

# *Deflation in the British Economy, 1870-1939\**

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## **1. Introduction**

For much of the last quarter century a principal focus of economists' attention has been inflation, and to some extent disinflation, and the associated costs. More recently deflation has attracted some interest although only its possible harmful consequences have been discussed; there has been no mention of deflation as the by-product of increased economic growth interacting with unchanged money growth. This latter is prompted by some sharp rises and falls in asset prices in Japan and more recently the USA and to a lesser extent the UK, and the interest taken in the relationship between these and the general price level. But also important were the actual deflations in prices in Japan, China, and Hong Kong, and the near zero inflation in the USA and Europe. An accepted view is that price stability underpins financial stability and that it is unanticipated changes in monetary policy that produces financial distress. What though, do we know about deflation? We need to go back to before World War II to find episodes in almost any OECD country, though there has been some recent experience in Japan and elsewhere. The purpose of this paper is to begin to investigate the effects of deflation in the British economy.

The depression of the 1930s stimulated many developments in economic analysis. But Keynes's ideas on deflation in the *General Theory*,

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and Irving Fisher's debt-deflation theory, have been at least by comparison neglected. These ideas suggest that 'debt deflation' causes or at the least worsens depressions. Our aim in this paper is to explore what these ideas can contribute to understanding the behaviour of the British economy both in the late nineteenth century and in the interwar years.

We set out the debt deflation ideas of Keynes and Fisher (the models are far from identical) and then see whether any of the key variables in these models moved as the models require for there to be debt deflation at work. We seek to evaluate what contribution the debt-deflation models make to understanding the behaviour of the British economy in the two periods.

The structure of the paper is as follows. The next section outlines briefly the course of the British economy in the two periods we examine, 1873-96 and 1920-1939. Then the debt deflation ideas of Keynes and of Fisher are outlined, and the variables crucial to those "debt deflation" models identified. As will emerge, price expectations, albeit different aspects of them, are central to both views, so the next section of the paper considers informally how these might be identified in our two periods. After modelling price expectations we provide differently constructed real interest rates and examine the informational content of the bond market. We then consider the behaviour of bond spreads as a possible route to understanding the role of debt-deflation, before finishing by noting the role of inter-temporal substitution.

## **2. The British economy**

Our principal focus is on the interwar years in Britain and the behaviour of the economy during these is outlined first. Following a boom at the end of the First World War there was a period that ran until the early 1930s when prices were either falling or flat. They fell most sharply in the recession at the end of the 1920s. Interestingly, asset prices rose quite consistently throughout, and in the later 1920s were rising quite rapidly. They then fell steeply in the recession years of 1929 to 1932 and beyond. In the closest preceding period of falling prices, the

long deflation of the late nineteenth century (1873-96) the economy, while continuing to grow, was doing so at an ever slowing pace. In the 1920s and 1930s, in contrast, the economy performed much better than in the nineteenth century deflation – at least from peak to peak, 1924-29-37. There have been no deflations since then, though there have been several occasions when asset prices have moved in a way dramatically different from the general price level.

Price experience is our key concern. In the interwar period it followed a pattern that was not greatly out of line with what it had been in the past. But it should not be surprising that to a certain extent it also reflected the attempts at restoring monetary order following war. Thus there were fluctuations but also a slightly downward trend. Using the cost of living index gives the following picture. After considerable inflation in the war, prices continued rising and then rose sharply in the immediate post-War boom. They then collapsed from a peak of 154 in October 1920 to 99 in March 1923 as Britain sought to rejoin the international gold standard at sterling's old parity. They drifted down further until 1925 and were then more or less flat until 1929. They fell still further in the world-wide depression, levelled out in 1933 and from then on drifted up slightly in the upswing of the 1930s. At the end of the period they were a little lower than they had been at the beginning. How much expectation of this general deflationary path there might have been is an important question to which we return later.

The behaviour of the British economy over the years 1873 to 1896, the previous period of deflation was much less dramatic. That period was at one time described as "the great depression". But that was a misnomer that derived in part from the association of falling prices with relatively declining economic performance, and in part from the deteriorating position of agriculture (in the face of severe competition from the new world) and the voice that landowners had in parliament. In fact the trend rate of growth was not out of line with previous periods. Real output (GDP) rose from 1873 to 1896 of over 50 per cent in a 23 year period. There were some falls along the way, the worst of them being in 1879 and the mid 1880s. Unemployment, as captured in the percentage of insured workers unemployed, fluctuated broadly in line with output. Unemployment

averaged 5 per cent per year across the whole period. There were three years in which it went above 9 per cent, and four in which it fell below 2.2 per cent.

Prices fell on average from 1873 to 1896. An index of the GDP deflator (with 1913=100) began the period in 1873 at 109.2 (a peak), and finished it in 1896 at 86.2, an average decline of exactly 1 per cent deflation per annum. The decline was of course not smooth, but rather a fluctuating path about a downward trend. Prices did, though, move fairly modestly year by year. The biggest fall in the period was 4.7 per cent in 1879; and the biggest rise was 4.3 per cent in the following year, 1880. Short-term interest rates fluctuated substantially but showed no signs of any trend consistent with US experience and inflation expectations of close to zero, (see M Friedman's *Money Mischief*, 1992) while Consol yields drifted downwards very gently and showed little year-by-year movement.

