How Share Prices Fluctuate

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Key Points

- The stationarity of the stock market's value (q) and the mean reversion of its real return are its most obvious and exceptional characteristics.

- These characteristics allow the cost of capital to be calculated, and the results are incompatible with the consensus growth model. The Stock Market Model (SMM) includes these features. It is testable and robust when tested; it is therefore the model used in this paper.

- The ex post identity of investment and savings requires an ex post identity of the flow of savings available to finance the equity and debt proportions of new investment. This identity pulls q to fair value.

- Only temporary fluctuations in q around fair value are possible because net issues of equity will either depress net worth, relative to share prices, if q is above fair value, or boost it, if it is below.

- Changes in nominal corporate bond yields, profit margins and household liquidity cause fluctuations in q. Sustained misevaluations of the stock market require continuing changes in at least one of these three variables.

- Changes in these variables, which depend partly on endogenous political decisions, cannot be predicted, but past changes in q can be explained by their past fluctuations.

- The current prolonged excessive level of q has been driven by a rise in household liquidity, in response to the current secular liquidity trap. A similar experience in the 1930s ended in 1937 with the second worst recession in US history.

- Changes in corporate bond yields explain 7 of the past 10 major bull and bear phases of the stock market. One of these three exceptions is the current bull market, which depends on the rise in household liquidity.

Introduction

The ratio of the value ascribed to the corporate sector by the stock market to the net worth of the assets owned by its constituent companies (q) rotates around a stable mean. In addition, the real return on the market measured as a whole, or by any stable proportion of it, is mean reverting. The stock market thus exhibits two different forms of stationarity and, using these characteristics, its value can therefore be measured in two different ways.[1]

Figure 1: US: Stock Market Value q and CAPE

Data sources: For q, Stephen Wright 1900 to 1945 then Z1 Table B.103; for CAPE, Robert Shiller.
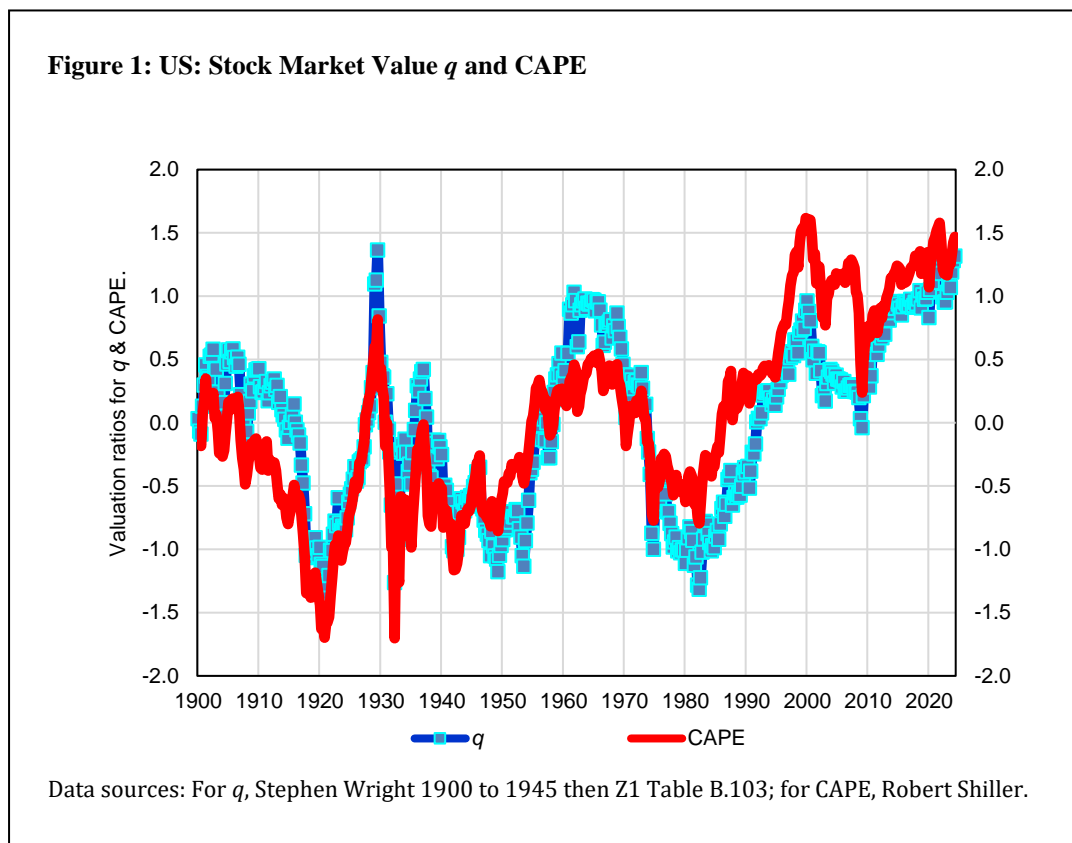
Figure 1 uses both these characteristics to show how the value of the stock market has varied between the start of 1900 and the end of Q2 2024. The ratio of stock market value to net worth is termed q^2 and the Cyclically Adjusted PE Ratio (CAPE) uses the stationarity of its real return. Details of the ways in which
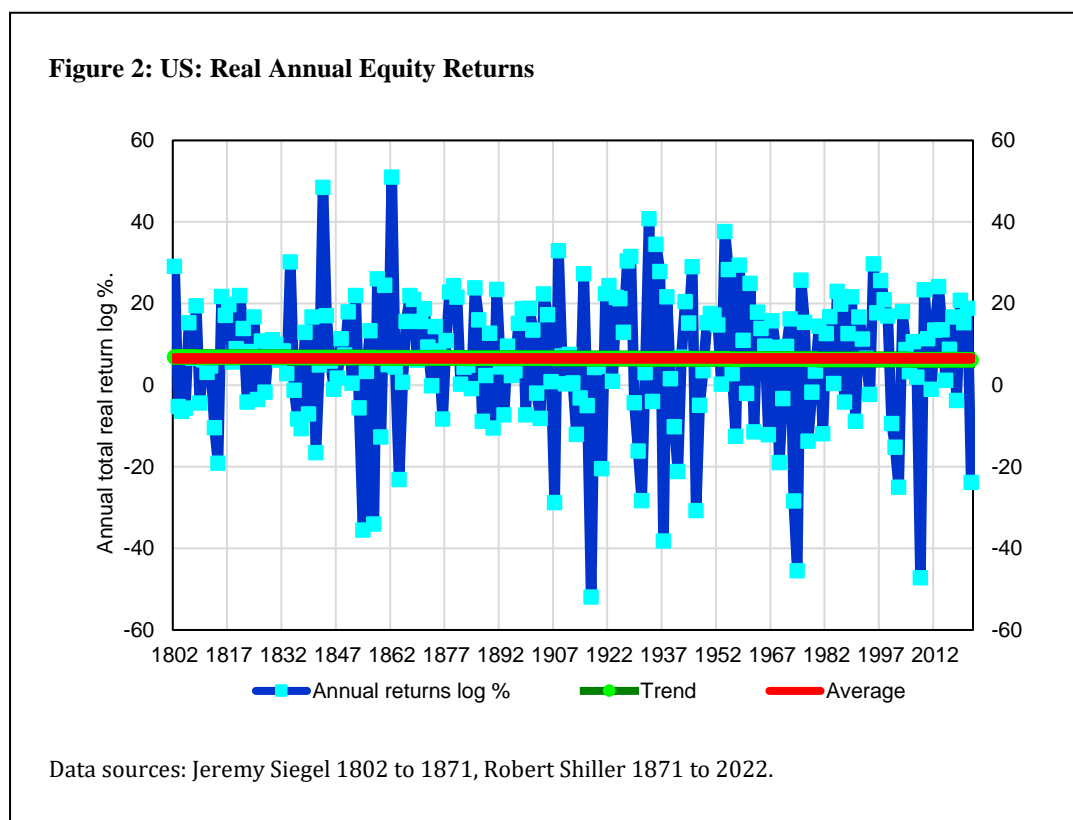
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[1] The key assumptions of the SMM are set out in Appendix 1.

[2] The definition of q used to value the stock market is different from that used by James Tobin for the value of the corporate sector including its debt, though both are based on the same principles. The background and differences are set out in Appendix 2

they are calculated are available for q^3 and CAPE[4]. To avoid distorting the relative size of falls and rises, the current values are shown in log terms.

As Figure 1 shows, both methods produce similar results using different data series and thereby confirm their own and each other's validity. This can also be judged by comparisons with past returns (hindsight value), which evaluates the accuracy and confirms the validity of both methods. The R^2 values (coefficients of determination) shown by these tests are 0.80 for q and 0.52 for CAPE. Both are very high and thus strongly confirm the validity of the measures used, with q being the one preferred in this paper as its R^2 is significantly the better of the two.

Currently both measures show that the market is c 150% of its "fair value".

Figure 2: US: Real Annual Equity Returns

Data sources: Jeremy Siegel 1802 to 1871, Robert Shiller 1871 to 2022.

The mean reversion of real equity returns can also be illustrated from the annual returns to shareholders, for which we have 220 years of data (Figure 2).

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[3] Valuing Wall Street by Andrew Smithers & Stephen Wright (2000) McGraw Hill
[4] The Economics of the Stock Market by Andrew Smithers (2022) Oxford University Press.

The near identity of the trend and the average of the log returns provide a convenient way to illustrate the high probability of this ratio being mean reverting. It also provides us with the value of the long-term return around which the annual returns have rotated, and which has been 6.7% (log % 6.49).

