DISSERTATION

PROGRAM: MASTERS INTERNATIONAL AND DEVELOPMENT ECONOMICS

AUGUST 2016

MINSKY AND THE SEARCH FOR DRIVERS BEHIND US TREASURY YIELDS

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ABSTRACT

In the first planning stage of dynamic systems modelling in order to ascertain the future direction of US Treasury yields, (more specifically using the program Minsky), this dissertation critically discusses the key drivers of treasury yields overlapping on interest rates in general in the US economy.

Many drivers, questions and concerns were uncovered. Particularly so were the somewhat complex mechanics of the Federal Reserve balance sheet and adaptive nature of their decisions as expressed by way of their numerous policy tools, or the power of the private sector within a model, along with a discussion of the standard reasons for interest rate fluctuations such as inflation.

Assumptions based on endogenous money and real world double identity based accounting and modern money theory principles separate this discussion from the neoclassical DSGE modelling techniques more commonly used.

ACKNOWLEDGEMENT

Coming to Kingston University as an inquisitive classical economist with unanswered questions, I have been challenged to the hilt by the Keynesian and Marxist paradigm, making me somewhat of a defector (but not absolute). I have a whole range of lecturers to thank for challenging my views and exposing the other side of the debate in addition to Kingston University for providing first rate facilities and backup staff to accommodate my learning needs.

In particular I would like to thank Professor Engelbert Stockhammer, and Dr. Ewa Karwarwowski for a fascinating and challenging course in Micro, Macro, and Policy Economics. Dr. Ali Shamsava in Development Economics. Professor Paul Auerbachuer and Professor Julian Wells for introducing me to economic history and the provocative works of Karl Marx. And thanks to Professor Steve Keen, for agreeing to be my supervisor from whom I have learnt a vast amount albeit more through his You Tube videos and books than being able to attend direct lectures due to circumstance. Such are the efficient results of technological progression arriving at the same point nonetheless.

The basis of this dissertation being the culmination of the above. My sincere thanks to all once more.

INTRODUCTION

With a view to using the program Minsky (complex systems modelling), this dissertation looks at USA Government bonds, bills and notes, starting with a clean slate. The bedrock of this work is laid down by the work of Professors Hyman Minsky, Steve Keen (in viewing money as critical and endogenous, away from the mainstream), the financial instability hypothesis as given, and Professors' Randall Wray, Bill Michelle, Wynne Godley in reviving Modern Monetary Theory (MMT) (using double entries), the sectorial approach and running almost parallel to this, the Monetary circuit Theory approach (MCT) via Augusto Graziani.

This dissertation looks at trying to eventually model the future direction of US Treasuries yields, finally using actual data, some assumptions and limited judgement. Primarily here we assess a wide variety of dependent and independent factors that may have a bearing on this future model. We are limited to discussing the attributes of these factors alone, and justification for their use toward a next step Part two, basic model ready for back testing, (and an otherwise iterative process) before going on to a refined and detailed Part three model.

These part one factors as discussed include for example:

Basic Mechanics of Treasuries and their context
Estimates of Inflation
The Operations of the Federal Reserve
- Quantitative Easing and other policy tools (For example future market operations)
- An Inflated balance sheet
- Financial repression
- Short term Fed Funds rate

International interest rates and arbitrage
Default risk, and the creditworthiness of the US government, and flight to safety
Household and Business debt as it interacts with money supply and inflation
Commodity and Stock Exchange Prices as indicators
Drivers as compared to Sovereign Bond Rating Agents
Other drivers (Variable behavioural adaptations and dynamics)

Casting a wide net this dissertation brings in many assumptions and calls for concentrated focus, empirical backing and logic in establishing key drivers of US Bond yields with its reciprocal push/pull adaptive domino of consequences for the wider economy. It also concentrates on the intuitional aspects of economics and cause and effect, not so much the graphical or mathematical at this stage.

The first part aims to bring US treasuries into context and comment on key mechanics. The next section discusses, with a coherent argument, all material drivers perceived, while keeping in mind the need to predict the uncertain future and the importance of following the money. The final part of this thesis starts to form a suggested 'parts list' for a stage two basic model.

Identifying factors that move treasuries are interdependent with the wider economy, where bond yields are loosely linked to inflation or the interest rates attained via arbitrage as preliminary examples. It is easy to fall into the bottomless pit and tangle of analysing the *entire* economy. This was avoided, with our concern with treasury yields only as much as possible, nevertheless where important deviations were needed they were taken.

The fascinating question of how interest rates are formed has been debated in economics for centuries. Usually the loanable funds theory or Fisher's equation of inflation, real and nominal rates is quoted, and demand/supply side factors listed. The situation as argued below tries to consolidate these using a complex systems approach.

The knock on importance of the treasuries risk free rate cannot be overstated since it is the basis of a vast myriad of asset and portfolio computation, valuation and basis of project appraisal around the world. Parallel mortgage rates impose real consequence for the common working man having to pay a mortgage that forms a substantial part of his servitude and therefore direct the wellbeing of his family.

Possible independent and dependent variables were identified in addition to those more commonly used in passing. The view taken by credit rating agencies was also considered briefly. It was deemed extremely important to understand the intricate mechanics of the system as much as possible, and predictably found that without the full inclusion of the Federal balance sheet in this model, any outcome or principle derived would be seriously flawed. Balance sheet status for, and the adaptive response of the household and firm sector has been highlighted, giving prominence to the use of the Minsky program itself above other such similar computer programmes. Reasons why the Federal Reserve does not have that much control over the long run section of the yield curve, (or control over long term interest rates) was also explored, giving way to an intriguing vast and complex landscape.

GENERAL MODELLING ASSUMPTIONS FROM THE OUTSET

1. Dynamic systems modelling is used as the basis of all future work for its more realistic attributes, where we assume the interconnected play of markets have the following attributes to make this approach valid:
    a. Diversity in Markets. For every bull player there that is buying there can be found a bear selling, each with her own justified opinion. There now exist thousands of different financial instruments with trading volume into the Trillions each year.
    b. Connectedness in Markets. Even the most remote places around the world are now connected into the system via the internet.
    c. Interactions in Market. As will shortly be discussed, the bond Market in itself has trillions traded each year around the world in volume.
    d. Adaptation. As a reaction to the behaviour of others, market participants react. Crowd mentality or exuberance are examples.
2. The normal risk distribution to risk and the power law might apply depending on the variables. No one is taken to the exclusion of the other or struck off.
3. Equilibrium modelling is rejected out of hand. It is beyond the scope of this paper to discuss the reasons why, however, suffice to state that it is asserted that modelling reality requires a dynamic adaptive systems approach where cycles, as with nature are more plausible an assumption.
4. Aggregation of the representative agent and reductionism is dismissed as a method to establish demand and supply curves for example. A macro aggregate approach is taken in our analysis.
5. The only system (known) that takes account of and can record the most fundamental double entries in the wider economy, (such as that of quantitative easing or the monetary system) and can plot consequence in graphical form is the program Minsky. (Developed by Pro. Steve Keen and Associates)
6. Our eventual model will have a minimum of four sectors, so as to model reality as closely as possible. These are:
    a. Household sector
    b. Government sector
    c. Banking sector
    d. Foreign sector
7. In addition to the above, we assume the reader has a basic understanding of bonds, the computation their yields along with an understanding of the yield curve.
8. Extreme acts of man and or providence are not considered such as war, famine, meteorites or alien invasions.

FURTHER ASSUMPTIONS MADE IN MONETARY ACCOUNTING

1. Money is a unit of account as per the Circuit school with our model that needs at least 3 parties. Institution 1 and 2, and a bank to process the transaction. A barter economy is rejected.
2. Taxation drives the demand for the currency, and government spending is seen as the ignition in the system that primarily pushes money into the system.
3. A sovereign Government cannot go bankrupt, although it can run into problems associated with inflation if too much deficit spending occurs, political problems or be exposed to the trials and tribulations not imagined. This is beyond our scope here. Also the US sovereign government possesses unlimited policy space.
4. The government is *not* dependent on credit markets.
5. QE in its present form does not necessarily increase money supply. As discussed below.
6. Household borrowing does not necessarily need bank reserves, and this can increase money supply. The money multiplier is rejected as explained below.
7. The deficit of one sector is always offset by the assets of another sector. Total *financial* assets therefore sum to zero, where real assets are the only item that remains. In order to record this phenomenon we use strict double entry book keeping in our analysis, using a monetary approach.

8. Our project follows financial assets only. Values for real assets are reflected accordingly. Or if a person buys a house, we are only interested in the monetary value of the house, the monetary value of the mortgage and repayments, NOT the house itself, nor do we debate the 'true' value of the house.
9. The central bank can do little to control bank lending to the household sector via fractional lending and the money multiplier and therefore their control over money supply is limited in this way. Banks lend the money first in the form of loans and find reserves later, where the central bank must always accommodate the move or risk a credit crunch. Central banks use other methods to control interest rates as discussed below.
10. Central banks must accommodate the demand for reserves as they have done after the crisis.
11. Legal constraints on the banking sector remain. For example
    a. The Federal Reserve cannot by Treasuries directly from the government but only from primary dealers
    b. The treasury has a deposit fund at the Federal Reserve and must draw on this with respect to all spending.
    c. A self-imposed debt ceiling might be set up by the government. The current 'No budget, no pay Act 2013' has abolished this ceiling temporarily. (Fig 16)

US TREASURIES IN CONTEXT

A basic understanding of Treasuries is assumed, however the following section gives some key points in understanding how treasuries fit into the larger economic scheme.

Currently in August 2016, the treasury offers Treasury Bills, Notes, Bonds, Inflation protected TIPS and floating rate notes. Most of these can be traded on the secondary market once sold. They conduct around 270 auctions per year in the issuance of new debt. As discussed throughout, Investors purchase these according to price, risk and expected return.

Since any sovereign nation create its own currency, it can ultimately, over the longer run never become insolvent, but its citizens may experience financial hardship over its evolution. At inception the nation creates currency by issuing debt. Absent another system, debt is currency and therefore treasuries can never be fully satisfied and disappear without the currency disappearing also. If money in circulation is used to purchase these new issues, there is no change in money supply over the long term. The government receive and spend the funds back into the economy. With deficit spending, however commercial banks create an asset by way of a Debit entry and fund the deposit account of the treasury with a Credit Entry so creating new money. Figure 16 shows the self -imposed debt ceiling that asserts constitutional prerogatives.

As per figure 1, and running over $18 Trillion as at 31st December 2015, total US debt is huge, with around 41% of this is owned internationally outside the USA (SIFMA – Q1 2016), however the majority of all government debt is owned by mutual and pension funds, individuals and entities within the USA. (Fig 1B)

The size of the US treasury market is shown in figure 1 and in figure 2 put alongside some key economic stocks and flows to give proportion. At present there are some $19 trillion of treasuries outstanding, (or seen as the financial asset of the holder, not to be seen as debt alone). US Bonds ($36 trillion) are the most abundant as compared to any other nation in the world (Japan is the second with $11 Trillion and the UK third with $5.8 trillion in issue.

Nominal US GDP for 2015 was also high at about $19 Trillion in the same year, giving a debt to GDP ratio of about 95%. This is a level not seen since the end of the Second World War.

The USA government issue bonds using an open auction system, and is not allowed by law to sell these securities to the Federal Reserve directly. It may for example offer a bond with a coupon of 7% over 30 years in increments of $100 for the face (or par) value and the market decides what the clearing price should be depending on the factors that we discuss below. Although it is the primary dealers who are authorised to make the initial purchase, these are usually sold directly into the secondary market where “when issued “participants have already set a price and therefore market yield.

In the example above, if this was sold for its par value and then market interest rates fell to 5%, market prices would increase by 30.9% in the open secondary market (The sensitivity is greater the longer the maturity). Since there exist numerous different types of bond each with different expiry dates and terms, there can be no *one* market price for individual bonds for this reason. The common aspect that unites all bonds of a certain maturity is however the *market* yield at any point in time. This is the aspect that we hope to understand and model, with its movement set out in figures 3 and 6. Bills are for securities that expire with a year, Notes expire between 2 and 10 years and bonds represent an expiry date of greater than 10 years. Each has its own market rate, and if plotted (maturity v’s yield)

one usually finds rates rise at a falling rate with maturity. Fig 23-28 shows how this curve changed going into the crisis of 2008 from being inverted and flat to normal.

There is generally an inverse relationship of interest rates with that of bonds. In many ways it is easier to measure the value of these instruments than other higher risk financial assets such as equities.

If we consider the Net present value approach, then the value of any financial asset is the present value of all future cash flows. The equation that follows is:
Price = Yearly coupon/$(1+r)^{\wedge n}$

Where n is the number of years the bond is bound to be paying out and r is the current market rate. Certainly, there exist derivatives of this basic equation, depending on specific terms of the bond and frequency of payment for example.

Another important observation would be that although this does represent a portion of money supply coming from debt as money, the other substantial portion is that of private sector debt, which is not by way of bonds and stands at about $17 Trillion in the USA. Non-funded liabilities and obligations are not considered.

A full in depth analysis of the national accounts is not undertaken at this initial stage. It is interesting to note however that the total value of real assets in the USA, stands at $86 Trillion once financial assets are cancelled out over all conceivable sectors, making governmental debt obligation stand at about 21% of all non-financial assets.

The balance sheet and income statement is key, along with expectation when a bank considers lending to business. If the banks are able to obtain a high interest rate from the government risk free, why lend to business at all? This becomes an adaptive turn when interest rates are high therefore, but in all other situations the banks use cost plus interest rate pricing as standard.

As a reminder for the purpose of context once more, mortgage lending banks create profits by imposing a differential between their acquisition rate of funds and that charged to the borrower. If the acquisition rate should increase as attached to treasury yields via arbitration, then the mortgage rate for all those with business and consumer loan will rise.

As per Net Present Value (NPV) analysis, as the discount rate falls, so more projects with a positive NPV are now approved and undertaken. Furthermore, the price of securities tends to rise also as per the same equation assuming dividends that stay the same or rise and discount rate that has fallen. As per figure 11, there exists a negative relationship between returns on the Stock market as given by the Dow Jones and average yields on a 10 year treasury. A correlation co-efficient of -43.68% was found to exist[1], which is not absolute, but significant enough to tally with general observation.
The important principles with regards to all treasuries with few exception are as follows:

1. Bond prices move inversely to interest rates.
2. For a given bond, the increase in price caused by a decrease in interest rates is greater in magnitude than a decrease in price caused by a corresponding increase in rates. Or the relation of price (y axis) and rates (x axis) is negatively sloped, with a gradient that diminishes.
3. The longer the maturity of the bond, the more sensitive it's price to changes in interest rates.
4. The price sensitivity of bonds increases at a decreasing rate with maturity.

[1] Computations are based on a daily movement in both variables. Computations are available on request.

5. The lower the coupon rate on a finite maturity bond, the more sensitive it is to a change in interest rates.
6. Term Structure of interest rates for bonds with different maturities dates, are usually "normal", with longer term maturities having a higher interest rate than shorter ones. Sometimes this can flatten and even invert as explained below.

FACTORS THAT MOVE THE MARKET YIELD OF TREASURIES

Not assuming the linear equations or a steady state equilibrium, but an arbitrary framework for our analysis we consider those elements that demand treasuries and those that the supply them. Traditionally this is viewed as loanable funds model, however its predictive value is negligible and drawing a polynomial to represent demand and supply, likely impossible. Nevertheless the graphical concept is still useful in segregating demand and supply side components, and understanding for example the Fed's system of market operation for short term treasuries where this is illustrated (ceteris paribus) quite well in the short term

RATING AGENTS: FACTORS USED

Various rating agents use their own modelling techniques to rate sovereign bond assets and deem a quality to them. Currently and for decades prior, US treasury bonds are rated the highest in the world standing at AAA. Standard & Poor's, Moody's, and Fitch Group are the top three rating agents, each of them using slightly different techniques to rate bonds. The trading economics rating is another more recent measure valuing the US at 97%, Switzerland, Denmark, Germany at 100%, while Greece stands at just 10%. Although a deep understanding of their system, and dreg of the factors they utilise is somewhat beyond our scope, the most common are listed below, and we endeavour to account for all these elements as we proceed.

As regards the faith attached to rating agencies, possible conflicts of interest and full independence that may or may not be internally present is not discussed. Prior to the 2008 crash and several years before this point in time, rating agents did nothing to demote their ratings in several key areas of the economy. Particular so were sub-prime loans that went from being rated triple A but fell to that of Junk status by 2010 after the crisis. Their ratings turned out in hindsight to be wrong. An investigation into this aspect is also beyond our scope here.

Moody's assessment factors

Growth Dynamics
Scale of the Economy
National Income
Institutional Framework and Effectiveness
Policy credibility and effectiveness
Debt Burden
Debt Affordability
Political Risk
Government Liquidity Risk
Banking Sector Risk
External Vulnerability Risk

Standard and Poor's assessment factors

Institutional effectiveness
Economic Structure and growth prospects
External Liquidity and international investment position
Fiscal flexibility and fiscal performance, combined with debt burden
Monetary flexibility

Should any of these variable take a turn for the worse, rating agents will begin to downgrade US treasury ratings. If this were to solidify, demand for treasuries would fall and interest rates would rise.

Overlapping on the actions of the government and Fed as discussed below, they will do their utmost in halting this, thereby giving us a hint as to their future policy choice before it actual occurs.

Default Risk

"Guaranteed by the full faith and credit of the US Government", there has not been a default on treasury obligations for over 200 years, and treasuries now enjoys the status of "risk free". The CAPM model, with its pros and cons (and others like it) elegantly show and form the basis of finance that a diversified portfolio established with this risk free asset is not just desirable but essential. The bond market being about double that of the US stock market, is highly liquid with trading volume at 5.9 Trillion USD for 2015 (Sifma[2]).

As debt to GDP of any nation should rise however, so does the risk of default. Nations with higher debt to GDP ratios are susceptible to higher debt servicing costs. Where confidence, being an operative word, is somehow lost, treasuries are dumped and interest rates increase. Governments typically introduce austerity and raise taxes (Greece during 2010), where arguably the situation stagnates or deepens and is the cause of lost votes also. The United States and many other nations such as the UK and Germany have bucked this logical relationship. Comparing Fig 5 of rising debt to GDP with Fig 6, yields, it seems that investors are ignoring default risk altogether. Further it highlights the point, that no one driver of yields has supreme power.

To add balance to this section there have been approximately 250 defaults on government debt recorded since 1800 around the world[3]. Sovereign governments have defaulted, reneged or adjust the terms of their debt with economic malfunction or political change. The notion of risk free for any sovereign nation should consistently come under examination and enquiry for oneself therefore.

Figure 18 shows a situation where default was imminent on US treasuries, an episode largely forgotten or unknown to the American people. In the 1970's, inflation began to spiral upward and confidence in the US dollar was temporarily lost, with nations and business refusing to accept this currency in payment for goods and services world over. Coming close to default and losing world reserve currency status, interest rate spiked and the IMF had no choice but to flood the market with 12.1 billion in special drawing rights (SDR's) in order to avert the above in addition to the negotiation with Saudi Arabia, establishing the Petro dollar.

[2] https://www.sifma.org/.../statistics/statisticsfiles/cm-us-bond-market-trading-volume-sif.
[3] Reinhart, Carmen M. (2011)

The flight to Safety

Treasuries are seen as a top grade risk free financial asset, in addition to being highly liquid making them very easy to buy or sell at any time. With Interest payments assured in the main, minimal risk and sometimes considerable (non-linear and disproportionate) upside in price for those making a purchase in times of high interest rates, and selling into lower rates (Losses are also possible in reverse). Consequently this financial asset is sought worldwide and especially so in times of uncertainty. As the demand for US treasuries increase during this time, so does the demand for the US dollar. Both are regarded as the flight to safety partly due to accrued faith, liquidity and world reserve currency status. Figure 13 shows this clearly after the 2008 crisis, where the government went into a considerable deficit, while the private sector sought safety by buying the same.

Figure 21 shows this relationship to a degree, however not very clearly. One would expect a positive negative relationship between perceived market fear (as measured by the VIX) and lower yields as investors are ready to accept lower yields in their flight to safety, where they believe their economic safety is at treat. As per figure 1b, also, but only marginally so, the US private sector too has sought safety (Yellow section) in treasuries.

In addition the USA is trusted with a transparent regulatory framework in the main, with a good banking system that is certainly better than many other nations.

If restriction are placed on capital flows, this can have a significant effect on interest rates also.

Other Market Yields Available

In a situation where the only debt in an economy was corporate, and as an example we assume that they offered $10 trillion in instruments, but the demand is for $5 trillion alone, rates need to rise in order to clear the market. In this sense the fixed income market is no different to any other where income and substitutional effects take hold. Figure 1 shows the total fixed income market in the USA alone, with about 50% pertaining to Treasuries.

Figure 6 shows how yields investors are ready to accept on US Treasuries have continued to fall away since the high of 15.84% (September 1981), where it has to 1.5% now in August 2016 on a 10 year treasury for example. Many have pondered as to why investors are accepting such low rates.

Taxation drives currency at it most basic and due to legislation banks are required to hold some treasuries on their balance sheet due to reserve requirements creating demand. Investors do not just hold currency but favour interest even if it is low. With arbitrage (or substitution / income effect) in all markets however, treasury investors have a wealth of alternatives to buying just US treasuries alone. These include treasuries from other countries that may be offering yields that are larger, not to mention bonds from other sectors including the corporate sector. The outstanding bond market around the world stands at $88 trillion at Q4 2015[4]. About 42% of all bonds are USA issued, of which about $19 trillion are US treasuries.

