# The Liquidity and Volatility in the US Capital Market behind Financial Policies and Crisis Empirical Study

Author: Mohammad Ikbal Abduljabbar\*

# ABSTRACT

This research focuses on the liquidity and volatility according to debt limit and Federal rate policies. Furthermore, the core of this research stands for testing the liquidity and volatility to find possible quarterly or even annual significant levels along ten years affected by global events and financial policies. Moreover, I find that there is significance around the dates of issuing debt limit and federal rate decisions. So, I discuss the results and analyze the whole picture of current market movement. Finally, I spot the light on forecasting and estimating for some economics like liquidity, GDP, deficit, and government expenditure, and I note a possible solution.

\* Consulting Bureau for Studies and Financial Analyzing, M. Ikbal Abduljabbar BBA, MBA in financial management. Founder/ CEO of Consulting Bureau for Studies and Financial Analyzing.

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## Introduction

In the past ten years financial markets have faced many monetary and fiscal upsets; this reflected dramatically on the economies of the big industry giants. Consequently, the financial crisis began in mid. 2007 which was followed by the mortgage credit policy. Till nowadays, the global economy suffers from the side effects of this non ending crisis. The USA along with European countries have taken precaution arrangements to avoid falling into deep recession, as a result they took strict policies to decrease the deficit. Therefore, this work sheds the light on this case of a global problem utilizing the USA market since it is the biggest market and the leading wheel for other economies.

This research consists of two main divisions; the first one explains the financial terms that are related to the empirical study; and a brief historical demonstration of US debt limit and federal fund rate. I chose these two because they are issued from different governmental administrations. Furthermore, the Federal Reserve points the monetary policy through hiking or cutting the interest rate. Furthermore, Interest rate affects strongly the volatility and liquidity in the financial markets. On the other hand, the debt ceiling is determined and assigned by the congress under recommendations of the department of treasury, and signed thereafter by US president. This fiscal decision also affects the financial market. Moreover, this has drawn my attention to study the US markets under these financial policies, and to find out the effects on the liquidity and volatility along ten years starting from 2001. The second one is about the empirical study; it takes in to concern the significance of value of volatility and liquidity through the studied period and in the interval before and after issuing new debt limit and even new federal fund rate.

However, the research is divided into three chapters. Chapter one stands for the historical overview of the federal debt limit; which explains the federal debt and demonstrates it between 2002 and 2011 in the manner how the debt policy has been discussed, voted, and signed by the US president, noting to the date of issue the

debt limit in that time. Moreover, this chapter takes also in to concern the federal fund rate, explains, treats it, and shows its changes over the studied period.

Chapter two cites the economic terms liquidity and volatility precisely. Chapter three is the core of this research as it presents the empirical study which consists of four parts. Part I cites the methodology of the research. Furthermore, part II stands for testing the liquidity over the studied period to find possible quarterly or even annual significant levels along ten years affected by global events and financial policies. Moreover, part III studies if there is significance after dates of issuing debt limit and federal rate decisions. Finally, part IIII discusses the results and analyzes the whole picture to find good and rational explanations for the results, and for the present situation of current market movement. As a complement to this analysis; I spot the light on forecasting and estimating for some economics like liquidity, Gross Domestic Product (GDP), budget deficit, and government expenditure showing both scenarios of whether or not the market is continuing further in this direction, and I note a possible solution according to the results.

## I. The History of US Liquidity in the Past Decade

## A. Debt Ceiling

Before the First World War the government can only borrow for different targets, for instance, for military activities and construction of Panama Canal.<sup>1</sup> After 1939, the government had put a limit for borrowing for all type of bonds. Furthermore, debt suggestions are incurred by the treasury department, and subject to the statutory limit set by congress, so treasury does not have a legal authority to issue any debt above this statutory limit. Moreover, this limit has not been tied to any particular fiscal policy goal, it is only to meet the government's obligations. Federal debt is a standard method for financing federal activities. If the limit prevents the treasury from issuing new debt to manage short-term cash flows or to finance an annual deficit, the government may be unable to obtain the cash needed to pay its bills or it may be unable to invest the surpluses of designated government accounts so, this prompts the congress to vote on new or higher debt ceiling.

However, this debt could vary over time, in other words; it could increase when the national budget has a deficit and decrease when it has a surplus. Furthermore, this total debt of the federal government can increase in two ways. First, debt increases when the government sells debt to the public to finance budget deficits and acquire the financial resources needed to meet its obligations. This increases debt held by the public. Second, debt increases when the federal government issues debt to certain government accounts, such as the Social Security, Medicare, and Transportation Trust Funds. This increases debt held by government accounts. The sum of debt held by the public and debt held by government accounts is the total federal debt.<sup>2</sup> Surpluses generally reduce debt held by the public, while deficits raise it as mentioned before. On the other hand, a statutory limit has restricted total federal debt since 1917. Note that the following demonstration for federal debt limit history

<sup>&</sup>lt;sup>1</sup> The Debt Limit: History and Recent Increases, CRS report for congress, April 29, 2008, p5.

<sup>&</sup>lt;sup>2</sup> DEBT LIMIT, Delays Create Debt Management Challenges and Increase Uncertainty in the Treasury Market, United States. Government Accountability Office, February 2011, p6.

is taken from the reports of Congressional Research service and Congressional budget office (CBO) along nine years. According to research time line, this demonstration takes debt limit history from 2002 to 2011.

## B. A Brief History of the Federal Debt Limit

The statutory limit on federal debt began with the Second Liberty Bond Act of 1917, which helped finance the United States' entry into World War I. In 1939, Congress eliminated separate limits on bonds and on other types of debt, which created the first aggregate limit that covered nearly all public debt.<sup>3</sup> After World War II has ended the debt limit has begun to raise it reached after war time to \$275 billion which was set in 1919 at \$25 billion.<sup>4</sup> During 1998 and 2001 the Federal budget had surpluses, federal debt held by intergovernmental accounts grew by \$855 billion and debt held by the public fell by almost \$450 billion. But since FY2001, debt held by the public grew continually due to budget deficits. Furthermore, the statutory debt limit has been increased since 1995 13 times to its current level of \$16.40 trillion.<sup>5</sup>

#### FY2002

In the fall of 2001, the administration recognized that a deteriorating budget outlook and continued growth in debt held by government accounts were likely to lead to the debt limit soon being reached. In early December 2001, it asked congress to raise the debt limit by \$750 billion to \$6.7 trillion.<sup>6</sup> As the debt moved and reached the debt limit over the first six months of FY2002, the administration asked congress repeatedly to increase the debt limit, by the middle of May 2002, debt subject to limit had again risen.

#### FY2003

<sup>&</sup>lt;sup>3</sup> The Debt Limit: History and Recent Increases, CRS report for congress, April 29, 2008, p5.

<sup>&</sup>lt;sup>4</sup> The Debt Limit: History and Recent Increases, CRS report for congress, April 29, 2008 , p6.

<sup>&</sup>lt;sup>5</sup> The Debt Limit: History and Recent Increases, CRS report for congress, April 29, 2008, p9.

<sup>&</sup>lt;sup>6</sup> The Debt Limit: History and Recent Increases, CRS report for congress, April 29, 2008 ,p9.

On Christmas Eve, 2002, Kenneth Dam, deputy secretary of the treasury sent a letter to congress requesting an increase in the debt limit by late February 2003, The senate received the debt-limit legislation on April 11 and sent it to the president, who signed it on May 27. This legislation raised the debt limit to \$7.384 trillion.<sup>7</sup>

#### FY2004

In January 2004, CBO estimated that the debt limit, then set it at \$7.384 trillion, this would be reached the following summer. In August, and again in September, the treasury declared that the debt limit would be reached in the first half of October. On October 14, debt reached \$7,383.975 billion, just \$25 million below the existing limit. On November 16, 2004 raised the debt by \$800 billion, from \$7,384 billion to \$8,184 billion. The senate approved the increase on November 17, 2004. The house considered and approved the increase on November 18. The president signed the legislation into law on November 19, 2004. Estimates made at that time anticipated the new limit would be reached between August and December 2005.<sup>8</sup>

#### FY2005 and 2006

In 2005, specified a \$781 billion debt limit increase, to \$8,965 billion, with a reporting date of no later than September 30, 2005. At the end of December 2005, secretary of the treasury Snow wrote congress that the debt limit would probably be reached in mid-February 2006. Letters were sent on February 19 and March 6 advised congress that the treasury was taking measures to avoid reaching the limit until the middle of March 2006. On March 16, the senate passed a debt limit increase. The president's signature on March 20, 2006, and then raised the debt limit to \$8.965 trillion.

