Appendix

The St. Louis Fed's Financial Stress Index (STLFSI) is constructed using principal components analysis, which is similar to the construction of the Kansas City Fed's FSI (KCFSI). Briefly, principal components analysis is a statistical method of extracting factors responsible for the comovement of a group of variables. We assume that financial stress is the primary factor influencing this comovement, and by extracting this factor (the first principal component) we are able to create an index with a useful economic interpretation. We construct the STLFSI using 18 weekly data series over the sample period December 31, 1993, to December 11, 2009. The series are listed below.

Interest Rates:
- Effective federal funds rate
- 2-year Treasury
- 10-year Treasury
- 30-year Treasury
- Baa-rated corporate
- Merrill Lynch High-Yield Corporate Master II Index
- Merrill Lynch Asset-Backed Master BBB-rated

Yield Spreads:
- Yield curve: 10-year Treasury minus 3-month Treasury
- Corporate Baa-rated bond minus 10-year Treasury
- Merrill Lynch High-Yield Corporate Master II Index minus 10-year Treasury
- 3-month London Interbank Offering Rate–Overnight Index Swap (LIBOR-OIS) spread
- 3-month Treasury-Eurodollar (TED) spread
- 3-month commercial paper minus 3-month Treasury bill

Other Indicators:
- J.P. Morgan Emerging Markets Bond Index Plus
- Chicago Board Options Exchange Market Volatility Index (VIX)
- Merrill Lynch Bond Market Volatility Index (1-month)
- 10-year nominal Treasury yield minus 10-year Treasury Inflation Protected Security yield (breakeven inflation rate)
- Vanguard Financials Exchange-Traded Fund (equities);
  accessed on Yahoo! Finance at http://finance.yahoo.com/q?s=vfh&.yficrumb=CgCsdHP9jeG

Each of these variables captures some aspect of financial stress. Accordingly, as the level of financial stress in the economy changes, the above data series are likely to move together. We assume that financial stress is the most important factor in explaining the comovement of the 18 variables. Using principal components analysis, we identify this factor (the first principal component). The following steps are taken to construct the index:

First, each of the data series is de-meaned. The de-meaned series are then divided by their respective sample standard deviations (SDs). With the variables now expressed in the same units, we use the method of principal components to calculate the coefficients of the variables in the financial stress index (FSI). We then scale these coefficients so that the SD of the index is 1. Finally, each data series is multiplied by its respective adjusted coefficient, and the observation of the FSI for time t is the sum of each series multiplied by its respective adjusted coefficient. Higher values of the FSI indicate a greater degree of financial stress in the economy.

The adjusted coefficients are listed in the table. Because each variable was standardized, the coefficient of a variable represents the influence of a 1 SD change in that variable on the FSI. However, it is important to be cautious when inter-

preting the sign of a coefficient. For instance, the de-meaned, standardized data series can (and will) take on negative values, so a negative coefficient does not imply that the variable always contributes to a decline in financial stress. A negative coefficient multiplied by a negative data value will result in a positive contribution to financial stress. In other words, although the effective federal funds rate cannot dip below zero, the de-meaned, standardized effective funds rate data series can take on a negative value when a federal funds rate observation is less than the federal funds rate sample average. Thus, since the federal funds rate variable has a negative coefficient, federal funds rate data points below the sample average contribute to an increase in the FSI, while observations greater than the sample average contribute to a decrease in the FSI. The last row in the table indicates the percentage of the total variation in the 18 variables over the sample period that is explained by the index.

When the sample changes (i.e., a new week of data is added), the values of the FSI in the original sample can be changed. This alteration can occur either through a change in the coefficients of the variables in the index or by a change in the actual values of the variables in the original sample. The overall magnitude of the coefficients, as well as their relative magnitudes, can change. Because the data are de-meaned and standardized, the value of a variable in the original sample will change as the sample mean and sample SD of the variable changes.

Adjusted Coefficients (12/31/1993 to 12/11/2009)

Variable	Coefficient
Effective federal funds rate	−0.083
2-year Treasury	−0.093
10-year Treasury	−0.092
30-year Treasury	-0.086
BAA-rated corporate	0.035
Merrill Lynch High-Yield Corporate Master II Index	0.108
Merrill Lynch Asset-Backed Master BBB-rated	0.105
Yield curve: 10-year Treasury minus 3-month Treasury	0.060
Corporate credit risk spread	0.125
High-yield credit risk spread	−0.116
3-month LIBOR-OIS spread	0.122
TED spread	0.074
Commercial paper spread (3-month)	0.061
J.P. Morgan Emerging Markets Bond Index Plus	0.050
Chicago Board Options Exchange Volatility Index (VIX)	0.110
Merrill Lynch Bond Market Volatility Index (1-month)	0.098
Breakeven inflation rate (10-year)	−0.125
Vanguard Financials Exchange-Traded Fund (equities)	−0.008
Percent of total variation explained by the FSI*	44.3

NOTE: FSI, financial stress index; LIBOR-OIS, London Interbank Offering Rate–Overnight Index Swap; TED, Treasury-Eurodollar.

*This is the percent of the total variation in the 18 variables over the sample period that is explained by the index. This number is 1 – SSE/SST, where SST is the total sum

of squares, $\sum_{N}\sum_{t}X_{Nt}^2$, and SSE is the sum of squared errors, $\sum_{N}\sum_{t}\left(X_{Nt}-a_{n}FSI_{t}\right)^2$.

X_{Nt} is the value of the nth standardized variable in month t, and a_{N} is the set of coefficients chosen.