Goods & Materials (SA, Mil. 1982$)	0.1891
FCI CITI	0.1918
FCI purged (Hatzius et. al.)	0.2045
Michigan Consumer Expectations (Q1-66=100)	0.2104
AAII Investors Sentiment Bullish (%) les Bearish (%)	0.2200
Interest Rate Spread: 10-Year Treasury Bonds Less Federal Funds (%)	0.2226
Manufacturers New Orders: Nondefense Capital Goods (SA, Mil. 1982$)	0.2296
Average Weekly Hours: Manufacturing (SA, Hours)	0.2425
Money Supply: M2 (SA, Bil.Chn.2005$)	0.2669
FCI Chicago FED (purged)	0.2703
NAPM Vendor Performance Deliveries Diffusion Index (SA, 50+=Slower Deliveries)	0.2911

Earliest lead 2qrts & latest lead 3qrts	QPS 1990/Q3 to 2009/Q4
Financial Indexes Comparison	
2-years Swap Spread	0.1501
LCI TCB TOP6	0.1624
LCI TCB TOP5	0.1724
Interest Rate Spread: 10-Year Treasury Bonds Less Federal Funds (%)	0.1812
FCI Deutsche Bank	0.2064
Senior Loan Officers C&I loan survey – Bank tightening Credit to Large and Medium Firms	0.2065
FCI Chicago FED	0.2065
LIBOR 3 month less 3 month Treasury-Bill yield spread	0.2137
FCI purged (Hatzius et. al.)	0.2163
Debit balances at margin account at broker dealer	0.2231
Total Finance: Liabilities – Security Repurchase	0.2232
Average Weekly Initial Claims Unemployment Insurance (SA, Thous)	0.2269
Building Permits: New Private Housing Units (SAAR, Thous)	0.2294
FCI CITI	0.2362
FCI Kansas City FED	0.2367
S&P 500 Composite Price Index (1941-43=10)	0.2458
Michigan Consumer Expectations (Q1-66=100)	0.2519
Manufacturers New Orders: Consumer Goods & Materials (SA, Mil. 1982$)	0.2539
AAII Investors Sentiment Bullish (%) les Bearish (%)	0.2670
Average Weekly Hours: Manufacturing (SA, Hours)	0.2674
FCI Chicago FED (purged)	0.2733
Manufacturers New Orders: Nondefense Capital Goods (SA, Mil. 1982$)	0.2748
Money Supply: M2 (SA, Bil.Chn.2005$)	0.2849
NAPM Vendor Performance Deliveries Diffusion Index (SA, 50+=Slower Deliveries)	0.2888

Table 7, Selected Financial Indexes and Their Relative Ranking based on QPS

Indexes Comparison	
QPS 1-2 Qtrs	
TCB LCI Top 6	0.0678
TCB LCI Top 5	0.0781
FCI Deutsche	0.1463
FCI Chicago Fed	0.1484
FCI KC Fed	0.1681
FCI Citi	0.1918
FCI_prgd_Watson	0.2045
FCI Chicago Fed Adj.	0.2703

6. Real time forecasting performance of the proposed index

6.1 Forecasting the growth of the Coincident Economic Index (CEI) with the LEI in Real Time

Given the selection of the components of the new LCI, we now turn to an evaluation of the forecasting performance of the new leading index which incorporates the LCI. We construct a forecasting test in the spirit of Granger causality tests by using a simple time series model which uses lags and the current (or old) LEI to forecast growth in the CEI. We then ask whether replacing the old LEI with the new alternative in this model reduces out of sample forecast errors. Our approach follows Diebold and Rudebusch (1999), McGuckin et. al. (2007), and McGuckin and Ozyildirim (2004) among others. Our hypothesis is that in real-time (unrevised) out of sample forecasts of the final (historical) data for the CEI can be improved when the new LEI composition is used compared to the old LEI composition (which includes real M2).

Since both LEI and CEI are nonstationary we first transform the variables into growth rates.[58] All of our forecast models use data in one-, three-, or six-month logarithmic differences for CEI and LEI. In our forecasting exercises, we look at one-month ahead, three-month ahead and six-month ahead forecast horizons. The LEI is commonly referred to as a short term forecasting tool effective over such short horizons. A useful leading index should be capable of anticipating changes in CEI over these near-term intervals.