#### FY2007

<sup>&</sup>lt;sup>7</sup> The Debt Limit: History and Recent Increases, CRS report for congress, April 29, 2008, p12.

<sup>&</sup>lt;sup>8</sup> The Debt Limit: History and Recent Increases, CRS report for congress, April 29, 2008, p13.

In mid-May 2007, at the end of July 2007, the treasury asked congress to raise the debt limit, stating the limit would be reached in early October 2007. The senate then passed the measure on September 27, which the president signed on September 29, 2007 raising the debt limit by \$850 billion to \$9,815 billion.<sup>9</sup>

## FY2008

A serious economic slowdown, which many economic forecasters say started in the last quarter of 2007, has led to sharply higher estimates of federal deficit spending in FY2008 and FY2009. The slowdown began with a rapid deceleration of housing prices and a rise in interest rate spreads between private lending rates and benchmark Federal Reserve rates, an economic recession affects the federal deficit in several ways. First, falling prices of many assets and equities can sharply reduce federal revenues from capital gain taxes and from the corporate tax. Second, more difficult economic conditions may reduce tax revenues on earned income and other income sources. Third, "automatic stabilizers" such as unemployment insurance and income support programs pay out more money as unemployment rises and the number of households eligible for means-tested benefits rises. An increase in deficit spending provides a fiscal stimulus to the economy, if the output levels of goods and services produced in the nation are below their potential levels. Deficit spending, however, can help accelerate inflation if output levels are near or at potential levels, and in addition, exacerbate long-term fiscal challenges. Moreover, when a government's expenditures exceed its revenues, this causes or deepens a deficit.<sup>10</sup>

## FY2009

On October 1, 2008, the senate voted on a different version of the Emergency Economic Stabilization that included the same debt limit increase. On October 3, 2008, and it was signed into law by the president on the same day, raising the debt limit to \$11,315 billion The American Recovery and Reinvestment. A report passed by

<sup>&</sup>lt;sup>9</sup> The Debt Limit: History and Recent Increases, CRS report for congress, April 29, 2008, p13.

<sup>&</sup>lt;sup>10</sup> The Debt Limit: History and Recent Increases, CRS report for congress, April 29, 2008, p15.

the Senate on February 10, 2009 contained a provision which would raise the debt limit to \$12,140 billion the final conference agreement was passed by the House and Senate on February 13, 2009, and signed by the president on February 17, 2009.<sup>11</sup> Thereafter, a next measure to raise the debt limit to \$12.394 trillion was introduced on December 15, 2009. The senate passed it on December 24 by a 60-39 vote, and the president signed the measure on December 28.<sup>12</sup>

# FY2010

On December 15, 2009, a measure passed by the house the next day on a 218-214 vote. The senate passed it on December 24 by a 60-39 vote, and the president signed the measure on December 28. The measure would raise the debt ceiling by \$1,900 billion, to \$14,294 trillion. The house approved on a 233-187 vote on February 4, forwarding the measure to the president.<sup>13</sup> The Obama administration had previously voiced its strong support for a debt limit increase. The president signed the measure on February 12, 2010 with \$14.29 trillion<sup>14</sup>.

# FY2011

On August 2, 2011, president Obama signed into law a compromise measure following house approval on August 1, 2011, and senate approval on August 2, 2011. Included in this measure were numerous provisions aimed at deficit reduction and an increase in the debt limit of up to \$2.4 trillion that would occur in several stages. These provisions would eliminate the need for further increases in the debt limit until late 2012 or early 2013.<sup>15</sup> The following figure shows up the increasing of debt ceiling over 70 years,

<sup>&</sup>lt;sup>11</sup> The Debt Limit: History and Recent Increases, Congressional Research service, February 16, 2010, p16.

<sup>&</sup>lt;sup>12</sup> The Debt Limit: History and Recent Increases, Congressional Research service, February 16, 2010, p17.

<sup>&</sup>lt;sup>13</sup> The Debt Limit: History and Recent Increases, Congressional Research service, July 1, 2011,p22.

<sup>&</sup>lt;sup>14</sup> Debt Limit: History and Recent Increases, Congressional Research service, July 1, 2011,p22.

<sup>&</sup>lt;sup>15</sup> The Debt Limit: History and Recent Increases, Congressional Research service , August 3, 2011.p25.



**Figure 1**: This Figure shows the increasing of debt ceiling over 70 years. The red area stands for statutory debt limit that is signed by the Congress, where the blue line stands for the changing in the debt according to increasing of federal outlays

## C. A Brief History of the federal funds rate

The interest rate is a paid fee in order to use money borrowed from someone else. Furthermore, interest calculated as a percentage of the amount borrowed, this percentage is called interest rate. Actually, it is the cost of having credits for a particular period. Moreover, there are two kinds of interest rate, the simple interest which is paid or received in a single period. The second one is the compound interest which is received and reinvested over a number of periods. It is also fair to say that the interest is the amount paid for renting something for a period of time. Furthermore, interest refers to investment opportunities theory, so it is based on the economic productivity of the capital.<sup>16</sup>

However, federal fund rate is an interest rate at which the depositary institute lends another one overnight, but discount rate is the rate that depository institute is charged to borrow short-term funds directly from a Federal Reserve. Moreover, this rate takes into account the time value of money. This could be

<sup>&</sup>lt;sup>16</sup> Mathematical interest theory, Leslie Jan Federer Vaaler, James W. Daniel, second Edition 2009, 10

understood in the following explanation: Federal Reserve usually determines the interest depending upon the Taylor rule. Furthermore, Taylor rule is a monetary policy model that describes the short term interest rate; it takes into consideration the inflation and Gross Domestic Product (GDP). Particularly, it considers the gap between actual and expected inflation, and the gap between actual and trend GDP.<sup>17</sup>

So Taylor rule is calculated as follow, <sup>18</sup>

#### Taylor rule % = i + inflation\* + 0.5 (inflation gap)+ 0.5 (output gap)

Which,

i	is the natural real interest rate
inflation*	is the actual or expected inflation
inflation gap	is actual inflation – Fed inflation ( target)
output gap	is actual GDP – trend GDP

Federal fund rate is an important benchmark interest rate in the world, it is used by Federal Reserve to guide money and credit growth as well affects the cost of borrowing through the whole United States economy and even the global. Furthermore, it is a leading rate so when it is set higher than traded the Federal Reserve injects money in the market by repurchase the agreements to push it back to the benchmark level. And when it is traded at lower than target Federal Reserve sells agreement or drains money to the market to back it up the old level.<sup>19</sup> Actually, federal fund rate has been changed many times over the past seventy years. This rate's modification or change is set according to the liquidity balance needs in the capital market. The table I shows the rate changing over ten years that is the period of the research.

<sup>&</sup>lt;sup>17</sup> The explanation and forecasting the US federal reserve rate, Matthew Clements, 2004,p9-10.

<sup>&</sup>lt;sup>18</sup> The explanation and forecasting the US federal reserve rate, Matthew Clements, 2004,p9-10.

<sup>&</sup>lt;sup>19</sup> Trading strategies for capital markets, Josef Benning, 2007, p. 153-154.