Figure 20 compares the 10 year yields of 4 major countries where the correlation is significant. Much speculation has been put forward that this has been intentionally synchronised by the central banks themselves in cartel like action.

Variations in free floating currency pairs will bring interest rate arbitration opportunities down to a slim window, but arbitrage is always very real. The carry trade in Japanese Yen for example borrowed at low interest rates from Japan invested into higher rates around the world. Arbitrage provides a reason for rates decreasing in the US along with Japan and the rest of the world. Our model should make some provision for perhaps a weighted index worldwide interest rate, which needs further analysis.

Figure 20(b) shows what should be the entwined adaptive relationship between economic growth and yields. As the risk free rate falls, so investors hope to earn more on their funds by moving their money away from treasuries into real assets, investment projects or into the ownership of companies that might grow in line with GDP also. (If expected GDP is thought to fall in the future, the reverse would take hold) One would assume that as treasuries are sold off, driving bond prices lower, yields should increase. Once again the stated relationship is not exclusive and need further investigation before the modelling process.

Another very interesting dynamic (Fig 30) is the number or triple A rated (green line) fixed income securities available around the world. This has fallen steadily since 2003, and since Finland's downgrade in 2014, this leaves only 9 countries around the world that are considered AAA rated by all three of the major rating agents. A low supply leads to a higher price and lower yields.

[4] Bank of International Settlements: http://stats.bis.org/statx/srs/table/c1

Inflation "money illusion AND the stealth destroyer of savings, capital and economic growth"[5]

As per figure 18, and perhaps the most direct and important driver of treasury yields and interest rates in general is inflation. Causing a drop in the *real* interest return for treasury owners if inflation were to take hold, this factor alone is citied at the main reason for the spike in bond yields to around 15% in the early 1980's. It is also the reason why longer term bonds attract higher yields, assuming a normal yield curve.

There is no sign of rampant inflation right now in 2016 (around 1%) with CPI running at 0.1% in 2015 and 1.6% in 2014 for the USA. Other measures differ at little such as the house price index ascent at an average of 5.16% since 1975 or gold at 10.5% for the last 14 years. Figure 18b. This is a major source of debate where a certain view needs to be established.

Bond mechanics are simple: That should inflation or expectations of future inflation rise, bond holders will demand higher interest rates (not withstanding our discussion on other factors) to compensate for negative real returns. In times of high inflation they will enter the primary auction markets where bonds are sold and simply not bid so high, so taking rates higher (ceteris paribus), through arbitrage this will domino itself into the wider economy. Since 1954 this can be seen to be the case where yields on the 10 year treasury are generally above CPI figures. Furthermore in our analysis (Fig 18) the simple correlation co-efficient stands at 67% positive which indicates a positive linear relationship between these two variables.

In our model and in establishing the causes of inflation, then a reluctant departure from Keynesian thinking becomes necessary. A realistic approach is debated here based on, as in all economics, ultimately one's own experience, learning and consequential belief.

As per the work of Milton Friedman, where all inflation is "always and everywhere a monetary phenomenon", a more rapid increase in the supply of money as compared to output is the cause. He has presented a mountain of evidence to this effect. For example the relationship between hyper-inflation and money supply in Germany, Austria and Russia after the first world war or Chili and Brazil during his lifetime.

In each case the common man within a union has always seemed to reacts to price increases in their demand for higher wages and not the other way around. Higher wages do not therefore pull the first punch. There must be another culprit, which is asserted here as the disproportional increase in the supply of money. (Figure 29)

As an example: In the experience of any hard working man in the thick of it will tell you. They went to buy a house, but interest rates were low with a lot of people now able to borrow from the bank. Due to our banking system mechanics, that simply debit their loan account as an asset and credit private bank deposits so directly increasing money supply. As these people start to outbid each other in order to purchase the house, these punters and thousands like them will start to drive up the most basic and largest expense for the common man, that of housing. The voting citizen who own houses in the main silently approve, but moan of inflation otherwise. As housing costs increase around the nation, there is upward pressure on wages, thereby causing the wage price spiral where the trade unions come into the picture. The point being that money supply is the culprit, pointing at another for the consequences of inflation. The debate over whether money supply drives prices or vice versa becomes absolute toward the former. Excessive government deficit spending then too is simply

[5] Rickards, J (2011), p7

where the lucky first in line spend their money into the economy, raising disproportionately the incomes of all, and where real output fails to rise, the result is inflation.

Where Professor Friedman and I differ (should he be alive today), would be his erroneous focus on deficit government spending *alone* as the reason for higher money supply, while ignoring the role of private debt. Following MMT, and other empirical research as outlined by Keen (2011), chapter 12, banks generally create money supply first and then look for reserves. The money multiplier and the control of money supply by the government both become a myth.

Minsky himself described the euphoric episodes as self-fulfilling, whereby profits reaped on prior projects cause businesses to borrow more on future projects, with expected prices perceived to go higher as they do (inflation). Greater gearing on their balance sheets follow (once again greater money supply).

Money supply as derived from the private sector including the household and business, general prices (inflation) and wages must therefore be factors in our model. Aggregate wages are depended on the total number of able workers and other dynamic demographics at work along with productivity in establishing GDP. The discretion of the banks is the other side of the coin. That is their perception of economic events in the sanctioning of loans. These factors too must be included in our model, which I suspect are intertwined once more in real wages, growth dynamics and capital appreciation since the borrowers real or financial asset are collateral for the bulk of private loans. Investments are assumed to be a resultant cause of the above and an exogenous factor, such as technological breakthrough.

Fisher's relationship between nominal and real interest rates and inflation[6] and others like it are dropped temporarily in the search of proof via a more detailed model. Cost push inflation is not totally ignored. Since (figure 30) a rising cost in commodities as defined by an index might also need inclusion.

The other alternative view of inflation, is term demand pull. Essentially as the economy grows, the demand for labour outstrips supply. Wages rise, causing prices to also rise. One would expect inflation to rise with economic activity, and therefore interest rates also. And indeed comparing the ISM manufactures index of activity with interest rates there is some correlation (not shown here). On the other hand, Figure 9, shows that while economic activity increased, interest rates actually fell, from 1980 to 2016. Other factors might be at work, (potential growth, capacity, and foreign trade) however these are not considered as yet.

[6] The relationship states that Nominal Interest rates are the sum of inflation and real rates.

The Private Sector (Household and Firms)

The connection to interest rates is mostly indirect through inflation. Should the private sector cause inflation through heavy borrowing (holding velocity constant), and increasing money supply, inflation will start to rise and there will be upward pressure on the yield curve. Here the Federal Reserve's only response is to increase rates on their side, or other monetary and fiscal options to curtail the same. In this sense the Fed and Treasury are powerless. Their actions depend on the moves of the population. If the population decide to destroy money by paying their debts down as discussed below, the opposite will unfold.

Although money supply has risen steadily over time, "official" inflation figures do not reflect this relationship clearly. Inflation remains low and along with it interest rates. Other factors are at play and velocity of circulation has also fallen in the same period however.

Perhaps one of the most important points and drivers is private sector borrowing; certainly of the great depression. The government can create infinite reserves, but if the private sector refuses to borrow, or the now shaken banks perceive lending risk the government is helpless as in Japan. Results sought by the government will not be achieved since the uptake in debt will be subdued.

All of the above depend it is argued on their current circumstance (wage, taxation, legislative freedom) and perceptions of the present and expectation of the future. This needs to be captured in pre-empting private sector human action.

Ultimately they are in charge of:

1. The choice to consume or not (C), one man's expenditure is another's income, the choice to produce (learn, work, endeavour and struggle) or not to do so, which is ultimately based on composition of the individual and society, beliefs, healthy eating habits, demographics and age related spending patterns etc.
2. To repay debt or to borrow, so adding or taking away from C above. Assuming that total spending is GDP plus the change in private debt (Keen, 2014) via the credit impulse as assumed (Biggs et al, 2009).
3. Investing more or less (I), so placing demands on loanable funds.
4. To want to purchase a house or forgo on it, (the source of major financial expenditure for the household in most cases).
5. To want to borrow on margin and invest or withdraw funds from the stock market or other significant financial instruments.
6. Increase the population which in time will drive C.
7. The ability or otherwise to invent and innovate, pushing the production function outward.
8. To leave the country altogether and so wipe away the above.
9. The choice to sell or buy treasuries directly.
10. The bid price when buying new treasuries in the auction process given circumstance (so setting rates). Currently around 1.588% per annum only on a 10 year US Bond is acceptable to them.

If as in Japan during the lost two decades, the private sector just did not want to borrow as per Koo, R (2013), even at 0% interest rates. Dubbed the "Balance Sheet recession", it is where expectation and future moves by the private sector are dominated by the state of their own balance sheet. Should this show negative equity as it did after the land, housing and stock market crash post 1990 (All significant assets), both households and business sector start to pay off debts with excess surplus. On

the micro level the best financial action to take, but at the macro subject to the paradox of fallacy of composition. As aggregate demand contracts, even with massive reserves and low interest rates (the money multiplier is falsified), all due to the reduced demand for loanable funds and the flight to safety. Money supply cease to increase and the government is forced to enter. Ko therefore suggests the following as key drivers of cause and effect:

A. Demand for loanable funds post crisis. (Please see Figure 5 where this has rebounded slightly)
B. Sentiments otherwise. Ko mentions that post 1929 depression, the majority of the older generation were so mentally scared, that they never borrowed again during their lifetime. Recovery came by way of government borrowing instead.
C. The *asset and liability sides* of the balance sheets for banks in lending by discretion, the balance sheet of Households and firms in assessing negative equity and the demand to borrow more or to pay down debts.
D. Interesting investment opportunities ahead to create the demand for funds once more.

Capturing the subjective above in a model is problematic and inexact. Consumer confidence index or the misery index falls short and is outdated. All the above is dependent on current financial situation and expectations of the future, and balance sheet analysis is the basis of their choice.

Deficit Spending

The propagated analogy of a household having to spend within its means is totally rejected in the case of a sovereign government and model formulation. The accounts of a sovereign nation that can simply create its own new currency means that it is quite separate from the household model.

As per Figure 12, (government budget outlays) another problem not widely mentioned in the mainstream media is that of rising long term deficit spending and its consequence. For one it will increase the money supply and put pressure on inflation and therefore interest rates in the future. And perhaps more ominously, it will also increase the supply of bonds into the market place, pushing prices down and thereby yields up. This is perhaps the main reason for balanced austerity post the 2008 crisis, where outlays have gone sideways more recently (Fig 12 & 13). (Should the government attempt at par spending, raising funds by the issue of treasuries for fiscal spending, this would increase via the spending and decrease money supply via the sale of Bonds by the same amount: No money supply effects). Government spending is therefore a major model variable, with the associated effects of crowding out the private sector and possible misallocations of capital.

Although the Federal Reserve would admirably aim to do its utmost in stabilising price and interest rates, it is building defences up against a "sea" of potential trouble by way of the market. The perception of the public that the market can be tamed by one organisation is ill conceived and unfounded, as can be seen by many cases in economic history where crashes and misfortune have repeated. As per the recent interview with Pullard, J (2016) (Fed CEO St Louis), he accepts that the Fed can only apply short term remedies, where ultimate growth is driven by population and productivity trends. At present they accept a short term time horizon and reactive policy tools, albeit considerable "ammunition". He also suggests that normalisation of the balance sheet needs to be re-thought. Accounting for the Federal Reserve's Balance sheet becomes another key variable, with an adaptive view on the future direction of interest rates.

Often overlooked, but by using Wynne Godley's sectoral approach, where the financial liability of one sector must be the financial asset of another by accounting identity, (also possible as per the Minsky program), we note that post crisis the domestic private sector moved sharply into a large surplus in flight to safety, the capital and current account deficit fell along with foreign demand and government budget deficits grew due to a decline in sales, employment and taxes (Figure 13).

Figure 18 also shows how lag in deficit spending can see inflation take hold some years later. In this example inflation was seen 7 years after the spending had occurred, and the same time period for common people to understand and reset levels post crisis. The rise in deficit spending post 2008 (Fig 14) might still play out into the economy in terms of inflation, however this and the effects of expected inflation require further analysis.

OPERATIONS OF THE FEDERAL RESERVE

By lowering the fed funds rate and pushing down the yield curve otherwise, the Federal Reserve's direct policy is to encourage market participants to invest into more riskier assets and business ventures in the wider economy and so drive up GDP and ultimately per capita income and prosperity, (without too much associated inflation). As per figure 9, 10 and 18 there formal aim as stated below seems to be intact.

"The Federal Reserve sets the nation's monetary policy to promote the objectives of maximum employment, stable prices (Low inflation), and moderate long-term interest rates. The challenge for policy makers is that tensions among the goals can arise in the short run…."[7]

And from the US Department of the Treasury their mandate is to "…manage the countries debt. The primary objective …is to finance the government's borrowing needs at the lowest cost over time"[8]

As discussed below the Federal Reserve working in unison with the government (MMT – they must do so), have the power to change overriding laws, and taxes and have ultimate policy freedom not to be underestimated. Both seem to be "doing a dance with the devil being stuck between a rock and a hard place", complexity abound. Estimated to now hold about 30% of MBS debt and 25% of all Treasuries, it has the ability to make yields move drastically, depending on policy. Figure 1 (b) show that the Federal Reserve hold a disproportionate amount of all treasuries in issue. An unusual and unexpected sight.

Short term Open Market Operations

The target discount rate is one of the main demand and supply factors controlling yields in the market. The Federal Reserve in concert with the Treasury, will buy Treasuries when they want to pump currency into the system, thereby increasing money supply and reducing rates. And vice versa, selling treasuries when they would want to drain funds, so reducing money supply and increase rates.

As can be seen by the overnight (non-collateralised) interbank lending on reserves via the fed funds rate in Figure 6. The entire mechanics of interest rate control is via the continual transacting in short term repurchase agreements, to bring rates toward the target as set by the central bank. Treasuries (long and short term) are therefore not a medium to raise funds for the government, as is the conventional view, but a monetary tool that controls interest rates over different time horizons.

Since short term treasury yields have been pushed to near zero, so yield curve and it's inversion as a forewarning to crisis has now become impossible (fig 23-28).

After the crisis of 2008, where significant losses arose. Banks and their liquidity needed to be saved and this was cleverly done by inflating their reserve accounts held at the Federal Reserve and in exchange for Financial Assets, was a simple key stroke transaction of (at its most basic):

DR_Long Term Bonds (Now held as an asset within the central Bank. These were bought from the Banks under distress, others failed such as Lehman Brothers)
CR_Reserves Account of troubled private banks held at the Federal Reserve.

[7] Federal Reserve: Purpose and Functions (2005)
[8] Dreissen, (August 2016)

Ultimately banks are using "fat spreads" and profits over time in order to repair and recover. (Figure 19)

The Federal open market committee (FOMC) in particular have approved several unconventional programmes over the years, (as outlined below) to increase their assets and liabilities on their own balance sheet in the years that followed:

1. March 2009 (QE 1)
    a. $1.25 Trillion in Mortgage Backed Securities (MBS)
    b. $200 Billion in Agency debt (E.g.: Fannie Mae and Freddie Mac Mortgage Loans)
    c. $300 Billion in government treasuries.
2. November 2010 to June 2011 (QE 2)
    a. The purchase of $600 Billion in long term securities of Treasury Bonds at the pace of $75 Billion per month.
3. September 2011 to June 2012, Operation Twist was a scheme to buy longer term treasuries in exchange for shorter term bills and notes held by the Federal Reserve.
4. September 2012 open ended (QE 3). The purchase of $40 Billion in agency and MBS per month and an additional $45 billion in longer term treasuries once more.
5. Addition "forward guidance" that transparently pre warns and publishes data, minutes and decisions taken by the FOMC were also stepped up in order to quell the markets.

The purchase of MBS and Agency debt was to inject liquidity and remove toxic debts, where in effect the federal government now has claim to $1.7[9] Trillion worth of Housing stock. The purchase of treasuries was to put downward pressure on long term interest rates. And during QE 2, it was to avoid deflation coming into the market place, while the reasons for QE 3 were to elevate the jobs market.

As per figure 8, and reminiscent (but this time legally) of the Hunt brothers attempt at cornering the silver market in the 1980's[10], the balance sheet of the Federal Reserve has increased by more than $3 Trillion and has met with a lot of criticism especially by the strict classical economists who believe in small government and enough to make the uninitiated "run for the hills"[11]. More accurately and as per Ricketts et al (2014), figure 15, this level of asset over GDP has not been seen since the Second World War. Notice the slow unwinding over the next 30 years since 1945. Is this the direction once more?

The implication of QE has not fully unfolded. Certainly there now sits a massive unprecedented accumulation of Treasuries on the books of the Federal Reserve and a mirror of private bank reserves as a liability. (Figure 7 and 8).

[9] As at September 2016, Condition Statement of Federal Reserve Banks (https://www.federalreserve.gov/releases/h41/current/)

[10] The Hunt Brothers buying heavily on margin with excessive reserves, helped pushed the silver market from $6.08 in January 1979 to $49.45 within one year, in an attempt to corner the market. But on the 7th January 1980, "Silver Rule 7" was introduced that severely restricted on margin purchases. The following fall in Silver, waves of disruption across many other markets and after extensive litigation on losses that followed, nearly bankrupted the Brothers where their estimated wealth fell by some $4 Billion.

[11] Graphs as per Gresham Law (2012)

Financial Repression, the implications of deflation and negative short term interest rates

As Debt to GDP goes up (figure 14 & 17), so interest on government debt is driven higher, along with a rise in default risk on US Treasuries, especially as the debt to GDP goes to unsustainable levels, where cash flow cannot meet interest payments. If the government is then in a position where further deficit spending must be carried out, there is great temptation if not necessity to bring the interest rate payments down, that the government must now pay, but also a dire need to bring debt under control. This is measured by debt to GDP. If one ponders why we need to have a "target rate of inflation at 2%"[12] at all and low long term interest rates (the Feds mandate), the cynic in the other would blame financial repression. Surely in the interest of the common man no inflation or even deflation would be more welcome, but for the government this is intolerable since taxes are automatically cut and real debt values rise (for the private sector too), with bankruptcies and therefore banking turmoil also. A "goldilocks" level is sought with no deflation, otherwise the real value of debts would not erode, but the need for some inflation, but not runaway inflation or chaos would ensue. This too needs to somehow be reflected in our model.

Although open to crisis, first termed by Stanford economists Shaw and McKinnon (1973), financial repression is a term coined to describe moves by the government to bring down the debt to GDP ratio with the use of legislation and reserve requirements or to make sure that the rate of inflation is larger than the current interest rate, as it is today. The effect is stealth redistribution (or tax) of wealth from savers toward the government ultimately by taxes via firms. Only one in a thousand however understand this tax with a smaller number aware of its mechanics. Suffice to state that saver and pensioners redistribute their savings income toward the government in the differential of negative real interest rates. While at the same time the common man must pay more since inflation has risen. General prices rise and the demand for incomes. Both of which now carry a higher tax charge.

Figure 18 and 19 show government debt to GDP peaking at around 100% just after World War II. Post 1945 an environment where interest rates were kept lower than inflation rates (Not shown here), however this same scheme is being rolled out today, where we see very low and talk of negative interest rates on our savings while the Federal Reserve is " on target" with respect to its inflation target. Certainly to reach the impossible uncompromising balance to please all, we will nevertheless witness debt to GDP ratios fall over the next few decades if the Federal Reserve have their way.

One must conclude therefore, that in this perplexing situation there is temptation to "fudge" inflationary statistics, and play down inflationary pressures. As evidence, figure 18 (a) shows CPI inflation (around 2% post 1990) mostly below 10 year yield rates. In contradiction however, average house price inflation which accounts for bulk of cost for the common man ran at around 5% and inflation on the finite resource of gold was at 10.5% per annum for 14 years!

The implication for modelling of these variable is profound, since to understand and add in these pre conditions or bounds, will lead to a completely different outcome.

Various commentaries exist on the possibility of adding negative interest rates to the policy toolkit. The most recent from the Fed downplay the eventuality[13]. Since many European countries are already in the same process, our model should be robust enough to handle this. The start of banks runs or

[12] What are the Federal Reserve's objectives in conducting monetary policy? Available at: https://www.federalreserve.gov/faqs/money_12848.htm.
In summary: "Stable prices (to maintain inflation at 2%), Maximum employment (around 4.8% natural rate unemployment) and moderate long term interest rates" (Federal Reserve Act)
[13] Bullard, J, August 2016

investment into precious metal should investors be charged to hold funds is possible. Certainly to accelerate the process of financial repression, this would be a good choice since it would stretch the inflation and interest rate differential.

The implications of an inflated balance sheet

Post the great moderation where inflation and unemployment were seen to be under control with a number of smaller cycles that seemed to come to an equilibrium, only to see total market meltdown a short time later in 2008, with much in the way of job losses, business and household foreclosures. It is asserted there exists a number of very dangerous situations that might cause another collapse as per the work of Hyman Minsky, that are more complex to perceive.

Before exploring these issues, one cannot be *all* critical of the Federal Reserve. It has done much, in a brilliant move to buy long term treasuries that give it time. Operation twist was such a move that essentially swapped short term debt for longer term bonds. Indeed "the can has been kicked down the road"…… for now.

"Stability is itself destabilising" is his most famous sentence after the condensation of his work. And there exist several potential "butterflies" that might cause another tornado of chaos for the masses through perhaps the rapid fluctuation of rates. These are discussed below.