These two stationarities are the most obviously exceptional characteristics of the stock market and the explanation of their cause [5] is essential if we are to understand its behaviour. Equity and debt are the two forms of capital which finance the economy's capital stock, and equity is much the largest and most expensive of the two. An explanation of the return, and thus the cost of equity, is therefore essential for growth theory. "A satisfactory model concerning the nature of the growth process in a capitalist economy must also account for the remarkable historical constances…"[6]

These constances have been termed "the great ratios"[7] and the authors of a recent analysis found "support for five of the seven ratios considered", but the subject of this paper, which is the mean reversion of the real return on equity, was not one of those they considered.[8]

This paper explains that share prices are determined by the decisions of companies and households who buy and sell them, and which follow from the way members of these sectors behave in aggregate. Their actions lead to the equity market's stationarity, while changes in nominal corporate bond yields, profit margins and government bond issues cause the stock market's fluctuations around fair value and the variations in the real return on equity around its average of 6.7%.

The stability of the average real return on equity enables us to value the stock market and thus to calculate the cost of equity at any time. For example, the cost of equity is 3.35% (6.7 ÷ 2) when the stock market is 100% overvalued (log value is plus one in Figure 1) and 13.4% (6.7 × 2) when it is selling at only half its net worth, and thus at log value minus one in Figure 1.[9] Managements, however, ignore these swings in the cost of equity and invest when the expected return on equity matches the average long-term return on equity of 6.7%. This

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[5] Net worth is the value of past accumulated retained profits. Provided that retained profits are accurately measured, the stationarity of the real return on equity will also result in the stationarity of published data on *q*.

[6] Nicholas Kaldor (1957). *A model of economic growth* The Economic Journal, Vol. 67, pp. 591–624.

[7] Klein, L. and Kosobud, R. F. (1961). *Some econometrics of growth: great ratios of economics*, The Quarterly Journal of Economics, Vol. 75, pp. 173–198.

[8] The five "great ratios" whose mean reversions the authors supported were: (i) Consumption/GDP, (ii) Imports/Exports, (iii) Investment/GDP, (iv) Government debt/GDP and (v) Short-term/Long-term interest rates.

[9] I use log values to base 2 in this version of Figure 1.

is known as the "hurdle rate" and its stability results in the return on equity itself being stable, as set out in the stock market model (SMM).[10] The validity of both its assumptions and the conclusions which follow from it are shown to be robust when tested, using US data, and the details are summarized and set out in Appendix 1.

Mean Reversion of q

The balance between equity and debt in company balance sheets (corporate leverage) has its counterpart in the balance of the financial assets owned by the household sector (portfolio preference). In addition to the corporate sector, the only other net source of debt assets owned by the household sector for a closed economy is the government[11] and, if that sector's debt requirements are stable, changes in corporate debt liabilities must match changes in the household sector's net debt assets.[12] Both existing corporate balance sheets and new investment are financed with a mixture of debt and equity, which are provided by the household sector, so the value of corporate equity, (its net worth), must equal the value of the equity owned by households using the same method of valuation.

In equilibrium the rate of interest must be that required to keep net *ex ante* savings at zero, but it must also be consistent with stable levels of corporate leverage and household portfolio preference, and this is only possible when q is at fair value. This can most easily be shown by defining the savings for the corporate sector as the profits after tax minus the broad dividend, which is all forms of cash paid out to shareholders and is the sum of dividends, as normally defined, plus buybacks and debt-financed takeovers, minus new equity issues. Companies then retain all the equity they need to finance new investment. They also require additional debt, and this must be provided by the household sector in a way that leaves leverage and portfolio preferences unchanged.

The value of the broad dividend differs from profits after tax by the amount of the narrow dividend and the value of any equity transferred between the household and corporate sectors, from buybacks, net new issues and changes in equity arising from debt-financed takeovers. If q is above fair value and companies buy shares from households, they are paying more than fair value

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[10] *The Economics of the Stock Market* op. cit.
[11] The gross level of debt assets includes borrowings by the members of the household sector from each other.
[12] This will also apply to an open economy unless there is a change in the balance of payments.

for the shares and their purchases will put upward pressure on share prices. Corporations' debt must then rise by more than the replacement cost value of the increase in their net worth. Net worth would then fall, and q rise, even if share prices were unchanged, and by even more if the prices rise in response to corporate buying.

If q is at fair value, the broad dividend equals the payout ratio of the stationary return on equity and the amount that companies must borrow from households to finance new investment is the total level of savings needed to finance total investment, minus the cash retained, i.e. profits after tax minus the broad dividend. As total investment equals total savings, in a simplified economy in which all investment is made by companies, consumption equals incomes from employment and the value of the cash lent by the household sector to companies must equal their requirement for debt finance. As companies seek to maintain a stable ratio of debt interest payments to profits, at any given levels of profits and new investment there is only one bond yield at which the value of the cash lent by the household sector to the corporate sector will equal the amount of debt needed to finance new investment.

If the bond yield is too low, the broad dividend will be greater than the amount of new debt that companies need to borrow and, if it is too high, the broad dividend will be insufficient. The supply of both bonds and equities is fixed in the short term and if households have excess cash, they will seek to spend it on goods and services or financial assets and there will either be consumer price or asset inflation and if households have insufficient cash there will be consumer price or asset deflation, probably accompanied by rising unemployment. Only if the bond yield is correct will household savings from the broad dividend match the need for corporate borrowing.

If the bond yield is too low, companies will seek to increase their borrowing and the value of new projects for which the expected return on equity exceeds the hurdle rate will rise. Demand will then be boosted by companies as well as households. Equally, when bond yields are too high, demand will be depressed by the actions of both sectors.

There are therefore two conditions for a stable stock market, bond yields must be at their equilibrium level and q must be at fair value.

To ease the simplicity of the explanation, I have defined corporate savings as profits after tax minus the broad dividend. In national accounts, however, they are defined as corporate after-tax profits minus the narrow dividend. The

difference is that the raising and reduction of equity through buybacks, takeovers and new issues are treated by national accountants as capital transfers and in the definition used in this paper as income transfers.

The explanation of how mean reversion works using the national accounts' definition is basically the same as that used here, just a bit more complicated. If net equity issues are treated as capital transfers, the cash flow needed by the household sector will be greater than when they are treated as income transfers but, in addition to the cash needed to finance the rise in corporate debt, there will be the same amount needed to finance the addition to corporate equity. Recorded income will, however, be higher to the same extent, so the same shortfall will arise if q is above fair value. The pressure on share prices to revert to their mean will be unchanged, only the explanation of the process is slightly more complicated.

To draw attention to the essential point, and thereby risking excessive compression, the stationarity of q can be summarised as following from (i) the *ex post* identity of savings and investment, (ii) the ability of changes in interest rates, in the absence of liquidity traps, to control demand combined with the way interest rates determine leverage and thus the proportions of equity and debt used to finance the corporate sector and (iii) the need for changes in corporate leverage to reflect the portfolio preferences of the household sector.

Liquidity Traps

In liquidity traps interest rates cannot be reduced to a level at which private sector *ex post* savings equal *ex post* investment. Household intended savings are greater than the amount that companies need to finance the debt element in their new investment. Government borrowing can be expanded by an increase in the budget deficit, so that there is no longer a national *ex ante* net savings' surplus, and the government can provide the bonds that the household sector needs to buy and which are not being issued by companies. This is not, however, without its problems. Household ownership of corporate equity and bonds must reflect that of companies, as only companies can issue new equity or redeem any of the existing stock. Equities cannot be used to finance annuities which are needed by those who wish to maximize their consumption in retirement. The demand for bonds by those retired is thus, to a significant degree, unaffected by the level of bond yields and household portfolio

preference for equities compared with bonds is thus inelastic and adapts to the supply of each asset class as determined by corporate leverage. The demand for bonds depends on the need for them to balance the demand for annuities; once the required level of household liquidity has been secured, the balance of household savings will be available for the purchase of bonds and equity. Government can provide bonds but not equity. It is likely that the demand for annuities will rise as household retirement assets rise in value but, as no new equities are being issued, the rise in value must come from a rise in the price rather than from the volume of shares outstanding.

Another way to solve the problem presented by a private sector net *ex ante* savings' surplus is for corporate investment to rise, for example in response to a cut in corporation tax. A new equilibrium will then be possible and will probably include higher levels of interest rates, as the broad dividend payout ratio will fall, but the reduction in household cash available to buy bonds issued by the corporate sector will be offset by a rise in household sector savings.