**Table I**: this table shows the Federal Fund Rate cut/raise since 2001 to 2011. Furthermore, we can understand that the Federal Reserve has started to cut the federal rate in the fourth quarter of 2007 in order to face the financial crisis and to pump more liquidity in the market. However, this data source is from Federal Reserve.

Period	rate	Perio	d rate	Period	Rate	Period	rate
2001-09	3.07	2004-02	1.01	2006-08	5.25	2009-03	0.18
2001-10	2.49	2004-03	1	2006-09	5.25	2009-04	0.15
2001-11	2.09	2004-04	1	2006-10	5.25	2009-05	0.18
2001-12	1.82	2004-05	5 1	2006-11	5.25	2009-07	0.16
2002-01	1.73	2004-06	i 1.03	2006-12	5.24	2009-08	0.16
2002-02	1.74	2004-07	1.26	2007-01	5.25	2009-09	0.15
2002-03	1.73	2004-08	1.43	2007-02	5.26	2009-10	0.12
2002-04	1.75	2004-09	1.61	2007-03	5.26	2009-11	0.12
2002-05	1.75	2004-10	1.76	2007-04	5.25	2009-12	0.12
2002-06	1.75	2004-12	1.93	2007-06	5.25	2010-01	0.11
2002-07	1.73	2004-12	2.16	2007-07	5.26	2010-02	0.13
2002-08	1.74	2005-02	2.28	2007-08	5.02	2010-03	0.16
2002-09	1.75	2005-02	2.5	2007-09	4.94	2010-04	0.2
2002-10	1.75	2005-03	2.63	2007-10	4.76	2010-05	0.2
2002-11	1.34	2005-04	2.79	2007-11	4.49	2010-06	0.18
2002-12	1.24	2005-05	3	2007-12	4.24	2010-07	0.18
2003-01	1.24	2005-06	3.04	2008-01	3.94	2010-08	0.19
2003-02	1.26	2005-07	3.26	2008-02	2.98	2010-09	0.19
2003-03	1.25	2005-08	3.5	2008-03	2.61	2010-10	0.19
2003-04	1.26	2005-09	3.62	2008-04	2.28	2010-11	0.19
2003-05	1.26	2005-10	3.78	2008-05	1.98	2010-12	0.18
2003-06	1.22	2005-11	. 4	2008-06	2	2011-01	0.17
2003-07	1.01	2005-12	4.16	2008-07	2.01	2011-02	0.16
2003-08	1.03	2006-02	4.29	2008-08	2	2011-03	0.14
2003-09	1.01	2006-02	4.49	2008-09	1.81	2011-04	0.1
2003-10	1.01	2006-03	4.59	2008-10	0.97	2011-05	0.09
2003-11	1	2006-04	4.79	2008-11	0.39	2011-06	0.09
2003-12	0.98	2006-05	4.94	2008-12	0.16	2011-07	0.07
2004-01	1	2006-06	4.99	2009-01	0.15	2011-08	0.1
2004-02	1.01	2006-07	5.24	2009-02	0.22		

Figure 2 demonstrates the rate changing over fifty years. Furthermore, it is seen that the monthly Fed. Rate reached its peak in 1981 between 15.85% -19.40% and thereafter it started to go down and landed in year 2000 on 6%. So, after that the Federal Reserve started to pump liquidity in the market in order to keep on the balance and to retain the surplus which is targeted in the Clinton presidency. In the beginning of 2005 the Fed Reserve issued a severe monetary policy to absorb the increasing inflation till mid 2007 in which began financial turbulence. Moreover, the interest rate slipped to a very low level in order to revival the financial markets and to prevent falling in a new deep recession.



Figure 2 chart demonstrates the rate changing over fifty years. Furthermore, it is seen that the monthly fed. Rate reached its peak in 1981 between 15.85% -19.40% and thereafter it started to go down and landed in year 2000 on 6%.



# A. Liquidity

Liquidity doesn't have a certain definition; In general, it could compress the degree to which a bank or a depository institute can cover its payment obligations.<sup>20</sup> Furthermore, a liquid market is defined as one in which

<sup>&</sup>lt;sup>20</sup> Managing liquidity in a banks. A top down Approach, Ruhdolf Duttweiler, 2009,p.1.

trades can be executed with no cost. In practice, a market with very low transaction costs is characterized as liquid and one with high transaction costs as illiquid. Moreover, *Wood and Wood* define liquidity as "the inverse of the amount of time that elapses between the decision to sell a security and the receipt of the full market by the seller.<sup>21</sup>Furthermore, going into corporate levels and according to balance sheet management the liquidity is defined as the rate of growth of aggregate balance sheets.<sup>22</sup> The liquidity is measured by different tools like outstanding central government debt, yearly cash and futures turnover, turnover ratio, and bid-ask spreads of 10year bonds, where turnover ratio is defined as yearly trading volume divided by outstanding volume.<sup>23</sup>

In this research we consider turnover (sold and bought equities in capital market-Dow Jones during specific time window) as annual trading volume, there are two ways to measuring or valuing the trading volume; the first one measures it by national or even international currency, and the second one measures it by the number of equities traded sold and bought. In our case the trading volume is valued in US dollars.

## B. Volatility

Volatility is a normal and necessary function of markets. Furthermore, markets are affected by the information provided. So, when the information is shocking enough the market's adjustment will be volatile.<sup>24</sup> The volatility of stock price changes is a measure of how much the market is liable to fluctuate.<sup>25</sup> With other words, volatility is the rate at which prices change, this rate refers to the standard deviation of daily return of a stock.<sup>26</sup> The volatility could be predicted by using the historical stock prices or the current prices of options.<sup>27</sup> Particularly, the volatility is an item of risk measurement so there are an absolute risk and relative risk. Examples

<sup>&</sup>lt;sup>21</sup> Measuring Residential Real Estate Liquidity, Brian D. Kluger and Norman G. Miller, p. 145.

<sup>&</sup>lt;sup>22</sup> Liquidity, Monetary Policy, and Financial Cycles, Tobias Adrian and Hyun Song Shin, Current Issues in Economics and Finance, p5.

<sup>&</sup>lt;sup>23</sup> Size and liquidity of government bond markets, Robert McCauley and Robert McCauley, p.54.

<sup>&</sup>lt;sup>24</sup> Liquidity black holes; understanding, qualifying, and managing financial liquidity risk, Avinash D. Persaud, 2003, P. xviii

<sup>&</sup>lt;sup>25</sup> The statistical properties of the volatility of price fluctuations, Yanhui Liu, Parameswaran Gopikrishnan, Pierre Cizeau, Martin Meyer, Chung-Kang Peng, and H. Eugene Stanley, January 24, 1999, p.3.

Asset Price Dynamics, Volatility, and Prediction, Stephen J. Taylor, 2005,p1.

<sup>&</sup>lt;sup>27</sup> Asset Price Dynamics, Volatility, and Prediction, Stephen J. Taylor, 2005,p2.

of absolute risk objectives are a specified level of standard deviation or variance of total return. The variance of a random variable is the expected value of squared deviations from the random variable's mean. Standard deviation (volatility) is the positive square root of variance. An example of a relative risk objective is a specified level of tracking risk. Tracking risk is the standard deviation of the differences between a portfolio's and the benchmark's total returns.<sup>28</sup>

The following equation shows the standard deviation as risk measure for the population

$$\sigma = \sqrt{\frac{\sum (X - \mu)^2}{n}}$$
(1)

Where,

 $\sigma$  = population standard deviation  $\Sigma$  = sum of...  $\mu$  = population mean n = number of scores in sample.

Precisely, volatility is related to- but not the same as - the risk. Furthermore, risk associated with undesirable outcome so it measures the strictly for uncertainty could be happen to the positive outcome.<sup>29</sup> Moreover this volatility is traded over its index VIX which is produced by Chicago Board Options Exchange (CBOE) in 1993. It was created to be a benchmark index for equity market volatility.<sup>30</sup> Next I will present the core of this work- the empirical study.