Post 2008, the balance sheet of the Federal Reserve has ballooned to around $4 Trillion, (Fig 7 & 8). The essential simplified double entry was to DR Assets in the form of Treasuries and CR private Commercial Bank reserves. Now the central bank has this vast pool of assets and liabilities on its books.

If the above were to reverse abruptly, private banking reserves would be slashed out of hand, so drying liquidity repeating the situation in 2008, pushing interest rates higher overnight and the influx of supply of treasuries into the open market would drive prices down and yields up here also. A situation the hardworking, overburdened common man might not bear. Should interest rates rise sharply across banks, mortgage payments would rise abruptly, residual incomes would fall and a domino of misfortune would ensue. If there is a 1% increase in rates this costs the Federal Government another trillion dollars in interest over a decade on its politically sensitive debt level. The argument that the Fed should sell off its assets and get out of the mess does not consider the consequence.

It is well understood that it is for this reason the Federal Reserve cannot let this now captured monster into the free market. On the other hand as the Bonds mature and terminate, the double entry above will reverse naturally, where there is no control. This will destroy the asset, and the reserve liability at the same time. As per fig 15, this slow natural reversal is exactly what happened after WWII and it is hypothesised that the same attempt is being made now where operation twist is presented as evidence. Should there be further economic turbulence there might be pressure to buy more bonds in the future and to increase the reserves of banks once more. The case for further QE is therefore strong and not ruled as per the Fed's own admission (Yellen, August 2016).

With massive free reserves on the books of many commercial banks, they are now, with new liquidity free to lend into the private sector. So far private debt to GDP has not risen by much (fig 5), with debatable reasons. Increasing the money supply and profiting from the interest rate differential is the mass of business for all banks. If the private sector should start to borrow and invest as intended, they will further increase the money supply. Some estimate that commercial banks have the potential

power to increase the money supply and lending by $26 trillion[14] and lead into the loop of inflation and nature pressure to increase interest rates. So far this is absent, perhaps in part due to economic fear in the public who have deleveraged since 2008, but also partly because the Fed, who know full well about this mechanism have dissuaded this flood by offering interest on reserves held at the Federal Reserve with new legislation passed in 2006 by congress. Perhaps another more straightforward reason might be the reversal of the original entries on the balance sheet once the treasury debt expires (Credit Treasury assets and Debit Commercial Bank Reserves). Indeed 48.5% of this debt is due to reverse within the next five years.[15] Alternatively time might be passing in order to let balance sheets repair themselves through organic profits. (Fig 19)

Speculating into factors outside our general model, should (another Black swan event) or cyclical downturn occur that the Federal Reserve is unable to handle, they may need to be bailed out by the International Monetary Fund with international currency in the form of Special drawing rights, so containing the threat once more. This would be mechanism to draw further toxic funds away from the balance sheet of central banks in exchange for reserves on their own balance sheet. By now one cannot help but think about déjà vu of great Ponzi financier, Charles. The implication for US treasuries by now become hard to conceive and measure, and the question of including the balance sheet of the international monetary fund in our analysis becomes necessary.

Others have speculated the Feds bankruptcy, based on the hollow value of MBS held and in times of increasing interest rates where their assets will begin to devalue at a disproportionate rate (while holding longer term 30 year debts). Should they not be able to pay their debts as they become due where payment on reserves will be greater than income from assets they will be technically insolvent and may need to borrow directly from the Treasury or the IMF. Creating more funds is possible but with consequence such as increasing high powered or base money. If events like these came simultaneously, where perhaps new money needed to be directed to the Fed, congressional action would be needed, compromising independence, possible loss of high treasury rating, or the forced sale of the Feds gold reserves or an erosion of confidence in the dollar itself.

[14] Norbert et al (2014)
[15] Federal Reserve Bank Quarterly Financial Report, August 2016, Table 5.

OTHER FACTORS TO CONSIDER

According to the very practical, Rickards (2011), we are heading for a 25 year great depression. Risk needs to be measured by the gross value of derivatives that stand at $650 trillion, which is nine times global GDP, and is external to our model. He stresses the point that should a system double in value, the risk that it holds will increase exponentially by 10 for example. He states that banking and government models used are extremely outdated and inaccurate, leading to bad policy decisions and confusion. Velocity of money (fig 22) is extremely low similar to the great depression and unfunded government liabilities stand at $127 Trillion. If the balance sheet of the Federal Reserve were translated into market values, they would already be technically insolvent already and the monetary dollar being backed by nothing whatsoever. He predicts the involvement of the International Monetary Fund in the near future to bail out the Federal Reserve Bank using SDR.

The dumping of US Treasuries by China and Russia in exchange for Gold will make interest rates surge. A massive surge in buying via Belgium by an unidentified player. Due to the size of the purchases, that are larger than Belgians total GDP, Rickards believes it is the Fed or Treasury acting indirectly to avert panic and so holding up the price.

Other catalyst toward the loss of world reserve currency status might come way of the collapse of Chinese Economy, or the Petro-dollar dismissal.

Analysis is needed to vindicate and support or oppose this view.

Interest rate futures and swaps might also be considered as signals, but beyond our scope here.

RESULTS

The final aim of this project is to collate components, emulate, back test and simulate the real world. Manoeuvres made by the government and or the other sectors should be flexible. All of the different situations and circumstances as discussed above must be somehow incorporated into the model before embarking on a gradual iterative improvement process.

Keen, S (2011)[16], provides the starting point example for a cyclical economy using an adaptive response based model, with cause and effect response, via the generated "Goodwin" model. The flow of logic is as follows:

Capital determines output
Output determines employment
Employment rate determines rate of change of wages
Wages determine profits
Profit determine investments
Investment is the rate of change of capital

Further this model clearly highlighting mathematical identities, which should be viewed as constraints in our future model:

"Employment will rise if economic growth exceeds the sum of populations and labour productivity growth"

"Wages share of output will rise if wage rise exceeds growth in labour productivity"

Since our direct aim is to deduce current and future interest rates directly, the use of actual values for wages and GDP are suggested to begin with, although full reconciliation with the above remains pressing.

Our starting point below temporarily diverges therefore in three ways. Firstly is the use of some actual values in the analysis to simplify. And the theoretical use of the quantity of money equation (M.V = T.P) as one of the main pillars of interest rate analysis and especially so in establishing inflation. Thirdly the even greater focus on balance sheet values for all sectors in their consequential adaptive choice of move and domino effect into the model.

The following "components list" is divided into the following:

1. Preliminary sector division needed
2. Pro-forma balance sheet (via Godley Table) to use for each sector. With variation for each sector to record all necessary transactions.
3. A list of working transactions that need to flow through the model.
4. "Meters and Gauges" needed that record model and actual real word values by way of graphical representation.
5. Suggested preliminary process to calculate key model variables.
6. Real world observations we must reflect.

[16] A monetary Minsky model of the Great Moderation and the Great Recession (2011)

PART 1 - SECTOR DIVISION

Foreign
Firms
Household
Government
US Commercial banks
Federal Reserve
International Monetary Fund

PART 2 - PROFORMA BALANCE SHEET VIA THE GODLEY TABLE

Each of the sectors will comprise a balance sheet using the pro forma below. The commercial bank example is used below for its central role, however each sector will need additional or reduced lines comprising for example: Wages, Consumption, Taxation, Special drawing rights, Paper Gold reserves and so on. Please also consult the list of standard transactions below for further information.

Commercial Bank Pro forma example:

- Assets
  - Deposits Held at Federal Reserve
  - Treasure Securities
  - MBS Debt
  - Other Assets
  - Householder Loans
  - Business Sector Loans
  - Government Sector Loans
  - Foreign Sector Loans
- Liabilities
  - Householder Deposits
  - Business Sector Deposits
  - Government Sector Deposits
  - Foreign Sector Deposits
- Equity
  - Current Income Statement
  - Net Worth

PART 3 – LIST OF NECESSASRY TRANSACTIONS

The list below is not exhaustive. As the iterative process goes on, each component can be analysed separately and replaced with a micro model where necessary. Where in doubt and to start with, actual static values are used based on US Treasury Accounting Information and other sources.

Since transactions occur between two sectors, they may not be stated twice below.

Federal Reserve Transactions
- SDR Transactions with the International Monetary Fund
- Paper Gold Transactions
- QE Accounting
- Commercial bank accounting
- Interest payments received on treasuries

Treasury Account Transactions
- Issue of New Treasuries, and Interest Payments
- Firm Sector
- Consumer sector
- Government Sector
- Foreign Sector

- Government spending into the (domestic) firm sector
- Taxation received

Consumer Sector Accounts
- Consumption Firm Sector Spending
- Foreign Sector Spending (Imports)
- Taxation

Commercial Banking Sector
- Loans created and Loans repaid
  - Firm Sector
  - Consumer sector
  - Government Sector
  - Foreign Sector

- Interest on Loans
  - Firm Sector
  - Consumer sector
  - Government Sector
  - Foreign Sector

- Direct Spending into the economy
  - Firm Sector

Firm (Domestic) Sector Accounts

Wages to Consumer Sector (Domestic)
Business Investment Spending
Consumer Sector
Foreign Sector
Exports into the Foreign Sector
Taxation on corporate profits

Foreign Sector Accounts (Simplifying assumptions needed)

Consumer Sector Exports
Firm Sector Exports

Part 4 – METERS AND GAUGES

Computed Meter Readings

Balance Sheet Asset, Liability and Net worth values for all sectors

10 Year Treasury Price Index and derived yield (Interest Rate)

Interest Rates
Household Debt Levels and Debt to GDP ratios
Firms Debt Levels and Debt to GDP ratios
Government Debt Levels and Debt to GDP ratios

Velocity of circulation
Money Supply
Number of Transactions
Average Notional Market Price and current inflation rate

Employment Rate

Actual Meter Readings from the real Economy

C BOT Treasury Price Index on 10 Year Notes
Inflation Rate
S&P 500 Index
Treasury Yield Curve
Money Supply measures (M1-4)
Sector holding of US Treasuries
World Interest Rate Index
Banking Sector Market Capitalisation
GDP and the Credit Impulse
Productive Income Distribution

PART 5 – KEY COMPONNENT PARTS:

Inflation computation:

Using the Quantity Theory of money

$$M.V = T.P$$

M = Money Supply
V = Velocity of circulation
P = Average notional Price Levels
T = The notional number of transactions

Work out Velocity by solving for Actual GDP + Credit Impulse = M.V
Using actual values for GDP and the credit impulse.

Calibrating Initial Price using historic actual values

From a tranquil point in time in economic history, find the average of:
Consumer price Index
Commodity Index Price
Gold Price
Shiller House Price Index

Derive arbitrary initial value for T, however let this move with population, demographics and employment oscillations in the future. It should not remain fixed.

Then P is derived through the model, and differentiate P in order to find current actual inflation.

An arbitrage Interest Rate Index

Using actual values bond yields from different countries in the same risk class and attaching a weighted value to the portfolio. Considering the use of corporate bonds and other permutations also.

Initial Interest rate computation

Instead of predicting yields for each duration of maturity, an indexed price and yield is taken initially to represent the entire range.

Using the factors listed below we may derive an expected interest rate.

Inflation as derived in our model.
Fisher's equation of interest rates at point t and t+1 with inflation rates[17]
Possible real interest rates at point t.
Index of alternative interest rates as above
Consider theories of term structure (Expectation, liquidity and market segmentation theory)

[17] Fisher's most commonly used equation: $1 + \text{Interest Rates}_{t+1} = (1 + \text{Interest rates}_{t}) \times (1 + \text{inflation rate})$

An incorporation (perhaps weighed, via the model or otherwise) of the factors set out in section 5 below:

PART 5 - TO INCORPORATE IN OUR MODEL

Commercial Banking Balance Sheet

A measure for the need to lend
In case of negative equity and loan write offs, the need to repair a damaged balance sheet using "FAT" spreads and time.
Ponzi financiers in euphoric economic states
Restrictive vs unrestrained lending practice.

The consumers Balance Sheet

A measure for the need to borrow
As soon as the consumer enters into negative equity, borrowing ceases. A greater proportion of all income pays down debt.
The greater the near term economic tragedy, the greater the memory and smaller (or negative) the rate of borrowing in the future.
Flight into Treasuries in times of panic.
Balance Sheet ability to buy treasuries.
External market Interest rate available.

Firms (A repeat of the household sector, but also below)

A measure of opportunity in the economy itself needs to be established away from the objective rate of interest. A measure of "animal spirits" of sorts.

Federal Reserve balance Sheet

The buying and selling of treasuries in order to maintain target interest rates.
Using other balance sheet techniques in order to achieve the above.
Reactionary funds flow rate increases and decreases as a result of inflation.
Use of other policy tools
Impact of freezing treasuries on the its balance sheet
Reversing of treasuries at maturity.

Treasury Accounts

The availability of treasuries issued by the government
Balance sheet and Financial position situation, possibly leading to:
Financial repression when Debt to GDP and servicing costs hike.
Expected fiscal spending where private Sector spending goes down

Foreign Accounts

The value of treasuries held
Potential to disrupt the financial market by either buying or selling treasuries in bulk.
Foreign sector demand given world perception of circumstance around the world. `

CONCLUSION

In our search for components, deeper research into the national accounts or rating agency methodology could have taken place, but with diminishing marginal returns at this stage. Already the model, assumptions needed, and basic computational has proven to be very challenging indeed. More relevant, accurate knowledge from a variety of disciplines including economics, banking, accounting, mathematics and financial modelling are called upon in tackling the entire problem comprehensively. Nevertheless this thesis is a first step overview highlighting key areas.

Although when an individual switches on the television and is told and sold that the central bank is changing interest rates, we tend to believe, perhaps out of apathy, that this institution is totally autonomous and has absolute power to control rates. On closer examination this certainly does not play out. Albeit governments may indeed control short term rates (as they offer them) and have made radical and exceptional moves to lower the longer end of yield curve, nevertheless the real drivers reside more so with the other sectors in the economy. The unprecedented purchase of treasury by the fed has injected liquidity, held bond prices high, and interest rates low, but what will be the outcome when these securities mature and a reverse entry is needed? Deficit spending too can be viewed as a forced move in response to a shaky *private sector*. With more treasuries in issue, there is downward pressure on prices and interest rates tend to rise. Financial repression is a clear and real phenomenon forcing an overburdened treasury to reduce debt and interest costs. Even with the policy levers and buttons, no doubt the Fed and Treasury are in a precarious tilt. Presumably on the advice of the commercial banks they are using “Fat spreads” and time in trying to rectify the situation and at present August 2016, the situation seems stable. Without further modelling and assumption I cannot comment if this will be seen in hindsight as the great moderation II.

Inflation (one of the major drivers as discussed), if we assume is based on the money supply, (ceteris paribus) then this is substantially a by-product of private sector borrowing in addition to deficit spending. A decision by the household to borrow and the discretion of the bank to lend become key hidden variables along with expectation, euphoric or otherwise. This in turn depends on the skill, ingenuity, hard work and innovation and determination for a better life by and of the people, where certainly they may see real uplift with or without inflation.

Although verification is sought, it is hypothesised that the money supply increase by way of private sector borrowing which stands at around 300% of GDP is one of the main reasons for low interest rates over the same period (Figure 29), due simply to the high supply of loanable funds in the market place. The implications of a deleveraging population, destroying money cannot be underestimated therefore, as seen in Japan post 1990.

Related to this and as logic might assert, all must be in the confines and limits set by monetary circumstance by way of the balance sheet in place per sector.

In lining up components for our model, we have discussed numerous factors for which the interplay is complex and where mathematical relation needs more thought. One of the most important are the transactions that take place on the central bank balance sheet and the need to form a logical view of the standard response of the Federal Reserve so that they may stay within their mandate. Or the

now well understood technique of financial repression. Other policy tools that add more 'buttons and levers' need to be set into any model also.

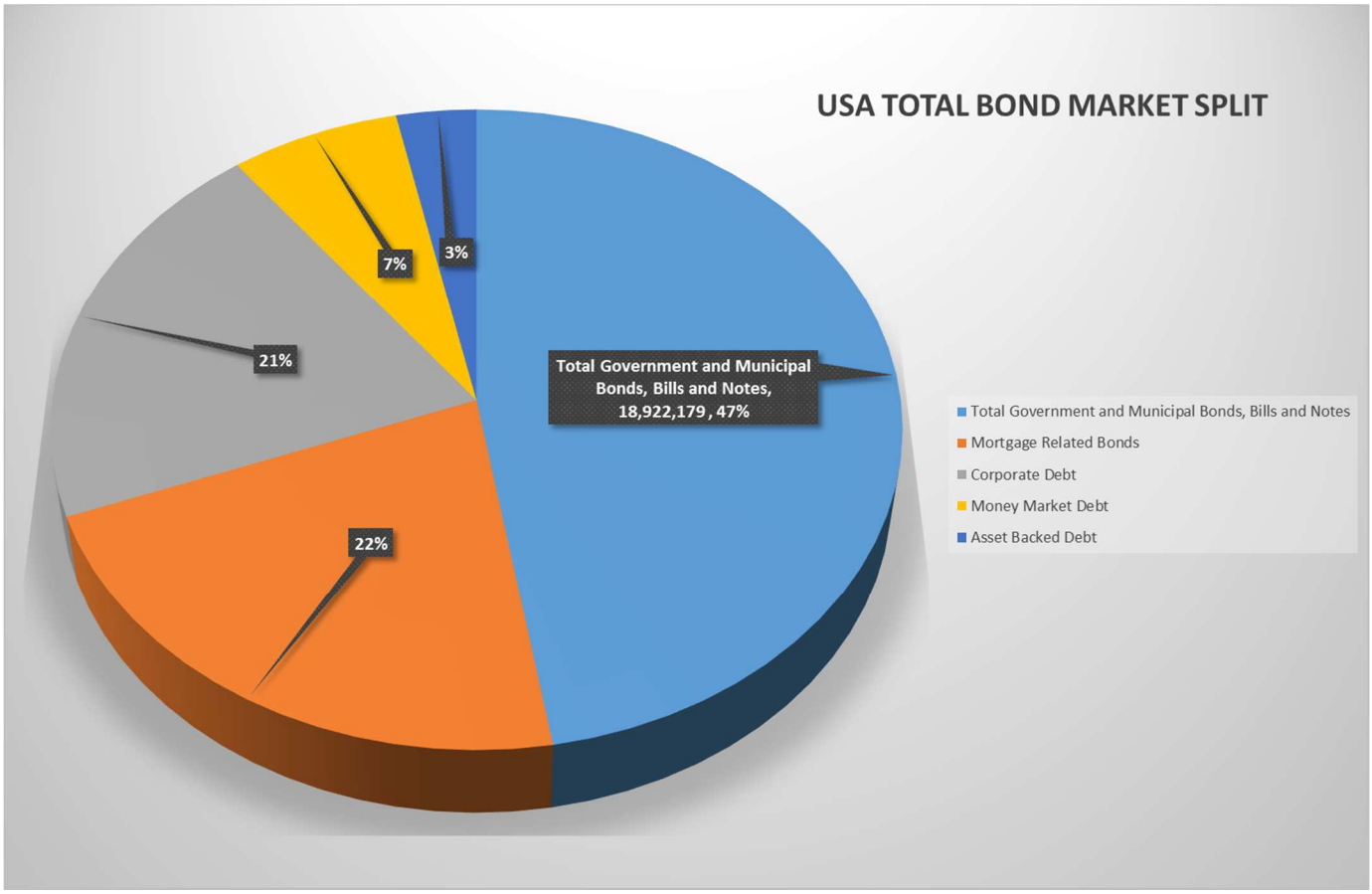
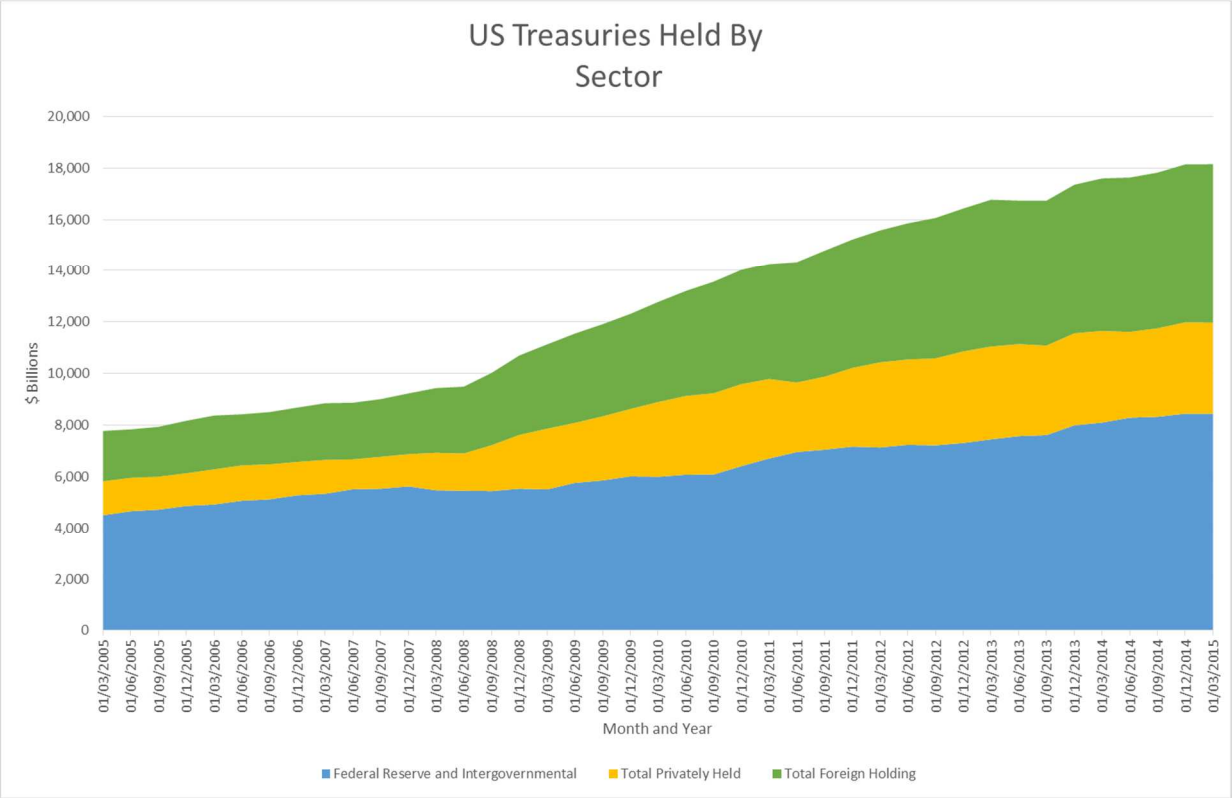