Corporate Leverage

Figure 3. US: Non-financial Companies' Interest Cover

Data source: NIPA Table 1.14.
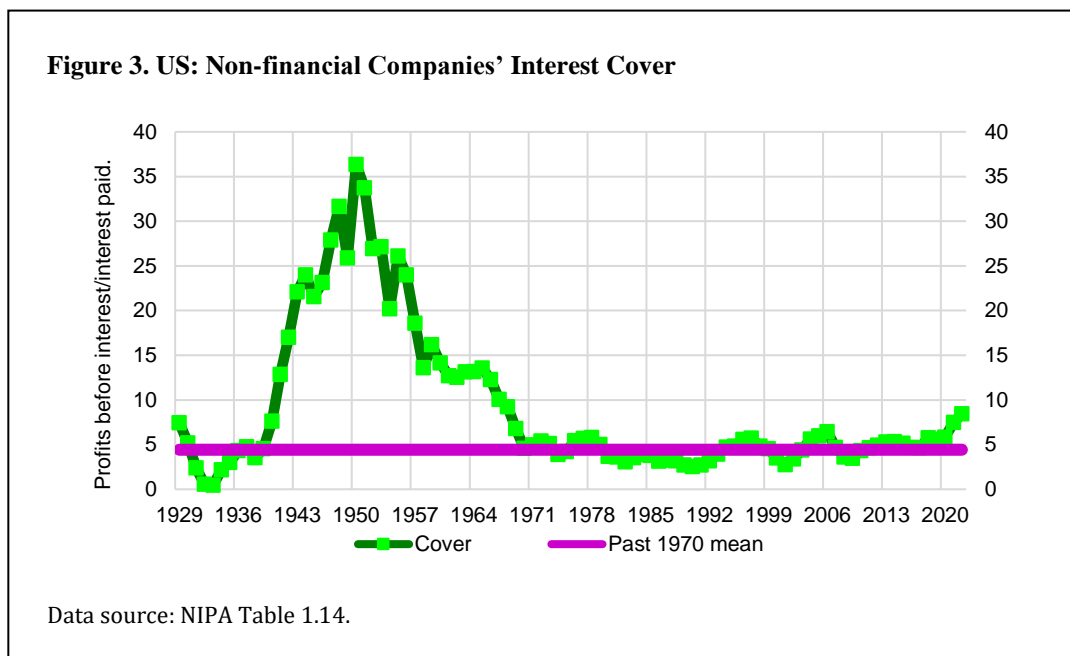
The time needed for the process of mean reversion is provided by the short-term flexibility of the corporate sector's leverage which, as Figure 3 illustrates, has an equilibrium level. Leverage therefore varies with the level of bond yields.

Borrowing short-term is risky for companies, as inflation has a more immediate impact on short-term interest rates than on profits, so companies prefer to raise new debt by issuing bonds. Debt is cheaper than equity, but the proportion of debt is limited by the risk involved. Leverage can be adjusted slowly by changing payout ratios and rapidly either by cutting dividends or raising new equity. Shareholders dislike both quick methods and managements risk their jobs if they incur the ire of their companies' owners. Leverage is therefore limited, despite the lower cost of debt, as managers wish to reduce the risk that declines in profit will force their companies to raise new equity capital rapidly. The risk aversion of corporate managers, which appears to be stable over time,[13] results in companies seeking to maintain a stable ratio of profits to their interest payments.

Maintaining a stable ratio of interest payments to profits proved, however, to be impossible during World War II as priority was given to government borrowing. From 1940 to 1950 corporate debt issuance was restricted and the ratio of profits to interest payments (cover) rose sharply, as illustrated in Figure 3. It then fell quickly when the restrictions were removed and corporate leverage had, by 1970, returned to its target ratio.

As companies seek to maintain a stable ratio of interest payments to profits, they reduce leverage when the cost of new bonds rises. To do this they need to increase their net worth either by issuing new shares, reducing dividends, buybacks and debt-financed takeovers or making more equity new issues. As shareholders dislike cuts in dividends, which are often interpreted as being driven by unrevealed problems, other methods are preferred. These involve increasing the supply of new equity, for example by fewer debt-financed takeovers or buybacks, thus reducing share prices.
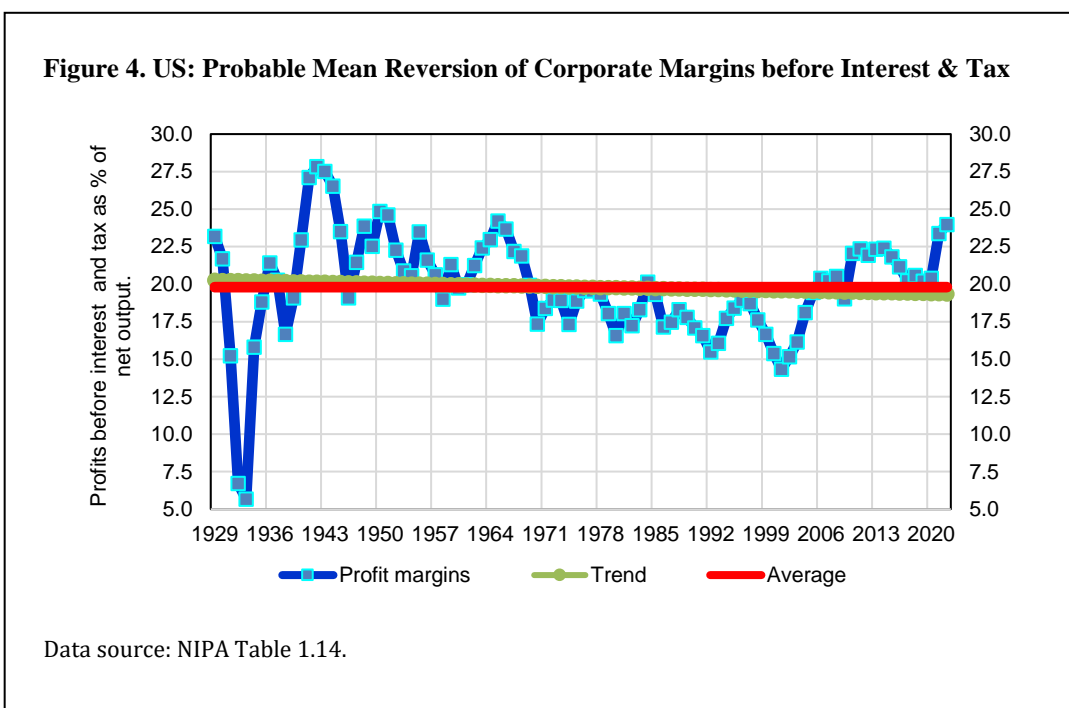
Changes in corporate bond yields consequently cause changes in share prices, but the impact is limited to the change and has no sustained impact. "Interest rate changes, which importantly include both anticipated and unanticipated movements, are seen to have a strong effect on stock price

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[13] "It is *populations* that evolve…Individual members of the population differ from one another, but the population itself has a stable genetic structure, i.e. a stable pattern of genetic inequality". *The Threat and the Glory* by Peter Medawar (1990) Oxford University Press (Medawar's italics). Blood groups and risk aversion provide examples of individual variations combined with hereditary stability for the population in aggregate.

movements 3–15 months after the interest rate change, although they have little immediate impact. But any effect disappears in the medium run, at forecast horizons of more than 18 months."[14]

The aim of a stable ratio between profits and interest payments leads to changes in leverage when profits as well as interest rates change. Profits change with output and profit margins but, as debt rises with output if leverage is stable, the key variables are profit margins and corporate nominal bond yields, rather than changes in total profits and total interest payments.

Profit Margins

Figure 4. US: Probable Mean Reversion of Corporate Margins before Interest & Tax

Data source: NIPA Table 1.14.

It is widely accepted by economists that profit margins are stationary.[15] Its probability is illustrated in Figure 4 and has been often tested. For example, "Using the annual data for US corporate profits margins, which we have for 1929 to 2011, the Augmented Dickey-Fuller (ADF) test statistic is -4.683. This is a clear rejection of non-stationarity (the associated p-value is 0.000) and

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[14] *Interest Rates, Profits and Share Prices* (2009) Appendix 3 by James Mitchell *Wall Steet Revalued* by Andrew Smithers John Wiley & Sons.
[15] *Public Debt and Low Interest Rates* by Olivier Blanchard (2019) American Economic Review 109 (4).

therefore indicates that US profit margins are mean reverting."[16] Profits will swing with changes in margins, but the impact will reverse as they are mean reverting. Share prices respond to changes in nominal bond yields, but the impact is ephemeral. For share prices to continue to rise, bond rates must continue to fall – unless, as I show later, there are changes in the supply or need for household liquidity.

Household Portfolio Preferences

Households save for three purposes: to have a reasonable standard of living in retirement, as a precaution against the sudden needs that arise from illness or unemployment, and for short-term bouts of spending on holidays and Christmas. The household sector's financial assets consist of three asset classes, cash, bonds and equity. Only bonds and equities are suitable for pension saving, as returns on cash are low and liquidity is not needed once adequate provision for it has been made, but only cash is suitable for other types of savings. In equilibrium households hold the amount of cash they need to match their needs for liquidity and the remainder is available to finance their consumption in retirement (their pension assets) and will sensibly be invested in bonds or equities.

If real and nominal interest rates are unchanged, corporate leverage will be stable, as both the ratio of debt interest to profits (Figure 3) and profit margins are stationary (Figure 4). Household ownership of corporate equity and bonds must reflect that of companies, as only companies can issue new equity or redeem any of the existing stock. The portfolio preferences of the household sector, which determine the division of its long-term financial assets between bonds and equities, depend on their different characteristics, of which a key one is that equities cannot be used to finance annuities which are needed by those who wish to maximize their consumption in retirement. This is important both for individuals and for pension schemes. The demand for bonds by those retired is thus, to a significant degree, unaffected by the level of bond yields and household portfolio preference for equities compared with bonds is thus inelastic.

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[16] *Mean Reversion of US Profit Margins* (2013) by James Mitchell Appendix 1 *The Road to Recovery* by Andrew Smithers John Wiley & Sons.

Households will seek to change their ratio of long-term financial assets (equity plus bonds) to cash if they find that their precautionary needs have changed, as may occur in response to changes in health or unemployment benefits, or the amount they own. Large and rapid changes in the need for precautionary savings are unlikely but the supply of liquid assets by the government can alter sharply, as has occurred recently in the US. Longer term changes in the precautionary need for liquidity will have an impact on bond yields but, because of their relative inelasticity, not on the return on equities and the hurdle rate.

