

## **A Comparative Analysis on US Financial Stress Indicators**

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### **ABSTRACT**

This paper provides a comparative analysis on different financial stress indexes (FSIs) available for the United States. The main objective of these stress indexes is to provide detailed insights about the financial conditions in the U.S. economy. In general, all stress indexes indicated a very high financial risk during the 2008 financial crisis. Among all the Federal Reserve Bank FSIs, the Kansas city fed FSI and the St. Louis fed FSI show considerable similarities during 2008 financial crisis. However, the behavior of Chicago Fed's National Financial Conditions Index and the Cleveland Fed's FSI were different. The stress indexes had responded to notable events with considerable shifts in their values. Indexes showed a significant increase for Fannie Mae/Freddie Mac and Lehman Brother bankruptcies while significant reductions for financial healing processes such as TARP, TALF and fed funds rate cuts during the great recession. If a researcher wants to study the financial conditions of the U.S. economy then these FSIs should be the first choice.

**Keywords:** Financial Stress Index, Financial Crisis, FED, US Economy, Recession

**JEL Classifications:** E44, E58, G10

### **1. INTRODUCTION**

The great recession in 2008 has created a significant uncertainty in the global economy. It is also identified as the most serious financial disruption since the great depression in early 1930 (Hatzius et al., 2010). The financial crises involve significant disruptions in asset prices and failures in financial institutions and negatively influence macroeconomic indicators such as the gross domestic product, economic growth, employment, interest rates and stock market values (Reinhart and Rogoff, 2008; Hall, 2010). In addition, it makes monetary and fiscal policy more volatile and inapt (Gertler and Karadia, 2011; Hamilton and Wu, 2012). The high volatility in financial stability also makes policy makers insecure in their policy decisions (Baxa et al., 2013). These facts stimulated researchers in further investigating the dynamics of financial crises. Once the former Federal Reserve Bank chairman, Ben Bernanke<sup>1</sup>, suggested the policy makers to provide a significant attention on studying the financial stability similar to the effort they allocate in monetary policy decisions as it helps managing the financial crises efficiently. Today, the

financial stability and its measures have become key concerns in both monetary and fiscal policy decision making. As a result, the development of tools which can monitor the vulnerability in financial markets has become one of the prominent research areas. The financial stress indicator is one of the key tools. An exogenous shock to financial conditions can create changes to existing financial structure. If the shock is negative, then it can create a negative financial stress in the economy (Illing and Liu, 2006). The 1973 oil price shock and the 2007 asset price shock are some of the many negative shocks in U.S. history. Financial stress indicators provide information on current levels of financial variables which can influence future economic conditions (Hatzius et al., 2010). Therefore they can be used as an effective tool in managing the monetary policy (Baxa et al., 2013). Financial stress indexes (FSIs) can also be used to forecast future financial conditions which provide better decision making prospects. The objective of this paper is to provide a detailed comparative analysis on different FSIs available for the United States. This study will be a great source for future research on financial stress conditions in the United States.

<sup>1</sup> Crutsinger 2012; [http://www.huffingtonpost.com/2012/04/13/ben-bernanke-financial-crisis\\_n\\_1424128.html](http://www.huffingtonpost.com/2012/04/13/ben-bernanke-financial-crisis_n_1424128.html)

The paper is ordered as follows. The Section II provides a historic evolution of FSIs available for the US. Section III provides a

comparative analysis of the FSIs in the US. Section IV concludes the results.

## 2. A HISTORIC EVOLUTION OF THE FSIS

Early literature on financial conditions has used single variables to measure financial stress. These include the slope of the yield curve, spread between 10 year treasury notes and federal funds rate, real Money2 (M2), S&P 500 index, short term credit spread measured as the spread between 3 month commercial paper rate, 3 month treasury bill rate and federal funds rate (Estrella and Hardouvelis, 1991; Laurent, 1989; Friedman and Kuttner, 1992). Some studies have used binary variables, 1 for stress period and 0 for non-stress period (Goldstein et al., 2000). However, these indexes outpaced the following comprehensive FSIs. The Bank of Credit Analyst (BCA) reports a monthly FSI (BCA-FSI) for the US by comparing the composition of banking shares to total market shares. However, this index only represents the stress in banking sector not the stress in entire financial sector which is a collaboration of banking, security market and exchange market. The Chicago Board of Exchange's VIX index does not observe the stress in entire financial market but measures the stress in security and exchange market. Therefore lack of measuring stress in entire financial market is one of the key limitations with BCA and VIX indexes. These deficits have stimulated the need of having new financial stress indicators which capture the stress in entire financial market. As a result, the Bank of Canada developed a comprehensive FSI for Canada (Illing and Liu, 2006). This index covered all three sectors in the financial market; equity, bond and foreign exchange. Later four regional US Federal Reserve Banks have created four different FSIs for the US; the Chicago Federal Reserve Bank's financial conditions index (FCI) (NFCI) in 2006, the Kansas city Federal Reserve Bank's FSI (KCFSI) in 2009, the St. Louis Federal Reserve Bank's FSI (STLFSI) in 2010 and the Cleveland Federal Reserve Bank's FSI (CFSI) in 2011.

The need for a common FSI for all countries in the world had become significant during great recession. Cardarelli et al. (2011) from International Monetary Fund (IMF) created a stress index to measure financial conditions in advanced economies named advanced country FSI (AE\_FSI). Balakrishnan et al. (2009) from IMF have also created another FSI for emerging countries named emerging country FSI. In addition, there are other FSIs available for the US such as the Bloomberg FCI (BFCIUS), the City FCI (CITI\_FCI), the Deutsche Bank FCI, the Goldman Sachs FCI (GS\_FCI), the macroeconomic advisor's FCI and Organisation for Economic Co-operation and Development (OECD) FCI. A variety of construction methods were used to create these indexes over time. The two main construction methods used are the principal component approach and the weighted sum approach. The principal component method uses its first principle component to represent a larger portion of variations in financial variables. The weighted sum approach uses the relative impact of financial variables on changes in real gross domestic product (GDP) as the weighting scheme. Most of the FSIs only use current financial variables to calculate FSI but some methods have tried adding the lagged financial variables to understand

the impact of past stress episodes on current financial conditions. Most stress indexes use common financial variables such as short term interest rates, equity market performances, exchange rates, yield spreads and stock market indexes. This paper focuses on providing a comparative analysis on different FSIs available for the US including STLFSI, KCFSI, Chicago City Fed National FCI (NFCI), CFSI, IMF FSI AE\_FSI, BFCIUS and the city FSI (CITI\_FSI). The following is a detailed description of these indexes.

