



# IMF Working Paper

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## Financial Conditions Indexes for the United States and Euro Area

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**IMF Working Paper**

Research Department

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**Abstract**

Financial conditions indexes are developed for the United States and euro area using a wide range of financial indicators and a dynamic factor model. The financial conditions indexes are shown to be useful for forecasting economic activity and have good revision properties.

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## I. INTRODUCTION

Financial conditions indexes (FCIs) have long been used to assess the current state of financial conditions. FCIs are typically constructed using either simple weighted averages or the first principal component of a range of financial indicators. This paper develops FCIs for the United states and the euro area using a wide range of financial indicators and a dynamic factor model (DFM).<sup>2</sup> A key advantage of this framework relative to other methodologies is that the FCIs can be estimated when values for some indicators are missing due to publication lags, which allows all available information to be used in a timely fashion.<sup>3</sup>

In a real-time forecasting experiment, it is found that simple closed economy VARs augmented with the estimated FCIs produce better forecasting performance than a range of other model specifications. It is also found that the revision properties of the FCIs are generally good over the sample period considered. The results suggest that the FCIs can not only provide useful summary measures of the state of financial conditions, but also useful information about the evolution of economic activity in real time.

## II. METHODOLOGY

The DFM assumes that each standardized indicator of financial conditions,  $y_t$ , can be decomposed into a common component,  $\chi_t$ , and an idiosyncratic component,  $\varepsilon_t$ . The common component captures the bulk of the covariation between  $y_t$  and the other indicators in the data set, whereas the idiosyncratic component is assumed mainly to affect only  $y_t$ :

$$y_t = \chi_t + \varepsilon_t, \quad \varepsilon_t \sim N(0, \psi) \quad (1)$$

where  $\chi_t = \Lambda F_t$  and  $\psi$  is assumed to be diagonal. The common component is thus simply a scaled common factor,  $F_t$ , which is estimated using the entire set of financial indicators. For each economy, the FCI is defined to be this common factor.

The dynamics of the FCI are captured by an autoregressive process:

$$F_t = \sum_{i=1}^p \beta_i F_{t-i} + \nu_t, \quad \nu_t \sim N(0, I_q) \quad (2)$$

where the  $\beta$ s are coefficients and  $p$  is the lag length of the process. In this paper, the lag length,  $p$ , is selected using the Swartz-Bayesian information criteria (SBC). See Giannone, Reichlin, and Small (2008) for a more detailed description of how the procedure deals with

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<sup>2</sup>See, for example, Giannone, Reichlin and Small (2008) and Matheson (2010).

<sup>3</sup>Hatzius, Hooper, Mishkin, Schoenholtz, and Watson (2010) use a similar methodology to construct an FCI for the United States, but do not take account of publication lags at the end of the sample in their forecasting experiment and the real-time revision properties of their FCI are not examined.

missing observations, and Doz, Giannone, and Reichlin (forthcoming) for details on estimation.

### III. DATA DESCRIPTION AND RESULTS

For each economy, selecting data from a broad set of financial indicators is a crucial step. Most series are measured at a monthly frequency, with the remainder measured at daily or quarterly frequencies. Before estimation, all series are converted to monthly frequency, transformed to be free from non-stationarity, if necessary, and standardized.<sup>4</sup> The remaining indicators are not transformed. The sample period for the FCIs used here begins in 1994. Indicators that are not available for the entire period, such as survey data for the euro area, are backdated using the DFM prior to estimation over the full sample.<sup>5</sup>

The indicators used in each economy's FCI and information about how the indicators are classified and transformed is listed in table 1. The table also includes the estimated factor loadings,  $\lambda$ , which reflect the weight of each indicator in the FCI. Each loading can take a positive or negative value, depending on whether a high or low value of the indicator in question implies a tightening or an easing in financial conditions. The Senior Loan Officer Survey (SLOS) data (for which a positive number indicates a tightening of financial conditions) generally have high positive factor loadings. Some of the indicators in the "spreads" category also have high factor loadings, such as the BAA/10-year government bond spread in the United States and the high-yield corporate/10-year government bond spread in the euro area. Negative loadings generally predominate in the "prices" categories, reflecting a tendency for prices to rise when financial conditions ease.