[58] For the US LEI, Camacho and Perez-Quiros (2002, pp. 62-63) note that the augmented Dickey-Fuller test cannot reject the null hypothesis of a unit root in the levels of the LEI series but is consistent with stationarity of log differences of LEI. We have also used detrended the data before estimating the models. The results parallel those in growth rates. Detrending the composite indexes requires that an appropriate long term trend be estimated. In this we follow the guidance of Zarnowitz and Ozyildirim (2006) who compared different trend estimation methods used in the recent literature, such as Hodrick-Presscot and band pass filters, with the Phase Average Trend (PAT) method used by the traditional NBER approach (see Boschan and Ebanks, 1978). They argue that if the smoothing parameters are chosen appropriately more sophisticated methods compare well with the PAT method for business cycle analysis. Specifically, they found that the Hodrick-Presscot trend estimated with a lambda parameter of 108,000 is almost identical with the PAT. Similarly, Ravn-Uhlig (2001) argue for a smoother trend, especially for higher frequency data. And this approach has already been incorporated into major statistics packages (i.e. Eviews 7.0). Thus, because of its appropriate trend estimation and computational ease, we have decided to use Ravn and Uhlig's modification of the Hodrick-Prescott trend.

Our benchmark models are simple autoregressions with one lag of the CEI augmented with lags of the LEI. The alternative models use lags of real-time LEI, in addition to the lags of the CEI. In order to mimic real time forecasting conditions as closely as possible we generated 187 vintages (from January 1996 to July 2011) of the LCI and the LEI.[59] Each of the vintages in our dataset provides inputs for out of sample forecasts of CEI in real time. We use an initial in-sample period starting in May 1990 (when the LCI begins and enters the LEI) and ending in December 1995, so the first forecast for the one month horizon is made for January 1996, and the first forecast for the six month horizon is made for June 1996.

The models are specified as:

$$CEI_t = c + \sum_{i=1}^{k} \delta_{1,i} oldLEI_{t-i} + \varepsilon_{1,t}$$

where CEI_t denotes 1,3 or 6 month changes in natural logs of CEI. Rather than optimally choosing the number of lags, we estimate the models with k=6. In the benchmark model, LEI refers to the current LEI. The results could be improved if the lag lengths were selected optimally and regressions were specified more parsimoniously. In the alternative models, we replace old LEI with lags of new LEI so that

$$CEI_t = c + \sum_{i=1}^{k} \beta_{2,i} newLEI_{t-i} + \varepsilon_{2,t}$$

These benchmark and alternative models are used to generate forecasts for three different forecast horizons: one-month ahead, three-month ahead and six-month ahead.

For each vintage in our sample we estimate the benchmark and alternative models and forecast changes in the CEI one, three and six-months ahead. Subtracting these forecasts from the corresponding actual (revised) values of CEI[60] gives us sequences of out-of-sample forecast errors for each model and horizon. We summarize these sequences for all models by an estimate of the mean square error (MSE).[61]

6.2 Empirical Findings

Table 8 summarizes our findings from a range of forecast models. The numbers shown in the table refer to the ratio of MSE's from the benchmark model to the MSE's from the alternative model (i.e. negative numbers show that the alternative model reduces the out of sample forecast errors as measured by MSE of the corresponding model). Thus, an improvement in the forecast indicated by a reduction in forecast errors is denoted by a negative number (in bold) in the table. The forecast horizons and the number of lags of LEI used in each regression are given in columns 1 and 2. Columns 3-5 refer to the different growth rates used (i.e., in logs 1, 3, 6 month changes). For the dlog transformation we only forecast one month ahead. For three month ahead forecasts both 1 month and 3 month log changes are used, and so on.

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[59] See the appendix for notes on the calculation of the real time indexes with unrevised data.

[60] The revised CEI is based on data from July 2011.

[61] Mean squared error is defined as $MSE = \sum_{t=1}^{n} e_t^2 / n$, where n is the number of out of sample forecasts and e_t refers to the out of sample forecast errors.