### 2.1. Chicago Fed's NFCI

Scott Brave and Andrew Butters of the Federal Reserve Bank in Chicago introduced NFCI in 2006 to measure financial conditions in the US economy. It provides weekly updates on financial conditions in banking systems, money markets, and debt and equity markets. Since economic conditions are correlated with financial conditions, an adjusted financial conditions index (ANFCI) is introduced to interpret the behavior of financial conditions relative to current economic conditions. This index is available since 1973 and is the longest FSI provided by a federal reserve bank in the US. The NFCI and ANFCI are revised on a weekly basis at 8.30 am eastern time on every Wednesday. One of the prominent features of NFCI is its use of 100 different financial variables in the construction process. A dynamic factor analysis is used to construct the NFCI (Doz et al., 2006). A positive NFCI indicates a tighter financial condition and a negative value indicates a looser financial condition than average. The level of how "tight" or how "loose" the financial market conditions is determined by its deviation from the average. A zero value indicates an average risk level. The following Figure 1 shows NFCI since 1973. The NFCI indicates a higher financial stress during mid-1970 recession and early 1980s than that during the late 2000s recession. In general, NFCI shows higher stress values during all the past recessions.

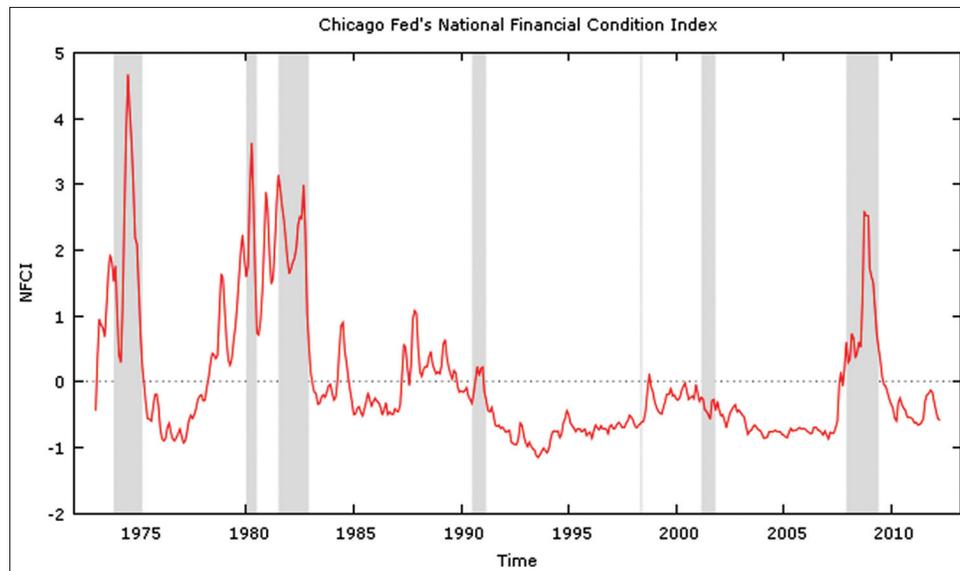
### 2.2. KCFSI

Hakkio and Keeton (2009) introduced the KCFSI from their paper "Financial Stress: What is it, How Can It be Measured, and Why does it matter?" They tried to identify all possible key phenomena of a financial crisis. The following five phenomena were identified as the most important features of any given financial stress although their relative importance may differ from one another; increased uncertainty about the fundamental values of assets, increased uncertainty about behavior of other investors, increased asymmetry of information, decreased willingness to hold risky assets (flight to quality), decreased willingness to hold illiquid assets (flight to liquidity). A positive value indicates a financial stress above the long run average level while a negative value indicates a stress below the long run level. The KCFSI shows a significant financial stress during the great recession (Figure 2).

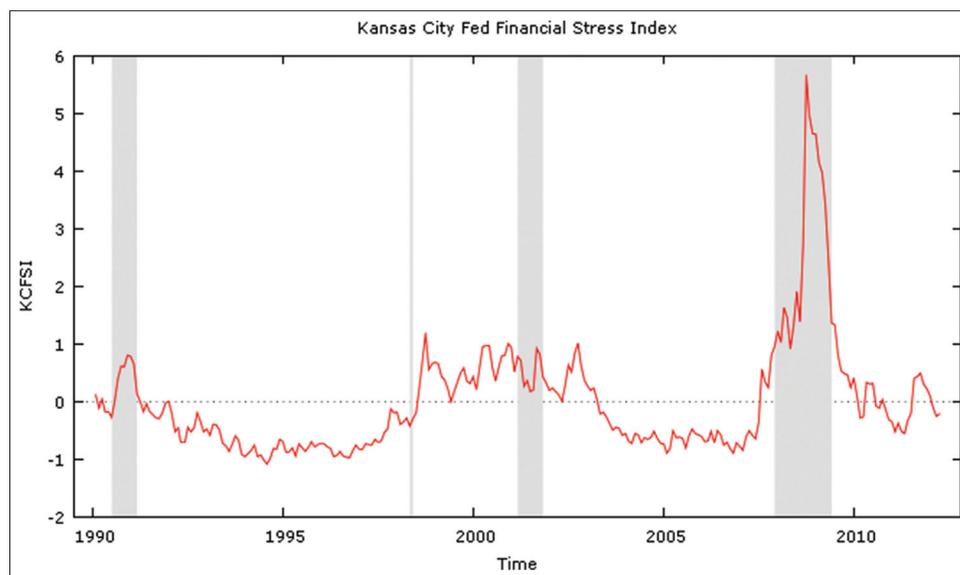
### 2.3. STLFSI

The St. Louis Federal Reserve Bank used principle component method in constructing its STLFSI in 2010. In general, the principal component analysis is used to extract the factors which are most responsible for the co-movements in a group of variables. Therefore the financial stress is measured as the first principal component of co-movements of all variables. The variables can be categorized in to three different groups; interest rate category,

**Figure 1:** The Chicago Fed Financial Conditions Index (NFCI): Shaded areas indicate recessions in the US history (<http://www.nber.org/cycles/cyclesmain.html>)



**Figure 2:** Kansas city fed financial stress index



yield spreads category, exchange market and inflationary pressures. The STLFSI also shows a significant financial stress during the late 2000s recession (Figure 3).

**2.4. CFSI**

The CFSI was initially constructed by Bianco et al., in early 2009 but it was published in November 2012. CFSI provides information on financial conditions in number of financial markets on a continuous basis. This helps analysts and policy makers to monitor stressful situations as they are building. CFSI has some novel contributions to the FSI literature. More importantly, unlike KCFSI, STLFSI and NFCI, the CFSI has a unique ability in measuring financial stress in following four markets separately; interbank, foreign exchange, credit and equity markets. This helps CFSI to provide more focused and accurate signals on the financial stress. Daily data since 1991 on 11 variables were chosen.