<sup>&</sup>lt;sup>28</sup> Managing Investment Portfolios: A Dynamic Process, John L. Maginn, Donald L. Tuttle , Dennis W. McLeavey , Jerald E. Pinto, 2007, P.29; Volatility Trading, Euan Sinclair, 2008, P.15; Volatility-based technical analysis: strategies for trading the invisible, Kirk Northington, 2009, p58.

<sup>&</sup>lt;sup>29</sup> A Practical Guide to Forecasting Financial Market Volatility, Ser-Huang Poon, 2005 , p.1.

<sup>&</sup>lt;sup>30</sup> Volatility Trading, Euan Sinclair,2008, P180; The Volatility Edge in Options Trading: New Technical Strategies for Investing in Unstable Markets, Jeff Augen, 2008, p5.

## III. Empirical Study

Federal Reserve and department of treasury affect the financial market through their policies. In this paper I test the liquidity and the volatility according to different financial policies. I find that the liquidity and volatility have been affected significantly by interest rate and debt limit hike. Furthermore, this indicates that market participators reacted to these policies surprisingly so this leads to important changes in liquidity affected by changing in volatility.

#### A. Methodology

I choose Dow Jones as a studied target because of its properties, So, DJI is the oldest (1896) and a most watched index- security market in US. Furthermore, it contains 30 biggest enterprises from various sectors and even registered in different markets. For instance, Microsoft Corp., Intel Corp., and Cisco Systems Inc. are registered in NASDAQ and the rest of them are listed in NYSE.

However, the data were demanded and imported from vary database like DJI, Federal Reserve, department of treasury, bureau of economic analysis, The U.S. Government Printing Office, and bureau of labor statistics. Treating and handling these data were through Excel program. I select ten years as a studied period starting from third quarter of 2001 to third quarter of 2011. Moreover, the selection of year 2001 as start depends on an idea that the market there before wasn't suffering from serious economic upsets, but the years after the US market has begun to waggle under increasing budget deficit and growing debts. After importing the daily trading volume of DJI index and trading volume for thirty firms I test liquidity according to two methods. The first one, I calculate the quarterly and annual average of trading volume and test them according to Analysis of *variance between groups (ANOVA)* using *two-factor without replication method* in order to exposure any

significance for liquidity performance along ten years over each interval (quarterly and annual). Thereafter, I test the liquidity according to its prior performance presented by moving average (MA) using the same (ANOVA) to figure out if the liquidity beat its historical performance significantly, where MA is calculated over 100 trading days. Continually, the second method is based on testing the liquidity before and after the financial events, in this paper I test it before and after federal fund rate and debt limit decisions, to find out if these policies have really affected the market through liquidity and volatility significantly. I use for this purpose *t-Test* (*Paired Two Sample for Means*). The time window for this test is twenty days before the event and twenty days after.

On the other hand, the volatility is estimated by the daily absolute price changes and tested through *t*-*Test (Paired Two Sample for Means),* and stretched over the same interval as in liquidity test; twenty days before the event and twenty days after. However, later the significance and NULL Hypothesis will be explained.

#### A.1 Significance

In normal English, "significant" means important, while in statistics "significant" means probably true (not due to chance), when statisticians say a result is "highly significant" they mean it is very probably true.<sup>31</sup> A theory usually has 99%, 95%, 90% confidence levels corresponding to 1%, 5%, and 10% significance respectively.<sup>32</sup>

#### A.2 NULL Hypothesis

The Null hypothesis cites that the means are equal, furthermore, Null hypothesis tells us that the cumulative means on sample's value are equal to zero if not we can reject the null hypothesis, so it claims that there is no difference between the two average returns.<sup>33</sup> Refuting the null hypothesis would require showing statistical

<sup>&</sup>lt;sup>31</sup> Statistics for People Who (Think They) Hate Statistics, Neil J. Salkind, ,p163.

<sup>&</sup>lt;sup>32</sup> Schaums Outline of Statistics, Fourth Edition, Murray Spiegel, Larry Stephens, p. 245-246

<sup>&</sup>lt;sup>33</sup> Statistics for People Who (Think They) Hate Statistics, Neil J. Salkind, ,P129; Statistics, Robert S. Witte, John S. Witte, P.225; 246,291

significance, which can be found using a variety of tests like *Analysis of variance between groups (ANOVA; Two-*Factor without Replication method and T-Test (Paired Two Sample for Means).<sup>34</sup>

#### B. Testing the volatility and liquidity according to financial decisions

Before testing the liquidity I do some preparations to the data taking in concern the time interval and the various sectors of the US economy. Furthermore, I order as mentioned before the daily volume in quarterly and annual interval. This was made to ease the controlling of liquidity over different periods along ten years. Moreover, I spread Dow Jones firms to sectors because I am not going to study each company apart and particularly, and to show up which sector was the most affected by these policies and which one was less affected. Furthermore, these sectors are; financial sector, transport sector, software and computer sector, oil sector, industry sector, chemical sector, and telecommunication sector, and then I collect the rest in one sector (household, retail, food and soft drinks). This division is not market standard; it is structured to this research. The table B I in the appendix B is showing it in details.

During the financial crisis it was clear that the liquidity of the most companies aimed no Sig. level this can be seen between mid. 2006 and late 2007 (see chart A2 in appendix A). Thereafter, the market liquidity was starting to jump up showing Sig. level so it reached in 2008 and 2009 for the most sectors the highest level ever since 2000, this returned to the financial (fiscal and monetary) policies that were taken that time. We should say that these policies were good enough to revive the economy and land the prices on attractive level. But in the beginning of 2009 started the liquidity outperformance accelerating to slow down for all sectors, so it plunged late 2009 to a critical level where the crisis has already begun. The liquidity for all sectors was affected with the crisis; this can be seen on the charts A1 in appendix A. The most active sectors were household, retail, food and soft drinks, computer and software, financial services, chemicals and telecommunication sectors. Furthermore, oil, industry and transport were the less affected by those policies.

<sup>&</sup>lt;sup>34</sup> Statistics for the Utterly Confused, Lloyd Jaisingh, P 265-274; Statistics Explained: A Guide for Social Science Students ,Perry Hinton, P.126-135, 291, 296, 394

However, in the following charts (figure 3) I demonstrate the annual average of the trading volume for all thirty firms and in the second chart I am showing the annual average volume of Dow Jones. Furthermore, I calculate average value to eliminate fluctuation that rose in the liquidity over a very long time period and to be clearer. Obviously, the liquidity in the chart below was moderate since 2001 to 2006; this indicates that the market that time was stable. Thereafter, started the liquidity to raise and reached in 2009 to the highest level ever since ten year affected by the precaution- and revival arrangements. After that the trading volume plunged sharply and reached the bottom in mid 2010. Moreover, this could be read as liquidity black hole, which is when the market price falls, this does not bring out buyers, but generates even more sellers and leads to more price fall,<sup>35</sup> this has happened in 2008 when the DJI price has fallen to a critical level. If we look to the prior liquidity test we can distinguish that when the liquidity has stopped to be significant, it started to fall down.



**Figure 3**: the liquidity in this chart was moderate since 2001 to 2006; this indicates that the market that time was stable. Thereafter, started the liquidity to raise and reach in 2009 to the highest level ever since ten year affected by the precaution- and revival arrangements. After that the trading volume plunged sharply and reached the bottom in mid 2010. Moreover, this could be read as liquidity black hole, which is when the market price falls; this does not bring out buyers, but generates even more sellers and leads to more price fall.

I notice in the other chart (Figure 4, annual average volume of Dow Jones) that the downside of liquidity that we mentioned as liquidity black hole in 2010 is happened in 2008 in Dow Jones. This explanation gives the impact that what happen in Dow Jones it could be happen after one or two years to whole market. So, DJI could consider as is a predicator for market and less volatile. Consequently, the liquidity of DJI started after 2008 to go

<sup>&</sup>lt;sup>35</sup> Liquidity black holes; understanding, qualifying, and managing financial liquidity risk, Avinash D. Persaud, 2003, P.xviii

up and to take moderate upward course. So, it indicates the same manner to the whole market. This will be analyzed further later in this paper.