In Table 8, we have split the out of sample forecast error evaluation period in two sub-samples. The first sub sample is 1996-2007 and it covers the second half of the 1990s expansion in the business cycle, the 2001 recession and the subsequent expansion. In this sub sample we exclude the 2008-2009 recession to isolate the models' performance during what are arguably more typical business cycle phases. In the second sub sample, 1996-2011, we cover the Great Recession of 2008-2009 to see how including this deep and long contraction affects the forecasting performance. In the first part of the out of sample period, one month ahead forecasts with the new LEI do not show a large improvement over the existing LEI. However, in longer horizon forecasts the improvement ranges from 1 to 7 percent. Once the 2008-2009 recession is included, however, there is an even greater improvement in the out of sample forecasting performance of the new LEI. These improvements range from 7 to 23 percent. All model specifications across horizons and number lags of LEI consistently show improvements.

Table 8, Real Time Out of Sample Forecast Performance of the old LEI and new LEI with LCI

Forecast improvement of model with alternative new LEI compared with old LEI, (MSE(new)/MSE(old))-1)

In-sample 1990-95, Out of Sample 1996-07

(1)	(2)	(3)	(4)	(5)
Horizon	**Lags**	**dlog**	**dl3**	**dl6**
	1	0.01		
1	**3**	**-0.01**		
	6	0.01		
	1	0.00	**-0.03**	
3	**3**	**-0.01**	**-0.02**	
	6	**-0.02**	**-0.02**	
	1	**-0.03**	**-0.07**	**-0.07**
6	**3**	**-0.03**	**-0.07**	**-0.06**
	6	**-0.04**	**-0.05**	**-0.05**

In-sample 1990-95, Out of Sample 1996-11

Horizon	Lags	dlog	dl3	dl6
	1	**-0.08**		
1	**3**	**-0.14**		
	6	**-0.12**		
	1	**-0.09**	**-0.23**	
3	**3**	**-0.13**	**-0.21**	
	6	**-0.12**	**-0.20**	
	1	**-0.10**	**-0.18**	**-0.21**
6	**3**	**-0.10**	**-0.16**	**-0.19**
	6	**-0.07**	**-0.13**	**-0.19**

7. Concluding Comments

In this paper we review financial, monetary, credit market indicators from the perspective of their relationship with the general business cycle of the U.S. economy. We document which of these financial indicators are useful in predicting recessions and recoveries (i.e. business cycle turning points) and argue that aggregating our selected indicators in a composite index offers advantages over relying on them individually. Given the nature of most of our selected indicators, we call this composite index the Leading Credit Index (LCI). The advantages of the LCI come from the ability of the simple, easy to calculate and transparent methodology of the composite index approach to generate reliable and smooth estimates of an unobserved business cycle variable.

Our proposed index is the principal component of six selected indicators and, thus, it aggregates different types of quantitative and qualitative survey indicators which are all related to the availability and cost of credit and economic agents' willingness to borrow or lend. We argue that this new index can reasonably capture important channels through which the financial sector can impact the real economy. We also show that the suitability as a leading indicator of one of the financial components of the current LEI, namely the real money supply as measured by M2, has declined in recent decades as a result of changes occurring in the U.S. economy. We argue that our leading credit index is an appropriate replacement for the money supply component of the LEI. We show that forecasting performance of the leading index can be improved upon if our new index of financial conditions is used as a component of the LEI replacing the money supply measure currently used as a component. The contribution of the new LCI to forecasting during the great recession is noteworthy. It is important to note also that the forecasting tests are constructed with the real time performance of the LEI in mind and that they were not used in the indicator selection process.

Considering our overall findings on the new leading index of financial indicators proposed in this paper, we believe the LEI can provide real forecasting improvements, both in forecasting growth and in turning points. The real time out of sample forecasting performance of a new LEI which replaces the real M2 component with this new index support this conclusion. The changes in the behavior and usefulness of real money supply (i.e. ceasing to be a useful leading indicator) to monitor and predict the economic cycle and the emergence of new more useful financial indicators result from the structural changes in the U.S. economy and financial markets over the last 2 or 3 decades. The changes to the LEI we propose help to address some of these structural changes.