**Table 1: Stress episode and the corresponding CFSI values<sup>2</sup>**

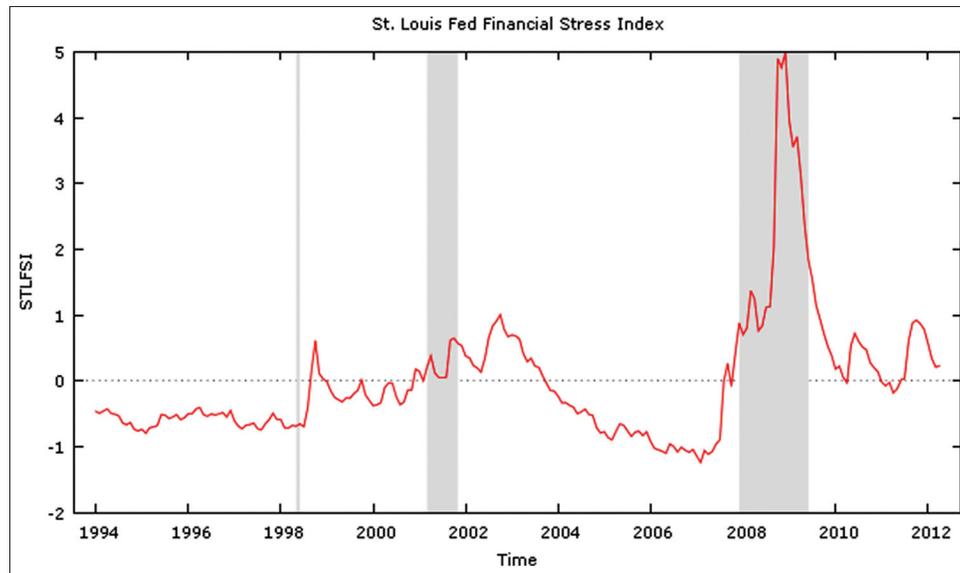
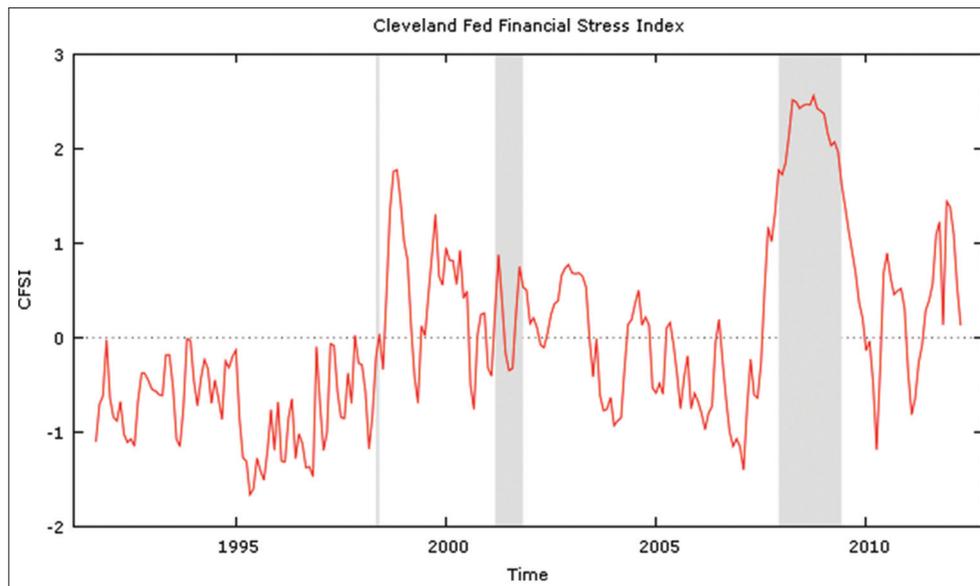
Stress episode	CFSI range
Grade 1 (below normal stress)	CFSI < -0.50
Grade 2 (normal stress)	-0.50 ≥ CFSI < 0.59
Grade 3 (moderate stress)	0.59 ≥ CFSI < 1.68
Grade 4 (significant stress)	CFSI ≥ 1.68

CFSI: Cleveland Fed's financial stress index

Following Table 1 shows an interpretation of stress episodes based on CFSI values. Figure 4 shows the flow of CFSI values. It depicts a significant stress during the great recession.

In addition, the BFCIUS, the CITI\_FCI, the Deutsche Bank FCI, the GS\_FCI, the Macroeconomic Advisors Monetary and FCI,

2 Cleveland FED Economic Commentary, (2012).

**Figure 3:** The St. Louis financial stress index**Figure 4:** The Cleveland fed financial stress index

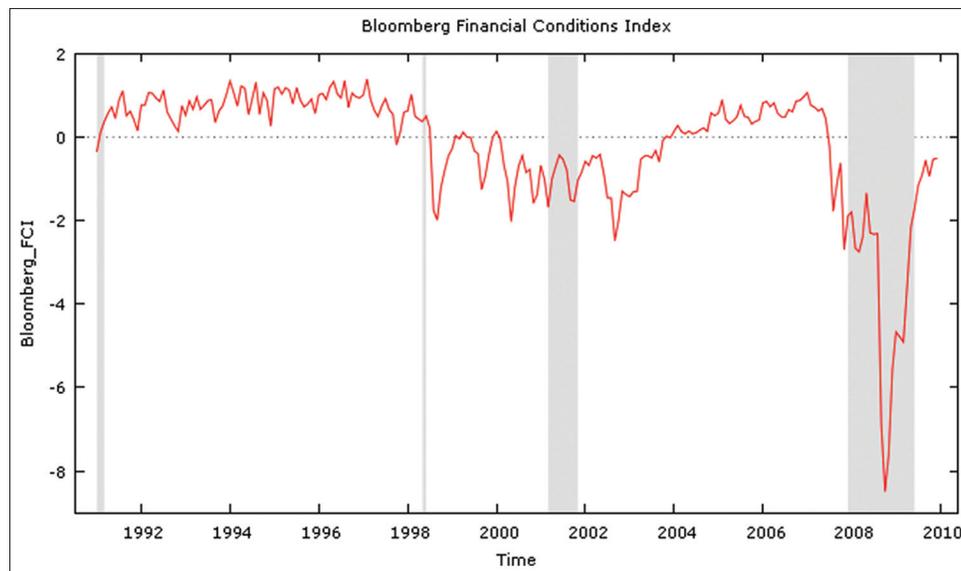
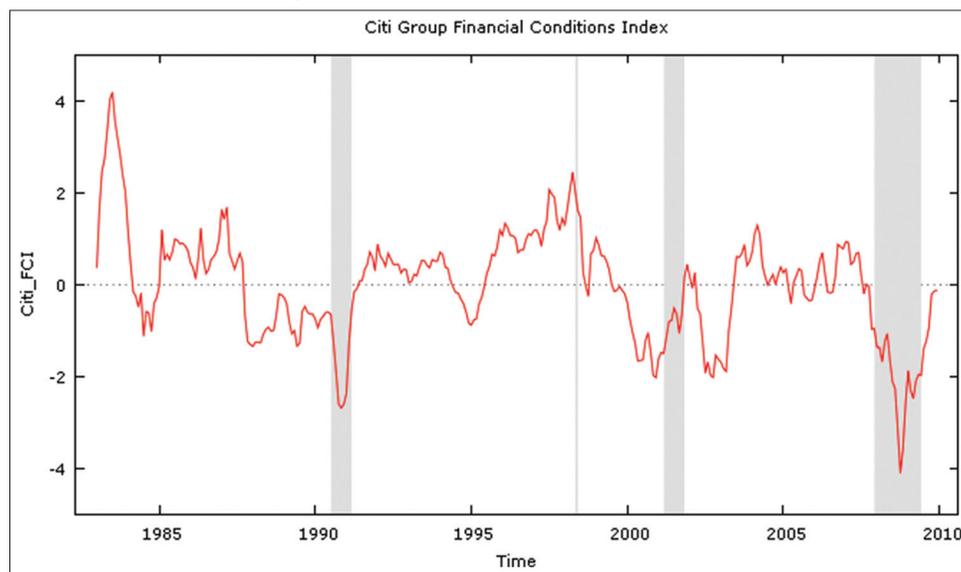
the OECD FCI and the Mishkin FCI are available in measuring the financial stress in the US. A short description of some of them is as follows.