If the fiscal deficit increases, the cash flow of the private sector rises to the benefit of the corporate or household sectors. The proportionate distribution between the two sectors will depend on the way the deficit changes. The immediate impact of tax cuts, for example, will first be a flow which benefits whichever sector pays less. If companies gain, this must be reflected in either a rise in depreciation, or profit margins, or output. As margins are stationary, an increased deficit will in equilibrium either increase depreciation or boost output. Depreciation is a function of the rate of growth of real wages and will only rise if the change in the fiscal deficit boosts investment and growth.[17]

When an increased deficit offsets a temporary weakness in "the animal spirits of entrepreneurs" corporate investment will be boosted and this will revitalise demand, as Keynes hoped, and as fiscal deficits are traditionally designed to do. The rise in the deficit can then be reversed without damaging demand. If it is not reversed, it would then be excessive given the recovery in corporate investment.

If households' cash flow rises from the increased fiscal deficit, the impact will vary with the use to which the increase in liquidity is put. If it is spent on goods and services, demand will rise and in a closed economy will lead either to more output or higher prices. If the response of the private sector, either through its corporate or household parts, is to raise short-term demand without raising inflation, the rise in the fiscal deficit will have been successful in dealing with a cyclical downturn.

The fiscal stimulus may, however, do no more than prevent unemployment from rising. If short-term interest rates are at a level at which demand does not respond to further cuts, the economy is suffering from a structural rather than

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[17] *Neoclassical Growth with Fixed Factor Proportions* by R.M. Solow, J. Tobin, C.C. Weizsacker & M. Yaari (1966) The Review of Economic Studies Vol 33 No 2.

a cyclical liquidity trap, which has also been termed secular stagnation.[18] The addition to private sector cash flow induced by a rise in the fiscal deficit does not, in a structural liquidity trap, lead to a revitalized economy in which output is rising at a satisfactory pace and unemployment and inflation remain low and stable. The increased deficit cannot be reversed without demand falling and unemployment rising, nor can it always be funded by the sale of either Treasury bills or government bonds, without precipitating a recession. The government can only issue bills to the extent that there is a demand for them at the current level of short-term interest rates, and it will not wish to sell bonds if the resulting rise in bond yields has an adverse impact on demand and unemployment.

An overvalued stock market then becomes a problem for the central bank's management of demand. The market will fall in the absence of support for share prices, and this tends to lower demand. Without rises in either the budget deficit, interest rates or household liquidity, q will revert to its mean through falling share prices.

The Threat of Falling Share Prices

Successfully managed economies combine brisk growth in output with low and stable rates of unemployment and inflation. We live in an economy with multiple potential sources of disequilibria, so that successful management of the economy cannot be assured simply by keeping demand properly balanced with available supply. We also need to avoid excessive levels of money supply and asset prices.[19] We do not know at any time either the levels of M2/GDP, which will precipitate sudden and unexpected rises in inflation, or the level of q, which will be inescapably followed by crashes in asset prices and the high levels of unemployment. A pragmatic approach to policy is thus essential if we are to avoid either of these errors.

The uncertainty over asset bubbles applies not only to the level at which they become dangers, but their impact once they burst. This is uncertain, as was wittily noted by Paul Samuelson when he remarked that "The stock market has predicted nine out of the past five recessions".[20] When a bear market is defined

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[18] *The Age of Secular Stagnation: What It Is and What to Do About It* by Lawrence Summers (February 2017) Foreign Affairs.
[19] *Escaping the Structural Liquidity Trap* (2024) by Andrew Smithers, Central Banking 19th February.
[20] Paul Samuelson article in Newsweek 19th September 1966.

as one in which nominal share prices fall by at least 20%, it is agreed that Samuelson's estimate has proved sound.

Sensible policy decisions do not, however, require certainty about the level of q at which asset bubbles are dangerous or the consequences of each fall. To avoid the danger of asset bubbles we need only to have a pragmatic view of the point above which they become dangerous, and to understand and thereby avoid the forces that create them. A similar pragmatism is needed to avoid the adverse consequences of a rise in money supply, as its impact on the economy is, to put it mildly, a subject of much and sometimes ill-tempered debate. Unfortunately, repeated attempts to relate changes in money supply to inflation have yielded negative results[21] and there appears to be no monetarist model which sets out assumptions, based on testable hypotheses supported by data, which can be used by policymakers seeking to maintain economic stability. The lack of theory to support policy is not, however, a sensible reason for ignoring threats to economic stability. Mervyn King has thus reasonably blamed the failure to forestall the post-pandemic surge in inflation on "...the collective amnesia in the economics profession about the role of money supply".[22]

As Figure 1 illustrates, it is rare for q to rise to dangerous levels. On only three occasions, 1929, 1999 and now (since 2016), has the US stock market been overvalued by more than 100%. Except when q shows that the stock market is more than 35% overvalued (log ratio 1.30), precipitous falls have been restricted to responses to sharp rises in nominal corporate bond yields or, for periods when corporate bond yields are not available, those of short-term interest rates. For example, short-term rates rose from 1.78% to 7.01% in 1904 to 1907 and from 1.92% to 7.74% in 1915 to 1920, while corporate bond BAA yields rose from 4.49% in January 1935 to 6.42% in April 1936 and from 6.79% in September 1968 to 8.65% in December 1969. One condition for avoiding a stock market crash is thus to avoid sharp rises in corporate bond yields. The other, which is to keep q less than 35% overvalued, means avoiding the forces that push it up.

Avoiding sharp rises in interest rates may not be possible if the economy suffers from great shocks, but it seems that the economy is readily stabilised in

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[21] E.g., *Revisiting the Great Ratios Hypothesis* by Alexander Chudik, M. Hashem Pesaran and Ron Smith (2023) *Oxford Bulletin of Economics and Statistics,* published by Oxford University and John Wiley & Sons Ltd.
[22] Delfine Strauss in the *Financial Times* 2nd May 2024 reporting his comments in the House of Lords on 30th April 2024.

the face of extraneous random variables called "sunspots",[23] which are less serious fluctuations in supply or demand. Monetary policy is liable to make mistakes when seeking to keep demand at its optimal level. Fortunately, subject to an important proviso, the work of Evans, Honkapohja and Marimon indicates that such errors can be readily rectified by changes in interest rates. In the absence of great shocks, monetary policy should therefore be capable of being successful provided that high levels of M2/GDP and q are avoided. The proviso is that the economy responds to changes in interest rates and is not therefore in the grip of a structural liquidity trap.

As noted above, without changes in the budget deficit, interest rates or household liquidity, q will revert to its mean through falling share prices. Avoiding such continuous changes is therefore necessary if the stock market is to be prevented from becoming overvalued. The obvious conclusion is that this should be a major policy aim, but it has, in the past, been resisted.[24] When proposing that central banks should avoid excessive share prices, two decades ago, Stephen Wright and I doubted whether this view would then be accepted by most economists. "We attribute this lack of support, at least so far, to the influence of two key ideas. The first of these is the Efficient Market Hypothesis (EMH), which asserts that markets provide the best available estimate of the value of any asset, including corporate equities. The second is the general consensus that monetary policy should be about controlling inflation and nothing else."[25] "For the purposes of compactness and symmetry" we referred to this second idea as "The Efficient Central Banker Hypothesis (ECBH)." We later noted that "...the proponents of the ECBH are disingenuous since central bankers do respond to stock markets, and openly maintain that they should – but only when they fall not when they rise."[26]

Opposition to preventing asset bubbles has probably weakened since the 2008 financial crisis, as events have once again proved to be more convincing than logic, but it is too late to prevent the asset bubble which we now have and which Figure 1 shows is as pronounced as any recorded before.

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[23] *Stable Sunspot Equilibria in a Cash-in-advance Economy* George W. Evans, Seppo Honkapohja and Ramon Marimon (2007) The B.E. Journal of Macroeconomics Vol 7 Issue 1.

[24] When at Jackson Hole in 2005, Claudio Borio and William White of the BIS suggested "leaning against the wind when faced with debt and asset price expansion" Alan Greenspan responded that he knew of no instance where this had been tried and it had worked.

[25] For a (then) recent assertion that central bankers should concentrate solely on inflation see *Monetary Policy and Asset Price Volatility* by Ben Bernanke and Mark Gertler (1999) Federal Reserve Bank of Kansas City 4th Quarter.

[26] *Stock Markets and Central Bankers: The Economic Consequences of Alan Greenspan* by Andrew Smithers & Stephen Wright (2002) World Economics Vol. 1 No. 3.