Figure 4: We noticed in the other chart (annual average volume of Dow Jones) that the downside of liquidity that we mentioned as liquidity black hole in 2010 is happened in 2008 in Dow Jones. So, DJI could consider as is a predicator for market and less volatile.

However, we are going to test in the next step the liquidity according to its prior performance presented by moving average. For this purpose I use *t-Test (Paired Two Sample for Means)* we want through this test to figure out if the liquidity beat its performance i.e. if the liquidity outperformed its history. Furthermore, the results show that the liquidity of the market sectors outperformed the MA significantly but in different degrees. Furthermore, these sectors are financial services sector, Telecommunication sector, Household, retail, food and soft drinks sector, and Chemical sector. This can be clearly seen in table II and tables B II and B III in appendix B. Consequently, the high significance record between 2008 and 2010 shows that the prices on Dow Jones were attractive which were down from 13000 toward 9000 points.

Table II: This table remarks the number of significance that occurred during ten years (2002-2011) for all sectors.

year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Sig	13	37	37	41	28	15	36	74	97	43	9

This gives the impact that the crossover of the daily volume to its moving average was highly significant influenced the market price. See figure 5,



Figure 5: The upper chart stands for significance of crossover of the daily volume to its moving average and lower chart stands for market price. Moreover, this crossover of the daily volume to its moving average is highly significant influences the market price.

Note that the significance record in 2011 is very low comparing to the past years; this is because of the testing is involved just to the mid. of third quarter of 2011. However, between 2002 and 2005 the significance was in the same range (see the table) till 2006 so it plunge 50%, this could be prediction for market turbulence after a long stable market liquidity starting in 2007 the year after. The high records thereafter happened under different financial stimulations.

#### B.1 Testing the Liquidity

In this section I am going to test both liquidity and volatility around debt ceiling and interest rate policy. Moreover, I divide the studied time window into two parts, so I spread it to days before decision was made and after decision was made, particularly, twenty days before and twenty days after. Furthermore, I use the *t-Test function (Paired Two Sample for Means)* to see if there is any occurrence of significance level behind these policies. As it is done before, I test the liquidity and volatility on the different sectors.

Consequently, Figure 6 illustrates the results of significance level of the liquidity behind interest rate decision which indicate that the most affected sectors by the Federal Reserve policy (interest rate decision) are computer and soft ware sector, and household, retails, soft drink sector in the first place then comes the financial sector. Furthermore, the less affected by this policy are industry sector, oil sector, telecommunication sector. From this demonstration we can interpret that the first group is very sensible against the interest rate changing than the second one.



Significance level of the Liquidity behind interest policy

**Figure 6**: This figure illustrates the results of significance level of the liquidity behind interest rate decision which indicate that the most affected sectors by the Federal Reserve policy (interest rate decision) are computer and soft ware sector, and household, retails, soft drink sector in the first place then comes the financial sector. Furthermore, the less affected by this policy are industry sector, oil sector, telecommunication sector. This scaling based upon the number of significance that occurred during announcement date of the studied period.

However, this sensibility against financial policies could alter according to which policy they are going handle with. In the next test, the liquidity of the market sectors shows different results. Furthermore, industry

sector, oil sector, telecommunication sector has shown different results, the liquidity of these sectors dominate a high significance records comparing to past record where liquidity of the first group plunge to lower level.

See figure 7,



Significance level of the Liquidity behind debt limit decisions

**Figure 7:** this figure illustrates the results of significance level of the liquidity behind debt limit decisions. The liquidity of the market sectors shows different results. Furthermore, industry sector, oil sector, telecommunication sector has shown different results, the liquidity of these sectors dominate a high significance records comparing to past record where liquidity of the first group plunge to lower level. This scaling based upon the number of significance that occurred during announcement date of the studied period.

Obviously, the specification of the financial policy affects the market sectors with different degrees as we saw in the prior test. Furthermore this could help the decision makers with scaling the market and to suit their financial policies in line with market needs.

## B.2 Testing the Volatility

In this test I calculate the volatility using the daily price of each sector then as mentioned before, I divide the studied period into two parts twenty days before and twenty days after announcing the decision. Furthermore, the results are surprising in the manner of debt limit hike which show that the volatility of all sectors in the date of announcement of debt limit decision is highly significant, it waggle between 8 and 11 scale (see Figure 8, note that this scaling based upon the number of significance that occurred during announcement date in the studied period). Moreover, the high record of significance represents the importance of the debt limit announcement to the US market as whole not for particular sector, and this also reflects that US security market is efficient and has a high transparency toward market traders. Table B IV and B V in appendix B show the values of the significance in details.



Significant changing of the Volatility behind debt limit decisions

**Figure 8:** This figure stands for Significant changing of the Volatility behind debt limit decisions. Furthermore, the results are surprising in the manner of debt limit hike which show that the volatility of all sectors in the date of announcement of debt limit decision is highly significant, it waggle between 8 and 11 scale. This scaling based upon the number of significance that occurred during announcement date of the studied period.

However, testing the volatility in line with federal fund rate decision shows that the volatility recorded almost significant changing in the value of the volatility before and after interest rate decision, except four sectors are less affected by this monetary policy (See Figure 9). Furthermore, these sectors are transport, oil, chemical, and household, retail, and soft drink sector. This result is logic because of nature of these businesses comparing to other sectors like financial services. In general, US market reacts to the debt limit and federal fund rate significantly. Significant changing of the volatility behind interest policy



Figure 9: this figure shows that the volatility recorded almost significant changing in the value of the volatility before and after interest rate decision, except four sectors are less affected by this monetary policy. Furthermore, these sectors are transport, oil, chemical, and household, retail, and soft drink sector.

## IV. Results and Analysis

Obviously, it is clear that the liquidity level in the US capital market for the most companies was tending to rise starting from mid. 2007 till 2011 compare this with charts A2 of liquidity for all Dow Jones companies in the appendix A. Furthermore, the US government was attempting to take all possible economic stimulations to avoid fall in a great deep recession that happened in 1929, for instance, pumping liquidity in capital market through cutting federal fund rate, hike debt limit to meet the government's payment and obligations, and carefully lowering the tax for specific categories and paid financial aid to consumers in order to stimulus spending and to prevent jobless rate to raise further. Moreover, these arrangements indicate that the US market suffers and it is very sensible to every taken financial policy, this can be seen in the price reaction on the Wall Street. Furthermore, the significant reaction of the stock price on critical fiscal or/and monetary policies took a place in the significant changing of the volatility. See the significance of the volatility in table B IV and B V in appendix B.

Federal Reserve tries through its monetary policy to stimulate the financial market by cutting the interest rate and to treat the inflation effect by raise it. Furthermore, the charts below (Figure 10) illustrate the relationship between interest rate and liquidity. Precisely, it explains the monetary policy through the past decade showing its effect on the liquidity in Dow Jones market. Obviously, comparing to the charts the federal fund rate was moderate, it stepped down from 3.09 % to 1.03% between 2001 and mid 2004 to pump more fund in the market this can be seen clearly in the second one where the liquidity moves stable. However, end of 2004 the Federal Open Market Committee (FOMC) started to raise the interest rate to decrease the growing of inflation and keep it in fairly level in order to ease the upcoming economy slowdown (see table III).