### 2.5. BFCIUS

This index was developed by Rosenberg in 2009. Daily and monthly data for BFCIUS are readily available in Bloomberg. There are totally 10 variables from money market; bond market and equity market used to calculate this composite index. Variables in each and every sub index were equally weighted inside their respective sub-indices. Then individual sub-indices were normalized and presented as Z score values. Finally, the composite FCI is constructed as an equally weighted sum of the above three normalized sub-indices and is available since 1991. The following Figure 5 indicates the distribution of the BFCIUS from January 1991 to December 2009. A negative financial condition indicates higher financial stress in the market.

### 2.6. CITI\_FCI

The CITI\_FCI captures a cumulative effect of series of financial variables on economic activity. The variables are chosen based on underlying relationships between financial variables and actual economy. It is constructed as a weighted sum of six financial variables; corporate spreads, money supply, equity values, mortgage rates, trade weighted dollar and energy prices. A zero value represents a normal financial and economic condition. A positive CITI\_FCI represents an expansionary pace in the economy while a negative value indicates a contractionary economic condition. The CITI\_FCI is available since 1983. Although this index does not capture stress in all three market segments; banking, security and exchange, it can still be used as a possible measure of financial stress as it uses some of the key financial variables from three segments. The following Figure 6 indicates the distribution of the CITI\_FCI.

**Figure 5:** The Bloomberg financial conditions index**Figure 6:** The CITI financial conditions index

According to Figure 6, the financial conditions go below its neutral levels during recessions indicating tighter financial conditions.

### 2.7. GS\_FCI

This index is calculated as a weighted sum of long term corporate bond yield, short term bond yield, exchange rate and a stock market variable. The weighting scheme was constructed using both the Federal Reserve Board's macroeconomic model (FRB/US Model) and Goldman Sachs modeling (Dudley and Hatzius, 2000). An increase in index shows a tighter financial condition while a decrease shows looser financial condition. The Figure 7 indicates the distribution of the GS\_FCI.

### 2.8. OECD FCI

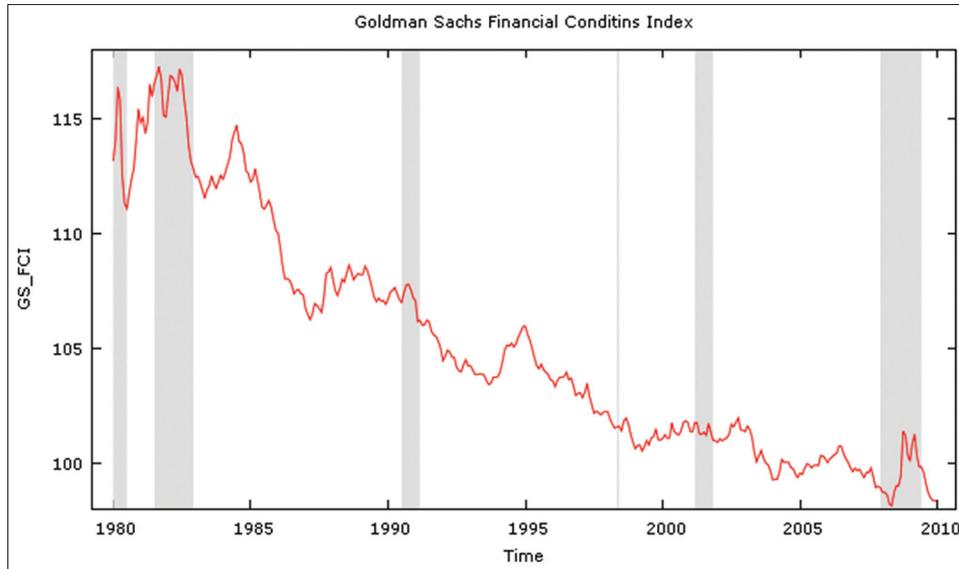
Guichard and Turner (2008) used a weighted sum of six financial variables to calculate OECD FCI. The weights were selected

based on variable effect on GDP over next four to six quarters. Variables were assigned the following weights; real short term interest rate (0.29), real long-term interest rate (1.00), high yield bond spread (0.47), credit standards tightening (0.04), real exchange rate (0.15) and stock market capitalization (-0.03). An increase in OECD FCI indicates a tighter financial condition and a decrease indicates a looser financial condition. This index is available in quarterly frequencies since 1995. Following Figure 8 provides the behavior of the OECD FCI from 1995 to 2008.

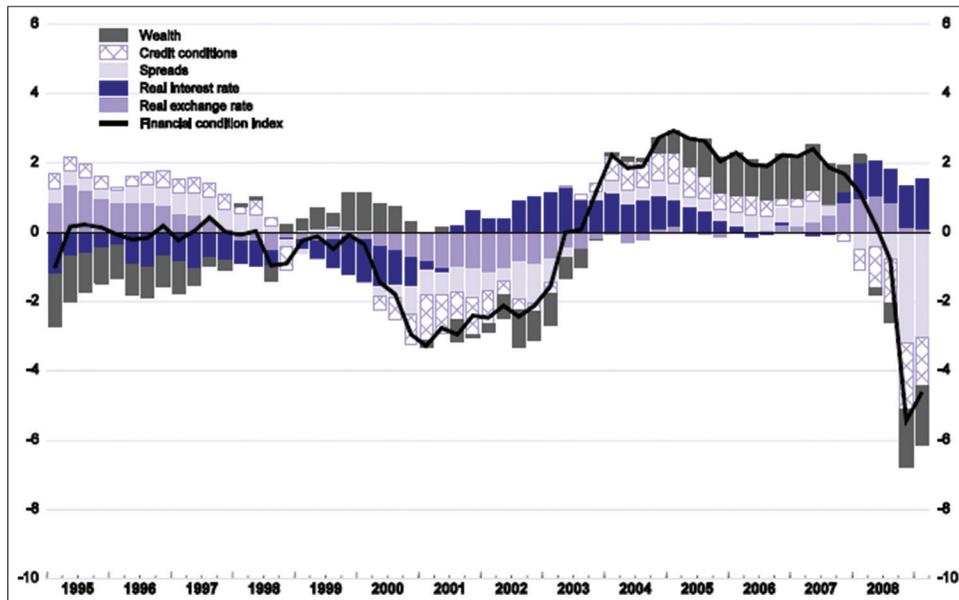
### 2.9. The IMF FSI AE\_FSI

The AE\_FSI was constructed by Cardarelli et al., from their IMF working paper "Financial Stress, Downturns and Recoveries" in 2011. The AE\_FSI comprises with seven different variables which represent three main financial market segments; banking, securities and exchange markets. It generates an individual FSI for