Figure 5. US: 10 Year Treasury Bond Yields


Data source: Robert Shiller
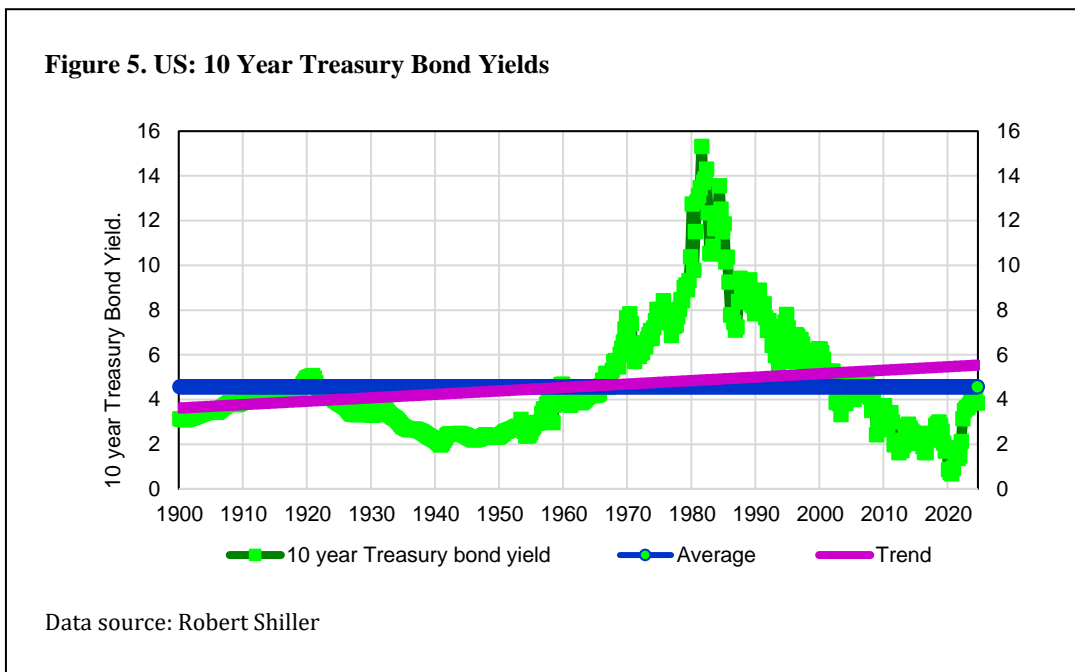
Corporate bonds cost significantly more than Treasury bonds, to pay for the costs of default and corporate analysis; between 1919 and 2024 the average markup for BAA bonds has been 2.06% and of course even more for bonds of lower quality. Treasury bond yields have since 2000 averaged 4.58%, but for three extended periods have been below 3% (Figure 5). That from 1940 to 1960 was affected by the wartime credit controls, but those from 1930 to 1940 (2.92%) and those from 2002 to 2022, have been periods of structural liquidity traps, when the level of nominal corporate bond yields and the resulting ability of the Federal Reserve to manage demand could only be brought down by QE or other forms of underfunding, given the normal premium for bonds over short-term interest rates. There were therefore also periods in which banks' reserves and household liquidity rose sharply.

q reverts to its mean unless it has continuous support from some positive change. To avoid the risk that a current overvalued stock market will decline and thereby precipitate a sharp rise in unemployment, either bond yields must keep falling, profits must keep rising, or private sector liquidity must keep expanding. As profit margins are mean reverting and currently above average, they are likely to fall and, as bond yields are currently around their post 1900 average (Figure 5), they cannot be relied upon to provide support for the stock

market by declining. To avoid the risk of a large rise in unemployment the Federal Reserve seems driven to keep private sector liquidity rising. "Since about 1997 at the latest, central banks have faced a dilemma which they could not resolve. They are always having to choose between bad outcomes and worse outcomes."[27]

Fluctuations in optimism and pessimism, whether purely random or stimulated by changes in bond yields, profit margins or liquidity, do not have great significance for the economy, but large falls in stock markets produce occasional panics. The evidence for this is shown by the fact that stock market falls have been faster and nastier than rises.

Figure 6: US: Distribution of Equity Returns 1871 to 2019

Data source: Robert Shiller
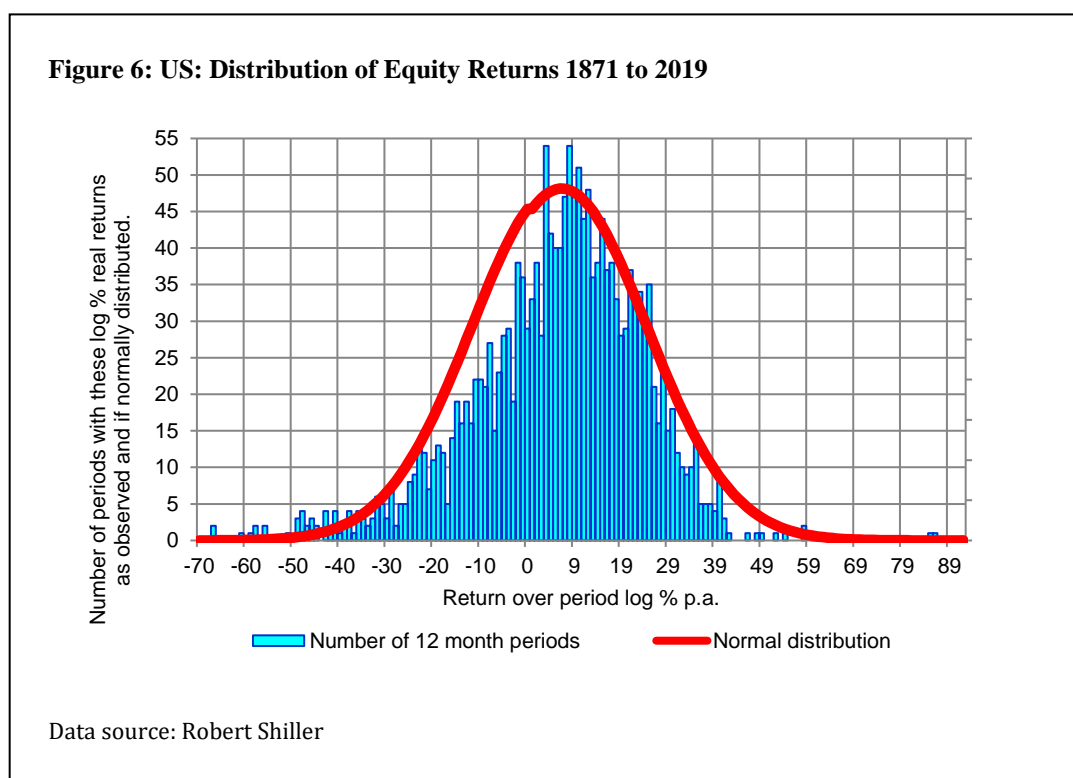
If rises and declines of the same extent were equally balanced, then a chart showing the frequency with which they occurred would be symmetric, but Figure 6 shows that this is not what history records.[28] Large falls have been far
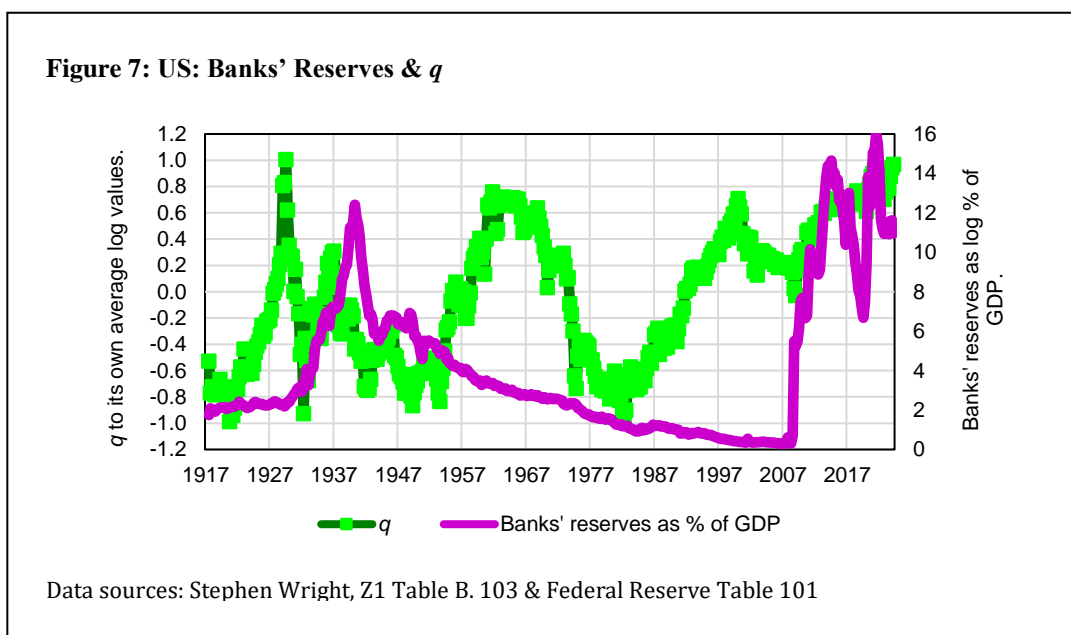
[28] Figure 6 shows returns as log % so that falls and rises have the same value and a fall of log x% followed by a rise of log x% would leave the level unchanged, which would not be the case if standard percentage changes were used.

more common than similar rises (kurtosis), and this is balanced by rises being more common than falls (skew). 90% of the time the stock market has given above average real returns, and this is balanced by the fact that 10% of the time investors have received negative real returns, which are usually strongly negative in nominal terms.