Table III: The table shows the inflation rate between 2003 and 2008- Source: bureau of labor statistic; Consumer Price Index Detailed Report, August 2011

2003	2004	2005	2006	2007	2008
1.6	3.4	3.5	2.4	4.3	-0.5

Furthermore, interest rate was rising till it reached 5.25% in mid. 2007 where the financial turbulence has begun and consequently affected the national economy. During this period the liquidity was very high because of uncontrolled loan policy. However, the crisis started to push the trading volume downward; losing trader trust has accelerated that fall. Moreover, the sharp fall has occurred between mid. 2008 and 2010. So in line with this liquidity collapse, started the FOMC to stimulate the market through cutting the federal fund rate till it reached to a very low level. This picture is clear when we look at both charts (Figure 10) between mid. 2007 and 2009. However, in 2010 the trading volume at stock market had made a notable sprint. This indicates that the taken financial policies have helped to revival the US economy. But the question is for how long is will go further; we will discuss it through analyzing and forecasting deficit, Liquidity, gross domestic product, total government expenditure, and inflation.



**Figure 10**: upper chart stands for Federal funds effective rate history and the lower one stands for Annual Volume Average. Interest rate was rising till it reached 5.25% in mid. 2007 where the financial turbulence has begun and consequently affected the national economy. During this period the liquidity was very high because of uncontrolled loan policy. However, the crisis started to push the trading volume downward; losing trader trust has accelerated that fall. Moreover, the sharp fall has occurred between mid. 2008 and 2010. So in line with this liquidity collapse, starts the FOMC to stimulate the market through cutting the federal fund rate till it reached to very low level. This picture is clear when we look at both charts between mid. 2007 and 2009. However, in 2010 the trading volume at stock market had made a notable sprint. This indicates that the taken financial policies have helped to revival the US economy.

We will start with gross domestic product which reflects the economy's performance. I will test the efficiency of financial policy; I mean debt limit policy for helping market's revival. Currently, debt limit has a highest record ever and even GDP and government expenditure is increasing, but is this really helping market's backup. This will be discussed next.

GDP Is the total dollar value of all final goods and services produced in a country during a year.<sup>36</sup> Gross domestic product can change in two ways: when the price change up or down, and when the goods and services target a larger physical quantity. So, the change in goods and service prices affects the GDP despite the GDP doesn't change, i.e. doesn't have larger physical quantity of goods and service. Actually, GDP increases each year

 $<sup>^{36}</sup>$  Macroeconomic essentials: understanding economics in the news, Peter Kennedy, 2000,1997, P.12

for both reasons; for price surging and growing of physical quantity of goods and service. Consequently, we have to distinguish between real GDP and nominal GDP, where nominal GDP is GDP valued at the current price. But the real GDP is valued by price prevailing during base year. For instance, we take the base year 2008 and we have GDP for 2011 so, if we price the GDP of 2011 to prices of base year 2008 then we get the real GDP. Otherwise, on the prices of current year we get the nominal GDP. The equation of real GDP is as follow, <sup>37</sup>

Nominal GDP= P \* real GDP (2)

Where P is the price during base year, which is nominal GDP/real GDP However, for this analysis I use the real GDP (inflation-adjusted GDP) which is valued by price base year (2005). It seems from chart below (Figure 11) that the GDP increasing with the time.



Figure 11: This chart illustrates the increasing of GDP as time passes. It is taken from 2001 to 2011

Furthermore, the slope of GDP is high and positive (see the equation of linear regression) this could give the impression that the US GDP is good and it is increasing as time passes,

$$y = 486.18x + 9960.2 \tag{3}$$

<sup>&</sup>lt;sup>37</sup> Macroeconomic essentials: understanding economics in the news, Peter Kennedy, 2000,1997, P.17,18

Correspondingly, the Figure 12 shows the total government expenditure according to GDP, this explains that government expenditure increases by having positive slope (see the equation 4). Moreover, the increasing of expenditure means that the government meets its obligations and payment.

$$y = 0.1464x + 24.498 \tag{4}$$



Figure 12: This figure shows the total government expenditure according to GDP over 64 years started from 1948 to 2010

However, considering the growth of GDP and the growth of government expenditure in the analysis explains total different results. Moreover, Figure 13 demonstrates the growth of GDP in the past decade (2001-2011) it seems that the growth of GDP is decreasing as time passes; the slope is negative and falling downward.

$$y = -0.0041x + 0.0652 \tag{5}$$



Figure 13: the chart below demonstrates the growth of GDP in the past decade (2001-2011) it seems that the growth of GDP is decreasing as time passes; the slope is negative and falling downward.

Furthermore, the growth of government expenditure is also decreasing with the time but with less downing slope (see equation 6, figure 14)

y = -0.0052x + 0.0661 (6)



Figure 14: This chart illustrates that the growth of total government expenditure to GDP growth (1948-2010). It is also decreasing with the time.

Consequently, this indicates that the real movement of those values is downward, and the deficit related to the prior explanation has to go further. Figure 15 tells us that the budget deficit (2001 to 2016)<sup>38</sup> with negative slope illustrates that it is going to increase with hope to decrease

$$y = -59468x - 127379 \tag{7}$$



Figure 15 This chart shows the budget deficit from 2001 to 2016 with negative slope illustrates that it is going to increase with hope to decrease. This time period consists of the studied period plus estimated years up to 2016. Note that over shorter period over 3 or 2 years the deficit would be shown straight rather than downward.

 $<sup>^{\</sup>rm 38}$  This time period consists of the studied period plus estimated years up to 2016.

The debt ceiling decision according to past analysis is affected by increasing deficit and negative growing of the national GDP. Moreover, in this analysis the debt ceiling is treated from 1972 to 2011 taking the year 1972 as base year for growth calculation. Obviously, the slope in figure 16 is more than one<sup>39</sup>, Notice that the R-squared value is  $R^2 = 0.8586$  which is a good fit of the line to the data. this indicates that the debt limit is growing spiral and very rapidly, this will not gear down unless the budget doesn't have surplus. This matches that debt ceiling is growing as long as deficit grows and GDP slows down.

$$y = 1.2678x - 8.0551$$
 (8)





## A. Liquidity forecasting

To see how will go further with liquidity; I use the function of the exponential equation (see equation 9) to estimate and forecast the liquidity values for two years ahead<sup>40</sup> depending on the slope to determine the liquidity trend.

$$y = 1E + 07e^{0.0606x}$$
 (9)

<sup>&</sup>lt;sup>39</sup> In some equation the slope has a very large number comparing to 1 this refers to, Y because of its value in millions like GDP and deficit. So we can get the similar numbers if we divide by 1000000.

<sup>&</sup>lt;sup>40</sup> estimating the liquidity is for 2012 and 2011 including third and fourth quarters

Furthermore, the results show that the liquidity grow 24% in 2011 after negative growth -76% in 2010 comparing with 2009. The liquidity forecast implies annual 6% growth depending on the slope grade exponential line. The table IV contains the estimated value of liquidity from 2012 to 2016 with growth rate 6%.

year	liquidity	growth	
2009	36,244,487.05		
2010	8,536,972.26	-76%	
2011	10,624,738.40	24%	
2012	11,288,506.60	6%	
2013	11,993,742.95	6%	
2014	12,743,038.12	6%	
2015	13,539,144.64	6%	
2016	14,384,987.00	6%	

**Table IV:** this table shows that the liquidity grew 24% in 2011 after negative growth -76% in 2010 comparing with 2009. The liquidity forecast implied annual 6% growth depending on the slope grade exponential line. The estimated value of liquidity from 2012 to 2016 with growth rate 6%.

Next I define the maximum/minimum level of the liquidity that it could reach according to its annual average and standard deviation. This formula explains the upper/lower level with 95% confidence which means that these levels could be reaching with 95% probability.

Upper/lower = 
$$\bar{x} \pm 1.96^* \sigma / V$$
 (number of days) (10)

Where,

 $ar{x}$  is the mean 1.96 is multiplier of 95% confidence  $\sigma$  is Standard Deviation

For instance, the maximum level of liquidity would be reached in 2011 and 2012 is \$ 22,314,035.76 and \$ 21,635,526.85 respectively. And the min. liquidity record could be noted in 2011 and 2012 is 11,845,838.99 and 11,471,360.48 respectively (see table V). Note that the values in 2012 are lower than year 2011.