**Figure 7:** The Goldman Sachs financial conditions index



**Figure 8:** The Organisation for Economic Co-operation and Development financial stress index. A unit increase in the index corresponds to an effect on gross domestic product equivalent to an increase in real long-term interest rates of 100 basis points



Source: Guichard and Turner (2008)

17 advanced countries<sup>3</sup> including United States and is available in monthly basis since 1981. They also provide sub stress indexes as banking stress index, security market stress index and exchange market stress index. This is a novel findings in this literature. Table 2 provides the variable selection for each sub market.

When the index value is one standard deviation above its trend, a financial stress is identified. The ability to represent all three sub markets of a financial crisis is one of the distinct advantages of AE\_FSI. Therefore AE\_FSI can be considered as one of the most reliable financial stress measurements available in current

literature. The following Figure 9 depicts the distribution of AE-FSI. Unlike the NFICI, IMF's AE\_FSI does not show a higher financial stress during the mid-1980s recession compared to the late 2000s recession.

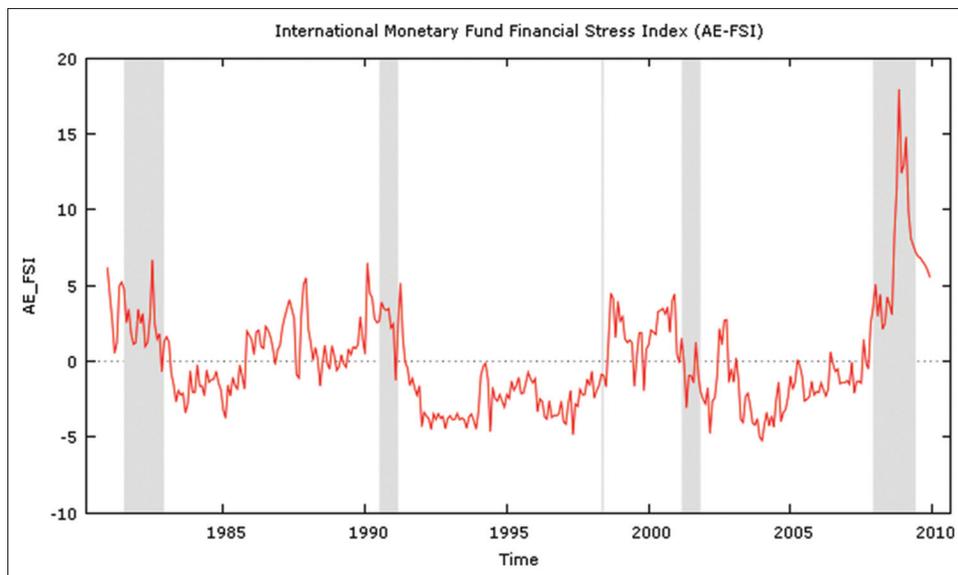
### 3. A COMPARATIVE ANALYSIS ON U.S. FSIS

#### 3.1. Descriptive Statistics of U.S. FSIs

The Table 3 provides a comparative summary of FSIs considered in this analysis. The principles component analysis is used to construct NFICI, STLFSI and KCFSI while a weights method is used to construct AE\_FSI, GS\_FSI, CITI\_FSI, BFCIUS and CFSI. Table 4 provides descriptive statistics for entire data sample. Table 5 provides descriptive statistics for data prior to December 2007 and Table 6 represents descriptive statistics for data after

3 Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom and USA.

**Figure 9:** The International Monetary Fund financial stress index (FSI) (advanced country FSI)



**Table 2: Variable composition of AE\_FSI**

Market	Variables
Banking sector	Banking beta The TED spread The slope of the yield curve
Foreign exchange market	Time varying real effective exchange rate volatility
Security market	Corporate bond spread Stock decline Time varying stock volatility

AE\_FSI: Advanced country financial stress indexes, TED: Treasuries over Euro Dollar Spread

**Table 3: A comparative summary of FSI**

Index	Frequency	Available from	Construction method
NFCI	w, m	January-1973	Principal components
AE_FSI	m, q	January-1980	Equal weights
GS_FCI	m, q	January-1980	U.S. macro weight model
STLFSI	w, m, FOMC, q	December-1980	Principal components
CITI_FCI	m, q	January-1983	U.S. CB weights
KCFSI	m, q	February-1990	Principal components
BFCIUS	d, w, m, FOMC, q	January-1991	Equal weights
CFSI	d, w, m, FOMC, q	September-1991	Dynamic credit weights

NFCI: National financial conditions index, AE\_FSI: Advanced country financial stress index, GS\_FCI: Goldman Sachs financial conditions index, STLFSI: St. Louis fed financial stress index, CITI\_FCI: City financial conditions index, KCFSI: Kansas city fed financial stress index, BFCIUS: Bloomberg financial conditions index, CFSI: Cleveland Fed's financial stress index, Frequencies are as follows; d-daily, w-weekly, m-monthly, q-quarterly. FOMC: Available data can match FOMC meeting schedule

**Table 4: A summary statistics of the FSI (all data)**

Data	Mean	Standard deviation	Max	Min	Skewness	n
NFCI	0.0500	0.9985	4.5400	-1.0400	1.7874	472
AE_FSI	0.2183	3.4165	17.9650	-5.2293	1.2539	361
GS_FCI	105.1793	5.1083	117.2600	98.1230	0.7188	360
STLFSI	0.0007	0.9982	4.9940	-1.2410	2.5239	220
CITI_FCI	-0.0182	1.1882	4.1861	-4.1118	0.0234	324
KCFSI	0.0731	0.0627	5.9700	-1.0200	2.7680	267
BFCIUS	-0.1846	1.4783	1.3920	-8.4980	-2.5019	228
CFSI	-0.0019	0.9562	2.5607	-1.6666	0.8262	248

NFCI: National financial conditions index, AE\_FSI: Advanced country financial stress index, GS\_FCI: Goldman Sachs financial conditions index, STLFSI: St. Louis fed financial stress index, CITI\_FCI: City financial conditions index, KCFSI: Kansas city fed financial stress index, BFCIUS: Bloomberg financial conditions index, CFSI: Cleveland Fed's financial stress index