Examination of panics and crises is termed by Ricardo Caballero as "belonging to the *periphery* (his italics) of macroeconomics rather than its core."[29] Papers on these peripheral issues have dominated economists' attention to the exclusion of those which address the core issue of how and why equity returns are stationary. There has also been a marked tendency for any explanation to concentrate on households' demand for equity, rather than on corporate supply, thereby underestimating the key determinant of share pricing.
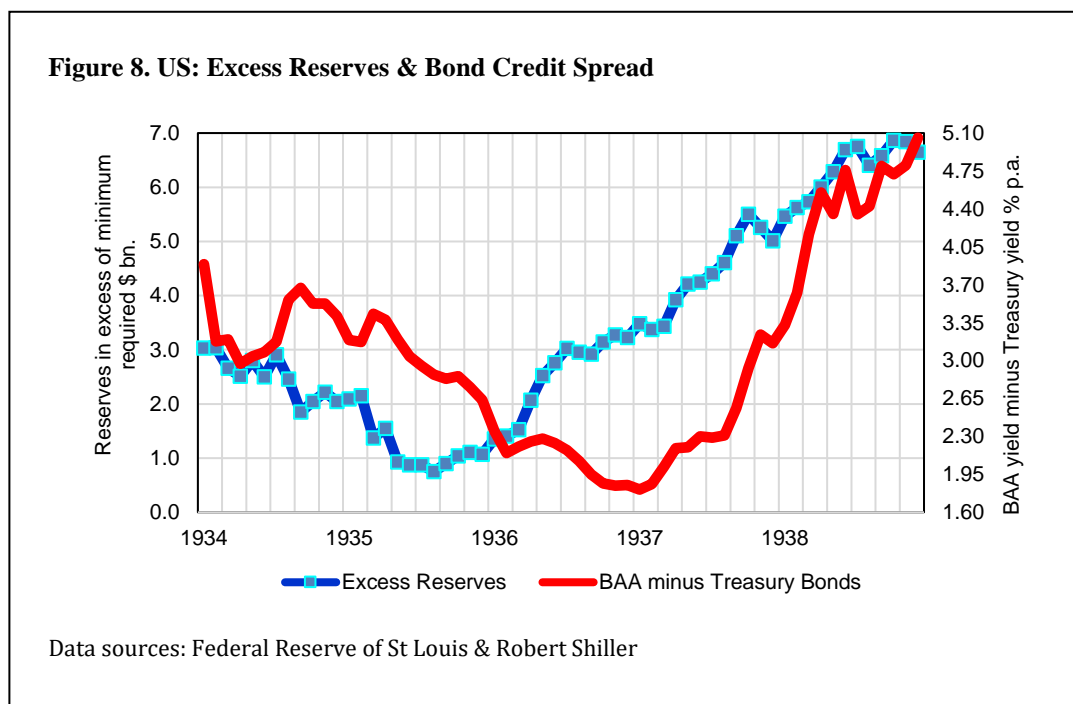
Two Structural Liquidity Traps

On two occasions banks' reserves as a percentage of GDP have risen dramatically. The most recent followed the introduction of quantitative easing (QE) in 2009 and a similar surge occurred in the 1930s. Both were occasions when the US was suffering from a structural liquidity trap.

Figure 7: US: Banks' Reserves & *q*

Data sources: Stephen Wright, Z1 Table B. 103 & Federal Reserve Table 101

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[29] *Macroeconomics after the crisis* by Ricardo Caballero (2010) Journal of Economic Perspectives 24 (4) 85–102.

Figure 7 compares *q* and reserve balances as a percentage of GDP from 1917 to 2023.[30] Both in the 1930s and since 2008, the rise in reserve balances has been followed by large rises to high levels of *q*.

The shorter-term relationship between bank reserves and share prices is, however, very different in the two periods. The dramatic stock market fall in 1937 followed the Federal Reserve's wish to sterilise the massive level of banks' reserves by the introduction of minimum reserve requirements. "Motivated mainly by a desire to put the System in a position where it could use open-market operations to affect the economy in the future should it wish to do so … in 1936 and 1937 the Federal Reserve doubled reserve requirements."[31] The increase in minimum reserves reduced the banks' ability to expand their balance sheets, though making additional loans or buying bonds, and it reduced their prospective profitability because additions needed to be backed by reserves on which returns were determined by short-term risk-free interest rates which were extremely low. The process whereby the rise in minimum reserves caused share prices to fall followed the steps set out below:

Figure 8. US: Excess Reserves & Bond Credit Spread

Data sources: Federal Reserve of St Louis & Robert Shiller

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[30] For GDP data before 1947, the quarterly data are derived by linear interpolation.
[31] *Does Monetary Policy Matter? A New Test in the Spirit of Friedman and Schwartz* (1989) by Christina Romer and David Romer NBER Working Paper No. 2966.
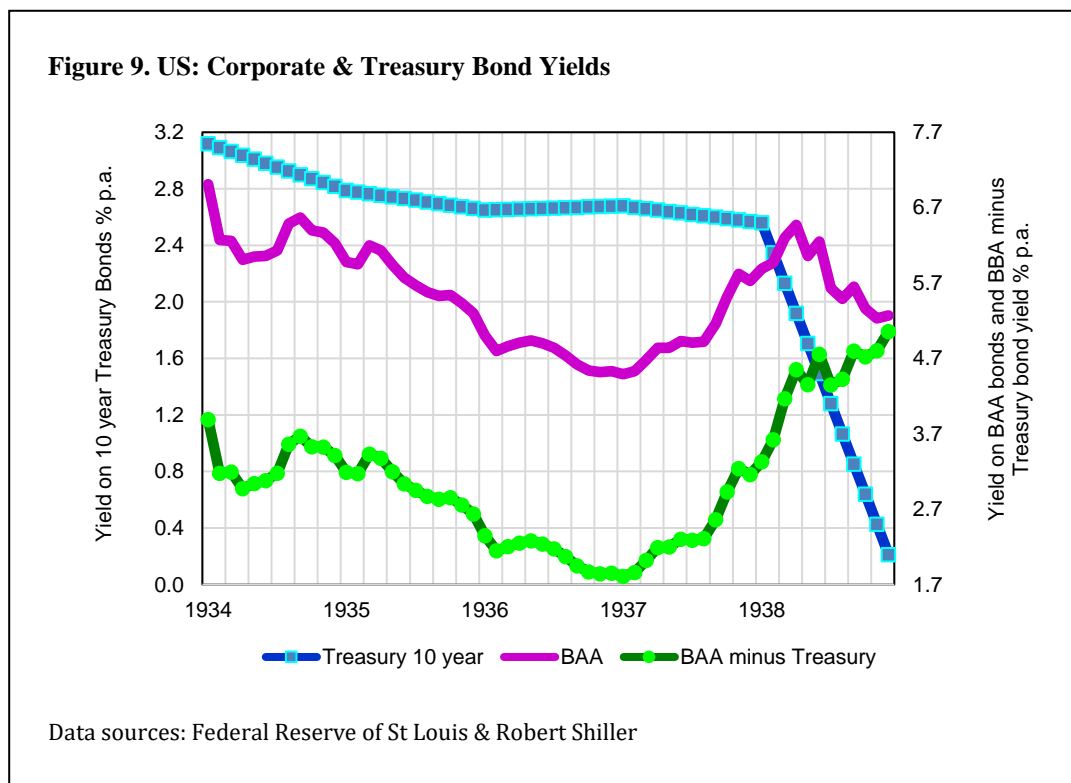
(i) With a lag of around eighteen months, credit spreads widened in response to the decline in excess reserves (Figure 8), so that corporate borrowing costs rose despite a continued fall in Treasury bond yields (Figure 9).

(ii) The rise in corporate borrowing costs, reduced corporate support for equities and share prices moved with corporate rather than Treasury bond yields (Figure 10).

(iii) Share prices thus moved with changes in excess reserves with a 12-month time lag (Figure 11).[32] (The coefficient of correlation is 0.70384, R^2 = 0.49569).

(iv) The reduction in the proportion of new investment financed by bonds reduced the amount of new investment for which equities' returns passed the hurdle rate. Business investment fell, unemployment rose from 14.3% in May 1937 to 19.0% in June 1938 and manufacturing output fell by 37%.

The Federal Reserve has not shown any similar worries about today's elevated level of banks' reserves. The 1936 experience suggests that seeking to sterilise them by altering reserve requirements has a substantial risk of precipitating a major recession.
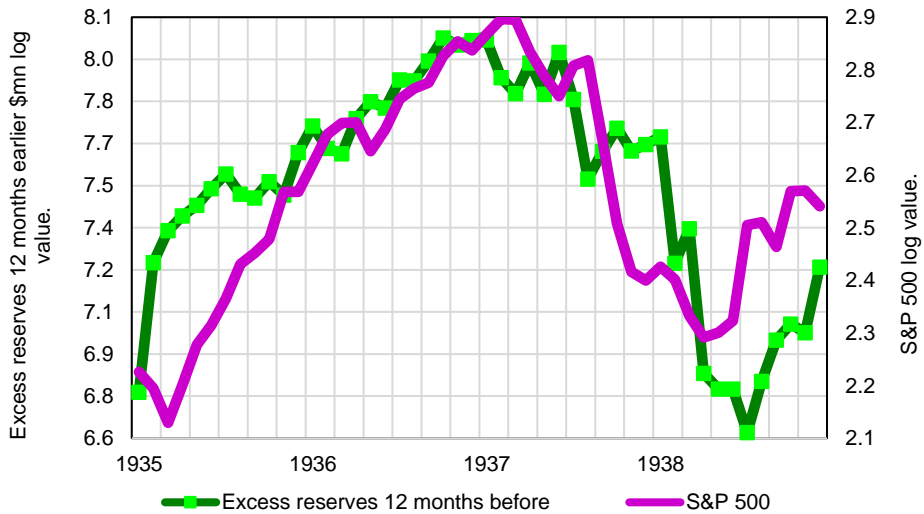

Figure 9. US: Corporate & Treasury Bond Yields

Data sources: Federal Reserve of St Louis & Robert Shiller

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[32] I use log values for both data series so that the proportionate changes are the same.