Figure 1: $(Millions): USA Total Federal government and Municipal Debt as a Percentage of all US Bonds. Monthly Statement of Public Debt of the United States, 31st December 2015. (Treasury Direct). And Figure 1 (B) Below. US

Treasuries held by sector. Source: Office of Debt Management, Office of the Under Secretary for Domestic Finance



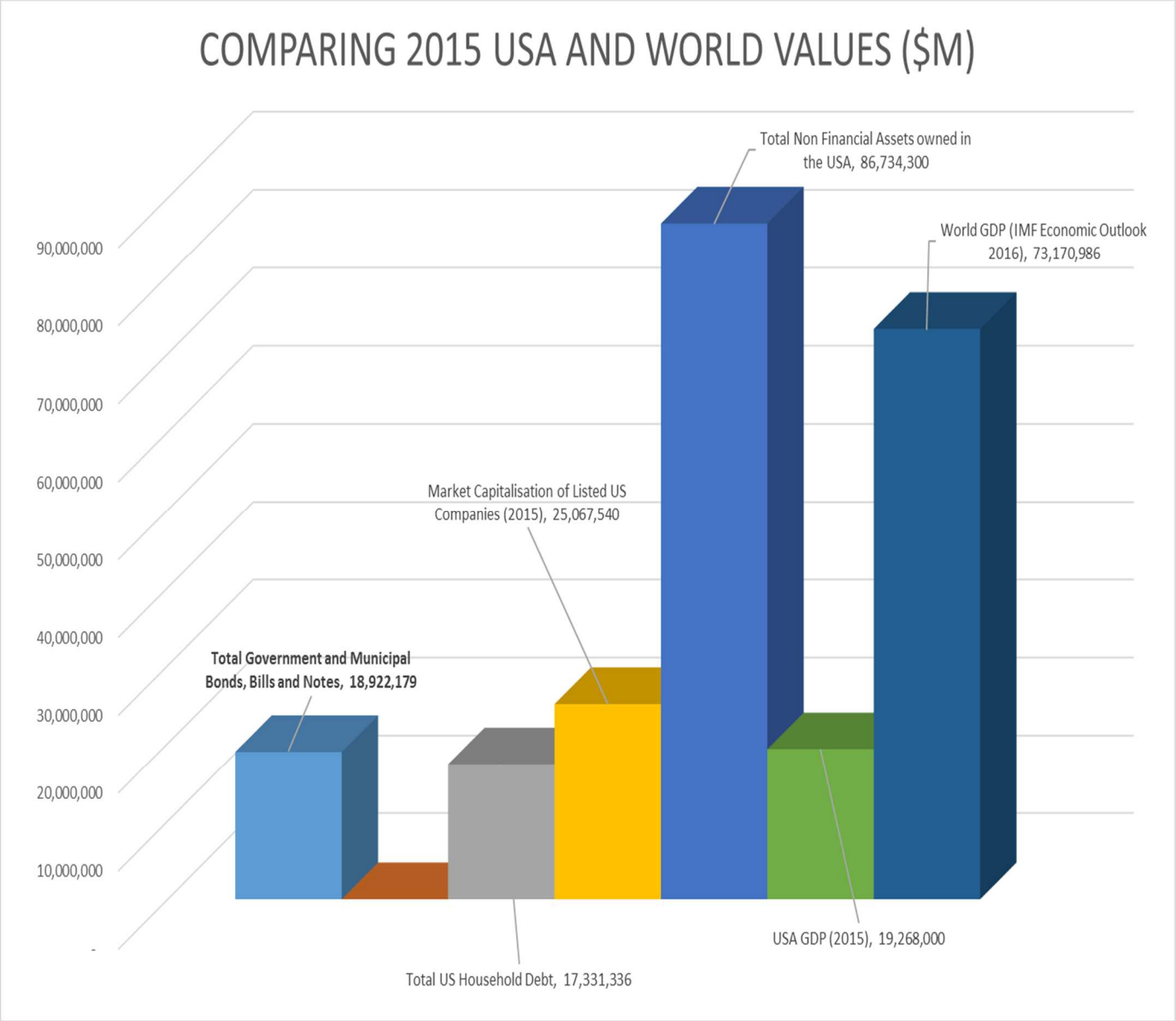


Figure 2: Comparing USA Government Debt to Various Stocks and Flows.

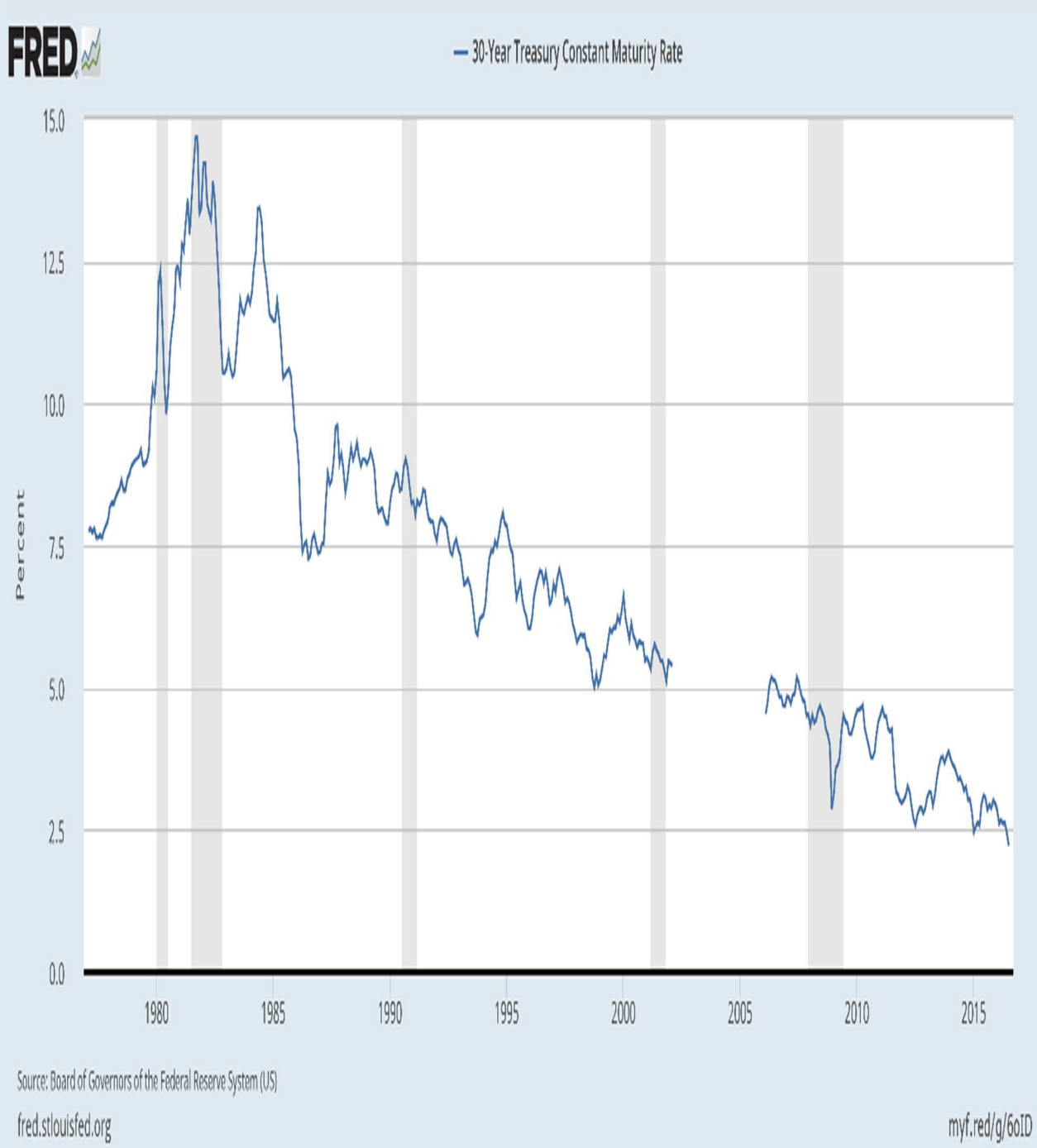


Figure 3: Non Index Linked USA Market Yields 30 Year Treasuries (Note: Temporary suspension of Long term Bonds between 18th February 2002 and 9th February 2006. Largely introduced again due to demand from Pension funds and long-term financial institutions)

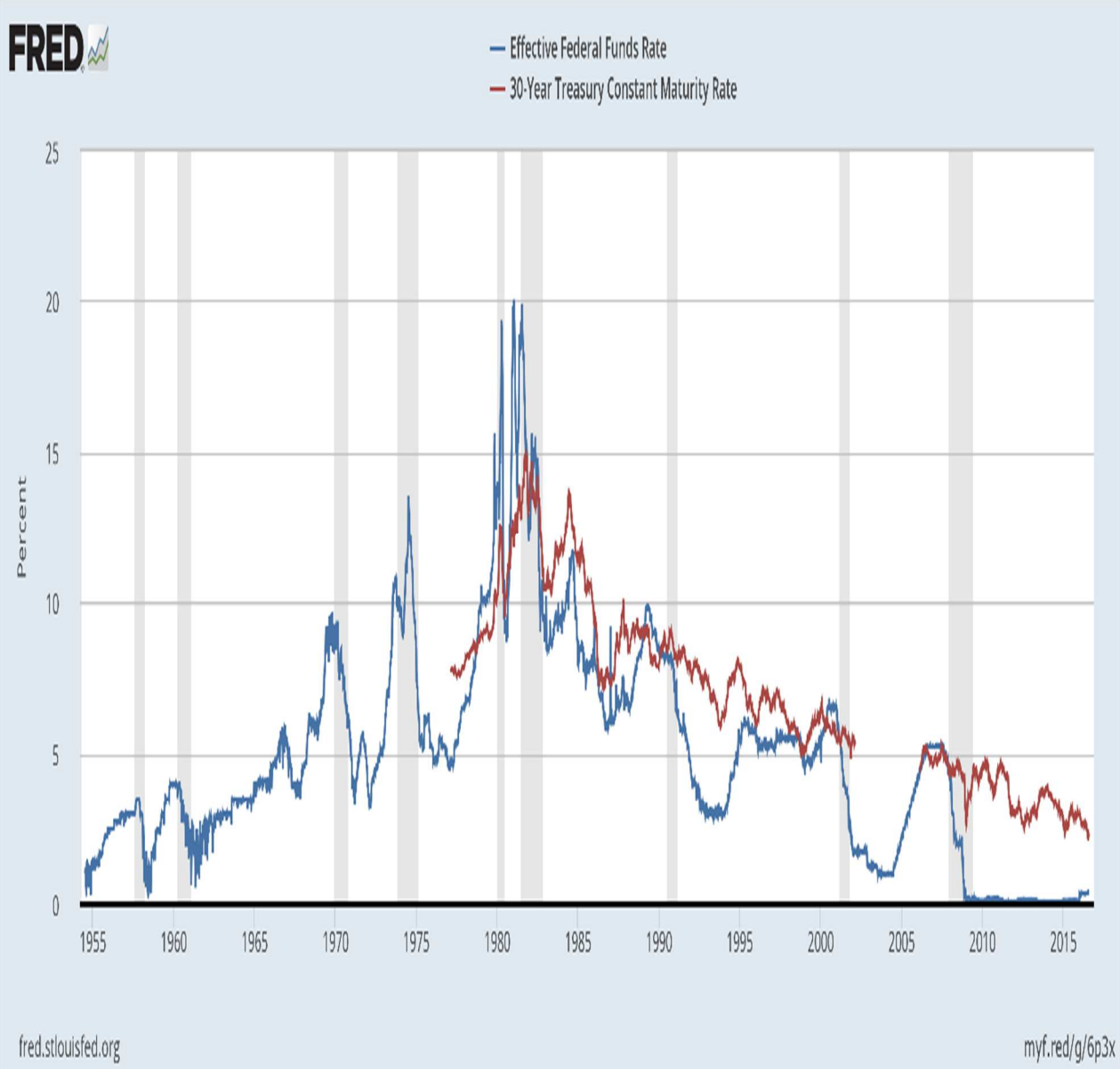


Figure 4: The Fed Funds Rate as compared to 30 year treasury yields. Source: Federal Reserve Bank of St Louis

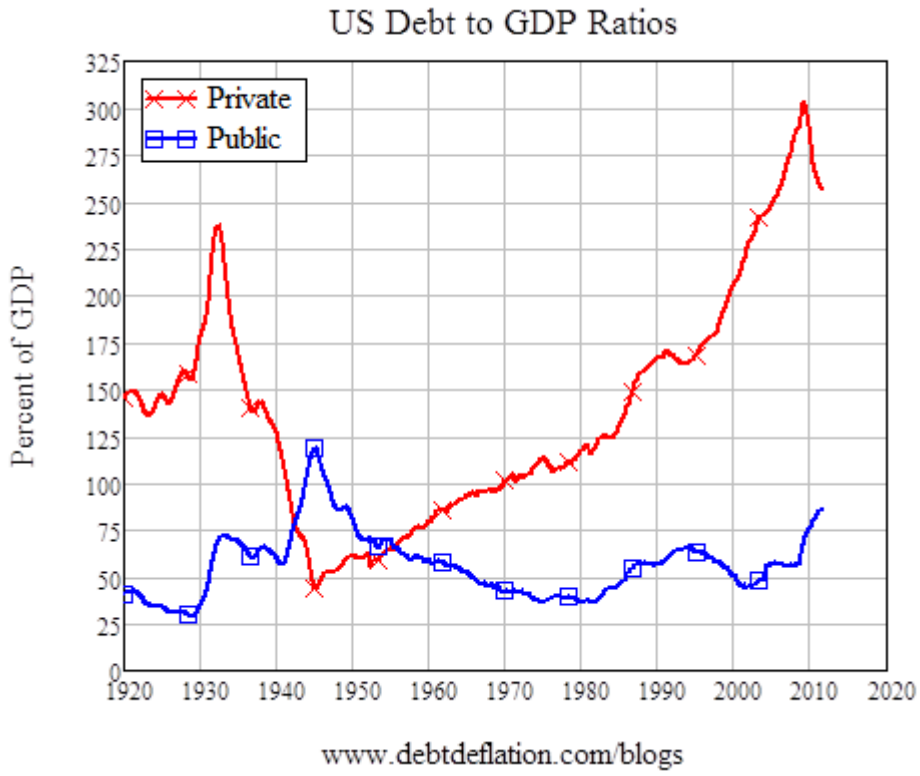


Figure 5: Private Debt to GDP USA ($). Source: Borrowed from Professor Steve Keen's Website, Debt Deflation (http://www.debtdeflation.com/blogs/manifesto/) Original Source: US Bureau of Economic Analysis and Federal Reserve Accounts for the USA. Private debt includes: Households, Non-Financial corporations, Nonfarm non-corporate, Farm and Financial Corporations. The figures are up to 2006. Below in Figure 5b, there are figures from 2006 to 2015. Source as above, (table D3, p5, USA Accounts 2016 Q1, computations are available on request.

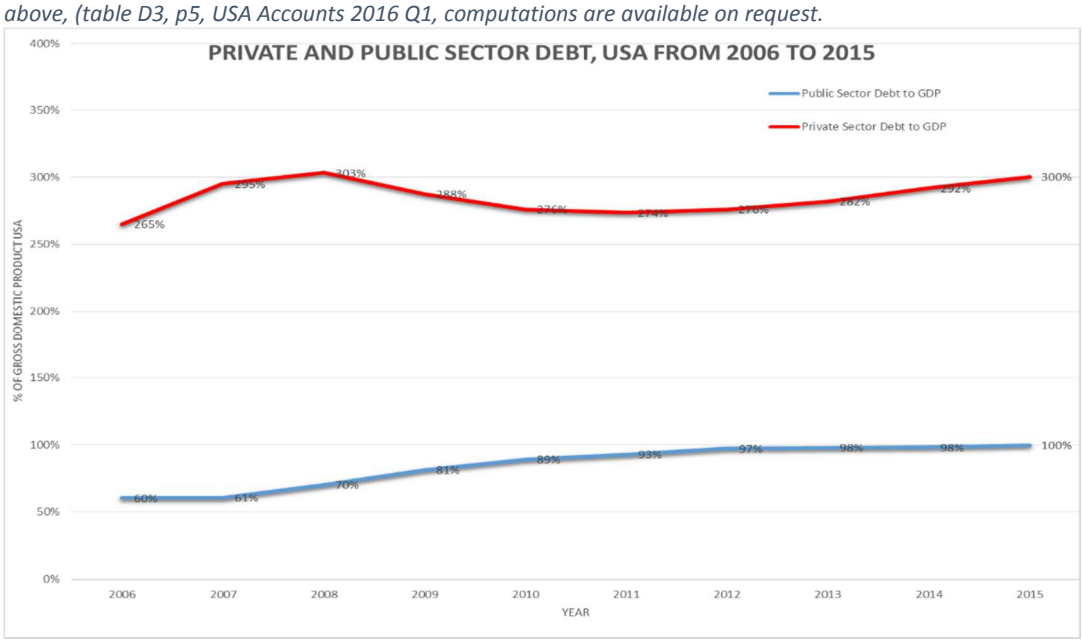


Figure 6: Fed Funds Rate compared to US Treasury Yields (10 and 30 Years)

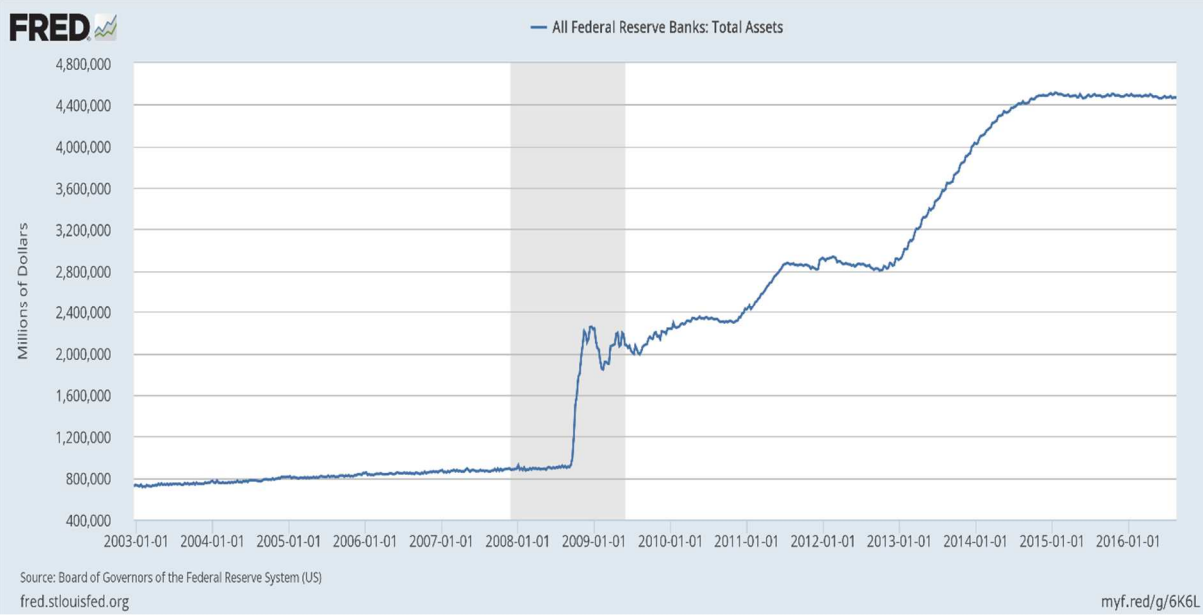


Figure 7: Total Federal Reserve Assets. Source: St Louis Federal Reserve

U.S. Financial Data

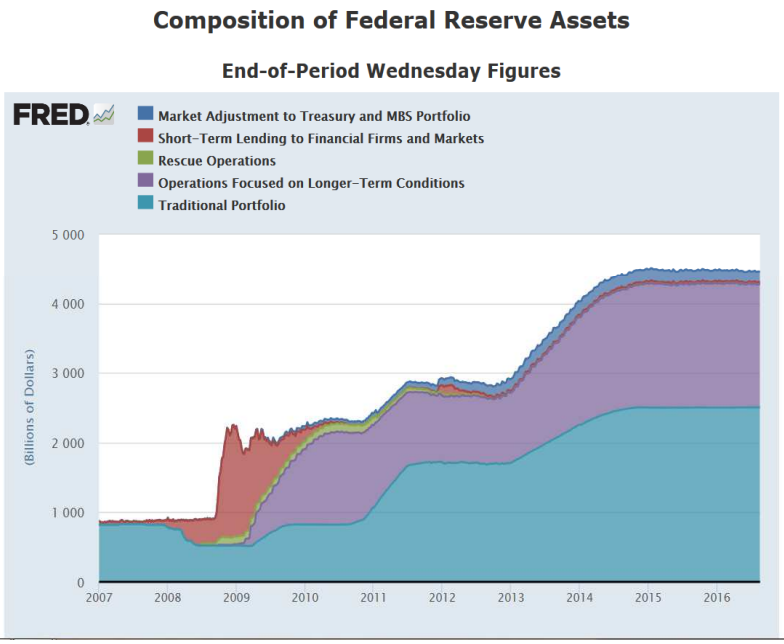


Figure 8: Composition of Federal Reserve Assets. Source: St Louis Federal Reserve