**Table 5: A summary statistics of the FSI (data before December 2007)**

Data	Mean	Standard deviation	Max	Min	Skewness	n
NFCI	0.0237	0.0499	4.5400	-1.0400	1.8438	420
AE_FSI	-0.5027	2.5402	6.6996	-5.2293	0.4534	325
GS_FCI	105.5810	5.0351	117.2600	98.9160	0.6752	336
STLFSI	-0.3403	0.5060	1.0050	-1.2410	0.6547	168
CITI_FCI	0.1236	1.0846	4.1861	-2.6904	0.3272	300
KCFSI	-0.0239	0.5827	1.1900	-1.0900	0.6246	215
BFCIUS	0.1509	0.8764	1.3920	-2.6970	-0.9481	204
CFSI	-0.2710	0.7211	1.7740	-1.6667	0.5370	196

NFCI: National financial conditions index, AE\_FSI: Advanced country financial stress index, GS\_FCI: Goldman Sachs financial conditions index, STLFSI: St. Louis fed financial stress index, CITI\_FCI: City financial conditions index, KCFSI: Kansas city fed financial stress index, BFCIUS: Bloomberg financial conditions index, CFSI: Cleveland Fed's financial stress index

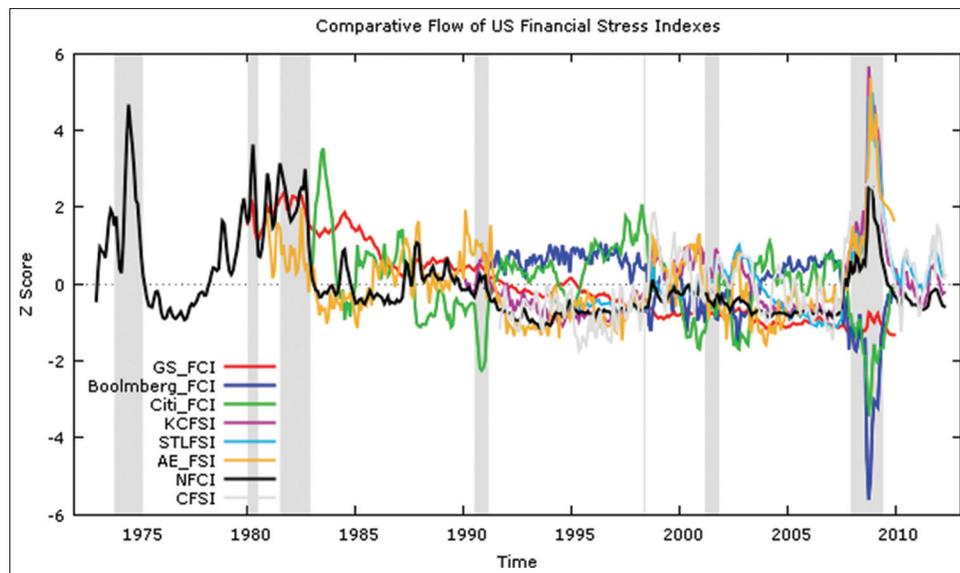
December 2007. The mean values were considerably higher for all FSIs after December 2007<sup>4</sup>. The moderate values can be seen in pre-December 2007. This indicates how intense the financial stress has become after great recession.

4 NBER official recession start date for great recession is December 2007.

### 3.2. A Graphical Comparison of FSIs

The Figure 10 provides a comparative graphical representation of all FSIs. First, each index is transformed to a Z-score to represent them in same units. According to Figure 10, FSIs have significantly responded to all recessions in U.S. history. Both NFCI and GS\_FCI have responded to early 1980's recession, a

**Figure 10:** A comparative flow of all US financial stress indexes. The shaded areas represent NBER U.S. recessions



**Table 6: A summary statistics of the FSI (data after December 2007)**

Data	Mean	Standard deviation	Max	Min	Skewness	n
NFCI	0.2625	0.1217	2.7700	-0.5500	1.4926	52
AE_FSI	6.7276	3.4523	17.9650	2.1170	1.5081	36
GS_FCI	99.4140	1.0279	101.3900	98.1230	0.6059	24
STLFSI	1.1024	1.3490	4.9940	-0.1850	1.6817	52
CITI_FCI	-1.7919	0.9948	-0.1300	0.9948	-0.3383	24
KCFSI	1.0748	0.2303	5.9700	1.5185	1.5185	52
BFCIUS	-3.0361	2.3036	-0.5100	2.3036	-0.9647	24
CFSI	1.0125	1.0546	2.5607	1.0546	-0.0398	52

NFCI: National financial conditions index, AE\_FSI: Advanced country financial stress index, GS\_FCI: Goldman Sachs financial conditions index, STLFSI: St. Louis fed financial stress index, CITI\_FCI: City financial conditions index, KCFSI: Kansas city fed financial stress index, BFCIUS: Bloomberg financial conditions index, CFSI: Cleveland Fed's financial stress index

*3.2.1. A comparative graphical representation of indexes issued by Federal Reserve Bank*

Figure 13 provides a comparative graphical representation of FSIs issued by regional Federal Reserve Banks; KCFSI, STLFSI, NFCI and CFSI. The KCFSI and STLFSI indicate a higher financial risk during the 2008 recession compared to NFCI and CFSI. All indexes have responded to the financial regulation change in 1998. However, this risk increase is considerably lower than that during great recession. During early mid 90's and mid 2000's, FSIs indicate significantly lower financial risks for the US economy.

consequence of increased interest rates to fight inflation in late 1970's. Both NFCI and GS\_FCI do not indicate a significant financial stress during early 1990's recession. However, the BFCIUS and AE\_FSI show significant changes during that time. Early 2000's recession, a result of both 9/11 terrorist attacks and the collapse of "dot com" bubble, has intensified the financial stress. More importantly, almost all FSIs have significantly responded to great recession in 2008-2009. In general, the Federal Reserve Bank FSIs show higher risks during recessions while lower or neutral risks during better economic conditions.