Figure 10: US: Corporate & Treasury Bond Yields and Share Prices
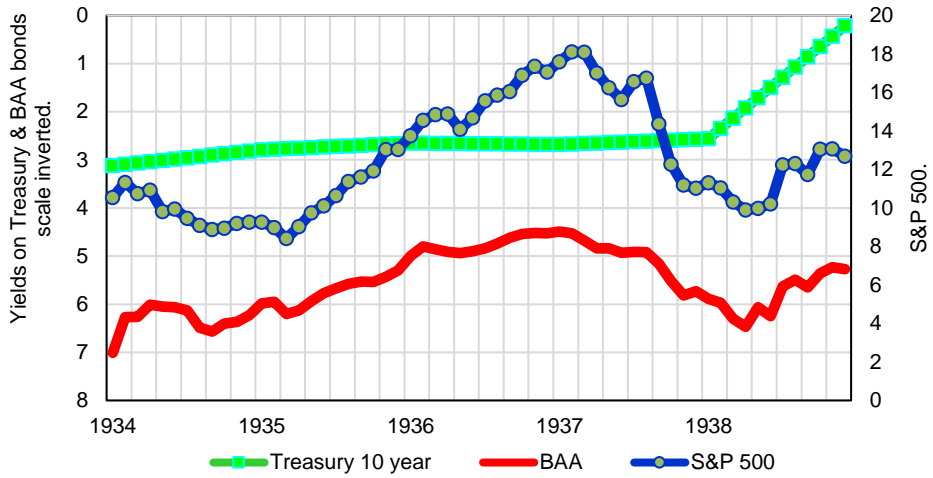
Data sources: Federal Reserve of St Louis & Robert Shiller

Figure 11: US: Excess Reserves & S&P 500

Data sources: Federal Reserve Table 101 & Robert Shiller

Measuring Excess Liquidity

Fluctuations of q around its mean follow from changes in nominal corporate bond yields, profit margins and the liquidity of the household sector. Without changes in one or more of these variables the market reverts to fair value. An overvalued market will revert to its mean if the changes which have pushed it above fair value halt and will fall back with additional force if they reverse. I therefore look at the historic changes in the level of q to identify the variables which, at different times, have been the cause of the major swings in stock market value.

I showed in the previous section headed Two Structural Liquidity Traps how changes in the effective level of household liquidity drove changes in share prices from January 1934 to December 1938, through changes in banks' reserve requirements. I shall seek to explain other historic changes in a parallel way, but this emphasises the problem that households and companies do not necessarily respond immediately to changes in the three variables. Figure 11 shows the delayed lagged response of share prices to changes in banks' excess reserves; allowing for a 12-month lag, the coefficient of correlation is 0.70384 and the coefficient of determination (R^2) is 0.49569, but without a lag there is no relationship as the coefficient of correlation is -0.18953 and the R^2 is -0.18953.

While we have data on Treasury bond yields from 1900 to 2024, I had only been able to find data on BAA yields from 1919 and quarterly data on profit margins are only available since 1947. The relevance of bond yields to share prices lies in the response of companies to the cost of new long-dated bonds and this did not apply from 1940 to 1970 due to the restrictions on the access of the private sector to the long-dated bond market during World War II and the subsequent delay while balance sheets adjusted (Figure 3).

Subject to these data problems, the period of credit restriction and recovery, and random short-term fluctuations in confidence, the movements of the stock market around fair value can be explained by the changes in these three variables and, in the absence of their changes, by its mean reversion.

Table 1: Correlation coefficients of US q and BAA bond yields, Profit margins & Banks' reserves as % of GDP.

	BAA yields	Profit margins	Banks' reserves
All data	-0.3403	0.3051	0.3049
Best 20 years	-0.9256	0.7343	0.9506
Best 10 years	-0.9201	0.8879	-0.9347
Best 5 years	-0.9559	0.9114	0.9363
20 years to Q2 2024	-0.8110	0.4735	0.8386
10 years to Q2 2024	-0.1914	0.2502	0.2670
5 years to Q2 2024	-0.1359	0.3330	0.6435

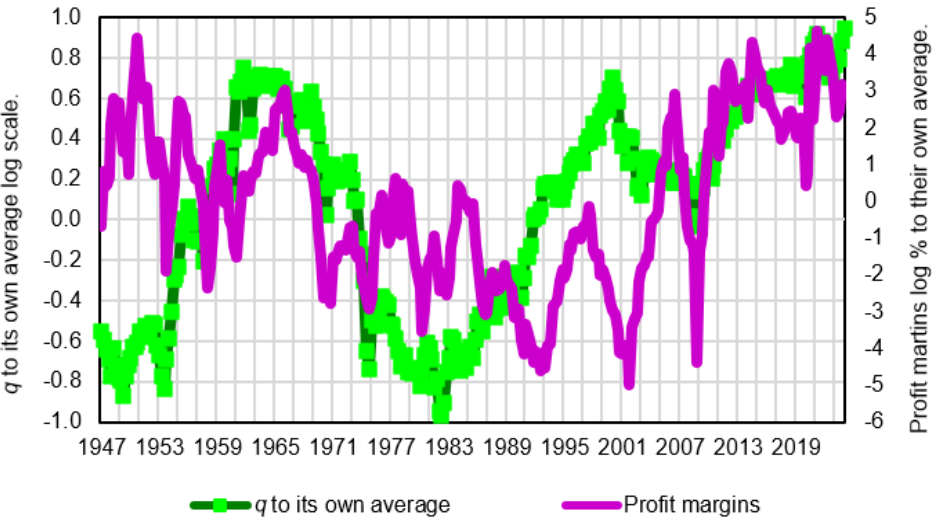Data sources: Stephen Wright, Z1 Table B. 103, NIPA Table 1.14 & Federal Reserve Table 101.

The importance of the three variables has varied, as set out in Table 1 and illustrated in Figures 12, 13 and 14. Judged by their long-term correlations, all three variables are of equal but limited importance. At times each appears to have been the main determinant of the market's level. In recent years banks' reserves have been much more important than either bond yields or profit margins. This is seen from the coefficients of determination (the square of the correlation coefficients R^2) shown in Table 1 which, over the past 5 years, have been 0.0185 for bonds, 0.0111 for profit margins and 0.4142 for banks' reserves as % of GDP.
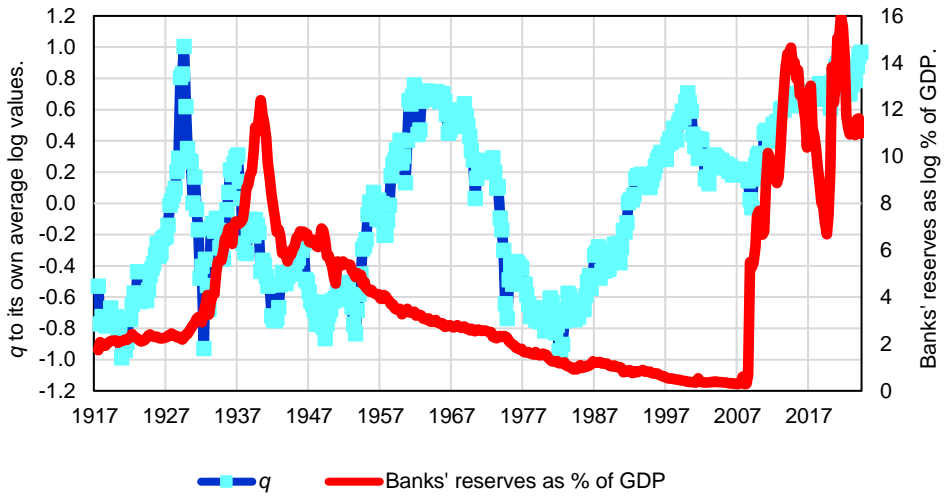
Figure 12: US: BAA Bond Yields & *q*
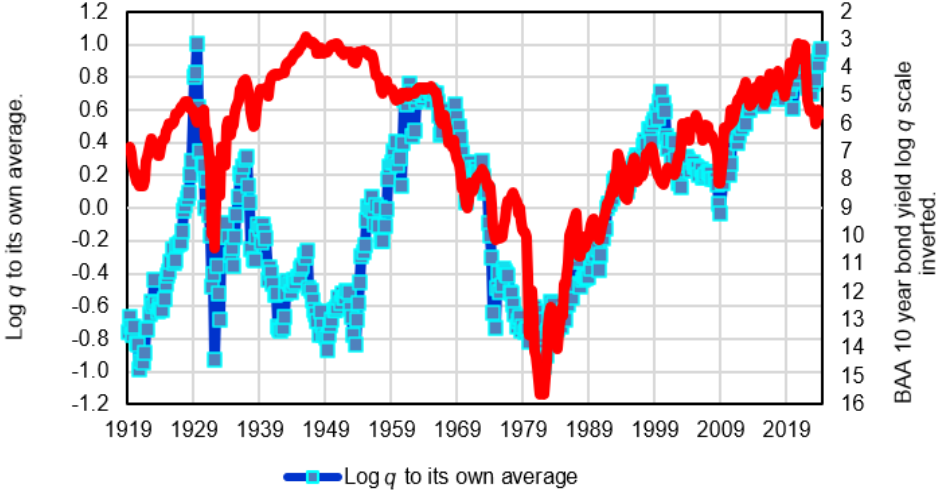
Data source: Federal Reserve of St Louis.
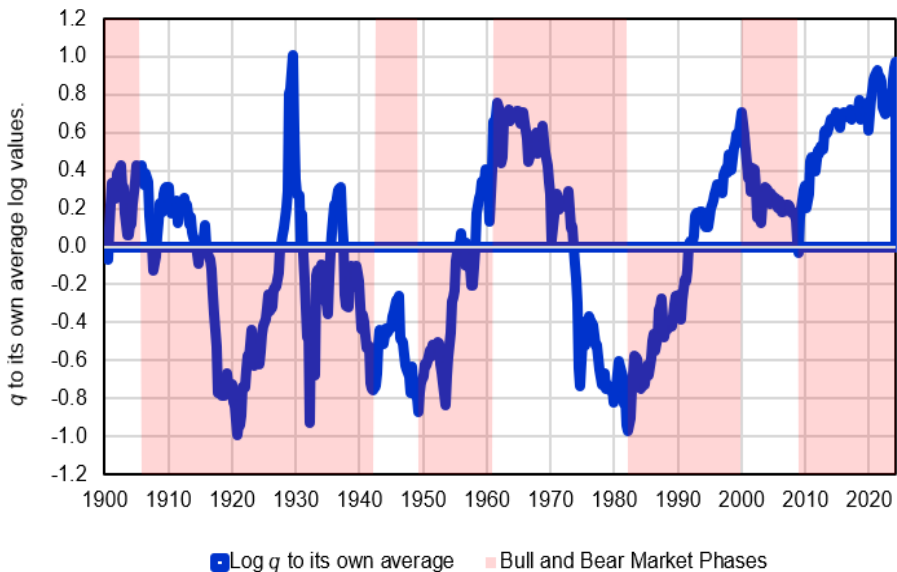
Figure 13: US: Profit Margins & *q*