**Table V:** this table shows the maximum level of liquidity would be reached in 2011 and 2012 and the minimum level of liquidity would be reached in same time period. The values in 2012 are lower than year 2011.

year	upper level	lower level
2011	22,314,035.76	11,845,838.99
2012	21,635,526.85	11,471,360.48

# V. Conclusion

Markets with high liquidity are good and healthy markets, for this reason governments' attempt to keep their markets liquid in order to defeat any financial turbulence that could rise and to accelerate the economy growth.

However, the financial crisis has affected the US economy strongly despite the continuous stimulus arrangements and financial aids. This was pretty clear on the economy's data like GDP, budget deficit and the liquidity. Furthermore, we find that the GDP growth over a long period is stepping down as time passes despite it increasing in annual values. The deficit records have increased in the past decade and its forecast has shown that this deficit increase will go further with hope to plunge. The debt ceiling increases rapidly, this refers to the slow growth of the GDP and increasing deficit. The liquidity as a scale for market's sensitivity drove in different course levels over the past ten year between high and low reflects financial upsets and government interventions. Through analysis the estimated liquidity we see that the liquidity will grow with annual rate 6% with likelihood to fall down, this is understood from the upper and lower level of 2012 was less than these in 2011.

I suggest the possible solution for the current markets situation by easing the deficit through spreading out more government expenditure in order to stimulate the markets.



Figure 17: This chart illustrates annual receipts, outlays, and deficit in US over 80 years (from 1937 to 2011 and followed by estimation to 2016). Numbers are in millions of dollars

Figure 17 illustrates that both receipts and outlays are competing to reach untouched limit, note that the outlays overcome the receipts. We see the more spending the more budget deficit despite the national receipts are also high. However, the expenditures should go to the most profitable sectors because they could pay more taxes in line with more sales more profits, and into the sectors which contain a large number of employees which supports the investment and freezes the saving and consequently increases the growth rate of the real GDP and avoid accumulate other debt limit through public account. Finally, economy status is a matter of the expense not a matter of income because without rationalization the expense, the income is useless despite how much is it. Moreover, to prove this I recalculate the receipts and outlays since 1980 till 2011 (where the deficit has begun) by increasing both receipts and outlays with different rates 3 : 1 receipts, outlays respectively in order to rationalizing the national spending in certain sectors. Furthermore, I found that over 24 years (1987-2008) the budget has surplus then it starts to plunge into zero level.

This ratio is based on the percentage of growth and volatility for both receipts and outlays in related to 95% probability. Furthermore, this ratio depends on the assumption that the state income will increase after implementation the rationalization of government expenditures. Both receipts and outlays have the approximate average annual values of growth 13% and 14% respectively and 0.9 correlation. We need to increase the receipts

to overcome the outlays in order to defeat the budget deficit, so I double the annual growth of receipts to 25% and divide it by the old outlays growth to get 1.8. So, I multiply 1.8 with the original volatility of receipts and then multiply the output with multiplier of 95% probability (using VaR parametric method) to ensure a completely different from the old volatility value so we get 96 % as new (fictive) volatility then I divide it by the real volatility of outlays 30% to get 0.32, so it is nearly equal to 3:1 ratio. I involve the volatility because it represents the likelihood future value that could happened, and I use the multiplier of 95% probability to ensure the results by rejecting null hypothesis and differentiate from the distribution of the old receipt values. (See figure 18).



Figure 5: this chart shows the US receipts, outlays, and deficit from 1937 to 2011- to estimated 2016, and how they are changed followed by possible solution that is taken over 24 years (1987-2008). The analysis shows that the deficit is turned into surplus. Numbers are in millions of dollars.

The plunging under zero level refers to the accumulated deficit after 2002, note that in the original manner and particularly in this phase (2002-2011) the receipts declined as outlays increased manifold, this leads to clear deficit in our scenario, if the receipts were running in the same way than before (year 2000) so the deficit in our simulation scenario would be over zero level or positive.

## Appendix A

**Chart Group A1**: These charts show up the significant level for liquidity over quarterly period for market sectors. The liquidity for all sectors was affected with the crisis; this can be seen in the chart below. The most active sectors were household, retail, food and soft drinks, computer and software, financial services, chemicals and telecommunication sectors. Furthermore, oil, industry and transport were the less affected by financial policies. The line illustrates the number of significance that occurs each year.









**Chart Group A2:** These chars illustrate the daily volume for 30 firms registered in DJI. However, during the financial crisis it was clear that the liquidity of the most companies aimed no Sig. level this can be seen between mid. 2006 and late 2007. Thereafter, the market liquidity was starting to jump up showing Sig. level so it reached in 2008 and 2009 for the most sectors the highest level ever since 2000, this returned to the financial (fiscal and monetary) policies that were taken that time.























## Appendix B

**Table BI:** I spread Dow Jones firms to sectors because I am not going to study each company apart and particularly, and to show up which sector was the most affected by these policies and which one was less affected. Furthermore, these sectors are; financial sector, transport sector, software and computer sector, oil sector, industry sector, chemical sector, and telecommunication sector, and then I collect the rest in one sector (household, retail, food and soft drinks). This division is not market standard; it is structured to this research. The table B1 in the appendix B is showing it in details.

Company	Market	Sector	Industry
		<u>Industry</u>	
3M Co.	New York SE	MMM	Diversified Industrials
General Electric Co.	New York SE	GE	Diversified Industrials
Alcoa Inc.	New York SE	AA	Aluminum
		<b>Transport</b>	
United Technologies Corp.	New York SE	UTX	Aerospace
Boeing Co.	New York SE	BA	Aerospace
Caterpillar Inc.	New York SE	CAT	Commercial Vehicles & Trucks
		<u>Oil</u>	
Chevron Corp.	New York SE	CVX	Integrated Oil & Gas
Exxon Mobil Corp.	New York SE	XOM	Integrated Oil & Gas
		computer a	nd software
Hewlett-Packard Co.	New York SE	HPQ	Computer Hardware
International Business Machines Corp.	New York SE	IBM	Computer Services
Microsoft Corp.	NASDAQ NMS	MSFT	Software
Intel Corp.	NASDAQ NMS	INTC	Semiconductors
		Financial se	vices
American Express Co.	New York SE	AXP	Consumer Finance
Bank of America Corp.	New York SE	BAC	Banks
JPMorgan Chase & Co.	New York SE	JPM	Banks
Travelers Cos. Inc.	New York SE	TRV	Property & Casualty Insurance
		<u>Telecommu</u>	nication
Cisco Systems Inc.	NASDAQ NMS	CSCO	Telecommunications Equipment
Verizon Communications Inc.	New York SE	VZ	Fixed Line Telecommunications
AT&T Inc.	New York SE	т	Fixed Line Telecommunications
Walt Disney Co.	New York SE	DIS	Broadcasting & Entertainment
		Household ,	, retail, food and sorft drinks
Home Depot Inc.	New York SE	HD	Home Improvement Retailers
McDonald's Corp.	New York SE	MCD	Restaurants & Bars
Wal-Mart Stores Inc.	New York SE	WMT	Broadline Retailers
Kraft Foods Inc. Cl A	New York SE	KFT	Food Products
Procter & Gamble Co.	New York SE	PG	Nondurable Household Products
Coca-Cola Co.	New York SE	КО	Soft Drinks
		<u>Chemicals</u>	
E.I. DuPont de Nemours & Co.	New York SE	DD	Commodity Chemicals
Johnson & Johnson	New York SE	JNJ	Pharmaceuticals
Merck & Co. Inc.	New York SE	MRK	Pharmaceuticals
Pfizer Inc.	New York SE	PFE	Pharmaceuticals

## Liquidity after interest policy

Table B II

This table shows up significance level of the liquidity using *p value test* behind interest rate decision which indicate that the most affected sectors by the Federal Reserve policy (interest rate decision) are computer and soft ware sector, and household, retails, soft drink sector in the first place then comes the financial sector. Furthermore, the less affected by this policy are industry sector, oil sector, telecommunication sector.