Figure 1 shows the estimated FCIs, along with contributions from each class of indicator. Both FCIs show an easing in financial conditions in the years preceding the global financial crisis. Just prior to the crisis, financial conditions began to tighten significantly in both the United States and the euro area, peaking around the beginning of 2009. According to the FCI, financial conditions only began to ease around the beginning of 2010, despite extremely accommodative monetary policy settings in both the United States and the euro area.

### IV. FORECASTING PERFORMANCE

To assess the usefulness of the FCIs, a baseline quarterly closed economy vector-autoregressive model (VAR), including the output gap, headline inflation, and a real

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<sup>4</sup>The quarterly series are linearly interpolated, whereas the daily series are converted to monthly averages. Quarterly log differences are taken of the non-stationary indicators. Note, the in-sample results are very similar if the FCIs are estimated using quarterly data, but using monthly data offers more timely estimates of financial conditions at the end of the sample in real time.

<sup>5</sup>The assumption that  $\psi$  is diagonal is relaxed when backdating these indicators.

short-term interest rate is adopted.<sup>6</sup>

An out-of-sample forecast evaluation exercise is then conducted for the period from the first quarter of 2004. The VAR forecasts are constructed in two steps in each quarter of the out-of-sample period. First, the FCI is estimated using all data that would have been available at the beginning of the third month of each quarter.<sup>7</sup> Second, the FCI is added to the baseline VAR specification and used to forecast all variables beyond the period in which the most recent GDP data would have been available in real time. Using the latest available estimates of the output gap as the target for the forecasts, root mean squared errors (RMSEs) are then computed for forecasts two- and four-quarters ahead.

For comparison purposes, RMSEs are also computed for a variety of other forecasts: an autoregressive forecast (AR); a forecast from the baseline VAR, without the FCI; and forecasts from the baseline VAR augmented with each of the underlying indicators that were used to construct the FCI separately. In each quarter of the out-of-sample period, all models are re-estimated and all lag lengths are re-selected using the SBC. The RMSEs for each model relative to those of the AR are displayed in the right columns of the table 1: a number less than 1 indicates the forecast is more accurate than the AR forecast.

The results are striking. For both the United States and the euro area, the forecasting performance of the VAR augmented with the FCI is good relative to the other models. The FCI forecast outperforms the AR and all other VAR forecasts for the United States. For the euro area, the FCI forecast is at least as accurate as almost all other models, with the VAR augmented with the indicators from the SLOS the only exceptions.

## V. REAL-TIME PROPERTIES

Because the FCIs are estimated and can change with the arrival of more data, it is useful to gauge their revision properties over time. Figure 2 displays estimates of the FCIs based on data available up to March 2011 (in black), along with the monthly estimates of the FCI made each month of the out-of-sample period (in red).<sup>8</sup> The figure shows that revisions to the FCIs over time have generally been small relative to their overall variance. Moreover, over this sample, there are very few ‘false signals’, where an initial estimate of an easing or tightening in financial conditions is later revised away. The period around 2008 in the euro area is an exception, with the real-time estimates indicating an easing in financial conditions, which were later estimated to be a tightening in financial conditions.

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<sup>6</sup>The output gap and the real short-term interest rate are taken from a much larger, more sophisticated model – the Global Projection Model (GPM). See Carabenciov, Freedman, Garcia-Saltos, Laxton, Kamenik, and Manchev (forthcoming).

<sup>7</sup>Due to a lack of available data, the data vintages that would have existed in real time are not used. Instead, the most recent vintage of data is used to simulate the data available each time a forecast is made. Real-time output gaps and short-term real interest rates are simply truncated from the most recent GPM estimates.

<sup>8</sup>In each month, the end point for the FCI estimate matches that of the GDP data that would have been available at the time.

## VI. CONCLUSION

This paper developed FCIs for the United States and the euro area, estimated using a wide range of financial indicators and a dynamic factor model. In a real-time forecasting experiment, it was found that simple baseline closed economy VARs augmented with the estimated FCIs produced better forecasting performance than a range of other model specifications. It was also found that the revision properties of the FCIs have generally been good over the sample period considered. The results suggest that FCIs can not only provide useful summary measures of the state of financial conditions, but also useful information about the evolution of economic activity in real time.