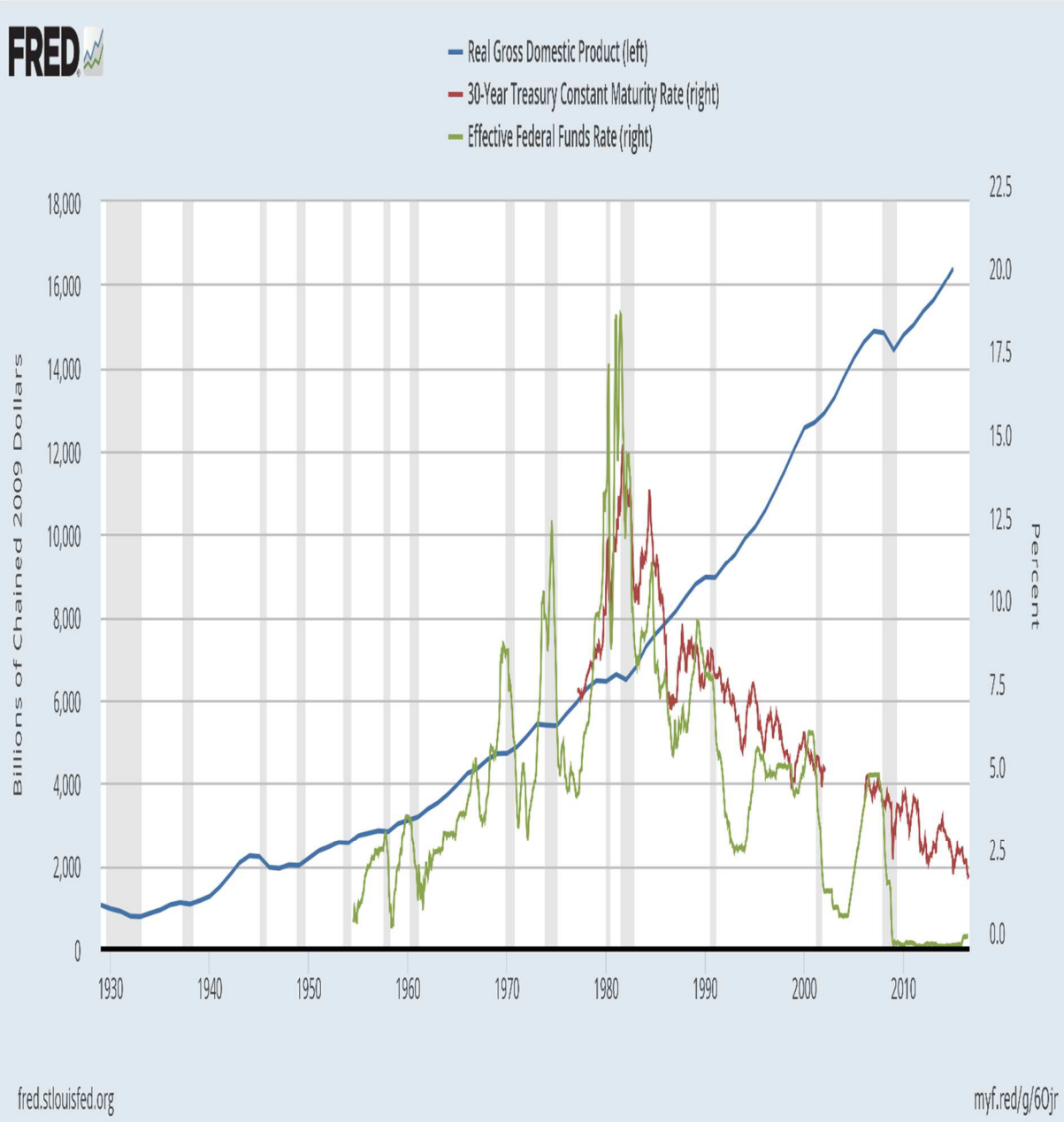


Figure 9: Long and Short Term Interest Rates v's Real GDP USA. Source: FRED

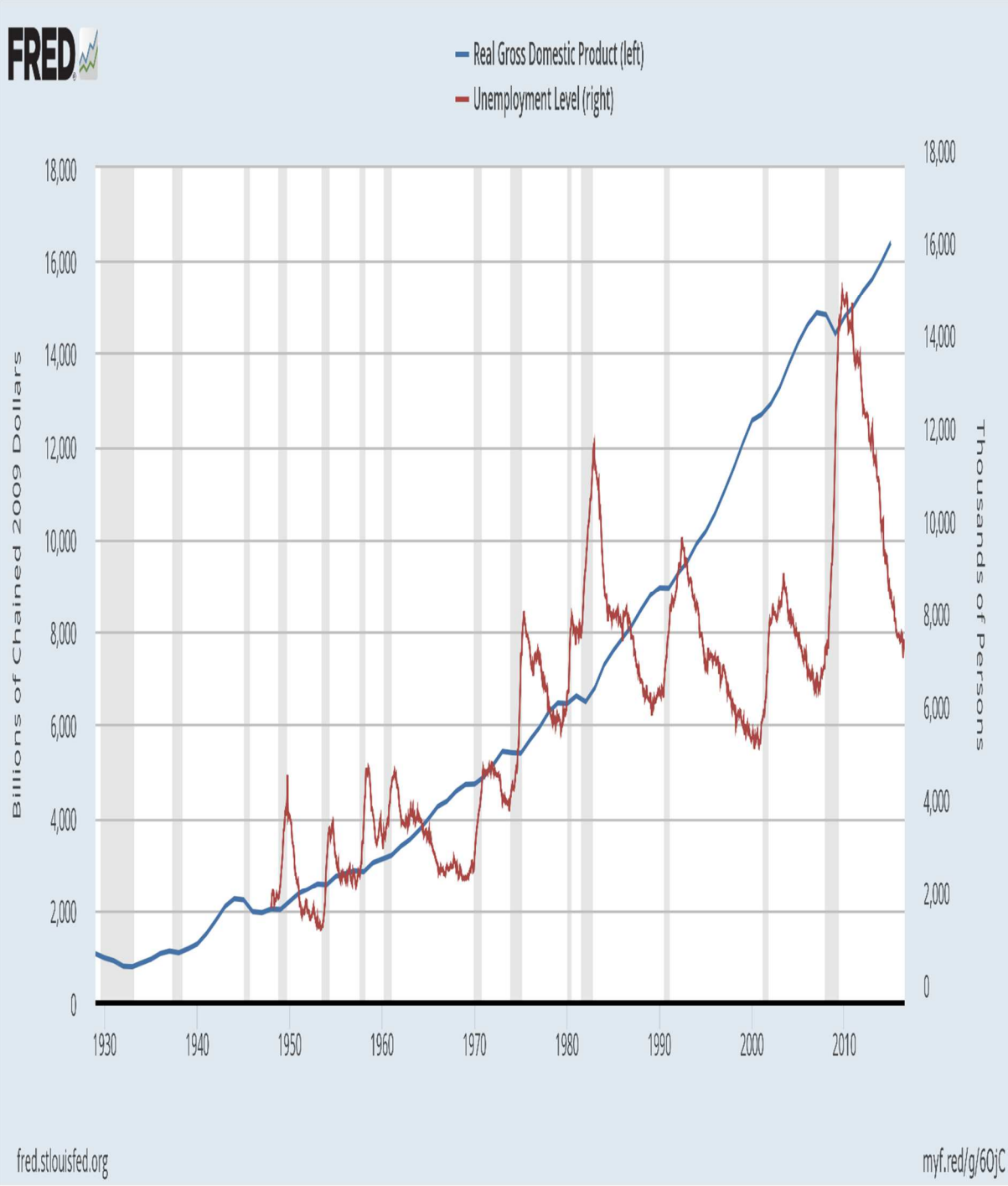


Figure 10: Unemployment in the USA vs GDP. Source: FRED

Figure 11: Dow Jones Industrial Average vs 10 year Treasuries. 2006-16. The inverse relationship of interest rates and the Price of Stocks. Source: FRED

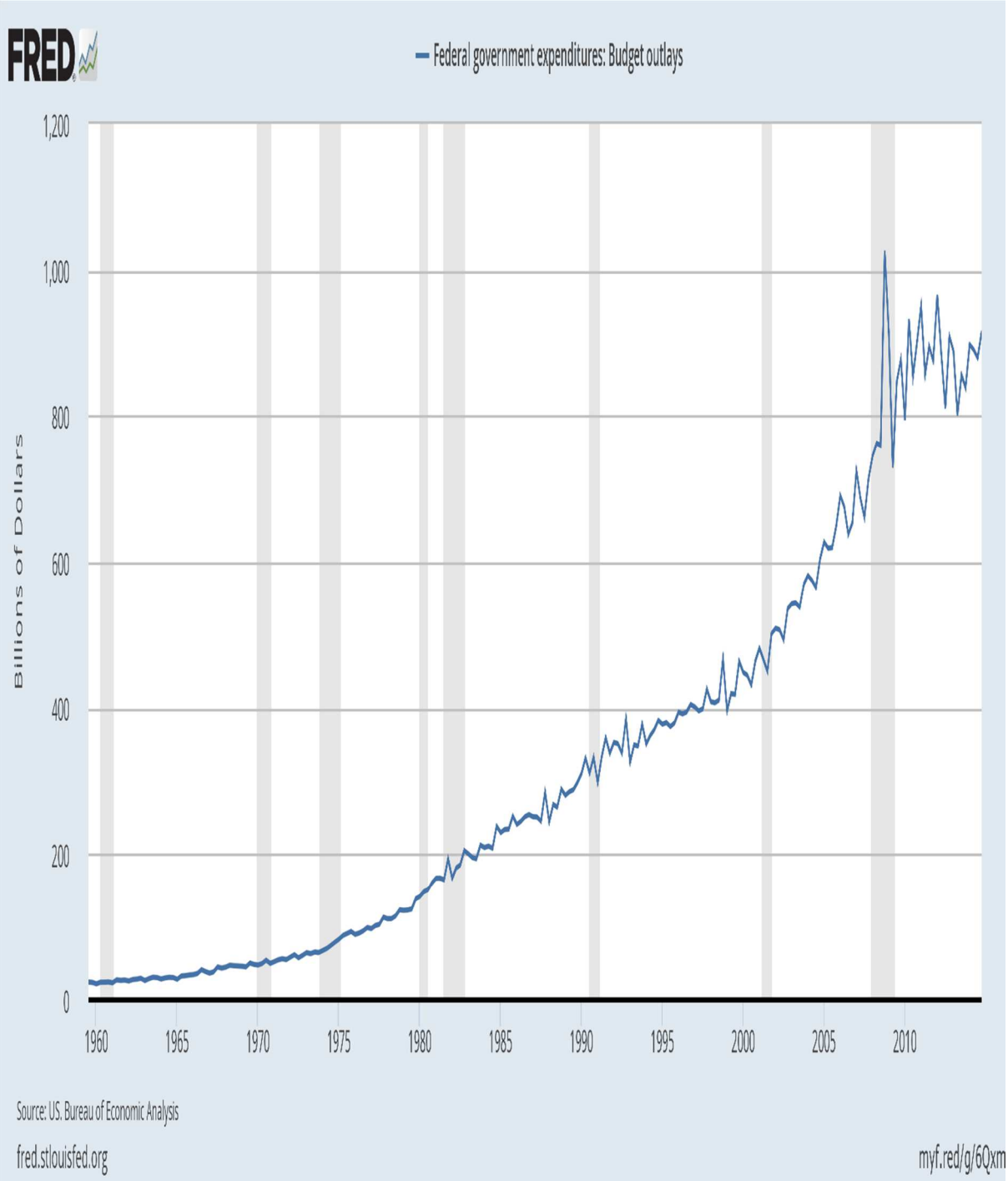


Figure 12: Federal Government Expenditure Budget Outlays. Source: FRED via the US Bureaux of Economic Analysis

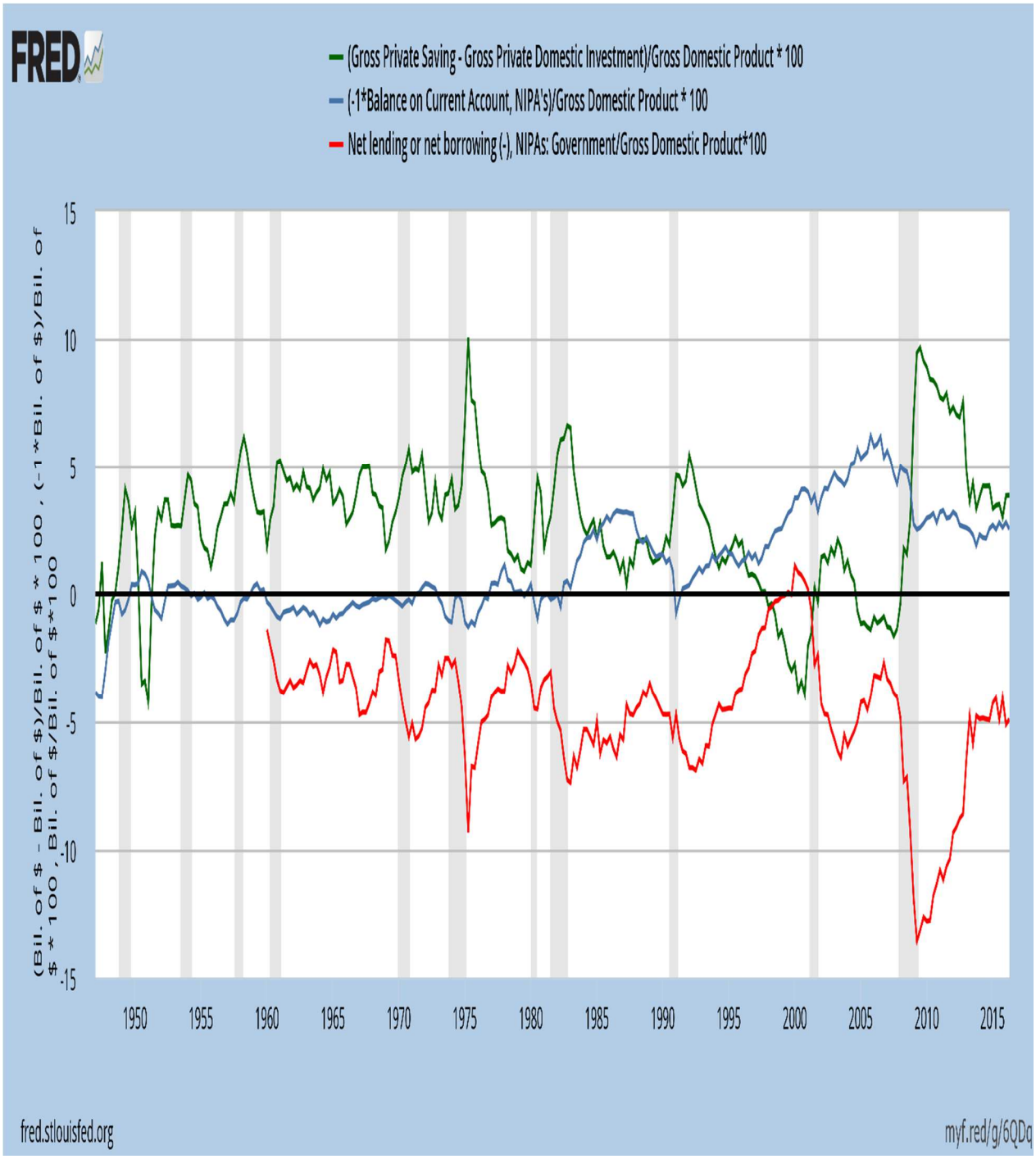


Figure 13: USA Gross government debt as % of GDP. Source: FRED via the International Monetary Fund and other sources. Please note that although the exact numbers might have statistical error, the mirror directional movement must hold as an identity where: (S-I) = (G-T) + (X-M)

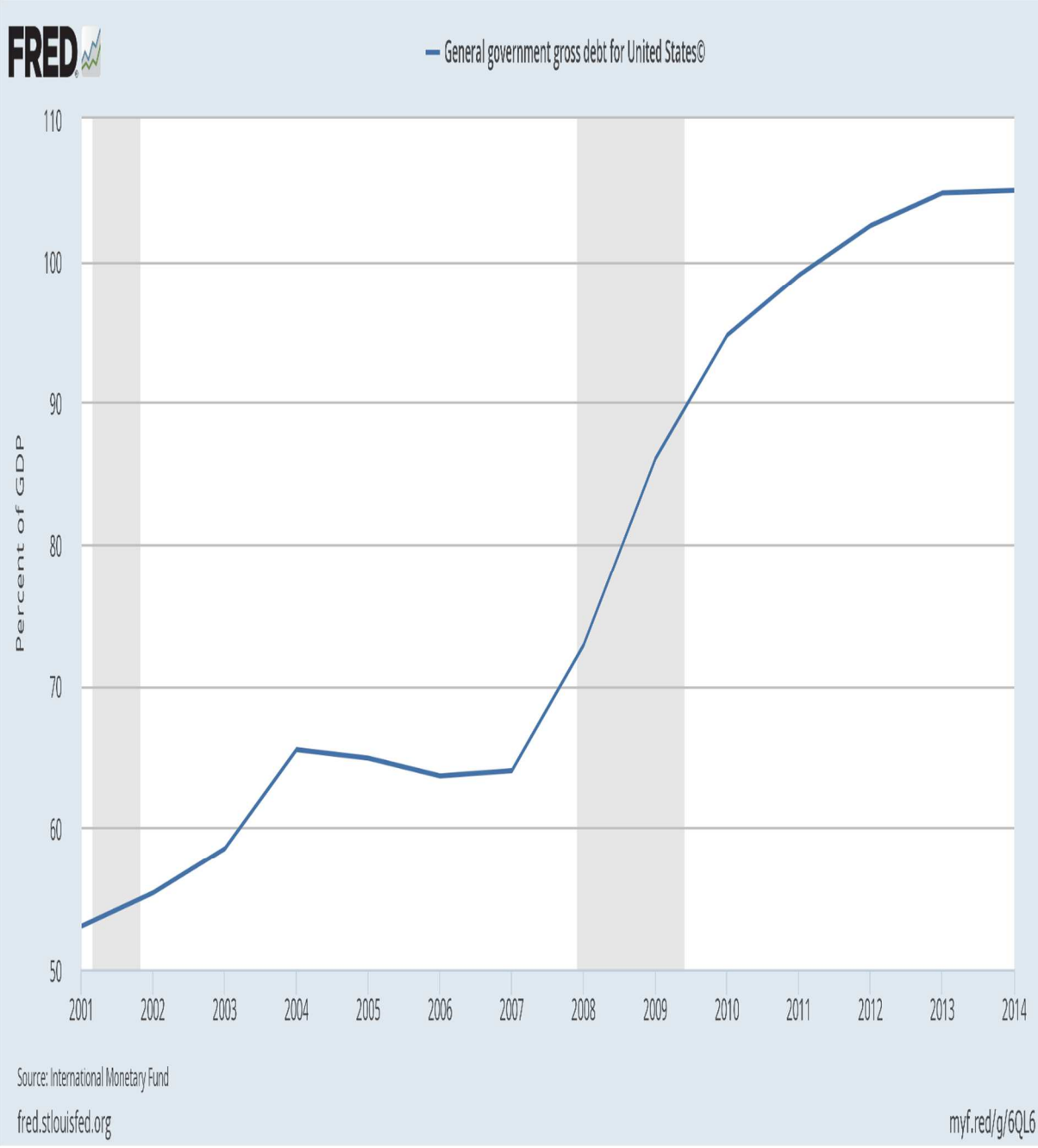


Figure 14: Gross Government Debt as a Percentage of GDP. Source: FRED via the International Monetary Fund