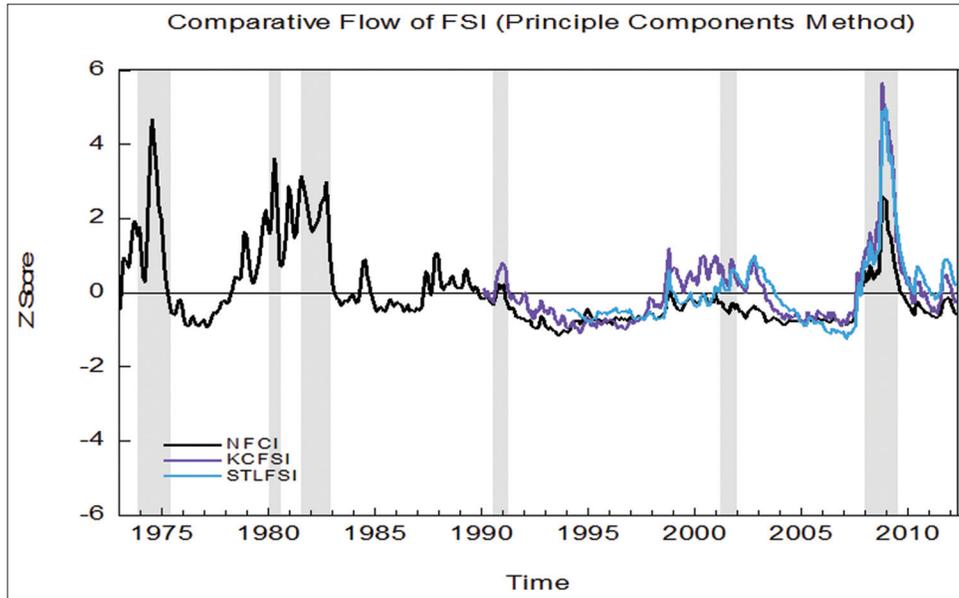
Figure 14 provides a comparative graphical representation between FSIs during great recession. All FSIs started showing positive Z-score values from June 2007. They identify the significance of Fannie Mae/Freddie Mac and Lehman Brother bankruptcies in the U.S. financial system. Therefore these two events can be considered as most influential during great recession. The indexes have also responded to financial healing processes during that period. The stress indexes immediately went down after TARP, TALF and fed funds rate cuts. The KCFSI, STLFSI, NFCI and CFSI reach to their lower levels in 2010 since late December for the first time.

Figure 11 represents stress indexes which use principle component construction method. They indicate a similar fluctuation along time. Figure 12 represents the indexes which use weights method. AE\_FSI and CFSI shows higher positive values during recessions to indicate the severity of the stresses while all the FCIs; GS\_FCI, Bloomberg\_FCI and CITI\_FCI, show higher negative values to represent tighter financial conditions during recessions.

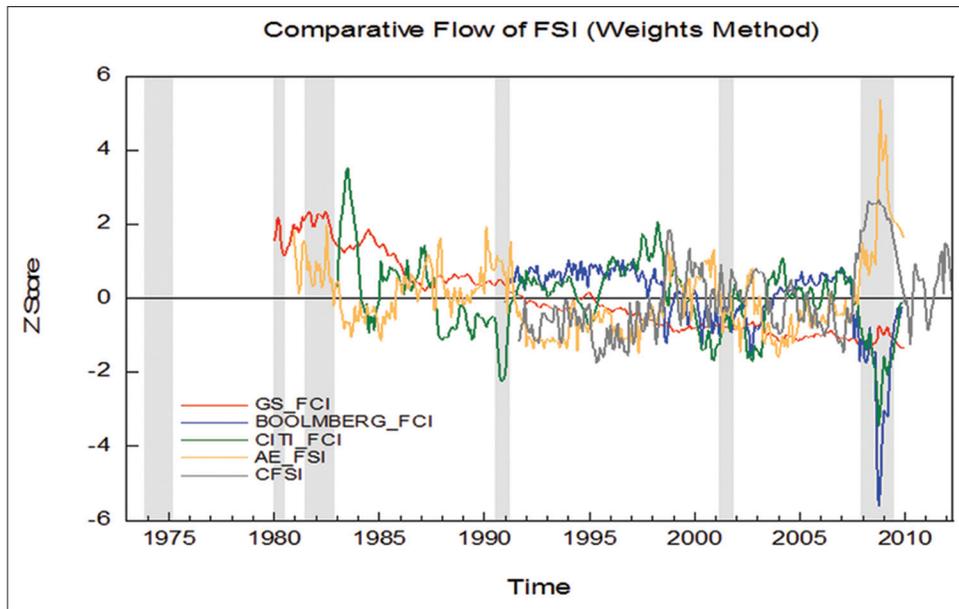
**3.3. Correlations between Financial Stress Indicators**

Table 7 provides correlations between FSIs for the entire sample. The GS\_FCI shows the lowest correlation between other FSIs. The CITI\_FCI shows moderate correlations with other indexes. The BFCIUS shows strong negative correlations with all indexes. Higher correlations between FSIs issued by different Federal Reserve Banks indicate common information sharing between its regional central banks. AE\_FSI has a lower negative correlation with GS\_FCI and a moderate negative relationship with CITI\_FCI and GS\_FCI. Moreover it has a strong negative correlation with BFCIUS and a strong positive correlation with all the Federal Reserve System banks' stress indexes. Table 8 provides correlations between indexes for pre great recession. Almost all the correlations in this situation got weakened compared to full sample information.

**Figure 11:** A comparative flow of US financial stress indexes (principle component method)



**Figure 12:** A comparative flow of US financial stress indexes (weights method)



**Table 7: Correlations between FSI (all data)**

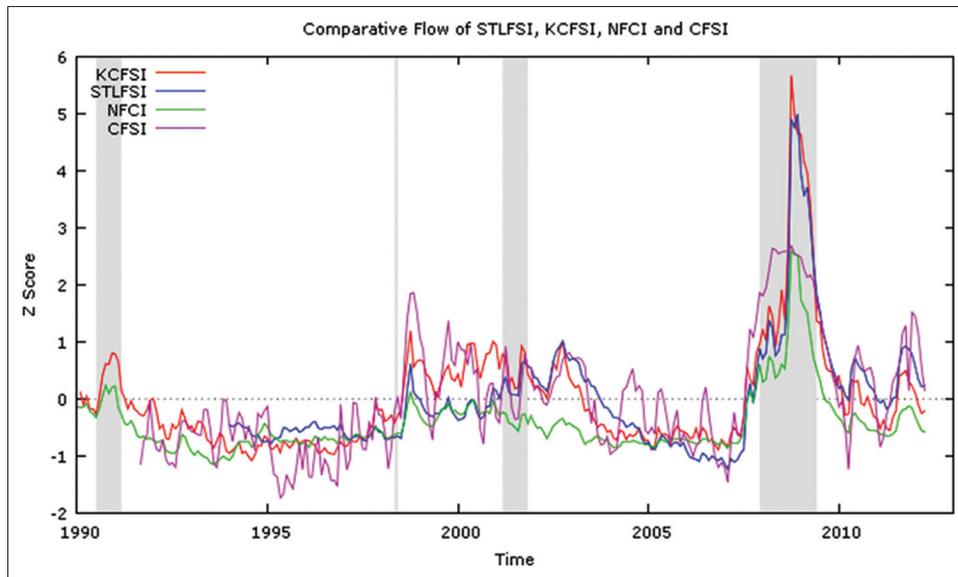
Data	GS_FCI	BFCIUS	CITI_FCI	KCFSI	STLFSI	AE_FSI	NFCI	CFSI
GS_FCI	1							
BFCIUS	0.4152	1						
CITI_FCI	0.1052	0.6245	1					
KCFSI	-0.1044	-0.8619	-0.6201	1				
STLFSI	-0.085	-0.8142	-0.5468	0.7527	1			
AE_FSI	0.3351	-0.5734	-0.4307	0.689	0.334	1		
NFCI	0.7388	-0.7262	-0.3733	0.8273	0.5969	0.6118	1	
CFSI	-0.3765	-0.743	-0.475	0.7504	0.6335	0.5665	0.7202	1