					<u>u</u>	o value					
Date	6-Nov-02 2	5-Jun-03	0-Jun-04	13-Dec-05 2	90-un[-6;	17-Aug-07 2	22-Jan-08	28-Oct-08	24-Feb-09	13-Apr-10 2	4-May-11
sectors											
<u>Industry</u>	0.43353	0.61576	0.21517	0.66335	0.27739	0.04969	0.72350	0.19107	0.00013	0.45257	0.31271
<b>Transport</b>	0.01788	0.70807	0.48880	0.90784	0.75961	0.07173	0.81895	0.03343	0.00204	0.05111	0.59598
<u>oil</u>	0.09020	0.20958	0.03453	0.90219	0.40193	0.37535	0.29671	0.36774	0.02397	0.02506	0.42051
computer and softw	0.00005	0.41248	0.05263	0.05121	0.05656	0.52526	0.23031	0.02990	0.00130	0.00042	0.00448
Financial sevices	0.00041	0.52708	0.09561	0.43439	0.58596	0.03211	0.19470	0.76314	0.07869	0.00249	0.00083
<b>Telecommunication</b>	0.00128	0.42006	0.33958	0.00252	0.06723	0.19756	0.10753	0.24770	0.09828	0.07823	0.69478
<u>Chemical</u>	0.42690	0.56072	0.43225	0.24100	0.93384	0.37902	0.86709	0.00454	0.02168	0.01156	0.30923
<u>Household , retail , f</u>	0.01311	0.04582	0.70707	0.18116	0.05513	0.07462	0.09643	0.11976	0.94710	0.00037	0.01846

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This table shows significance level of the liquidity using P value test behind debt limit policy. The liquidity of the market sectors shows different results. Furthermore, industry sector, oil sector, telecommunication sector has shown different results, the liquidity of these sectors dominate a high significance records comparing to past record(interest rate decision) where liquidity of the first group plunge to lower level.

				-	o value						
Date	Jun. 28	Ma.27 I	Vov.19 I	Mar. 20	Sep. 29 .	lul. 30 0	Oct. 03 f	eb.17 [	Dec. 28 F	eb. 12 /	Aug. 02
sectors	2002	2003	2004	2006	2007	2008	2008	2009	2009	2010	2011
Industry	0.00059	0.12006	0.04239	0.06003	0.27030	0.00000	0.66971	0.00023	0.02582	0.00448	0.90957
<b>Transport</b>	0.00301	0.27244	0.24960	0.06006	0.00857	0.00002	0.00030	0.00628	0.10979	0.01765	0.00153
<u>oil</u>	0.00045	0.00165	0.00165	0.00082	0.33353	0.01671	0.00004	0.03000	0.93474	0.00000	0.0000
computer and softw	0.04807	0.15550	0.54706	0.05520	0.29357	0.01333	0.00104	0.01333	0.03508	0.00001	0.00868
Financial sevices	0.00000	0.53184	0.32602	0.00283	0.59939	0.00000	0.38718	0.02991	0.84410	0.03622	0.00005
<b>Telecommunication</b>	0.00083	0.35874	0.06672	0.48734	0.88665	0.00206	0.06136	0.09221	0.00764	0.00002	0.01626
<u>Chemical</u>	0.00714	0.03588	0.18603	0.00494	0.91370	0.01160	0.02311	0.67339	0.78364	0.24753	0.00574
<u>Household , retail , f</u>	0.05887	0.05142	0.17026	0.05257	0.82132	0.07828	0.01800	0.10559	0.35162	0.53240	0.00011

sectors	6-Nnv-07	75-lun-03	30-lun-04 13-Der-05	70-1110-06 17-Aug-07	22-lan-08 28-Ort-08	24-Feh-09 13-Anr-10	24-Mav-11
Industry	0.00002575123	0.00000046507	0.02977991002 0.00012420707	0.0000000045 3.67965E-14	0.0000000000 2.30929E-14	1.27658E-15 0.0000000517	9.26049E-13
Transport	0.00001501270	0.0000088254	0.0000000083 0.21941772321	0.00024766287 0.0000000000	0.0000000001 2.78057E-14	1.98727E-17 0.00000011187	1.42198E-13
<u>oi</u>	0.46616594891	0.00035197763	0.00000318818 0.0000000039	0.34073681510 0.00000310287	0.0000000002 0.00000004322	8.80239E-16 0.0000002317	5.91291E-18
computer and softw	0.00082104454	4.25381E-16	2.25217E-13 0.83678838976	0.0000000001 0.0000000036	8.65075E-14 1.32905E-14	4.12086E-14 0.0000000528	5.38342E-16
Financial sevices	0.0000000714	0.00000204762	5.09206E-18 0.00001158102	4.19704E-12 0.0000000001	3.78534E-16 1.69073E-12	4.73797E-20 1.2686E-17	2.77531E-12
Telecommunication	1.84196E-13	0.00000004700	2.15367E-20 0.04941472500	0.0000000059 0.00001461952	8.00467E-18 0.0000000002	1.58653E-13 2.87701E-12	2.56414E-12
Chemical	4.41646E-16	0.0000098247	5.06044E-13 5.48565E-13	0.41409076451 0.01168457315	2.15388E-16 1.06538E-12	1.75392E-12 0.000000018	1.32922E-14
<u>Household , retail , f</u>	0.0000000046	0.0000000393	0.0000000210 0.93115528859	0.17990433070 2.68553E-12	7.81931E-17 0.0000000001	1.51776E-19 0.0000000006	0.0000000045

**Table B IV** Using *p value test*, this table shows that the volatility recorded almost significant changing in the value of the volatility before and after interest rate decision, except four sectors are less affected by this monetary policy. Furthermore, these sectors are transport, oil, chemical, and household, retail, and soft drink sector.

## Volatility after interest policy

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In line with *p value test*, This table shows that the volatility of all sectors in the date of announcement of debt limit decision is highly significant, the high record of significance represents the importance of the debt limit announcement to the US market as whole not for particular sector

-18	Ma.27-2003 10.06642381775	Nov.19-2004 3 0.0000000117	Mar. 20- 2006 3 0.01929798962	Sep. 29- 2007 0.0000008061	Jul. 30-2008 0.05714305206	Oct. 03-2008 7.38641E-20	feb.17-2009 0.000000000129	Dec. 28-2009 F 0.000000000001	eb. 12-2010 0.0000000014497	Aug. 020-2011 0.0000000053634
0.00042747200 0.00000	000000	00000	0.00000017146	0.00336054869	0.0000002484	0.0000000000023	0.00000000000516	0.0000000000891	0.00000000150284	0.0000000002967
0.00397538064 0.0000132	t 0.0000132	14893	0.00000000000000	0.28493162483	0.04842050372	0.0000000000010	0.0000000000451	1.41652E-18	0.0000000120907	0.000000000648
0.88065439229 0.00001148	9 0.00001148	571	0.00000062276	0.30593372026	0.24180511374	2.47683E-17	0.0000000000066	0.00000000000000007	0.0000000000000000000000000000000000000	0.00001471102552
0.00000676917 0.000000118	7 0.000000118	<u>8</u> 2	9.12639E-13	0.0000000000	0.00000405869	0.0000000001980	2.20361E-19	0.0000019828116	1.0835E-15	0.00000020497046
0.00951834890 0.00000000	0.00000601	55	0.01879289540	0.22333712924	0.00084725050	0.0000000000010	2.03427E-15	1.78453E-15	2.16095E-18	0.00004712581219
0.00007676973 0.71871818	3 0.71871818	687	0.0000000001	0.12975678220	0.00000086945	0.0000000000000000000000000000000000000	0.0000000074835	0.0000000000011	0.00000001529051	0.0000000017565
0.0000000578 0.02484313	8 0.02484313	674	0.00040806417	0.87539388045	0.00000004352	0.0000000000001	9.07722E-23	2.11201E-17	5.2725E-20	0.00006847242520

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