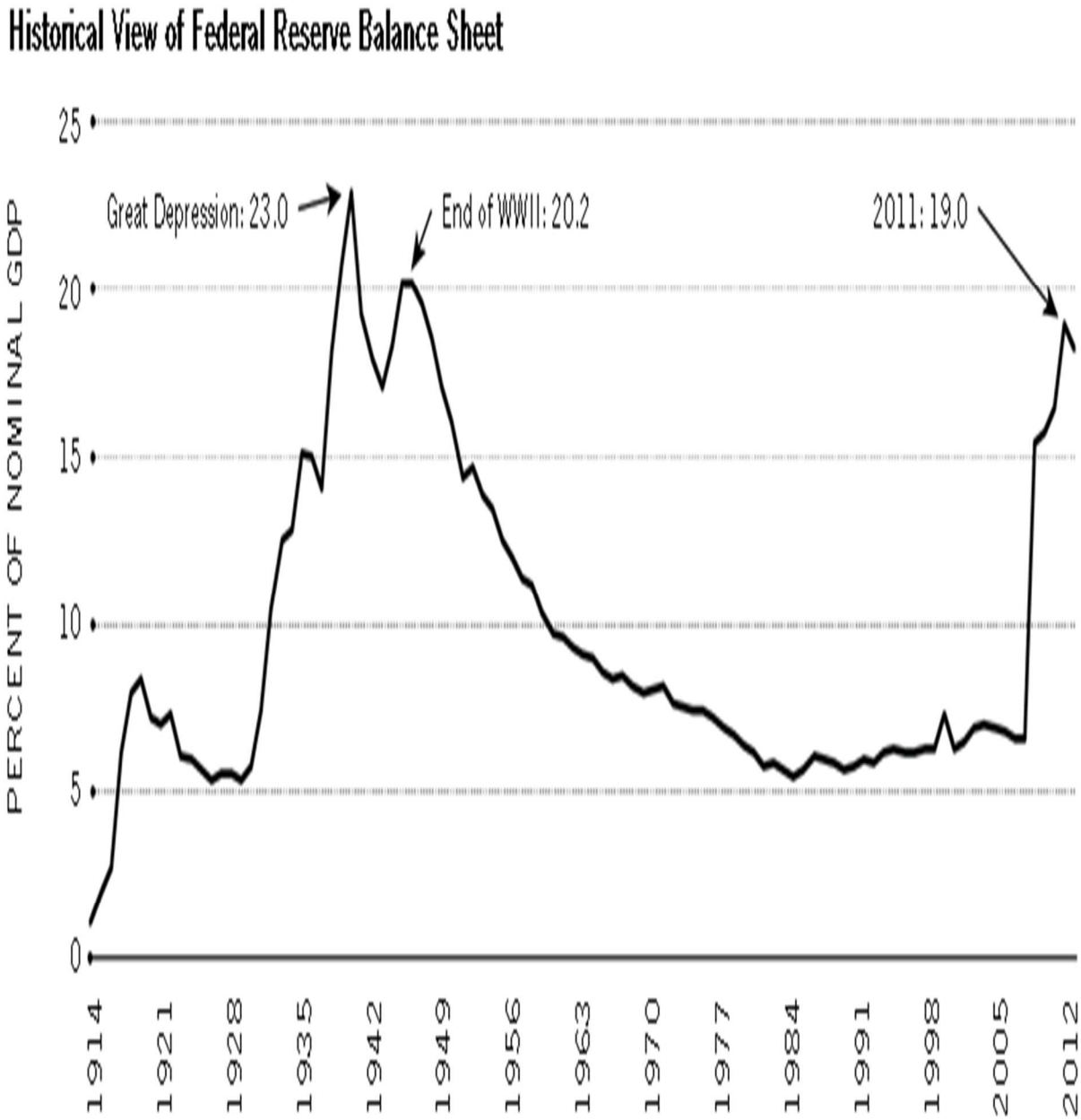


Figure 15: Historical View of Federal Reserve Balance Sheet. Source: Lowell. R et al (2014). Primary source: Federal Reserve board, Bureau of Economic Analysis.

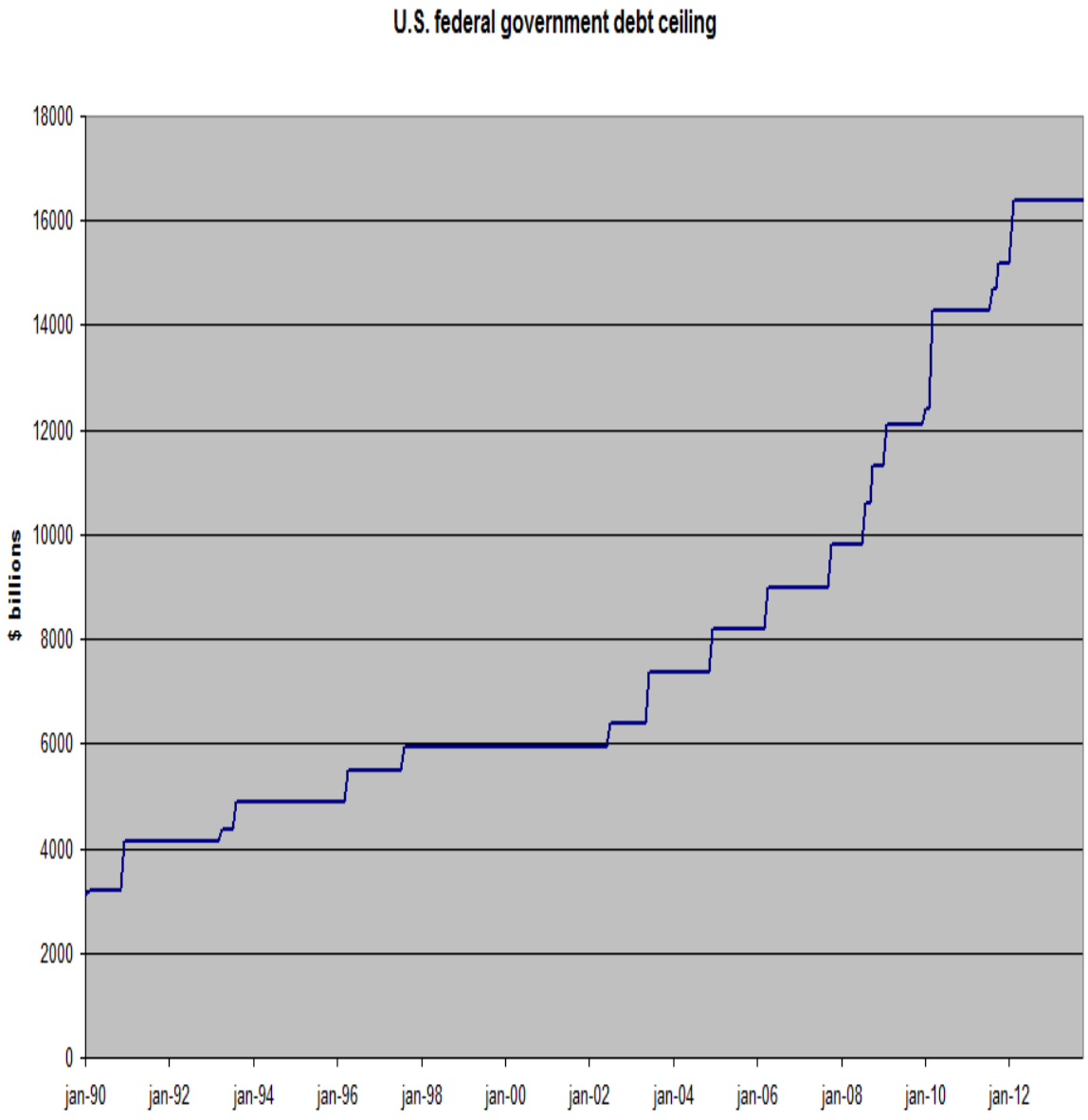


Figure 16: Development of US federal government debt ceiling from 1990 to October 2013; updated version of File:US federal government debt ceiling from 1990. Source:: http://www.whitehouse.gov/sites/default/files/omb/budget/fy2014/assets/hist07z3.xls

Figure 1. Surges in Central Government Public Debts and their Resolution: Advanced Economies and Emerging Markets, 1900-2011

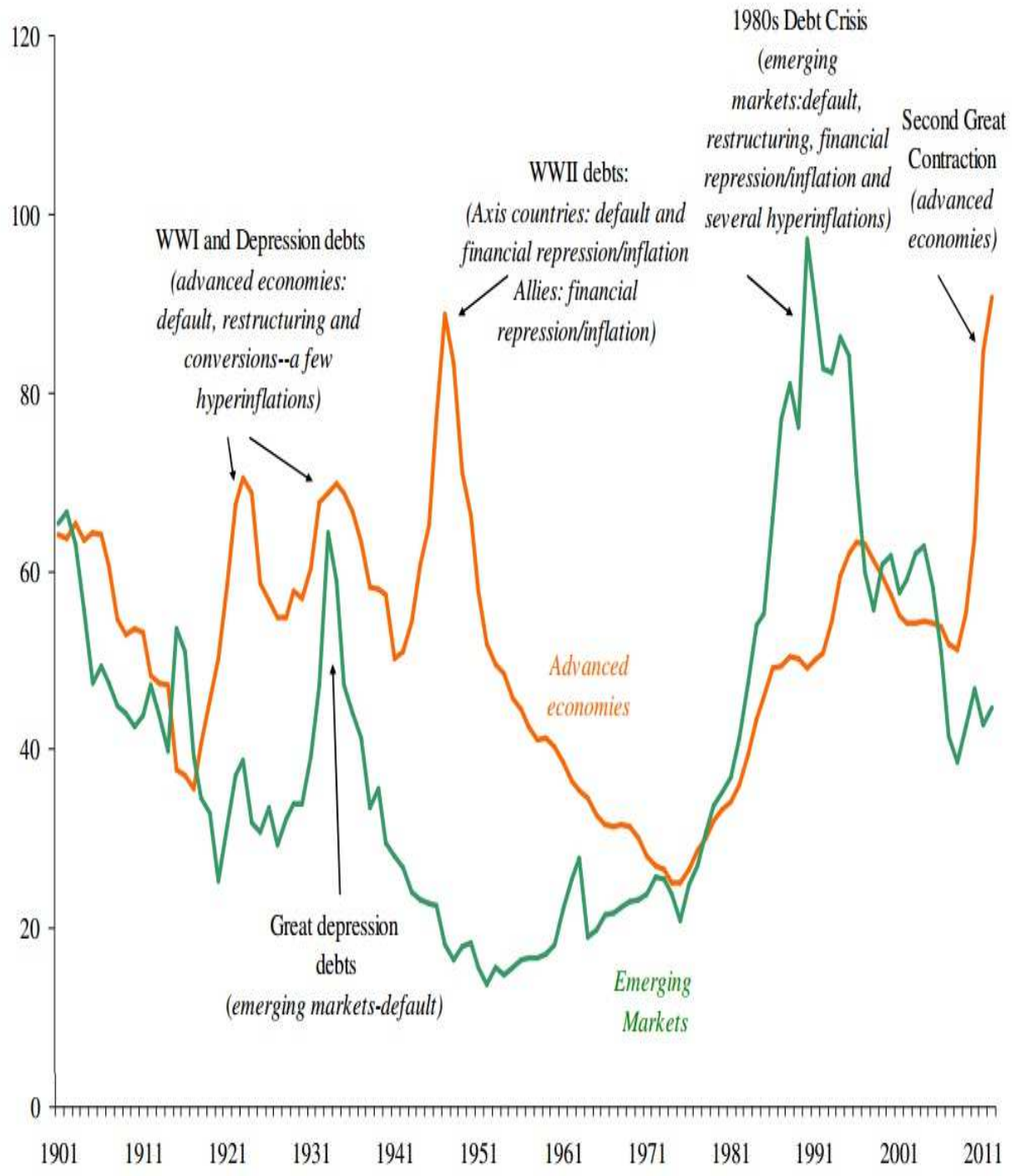


Figure 17: Debt to GDP Ratio's since 2011.

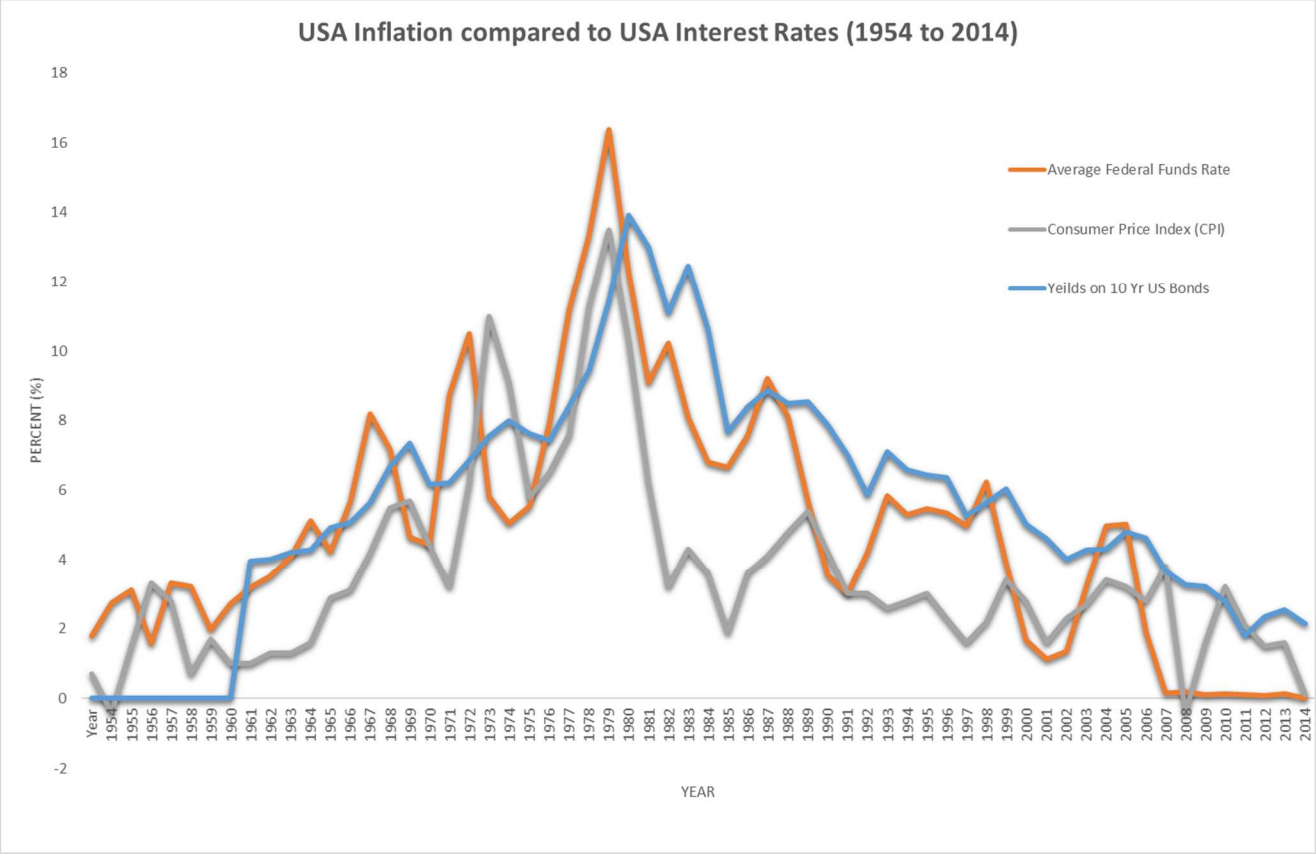
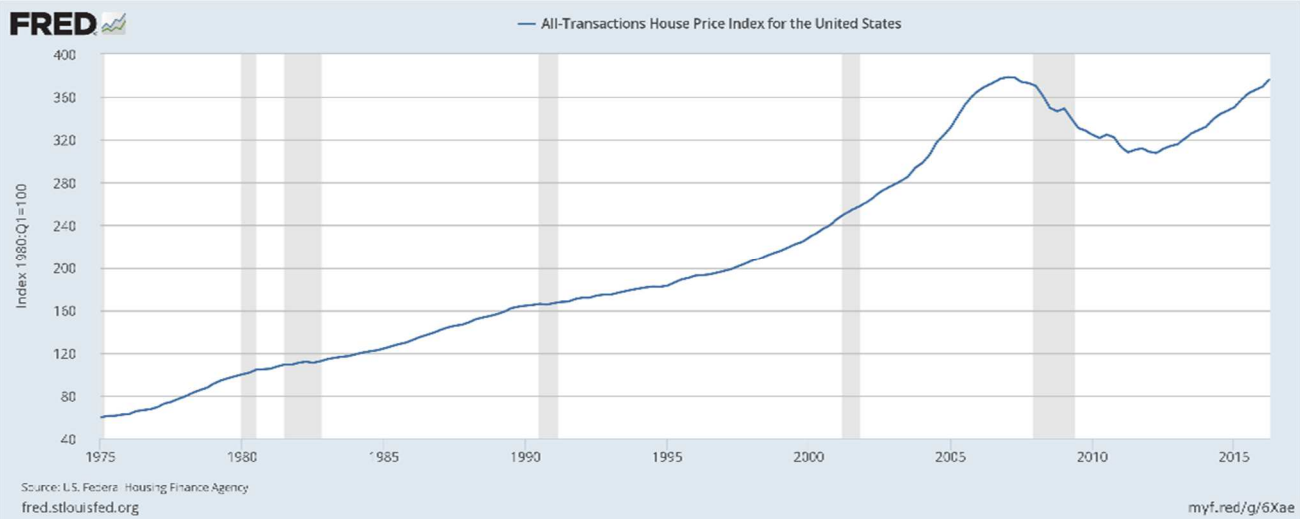
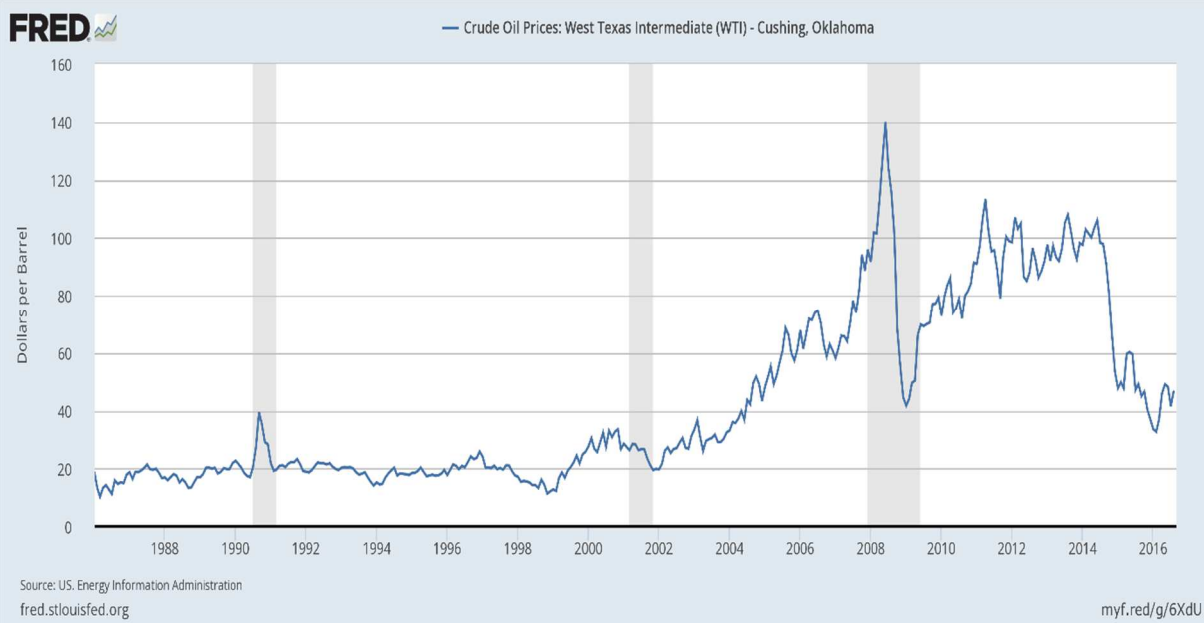


Figure 18: CPI Inflation compared to Fed Funds Rate and Yield on 10 Year Bonds. Source: Bureau of Labour Statistics, Federal Reserve and US Treasury. Please note 10 year yield values were not available for the period from 1950 to1960, and is shown as nil.