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Table 1. Data Description and Forecasting Performance

Indicators/Forecasting Models	Native Freq	First Obs.	Category	Transform	$\lambda$	RMSEs Relative to AR	
						2 Qtrs Ahead	4 Qtrs Ahead
<b>United States</b>							
Baseline VAR						1.23	1.05
<i>Baseline VAR augmented with:</i>							
FCI						0.84	0.79
10-Year Treasury Note Yield at Constant Maturity	daily	1994M01	Spreads	Level	-0.51	1.26	1.28
Fed Funds/3 month T-Bill Spread	daily	1994M01	Spreads	Level	0.33	1.23	1.19
2 Year Govt Bond/3 month T-Bill Spread	daily	1994M01	Spreads	Level	-0.09	1.23	1.06
10 Year Govt Bond/3 month T-Bill Spread	daily	1994M01	Spreads	Level	0.24	1.35	1.35
Baa/10yr T-note Spread	daily	1994M01	Spreads	Level	0.90	1.26	1.33
Auto finance company loan rate, New Car/2Yr Govt Bond Spread	monthly	1994M01	Spreads	Level	0.17	1.25	1.22
30-yr Conventional mortgage/ 10Yr Govt Bond Spread	monthly	1994M01	Spreads	Level	0.69	1.23	1.26
High Yield Corporate / Baa Spread	monthly	1997M01	Spreads	Level	0.88	1.28	1.31
Jumbo Mortgage/30yr Conventional Spread	monthly	2005M04	Spreads	Level	0.72	1.20	1.19
3-month LIBOR/OIS Spread	daily	2003M09	Spreads	Level	0.83	1.14	1.30
Bank rate on new car loans, 48 months/2Yr Govt Bond Spread	monthly	1994M01	Spreads	Level	0.17	1.25	1.22
Credit spread Corporate/ Financial Sector (Citi)	monthly	1994M01	Spreads	Level	0.61	1.09	0.98
TED Spread	daily	1994M01	Spreads	Level	0.67	1.19	1.34
1 Month Commercial Paper / Fed Funds Spread	daily	1994M01	Spreads	Level	0.51	1.17	1.35
Real Broad Trade-Weighted Exchange Value of the US\$	monthly	1994M01	Prices	Growth	0.18	1.27	1.17
Wilshire 5000 Price Index [Full Cap]	daily	1994M01	Prices	Growth	-0.55	1.08	1.00
PPI: Crude Petroleum Domestic Production	monthly	1994M01	Prices	Growth	-0.32	1.24	1.15
CoreLogic National House Price Index	monthly	1994M01	Prices	Growth	-0.62	1.14	1.06
Bank Credit: All Commercial Banks	monthly	1994M01	Quantities	Growth	-0.22	1.32	1.29
Commercial Paper Outstanding: All Issuers	monthly	1994M01	Quantities	Growth	-0.60	1.31	1.22
Value of Commercial Paper Issues	daily	2001M01	Quantities	Growth	-0.37	1.21	1.12
Value of Issuers of Commercial Paper: >80 Days	monthly	2001M01	Quantities	Growth	0.00	1.30	1.22
Money Stock: MZM Zero Maturity	monthly	1994M01	Quantities	Growth	0.45	1.24	1.22