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Appendix:

Overview of the LEI

The LEI is a commonly used forecasting tool that helps to predict changes in the direction of aggregate economic activity and business cycle turning points which are identified in the reference chronologies determined by the National Bureau of Economic Research (NBER).[62] Business cycles vary greatly in their duration and magnitude as well as their causes and consequences. The contributions of specific factors differ over time. Composite indexes like the LEI, and the coincident economic index (CEI), rather than individual indicators generally work better in tracking cyclical movements.[63] The multi-causal and multi-factor nature of economic movements is represented better by the LEI than by each of its components: the average workweek, initial claims for unemployment insurance, new investment commitments (orders, contracts, housing permits), real money supply, yield spread, stock prices, and consumer expectations. The monthly change in the LEI is the sum of the (unweighted) contributions from each component. As such, the index summarizes the cyclical movements of its various components.[64] The contributions of the individual components vary over time, depending on the characteristics of each cycle. The leading series themselves vary in timing, smoothness, currency, etc. The index gains from this diversification.[65] The LEI leads the CEI at all business cycle peaks and troughs since 1959.[66] Moreover, this relationship holds in growth rates as well.

Real time indexes

To create real time LCIs, we first need monthly historical series for its components. Using linear interpolation fails to incorporate information about intra-quarterly dynamics of the 2 quarterly series. We chose the Chow-Lin method to interpolate the quarterly series into the monthly frequency. For this we need a monthly series as an instrumental variable. In our case we used the Chicago Fed FCI as the instrumental variable for both quarterly series because it was highly correlated with the quarterly indicators. (The Chicago Fed FCI is a regularly published weekly index of financial conditions.)

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[62] Cyclical activity of the U.S. economy has been measured, monitored, and analyzed using the framework of monthly Business Cycle Indicators which have been classified and grouped according to their cyclical timing – that is, leading, coincident, and lagging indicators. The best of these indicators have been selected as components of composite indexes of business cycle indicators which can be thought of as representing unobserved cyclical indicators of the overall U.S. economy. The U.S. business cycle indicators and their composite indexes are currently published by The Conference Board.

[63] The NBER Business Cycle Dating Committee relies to a large extent on four principal coincident indicators (nonfarm establishment employment, real personal income less transfers, real manufacturing and trade sales, and industrial production (IP)) and real GDP. These are the same four indicators that make up The Conference Board Coincident Economic Index (CEI). The turning points of the CEI match the business cycle peaks and troughs. Growth rates of CEI also mirror peaks and troughs in the growth cycle (see Zarnowitz and Ozyildirim, 2001).

[64] The component contributions are standardized to have equal volatility so that more volatile components do not influence the index disproportionately.

65 Technical problems that arise from this diversity are discussed in McGuckin, Ozyildirim and Zarnowitz (2003). In that paper we dealt intensively with procedures to make the LEI timelier, which are now a regular part of The Conference Board's Program. Here all tests are done on a basis consistent with historical practice, to make the tests consistent with published versions of the LEI.

66 The correlation of the LEI to the CEI appears to be lessened since the mid-1990s. McGuckin and Ozyildirim () suggest that this could be due to structural changes in the U.S. economy underway in the 1990s. In this paper, we identify one of those structural changes, namely, those occurring in the activity of financial sectors of the economy that are not currently well represented in the LEI.

Month of Index being produced (Indexes produced for the previous month)			
	January	February	March
Debit balances at margin accounts	1	1	1
Senior Loan Officer Survey	0	1	2
Security Repurchases	4	2	3

In any given month, the LCI is calculated from data that would have been available at that time. Missing data are forecasted according to the schedule above using the equation below. This is similar to the way missing data due to publication delays are imputed in the LEI; however, it also relies on the high correlation between the Chicago Fed index and the indicator to get a more reliable current estimate.

$$V_t = \beta_0 + \sum_{i=1}^{2} \beta_i V_{t-i} + chicagofed_t$$

For Senior Loan Officer Survey the estimation is done in levels for the other two quarterly variables the estimation is done in dlogs.