The peak in the 1970's is often attributed to excessive deficit spending by President Lyndon Johnson, and his guns and butter program that financed the Vietnam war and national spending programmes in 1965 that went on into the 1970's with a period of lagged inflation that followed. Below is an all transaction House Price Index for the United States since 1975. This contradicts figure 18 above, where the average inflation rate is 5.16% since 1975 (60 – 350 in 35 years) and provides a controversial other view of actual inflation. The CPI fails to account for House prices, and yet housing costs, rental or to buy make up the bulk of expenditure from disposable income. Another measure of inflation might be US Dollar gold valuations that have risen from $263 in 2001 to $1061.5 by the end of 2015 (below). A rate of 10.5% per annum for 14 years. Figure 18 (c) below gives some indication about cost push inflation as a result of rising Oil Prices from 2000 to 2008, but somewhat negated by exchange rate changes, (not shown)




FRED
Crude Oil Prices: West Texas Intermediate (WTI) - Cushing, Oklahoma
Dollars per Barrel
160
140
120
100
80
60
40
20
0
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
Source: US. Energy Information Administration
fred.stlouisfed.org
myf.red/g/6XdU

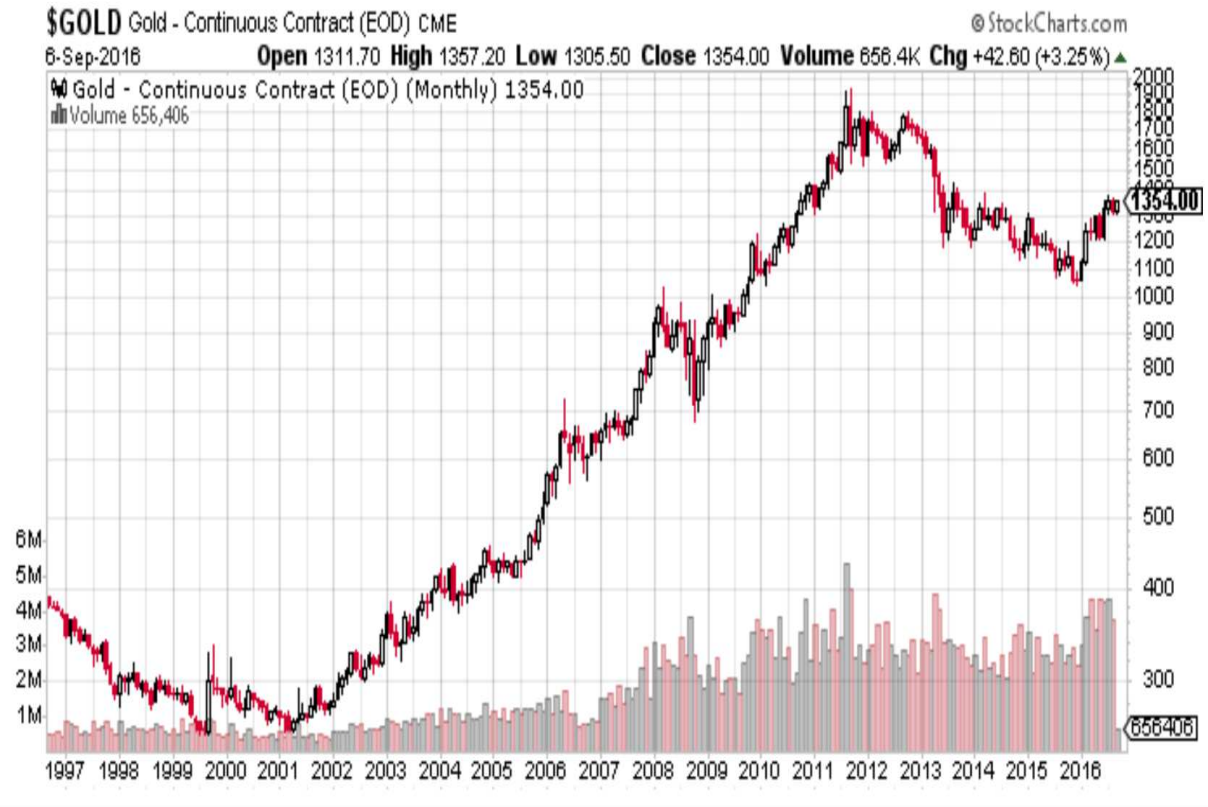

$GOLD Gold - Continuous Contract (EOD) CME
©StockCharts.com
6-Sep-2016
Open 1311.70 High 1357.20 Low 1305.50 Close 1354.00 Volume 656.4K Chg +42.60 (+3.25%)
Gold - Continuous Contract (EOD) (Monthly) 1354.00
Volume 656,406
2000
1900
1800
1700
1600
1500
1354.00
1200
1100
1000
900
800
700
600
500
400
300
6M
5M
4M
3M
2M
1M
656406
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

Figure 19: Share Price Index of top 30 Banks USA. Source: StockCharts.Com. Temporarily assuming the Efficient Market Hypothesis, the value of commercial banks have bounced back since the crash. With time they seem to be stabilising.

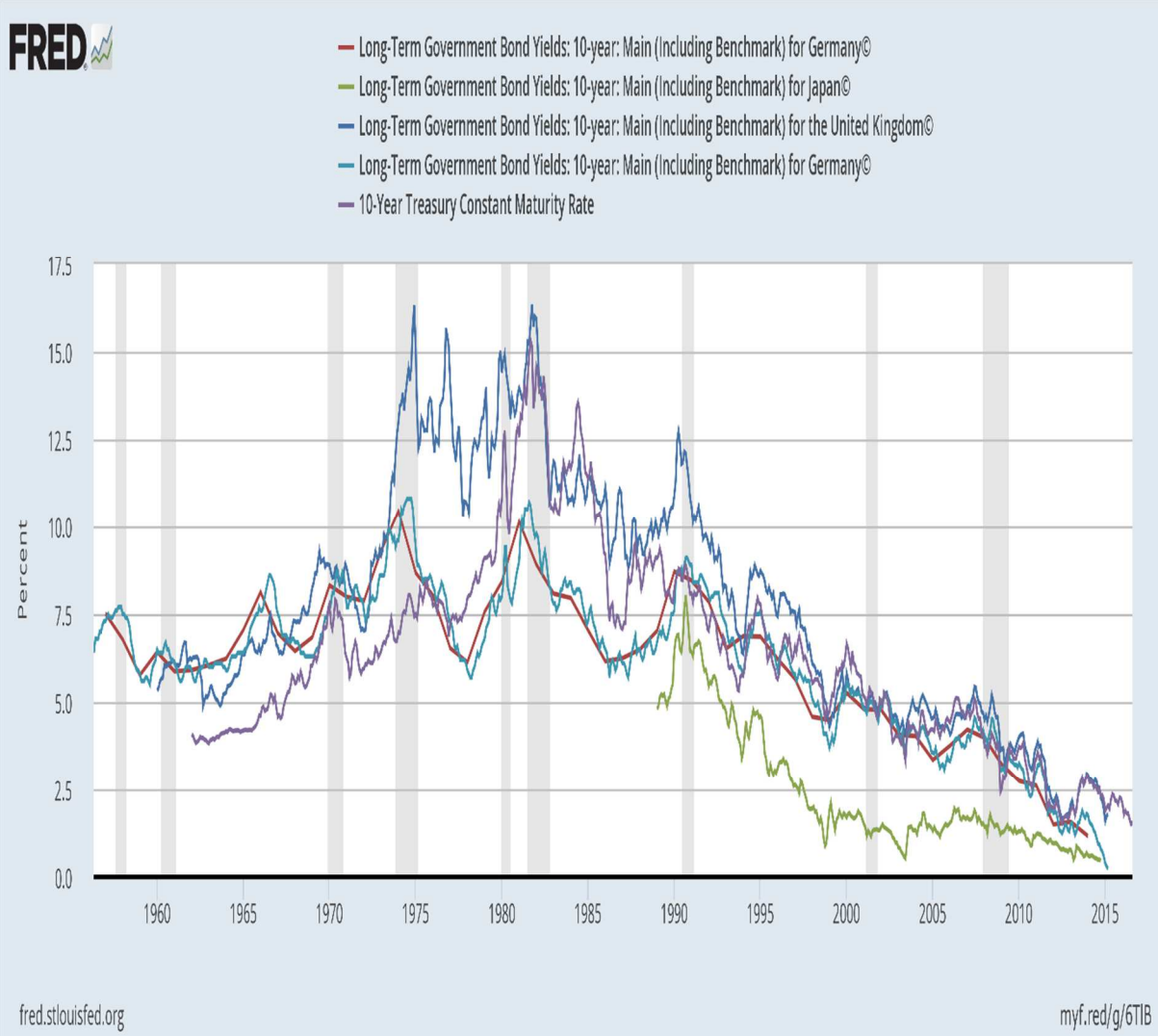
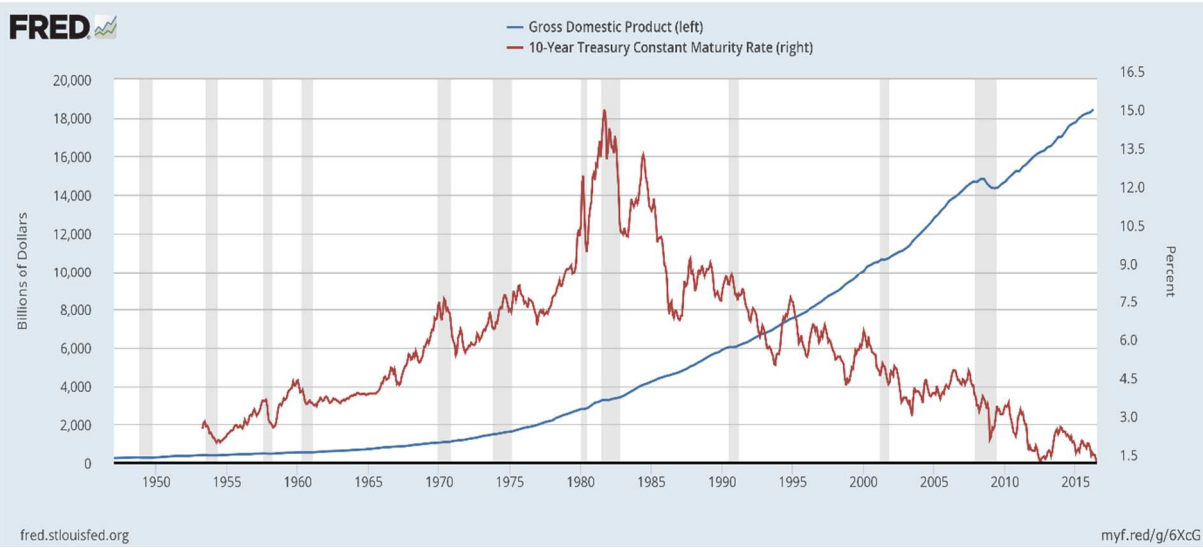


Figure 20: A comparison of 10 year yields for advanced economies in the same risk class. Below Fig 20.B, shows the inverse relationship between GDP and yields. As investors think the economy will grow into the future, they will not be so ready to leave their funds with the Government. There is a want to invest at a higher rate, perhaps in real assets or stocks that grow with GDP.



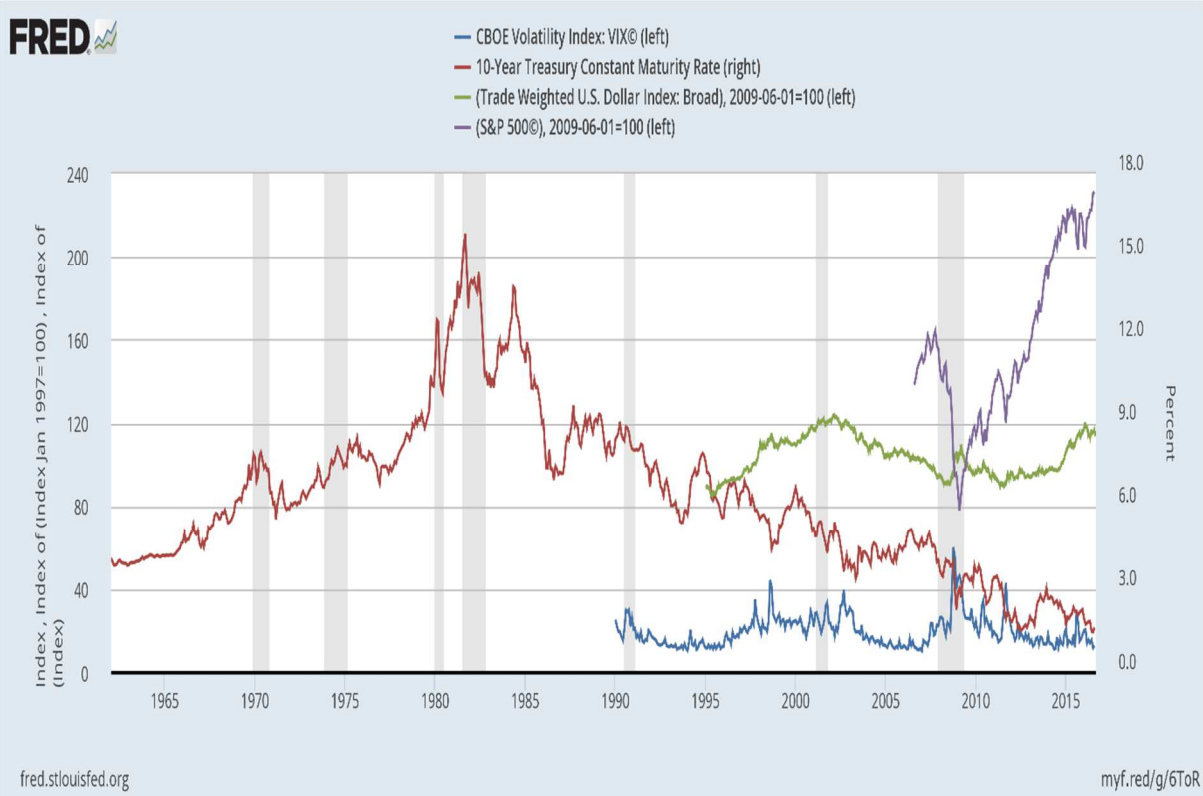
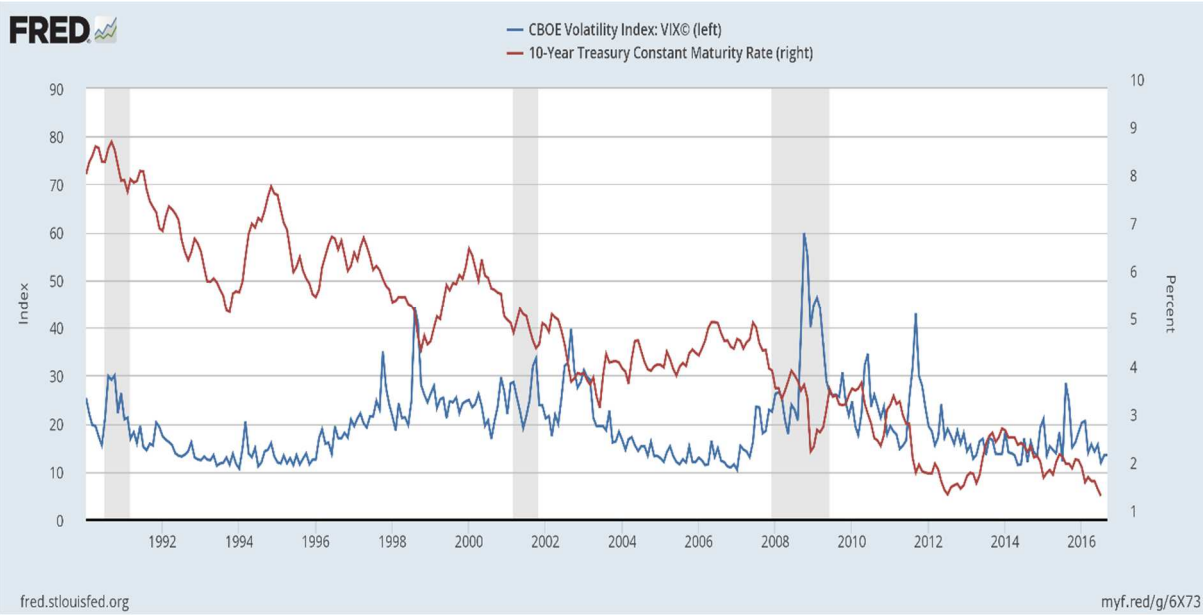


Figure 21: Flight to safety. As the markets collapsed in 2008, volatility increased (Vix Index), but treasury yields went down as there was a flight to safety. Internationally the demand for the dollar also increased. Below is a more close up version of the VIX as a measure of uncertainty and fear compared to the yields on 10 year US Treasuries. The relationship is not as clear as one might expect. When there is greater fear, people want to preserve their capital and are ready to accept lower yields.



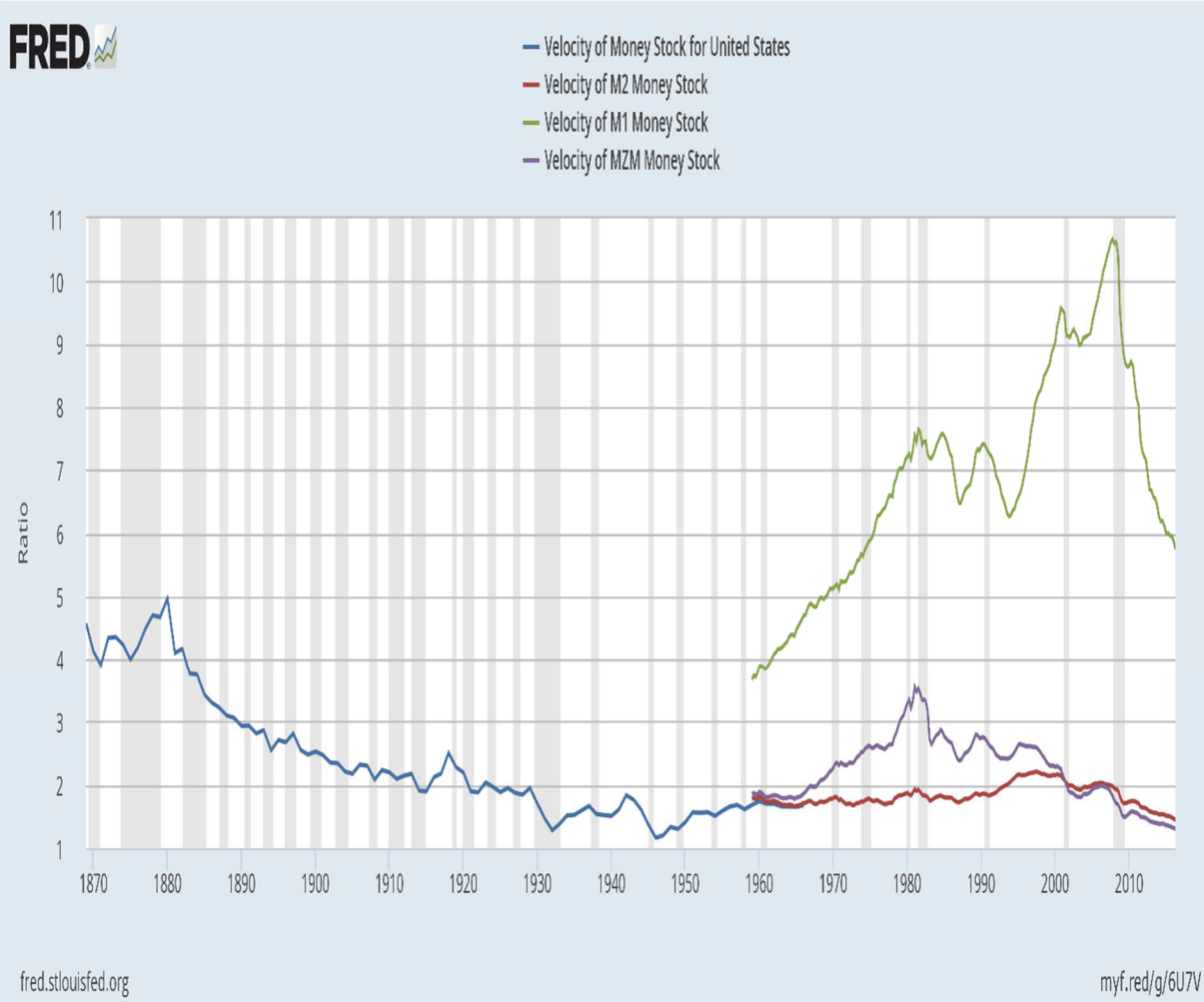


Figure 22: Velocity of Money, Various measures

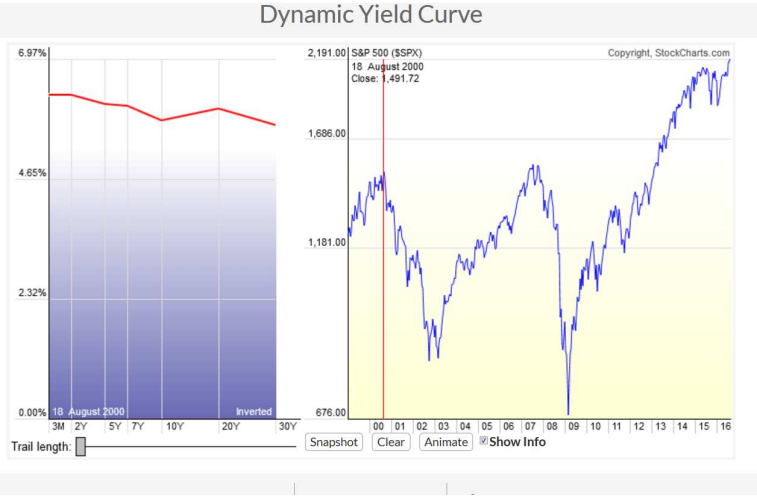


Figure 23: An inverted Yield curve (18 August 2000) (Source for all below: Stock Charts.Com)

All yield curves are a diagrammatical view of all market participation in the treasury market. Here short term maturities are being compensated more. The weight of market participants expect longer term rates to fall. Normally regarded as a sign that the market is in trouble and indeed this signal made a good prediction of the dot.com stock market fall just after this point. The S&P 500 dynamics are shown on the right hand side.

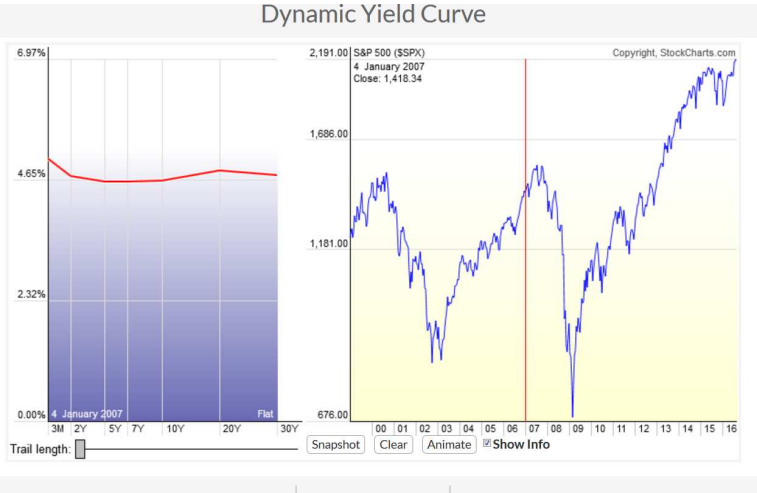


Figure 24: A flat Yield curve (7 August 2007) Pre Crash. A horizontal Yield or humped Curve, is similar to the above. But investors expect interest rates to stay about the same over time. The market it unsure.