Domestic Nonfinancial Sectors: Liabs: Credit Mkt Instruments	quarterly	1994M01	Quantities	Growth	-0.28	1.24	1.23
SLOS: Banks Tightening Loans to Large Firms	quarterly	1994M01	Quantities	Level	0.89	0.99	0.91
SLOS: Banks Tightening Loans to Small Firms	quarterly	1994M01	Quantities	Level	0.92	0.96	0.93
SLOS: Banks Willingness to Lend to Consumers	quarterly	1994M01	Quantities	Level	-0.80	1.13	1.00
SLOS: Tightening Standards for Commercial Real Estate	quarterly	1994M01	Quantities	Level	0.91	1.06	1.02
SLOS: Res Mortgages: Net Share, Banks Tightening	quarterly	1994M01	Quantities	Level	0.82	1.02	1.12
CBOE Market Volatility Index, VIX	daily	1994M01	Prices	Level	0.82	1.33	1.36
AR(RMSE)						1.09	2.01
<b>Euro Area</b>							
Baseline VAR						1.07	1.02
<i>Baseline VAR augmented with:</i>							
FCI						0.89	0.85
10-Year Government Benchmark Bond Yield	monthly	1994M01	Spreads	Level	0.46	1.20	1.08
Overnight/3 month Spread	monthly	1994M01	Spreads	Level	-0.50	1.34	1.24
2 Year Govt Bond/Overnight Spread	monthly	1994M01	Spreads	Level	0.06	1.15	1.01
10 Year Govt Bond/Overnight Spread	monthly	1994M01	Spreads	Level	0.43	1.17	1.04
Secondary Market 10-year Govt Bond /10yr Govt Bond Spread	monthly	1994M01	Spreads	Level	-0.31	1.62	2.53
3-month LIBOR/OIS Spread	daily	1999M01	Spreads	Level	0.68	1.25	1.20
High Yield Bond/Overnight Spread	monthly	1997M12	Spreads	Level	0.91	1.05	0.90
JP Morgan Broad Real Effective Exchange Rate Index	monthly	1994M01	Prices	Growth	0.05	1.17	1.02
EURO STOXX 50 Price Index: Based in Euro	daily	1994M01	Prices	Growth	-0.44	0.93	0.85
European Free Market Price: Brent Crude Oil	daily	1994M01	Prices	Growth	-0.27	1.00	0.90
Money Supply: Credit to EA Res	monthly	1997M09	Quantities	Growth	-0.62	1.11	0.94
Nonfinancial Corporations: Outstanding Debt	quarterly	1999M01	Quantities	Growth	-0.34	1.21	1.09
MFI ex ES: Debt Securities Issued: Euro Share	quarterly	1997M07	Quantities	Level	0.41	0.99	0.88
Money Supply: M3	monthly	1994M01	Quantities	Growth	-0.42	1.07	0.91
Euro Area: Market Capitalization	monthly	2001M01	Quantities	Growth	-0.57	0.94	0.86
SLOS: Chg in Credit Stds for Bus Lns to Med/Sm Cos. Past 3M	quarterly	2003M01	Quantities	Level	0.79	0.92	0.84
SLOS: Chg in Credit Stds for Bus Lns to Large Cos Past 3M	quarterly	2003M01	Quantities	Level	0.72	0.93	0.84
AR(RMSE)						1.19	2.14