NFCI: National financial conditions index, AE\_FSI: Advanced country financial stress index, GS\_FCI: Goldman Sachs financial conditions index, STLFSI: St. Louis fed financial stress index, CITI\_FCI: City financial conditions index, KCFSI: Kansas city fed financial stress index, BFCIUS: Bloomberg financial conditions index, CFSI: Cleveland Fed's financial stress index

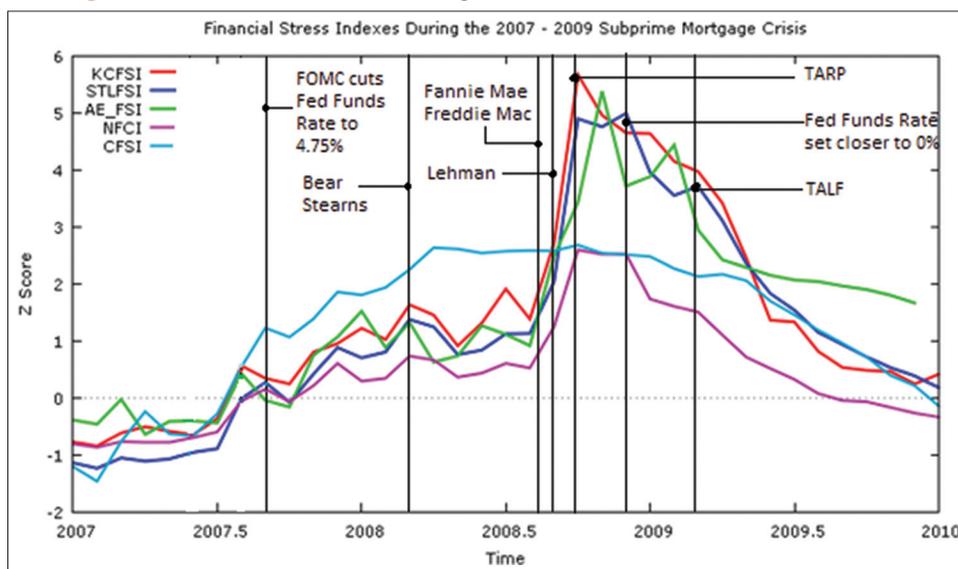
Table 9 provides correlations for late 2000s great recession. The correlations have become significantly higher during this period. It indicates how closely these indexes have responded to great

recession. However, the correlation between the GS\_FCI and other FSIs got further weakened during this time period. This may indicate the inability of GS\_FCI in measuring the entire nature of a

**Figure 13:** A comparative flow of all financial stress indexes issued by U.S. Federal Reserve Banks



**Figure 14:** Financial stress indexes during 2007-2009 financial crisis. TARP<sup>5</sup> and TALF<sup>6</sup>



complicated financial crisis as it only considers the nature of bond and exchange market. Since great recession includes issues in all three sub markets in a financial crisis; exchange market, security market and banking sector, the GS\_FCI may have lost its ability to capture the entire nature of great recession.

#### 4. CONCLUSION

This paper provides a comparative analysis on different FSIs available for the U.S. The main objective of these stress indexes is to provide detailed insights about different financial conditions in the U.S. economy. In general, all stress indexes indicated a very high financial risk during the 2008 financial crisis. Among the Federal Reserve Bank FSIs, KCFSI and STLFSI show considerable similarities during 2008 financial crisis. However the behavior of Chicago Fed’s NFCI and the CFSI were different to

KCFSI and STLFSI. In general, the stress indexes had responded to notable events with considerable shifts. All indexes showed a significant financial risk increase for Fannie Mae/Freddie Mac and Lehman Brother bankruptcies while significant risk reductions for financial healing processes such as TARP, TALF and fed funds rate cuts during the great recession.

For any research in the area of financial conditions of the U.S. economy, the above analyzed FSIs should be the first choice. However, it is more practical to select the Federal Reserve Bank issued FSIs as they are easily and freely accessible through Fred<sup>7</sup> data. However, if a researcher wants to study financial stress of

5 TARP – Troubled Asset Relief Program (Black and Hazelwood 2012)

6 TALF – The Term Asset Backed Securities Loan Facility (<http://www.newyorkfed.org/markets/talf.html>)

7 Fred data: <http://research.stlouisfed.org/fred2/>

**Table 8: Correlations between FSI (data up to December 2007)**

Data	GS_FCI	BFCIUS	CITI_FCI	KCFSI	STLFSI	AE_FSI	NFCI	CFSI
GS_FCI	1							
BFCIUS	0.412	1						
CITI_FCI	0.2114	0.7637	1					
KCFSI	-0.2546	-0.9363	-0.726	1				
STLFSI	-0.2368	-0.908	-0.7115	0.9226	1			
AE_FSI	-0.0683	-0.7968	-0.5768	0.8044	0.7785	1		
NFCI	-0.5887	-0.9052	-0.555	0.9471	0.9042	0.6144	1	
CFSI	-0.4928	-0.8152	-0.6839	0.7972	0.7564	0.7087	0.7984	1

NFCI: National financial conditions index, AE\_FSI: Advanced country financial stress index, GS\_FCI: Goldman Sachs financial conditions index, STLFSI: St. Louis fed financial stress index, CITI\_FCI: City financial conditions index, KCFSI: Kansas city fed financial stress index, BFCIUS: Bloomberg financial conditions index, CFSI: Cleveland Fed's financial stress index

**Table 9: Correlations between FSI (data after December 2007)**

Data	GS_FCI	BFCIUS	CITI_FCI	KCFSI	STLFSI	AE_FSI	NFCI	CFSI
GS_FCI	1							
BFCIUS	-0.0771	1						
CITI_FCI	-0.0956	0.7927	1					
KCFSI	0.1151	-0.9344	-0.7533	1				
STLFSI	0.0246	-0.9186	-0.7321	0.9228	1			
AE_FSI	-0.0137	-0.7856	-0.6707	0.8047	0.761	1		
NFCI	-0.0492	-0.9178	-0.7104	0.9651	0.9024	0.8166	1	
CFSI	-0.1045	-0.7825	-0.6741	0.7721	0.7568	0.6155	0.8017	1

NFCI: National financial conditions index, AE\_FSI: Advanced country financial stress index, GS\_FCI: Goldman Sachs financial conditions index, STLFSI: St. Louis fed financial stress index, CITI\_FCI: City financial conditions index, KCFSI: Kansas city fed financial stress index, BFCIUS: Bloomberg financial conditions index, CFSI: Cleveland Fed's financial stress index

other advanced (industrialized) countries, then AE\_FSI would be a better choice as it is available for 17 advanced countries. In general, these FSIs are highly useful in understanding the financial conditions in the U.S. economy.

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