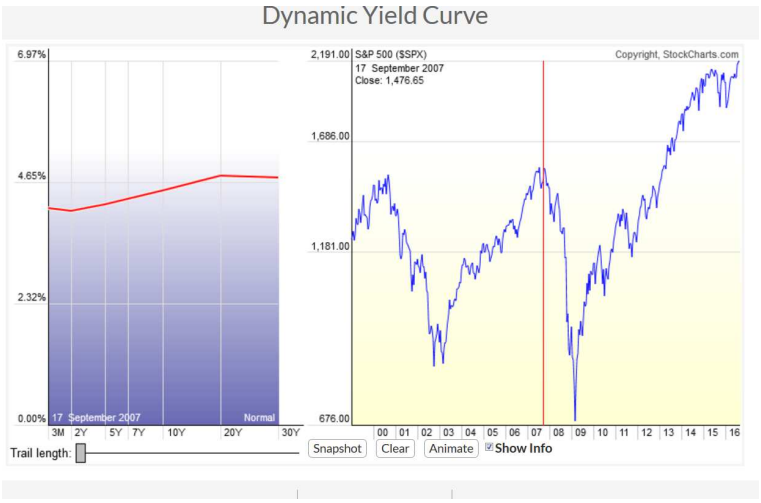


Figure 25: A correcting Yield curve (17 September 2007), Pre 2008 Crash, where the prediction here was also very good.

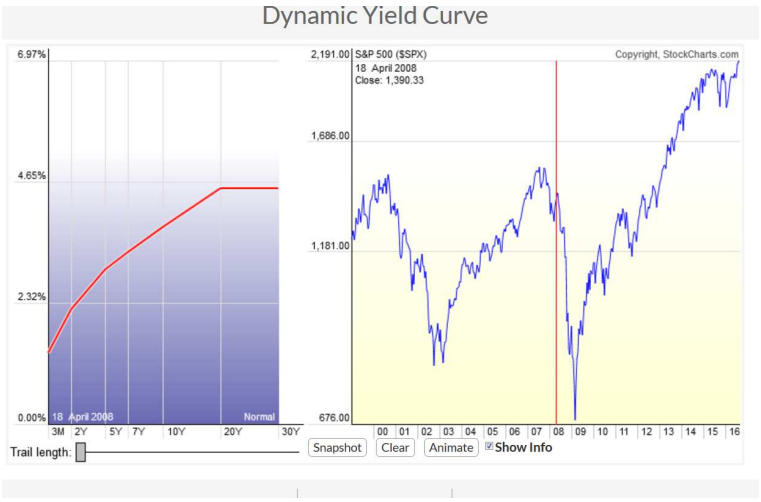


Figure 26: A Normal Yield curve (18 April 2008). Dropping short term yields.

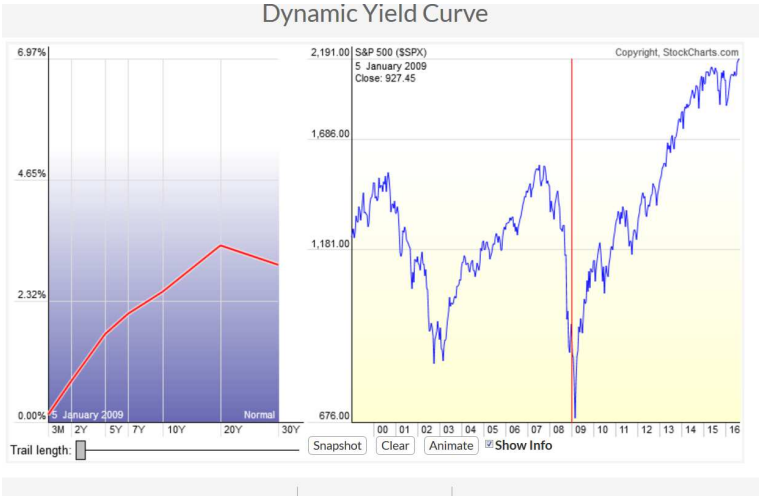


Figure 27: A normal Yield curve post crisis. (5th January 2009), Interest rates are expected to rise in the longer term.

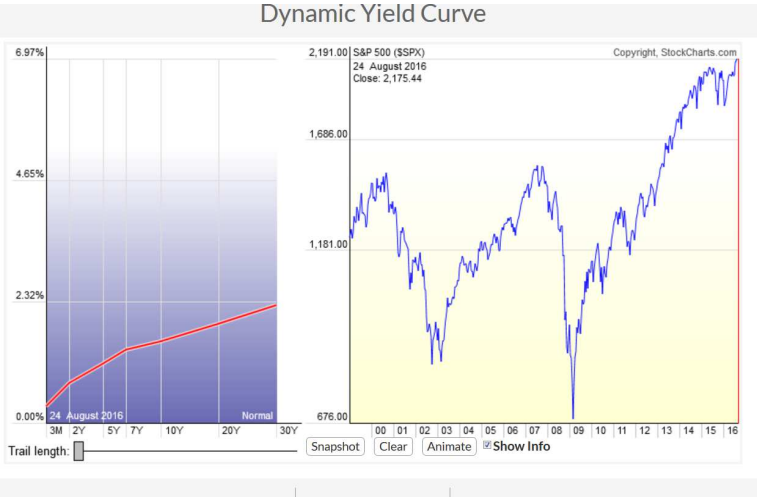


Figure 28: Current Yield Curve 24 August 2016). Since 2008, the Federal Reserve has locked in the short term rate for short term notes to virtually zero. The curve therefore cannot invert and relay a signal. This is the source of much debate, but it is not discussed here.

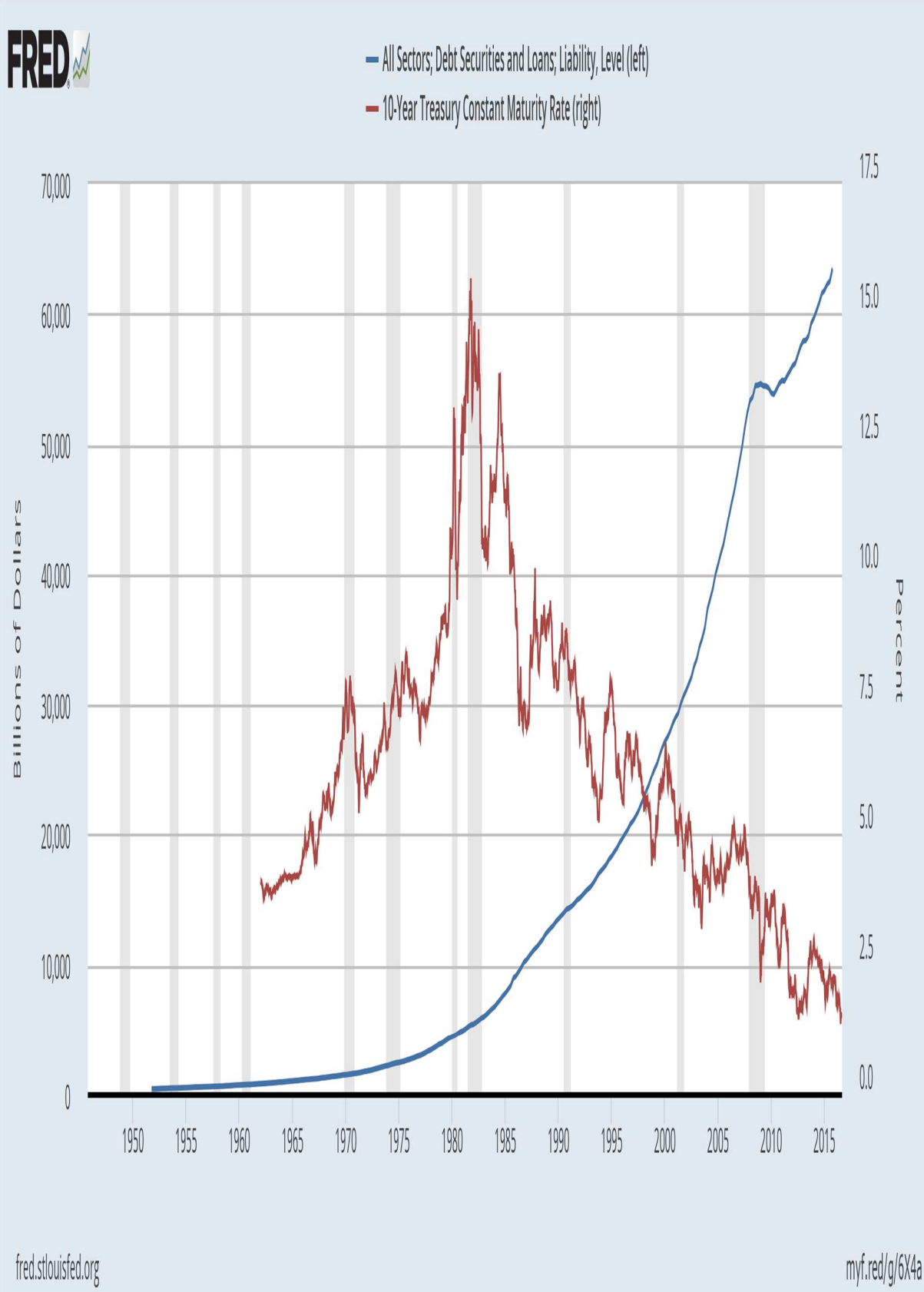


Figure 29: Total US Debt All Sectors, nominal Value, as compared to yields on 10 year US Treasuries. Since the 1980's there exists a negative relationship between total debt (money supply) and interest rates.

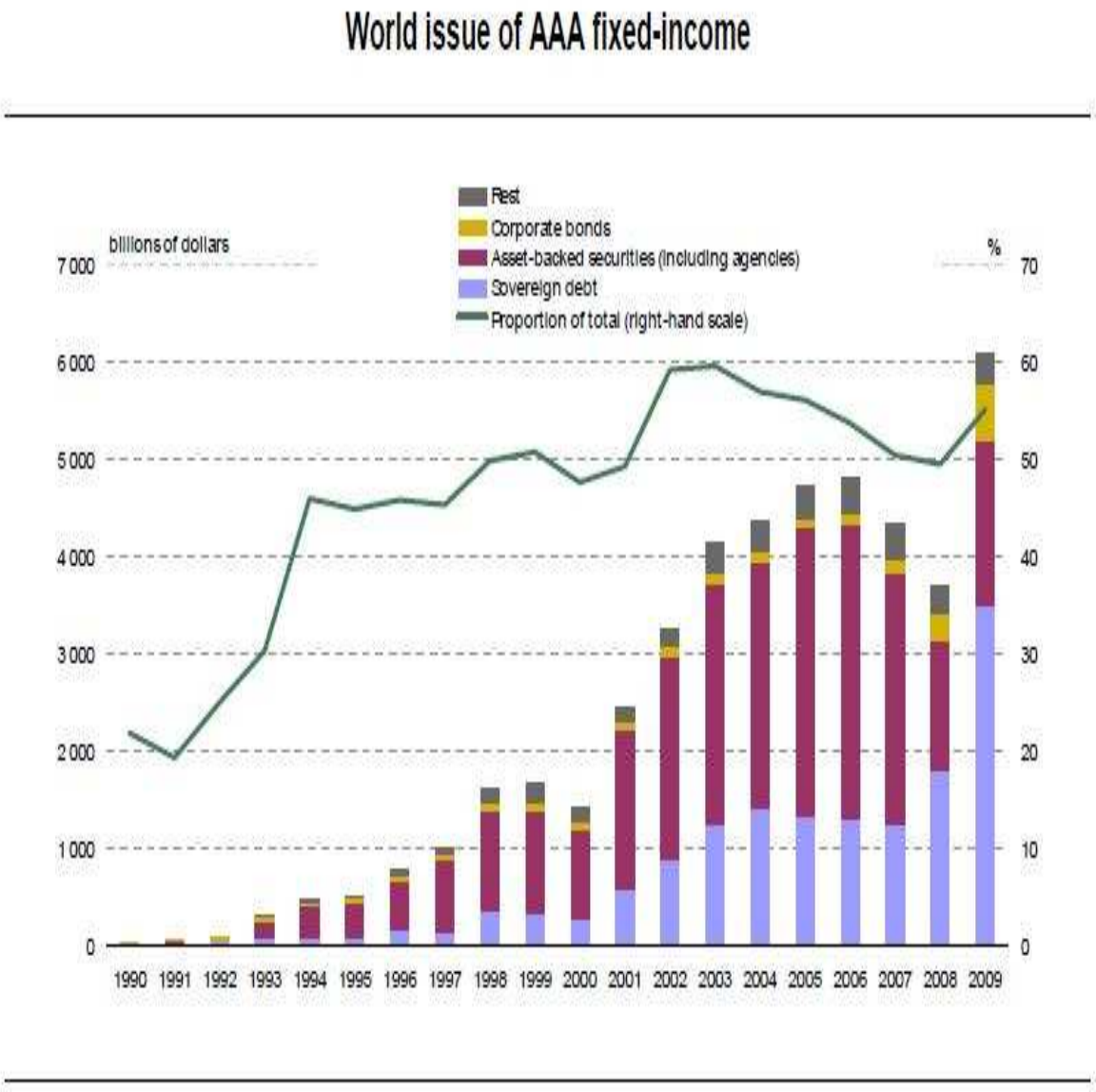


Figure 30: The AAA Bubble, Alloway, Tracy (http://ftalphaville.ft.com//2011/07/15/623881/the-aaa-bubble/), showing the proportionate fall of AAA rated securities since 2003..

i

BIBLIOGRAPHY

Alloway, T. (July 15, 2011) The AAA Bubble. Available at: http://ftalphaville.ft.com//2011/07/15/623881/the-aaa-bubble/ (Accessed: August 2016).

Biggs, M., Mayer, T. and Pick, A. (2009) 'Credit and economic recovery', IDEAS Working Paper Series from RePEc, .

Blodget, H. (2009, April 4th) Our Debt Problem Explained. Available at: http://www.businessinsider.com/henry-blodget-our-de-2009-4?IR=T (Accessed: August 25th 2016).
President Bullard speaks with Bloomberg on Monetary Policy and Economic Growth (26th August 2016) Directed by Bloomberg https://www.stlouisfed.org/from-the-president/video-appearances/2016/bullard-on-bloomberg-monetary-policy-economic-growth: .

Board of Governors, Federal Reserve Bank (August 2016) Quarterly Report on Federal Reserve Balance Sheet Developments. Washington DC: Federal Rerserve Bank.

Board of Governors, Washington DC. (June 2005) 'The Federal Reserve System: Purpose and Functions' (Ninth Edition), pp. 2nd August 2016.

Brealey, R. A. (2013) Principles of corporate finance.

Caruana, J. (. M. (October 2012) 'Why Central Bank Balance Sheets Matter', Bank for International Settlements, BIS Paper 66 .

Driessen, G. A. (August 18, 2016) How Treasury Issues Debt. https://www.fas.org/sgp/crs/misc/R40767.pdf: Congressional Research Service.

Fabozzi, F. J. (2013) Bond markets, analysis, and strategies. 8th ed., global ed.. edn. Boston ; London: Boston ; London : Pearson.

Federal Reserve Board (June 2016) Federal Reserve Banks Combined Quarterly Financial Report (Unaudited) 2016. Washington DC: Federal Reserve.

Finel-Honigman, Irene & Sotelino, Fernando B (2015) International Banking for a New Century. 1st Edition edn. Oxon, United Kingdom: Routeledge.

Friedman, M. (1980) Free to choose : a personal statement. Harmondsworth: Harmondsworth : Penguin.

Greshams Law (2012) Charting the Federal Reserves Assets - 1915 to 2012. Available at: http://greshams-law.com/2012/02/13/charting-the-federal-reserves-assets-from-1915-to-2012/ (Accessed: August 2016).

Greshams Law (2012) Charting the Federal Reserves Assets 1915-2012. Available at: http://greshams-law.com/2012/02/13/charting-the-federal-reserves-assets-from-1915-to-2012/ (Accessed: August 2012).

Jha, S. (2011) Interest Rate Markets. Wiley.

Joyce, M., Miles, D., Scott, A. and Vayanos, D. (2012) 'Quantitative Easing and Unconventional Monetary Policy – an Introduction*', Economic Journal, 122 (564), pp. F271-F288.

Joyce, M., Miles, D., Scott, A. and Vayanos, D. (2012) 'Quantitative Easing and Unconventional Monetary Policy – an Introduction*', Economic Journal, 122 (564), pp. F271-F288.

Keen, S, Will the Crash happen again?(July 2015) https://www.youtube.com/watch?v=JKy6_yy3C3U: .

Keen, S,, What might happen when QE is eased?(December 2013) Directed by Steve Keen https://www.youtube.com/watch?v=Kw3uXAQ4DwE: .

Keen, S. (2012) Credit Money: How it Works and Why it Fails_lecture series. Available at: https://www.youtube.com/watch?v=7ZK7aTBD97U&index=1&list=PLSM1JU9fjIpEhWv_LhWZt4hZWlnWuHYFc (Accessed: April, 2016).

Keen, S. (2015) 'Post Keynesian Theories of Crisis', American Journal of Economics and Sociology, 74 (2), pp. 298-324.

Keen, S. (2011) Debunking Economics The Naked Emperor Dethroned? - Revised, Expanded and Integrated Edition. : Zed Books.

Keen, S. (2011) 'A monetary Minsky model of the Great Moderation and the Great Recession', Journal of Economic Behavior and Organization, .

Koo, R. C. (2014) Escape from Balance Sheet Recession and the QE Trap. Wiley.

Krugman, P. (2012) End this Depression Now. 1st edn. United States of America: Melrose Road Partners.

McLeay, M., Radia, A. and Thomas, R. (2014) Money in the modern Economy: An introduction. 1st edn. http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2014/qb14q1prereleasemoneyintro.pdf: Bank of England.

Michel, N. J, Moore, S. (14th August 2014) Quantatative Easing, The Fed's Balance Sheet and Central Bank Insolvency (Heritage Organisation). Available at: http://www.heritage.org/research/reports/2014/08/quantitative-easing-the-feds-balance-sheet-and-central-bank-insolvency (Accessed: August 2016).

Milton Friedman, Money and Inflation: Milton, Friedman (1979, Chicargo Conference)

Moody's Investor Services (2015) Sovereign Bond Ratings: Rating Methodology. https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_186644: .

Reinhart, C. M. (2011) The Second Great Contraction From ""This Time Is Different"". Princeton: Princeton : Princeton University Press.

Rickards, J. (2016) The New Case for Gold. 1st edn. Great Britain: Penguin Random House.

Rickards, J. (2014) The death of Money: The coming collapse of the International Monetary System. 1st Edition edn. England: Penguin Group.

Rickards, J 2016: The death of Money Project Prophecy - Gods Economy (August 2016) Directed by Rickards. J and Myers. S https://www.youtube.com/watch?v=aLj_7BYhjd4: .

Ricketts, L. and Waller, C. (2014) 'The Rise and (Eventual) Fall in the Fed's Balance Sheet', Regional Economist, pp. 24-27.

Shiller, R. J. (2005) Irrational exuberance. 2nd ed.. edn. Princeton, N.J. ; Oxford: Princeton, N.J. ; Oxford : Princeton University Press.

Standards and Poors (2015) S&P Global Ratings: Sovereign Rating Methodology. Table 2: Standards and Poor, Sovereign Issuer Credite Rating Framework: Source: https://www.standardandpoors.com/en_US/web/guest/ratings/ratings-criteria/-/articles/criteria/governments/filter/sovereigns: .

Wesenthal, J. (May 2012) This Collapse in US Interest Rates Is History in the Making - Here's what it Really Means.
(Business Insider Magazine). Available at: http://www.businessinsider.com/what-the-collapse-in-interest-means-2012-5?IR=T (Accessed: August 2016).

Wray Randall. L - Modern Money Theory: Intellectual Origins and Policy Implications (16 October 2015) You Tube: International and Comparative Law Center (ICLC) Seminar Series.

Wray, R. L. (2012) Modern Money Theory: A Primer on Macroeconomics for Sovereign Monetary Systems. 1st edn. England, UK: Palgrave Macmillan.

Yellen, J. L. (26th August 2016) The Federal Reserve's Toolkit: Past, Present and Future. At
"Designing Resilient Monetary Policy Frameworks for the Future"
A Symposium Sponsored by the Federal Reserve Bank of Kansas City"
Jackson Hole, Wyoming. http://www.federalreserve.gov/newsevents/speech/yellen20160826a.htm: .
Unknown author,100 Years of Treasury Bond Interest Rate History. (November 2010) Available at: http://observationsandnotes.blogspot.co.uk/2010/11/100-years-of-bond-interest-rate-history.html (Accessed: August 2016).

Unknown Author, (HKIB), Hong Kong Institute,of Bankers (2014) Treasury Markets and Operations. Somerset: Somerset : Wiley.