All raw data were sourced from Haver Analytics.

Figure 1. FCIs and Contributions by Class of Indicator (positive = tightening)

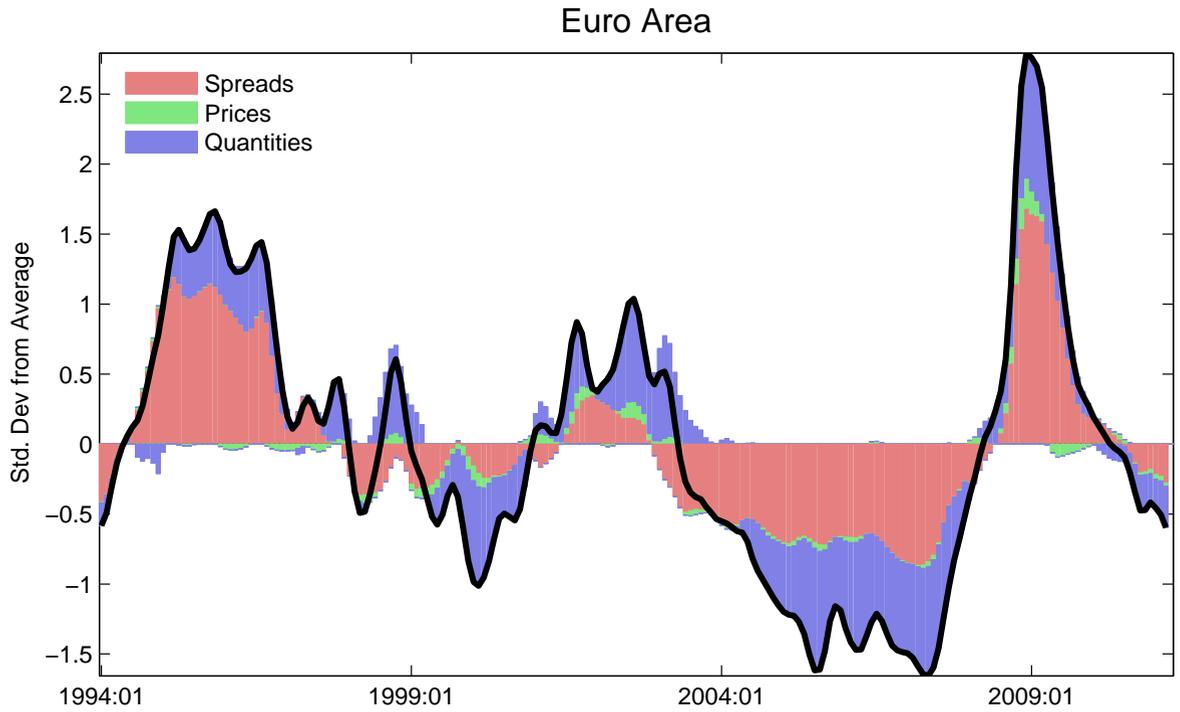
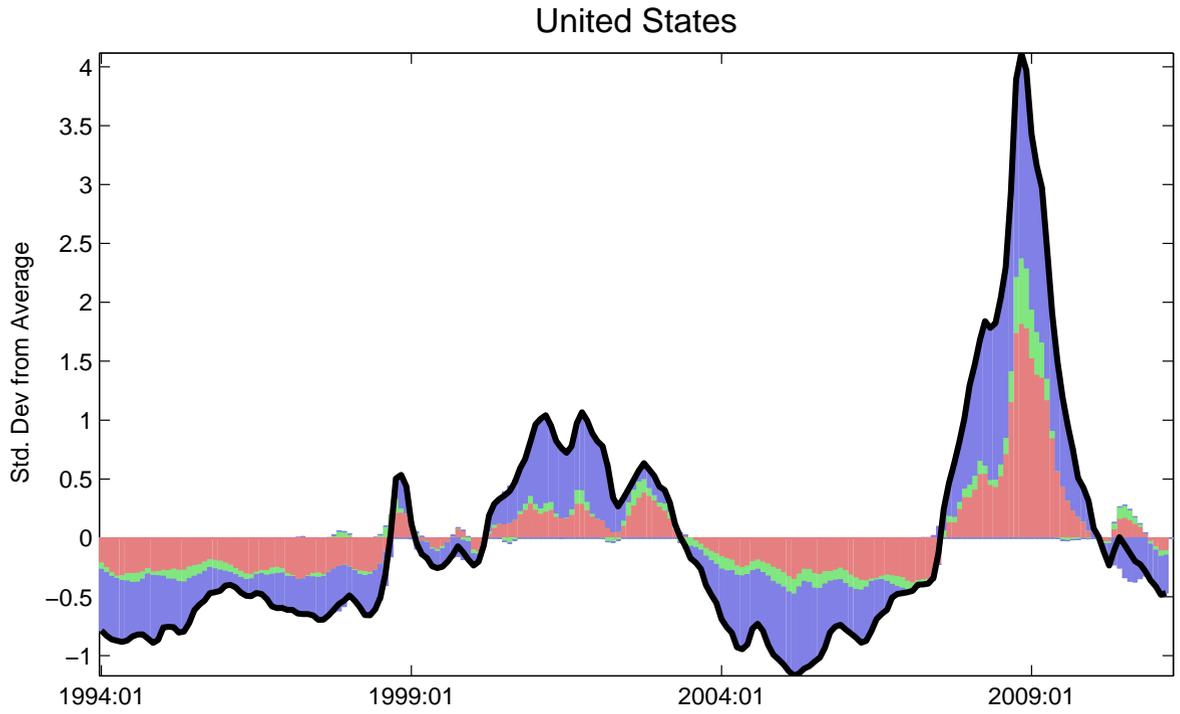


Figure 2. FCIs in Real Time