Data sources: Z1 Table B. 103 & NIPA Table 1.14

Figure 14: US: Banks' Reserves & *q*

Data sources: Stephen Wright, Z1 Table B. 103 & Federal Reserve Table 101

Figure 15: US: Bull & Bear Market Phases

Data sources: Stephen Wright & Z1 Table B. 103.

While the long-term correlations show the same level of importance for each variable, a comparison of Figures 12, 13 and 14 suggests that bond yields have more often been the main determinant of major stock market movements than the other variables. I test this by showing the major bull and bear market phases identified in Figure 14 and examining the importance of BAA bond yields during these phases.

Table 2: Correlations between q & BAA bond yields.

From	To	Coefficient of correlation	R^2
Q2 1921	Q3 1929	-0.7070	0.4999
Q3 1929	Q2 1932	-0.8768	0.7687
Q2 1932	Q1 1937	-0.9337	0.8718
Q1 1937	Q2 1942	0.3637	0.1322
Q2 1942	Q2 1949	-0.4094	0.1676
Q4 1961	Q2 1982	-0.8666	0.7509
Q2 1982	Q1 2000	-0.9131	0.8337
Q1 2000	Q2 2008	0.7010	0.4914
Q2 2008	Q2 2024	-0.7639	0.5835

Data source: Federal Reserve of St Louis

Table 2 shows the correlations between q and corporate bond yields during the 10 phases starting January 1919 for which data are available. In all but two bull and bear phases of the stock market, Q1 1937 to Q2 1942 and Q1 2000 to Q1 2009, there has been a strong negative correlation between bond yields and $q.$ The relationship from Q2 1942 to Q2 1949 was, however, weak, with an R^2 of only 0.1676

The lack of correlation between BAA bond yields during the period Q1 1937 to Q2 1942, arises from the break that occurred after 1940 when wartime restrictions on corporate access to debt markets became effective from 1940 onwards (Figure 3) and household liquidity dried up as banks' reserves fell relative to GDP due to sharp rises in both real output and inflation. From Q1 1940 to Q2 1942 q moved with banks' reserves as a percentage of GDP (correlation coefficient 0.83335) and the stock market fell as household

liquidity dried up. The weakness of the stock market's response to bond yields from 1942 to 1949 is due to wartime restrictions being applied throughout.

In Q2 2008 the Federal Reserve introduced QE and this produced a sharp rise in commercial banks' reserves (Figure 13) and the boost this gave to household liquidity has since driven the stock market. From Q2 2008 to Q2 2024 the correlation coefficient (R^2) of banks' reserves and q has been 0.83335.

Changes in corporate bond yields thus explain all but three of the stock market's major fluctuations. Those that took place in the 1930's differ significantly, however, from those between 1963 and 2000. Changes in the credit spreads between BAA and Treasury bonds were the key in the 1930's, while the large fluctuations in the level of inflation caused the changes in both Treasury and corporate bonds between 1963 and 2000.

Conclusions

(i) The real return on equity is mean reverting.

(ii) The proportions of equity to debt used in the financing of new corporate investment are determined by the current nominal cost of corporate bonds.

(iii) The *ex post* identity of investment and savings also requires an *ex post* identity of the flow of savings available to finance the equity and debt proportions of new investment. This identity is only possible when q is at fair value. Temporary swings around fair value can be accommodated by swings in leverage but, except when interrupted by wartime regulations and their aftermath, these swings are temporary as companies seek to adjust their leverage to a stable ratio of debt interest payments to profits. This process of adjustment causes mean reversion, with its force rising with the extent to which q differs from fair value*.

(iv) Changes in bond yields, profit margins and households' liquidity cause temporary changes in q, but the impacts are ephemeral and continued changes in the same direction are needed to prevent q reverting to its mean.

(v) Short-term fluctuations of interest rates, bond yields and household liquidity are partly dependent on exogenous political decisions, partly

on swings in managements' and shareholders' optimism and partly on sunspots.[33]

(vi) These are not predictable even in the absence of major shocks. The level of q is therefore unpredictable, but it can be explained with hindsight, particularly when alterations in interest rates or liquidity have dominated its changes. Examples are 1960 to 2000, when the rise and then fall in inflation led to continuous changes in nominal interest rates, and in the two structural liquidity traps of the 1930s and the 21st century. The unusual impact of wartime restrictions also explains why changes in interest rates were positively correlated with q from 1940 to 1970, but negatively correlated at all other times.

(vii) Stock market fluctuations can have an important impact on the economy and their unpredictability is one reason why economic forecasting is inevitably prone to error. The unpredictability of the economy does not, however, mean that some mistakes, such as allowing excess levels of M2/GDP and q, cannot be avoided. Avoiding excess levels of q requires that the causes of its overvaluation be understood.

(viii) The problem of structural liquidity traps can only be avoided if the tools used to manage the economy are extended by the addition of tax policy to supplement the current tools of fiscal and monetary policy.[34]

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[33] *Stable Sunspot Equilibria in a Cash-in-advance Economy* op. cit.
[34] *Escaping the Structural Liquidity Trap* (2024) by Andrew Smithers (Central Banking 19th February).

Appendix 1.
Testing the Key Assumptions of the SMM applicable to this Paper.
Assumptions.

1. The expected real return on US equity to shareholders is stationary at around 6.7%. It is robust when tested by reference to 220 years of data (Figure 2).
2. Non-financial companies adjust their leverage in seeking to maintain a stable ratio of around five (5) for profits before interest/interest payments. It is robust when tested with reference to all the available data, i.e. from 1929 to 2023 (Figure 3).
3. The labour and profit shares of income, and thus of net output after depreciation, are stationary. This assumption is robust when tested by reference to all the available data, i.e. from 1929 to 2023 (Figure 4).
4. Savings and investment must be equal *ex post* and this applies to their constituents as well as the total. The savings needed to finance business investment must be provided in the required proportions of debt and equity; this requires the mean reversion of real equity returns which is robust when tested by reference to 220 years of data (Figure 2).

Conclusions that follow.

5. The stationarity of the real return on equity allows the stock market to be valued, after adjusting for its cyclical fluctuations. The accepted standard approach (CAPE) is to adjust earnings per share (EPS) to constant prices and use 10 year moving averages to even out the cyclical fluctuations. The validity of this approach is shown by the mean reversion of CAPE (Figure 1) and its correlation with hindsight value.
6. If retained profits are accurately measured, the stationarity of the real return will also result in the stationarity of q, defined as the stock market value of corporate equity divided bv the net worth of its constituent companies. The validity of this approach is shown by the mean reversion of q (Figure 1) and its correlation with hindsight value.

Andrew Smithers

Appendix 2.
q **and Tobin's Q.**

The SMM follows James Tobin[35] who showed that the ratio of the stock market value of companies divided by the value of the assets they own must be mean reverting. There are, however, some complications over definitions. Q is the symbol Tobin used for the ratio between the value of the capital stock, which he termed its replacement value, and the value placed on it by the stock market. Simplified for an economy in which all capital is managed by business, Q is the total value of quoted companies' equity and debt, divided by the replacement value of their capital stock, which is the sum of their debt and net worth, whereas Stephen Wright and I defined *q*,[36] as the ratio of a company's net worth to the stock market value of its equity. To value the stock market, debt needs to be excluded; it therefore depends on *q*, which can also be termed "equity *q*" not on Q.

I am most grateful for the help of Kevin Coldiron, for drawing my attention to long-term data on banks' reserves which I had overlooked, for correcting errors in the text and generally for helpful email exchanges. Any errors, of course, remain mine.

[35] *A General Equilibrium Approach to Monetary Theory* by James Tobin (1969) Journal of Money, Credit and Banking Volume 1 No. 1.
[36] *Valuing Wall Street* op. cit.