Example of Vintages of LCI in real time

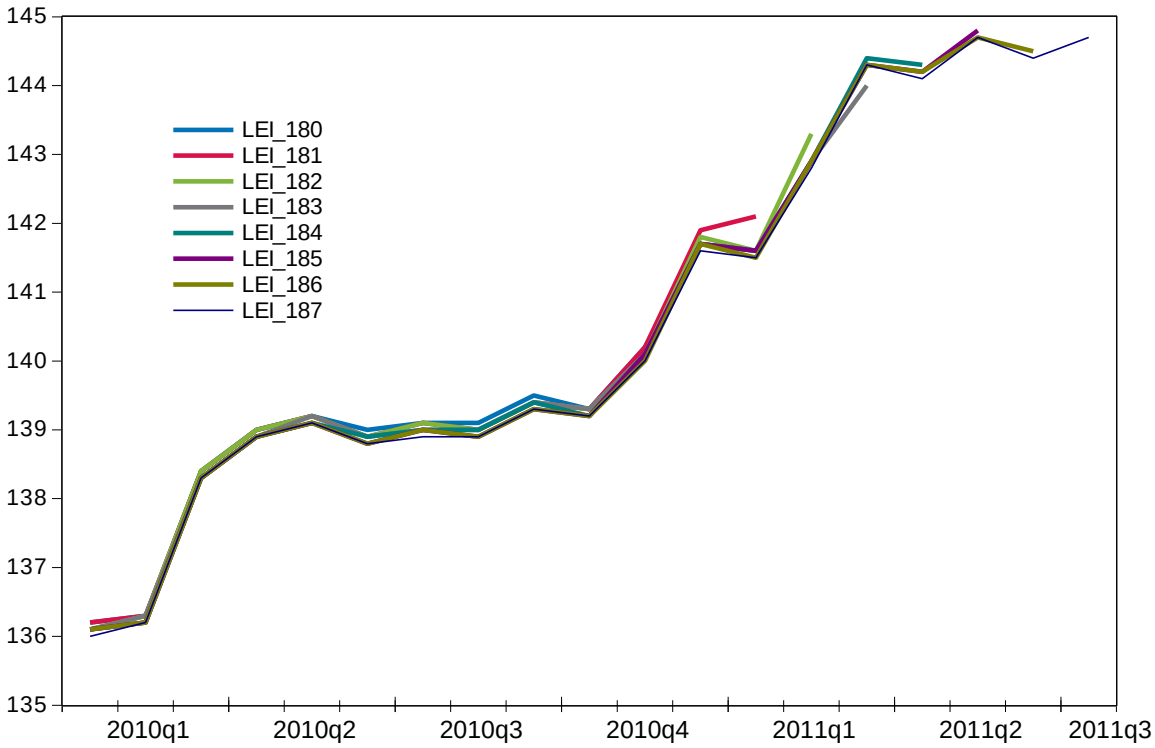
	Jan '96	Feb '96	Mar '96	Apr '96 – Apr '11	May '11	Jun '11	Jul '11
Vintage:	LCI_1	LCI_2	LCI_3	LCI_4 - LCI_184	LCI_185	LCI_186	LCI_187
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Jan-90	2.40	2.42	2.44	…	1.12	1.12	1.12
Feb-90	1.70	1.71	1.73	…	0.82	0.83	0.83
Mar-90	1.79	1.81	1.83	…	0.94	0.94	0.95
…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…
Oct-95	-0.21	-0.13	-0.11	…	…	…	…
Nov-95	-0.93	-0.85	-0.84	…	…	…	…
Dec-95	-0.46	-0.33	-0.31	…	…	…	…
Jan-96	-0.77	-0.43	-0.41	…	…	…	…
Feb-96	NA	-1.28	-1.38	…	…	…	…
Mar-96	NA	NA	-1.03	…	…	…	…
Apr-96	NA	NA	NA	…	…	…	…
May-96	NA	NA	NA	…	…	…	…
…	NA	NA	NA	…	…	…	…
…	NA	NA	NA	…	…	…	…
Feb-11	NA	NA	NA	…	-1.86	-1.86	-1.85
Mar-11	NA	NA	NA	…	-1.30	-1.30	-1.30
Apr-11	NA	NA	NA	…	-1.57	-1.57	-1.57
May-11	NA	NA	NA	…	-1.33	-1.11	-1.14
Jun-11	NA	NA	NA	…	NA	-1.09	-0.90
Jul-11	NA	NA	NA	…	NA	NA	-1.35

Now that we have obtained real time vintages of the LCI, we can turn to the same for the LEI. Several components of the LEI will not be available at the time of its release each month. Using a similar approach the missing components are imputed (the imputation only uses an AR(2) model in dlogs).

The following tentacle charts show how the LEI vintages look in real time following these procedures:

Real Time LEI Vintages

2011



Real Time LEI Vintages 1996-

2011