Financial stability is also at the centre of our interest, for it underpins macro-stability. Financial stability is difficult to measure, perhaps impossible. But if ever there was a country and a period in which financial stability could be said to obtain it would be Britain in the period between 1870 and 1939. We have noted that there were some sharp general price movements (though these were for the most part associated with war). There were, too, some sharp asset price movements. And there were of course fluctuations in the real economy. But financial stability prevailed. There were no banking panics, no financial crises (no threat to the money stock). No single measure can express the degree of financial stability but perhaps a good guide can be found in commercial bank profitability. That remained remarkably stable across the whole period. (Capie 1988, and Capie and Billings 2001). The behaviour of components of the money multiplier support that view; there was no example of a rush to cash or a collapse in the multiplier. (Capie and Webber)

### **3. Hypotheses**

The two basic approaches are those of Keynes and Irving Fisher. We first set out the approach which originated with Keynes, and then turn to that of Fisher. The first point to be made is that in developing their theories

Keynes and Fisher had rather different objectives. The former was primarily concerned to show that wage flexibility (a particular form of price flexibility) would not necessarily stabilise output. Fisher was concerned to show a stronger proposition – that price flexibility would *destabilise* output.

Keynes (*General Theory*, Ch. 19) argued that changes in money wages could affect output (and employment) only by changing aggregate demand. He listed several ways by which money wage falls could shift aggregate demand. The first was a transfer of income from workers to rentiers; this would, he conjectured, reduce demand. Then came two which applied to open economies with pegged exchange rates. A fall in wages would boost exports and reduce imports; but against that the resulting fall in real income would cut consumption spending. Fourth was inter-temporal substitution; if money wages fell relative to expected future money wages, current spending would be boosted, while if the fall led to expectations of further falls, spending would itself also fall; investment was the part of total spending Keynes expected to be affected by this channel.

Fifth was a monetary channel; the fall in wages and prices would produce a fall in interest rates, due to a rise in money supply relative to money demand. Sixth was an anticipation of Lucas. Businessmen may mistake a general wage fall for one specific to them, hire more labour in consequence, and thus break the cycle of depression. Last was the effect on indebtedness.

“On the other hand, the depressing influence on entrepreneurs of their burden of debt may partly offset any cheerful reactions from the reduction of wages. Indeed, if the fall of wages and price goes far, the embarrassment of those entrepreneurs who are heavily indebted may soon reach the point of insolvency – with severely adverse effects on investment.” (Keynes 1936 p.264).

Keynes laid greatest stress on the intertemporal substitution channel, and on interest rates. Keynes thought that effects through interest rates would be weak. Small falls in prices would have small effects and only on short-term interest rates, while large price falls would disturb confidence. He set out in some detail the possibility that a fall in money wages could raise the expected real rate of interest. (Keynes 1936, p.265).

"The most favourable contingency is that in which money wages are slowly sagging downwards and each reduction in wages serves to diminish confidence in the prospective maintenance in wages. ... For example, the effect of an expectation that wages are going to sag by say 2 per cent in the coming year will be roughly equivalent to the effect of a rise of 2 per cent in the amount of interest payable for the same period." (G.T. p.265) His analysis plainly suggests that wage (price) flexibility cannot cure depressions; but it does not suggest, as Fisher did, that such flexibility can cause depressions.

Fisher's views are set out very clearly in his 1933 *Econometrica* article. For Fisher, debt and deflation were key ingredients in recessions. We have to start from a situation of "overindebtedness". Nine factors then come into play. An initial shock causes a change in confidence, and produces distress selling, so bank loans are repaid and the money supply falls. This leads in turn to a fall in prices (a "swelling of the dollar" in the US case) and a decline in net worth and in profits. These lead in turn to falls in output and employment, followed by increased pessimism, hoarding of money, and decreases in nominal interest rates along with increases in real rates.

The "overindebtedness" which is a key ingredient can, Fisher suggested, arise through a route such as the following. A technological breakthrough fuels borrowing. This leads to speculative enthusiasm, followed by criminality. "Probably no great crash has ever happened without shady transactions". (Fisher, 1932, p40). Inflation can lead to similar results, by creating the illusion of easy profits. It is the interaction of debt and deflation which is crucial in Fisher's analysis.

"The very effort of individuals to lessen their burden of debt increases it, because of the mass effect of the stampede to liquidate in swelling each dollar owed. Thus we have the great paradox which, I submit is the chief secret of most, if not all, great depressions: the more debtors pay, the more they owe." (1933, p344)

The very process of liquidating debt leads to a fall in bank deposits and thus prices; prices fall faster than debt, real debt rises and "good risks" are thus exposed to problems. And not only does the real value of debt rise; so does the real interest rate payable on it. In deflations

there is a "... fall in the nominal or money, rates, and a rise in the real, or commodity rate of interest." (para 19, p.341)

A key point distinguishing Keynes from Fisher is that the former saw *expected* real rates as important, while Fisher saw an increase in *realised* real rates as having a damaging effect on *existing* debtors.

Before turning to the data required to examine these propositions, we next set out some thoughts on price expectations.

#### **4. Price expectations**

In modern macroeconomics, expectations are recognised as having an important role to play. In modelling different kinds of expectations, from extrapolative, to adaptive, to rational, have been employed. Currently, though with a range of interpretations, rational behaviour is assumed. This is broadly taken to mean expectations formed on a rational basis using the best information that is freely available, and based on the best economic model of price behaviour. Expectations now focus directly on changes in government policy.

Life was simpler in the nineteenth century in this important respect. Adherence to the gold standard largely removed monetary policy from government control. Thus price expectations were formed differently. In the nineteenth century, at least among the more advanced economies, there developed a respect and admiration for the gold standard. Britain was the strikingly successful economy of the time and had adopted the standard at an early date. Countries that followed that path had stable price experience in accord with the theory of the standard. Prices continued to move with the economic cycle but were flat on trend. More and more countries opted to adopt this regime in the 1870s and it has since been argued that there was a relative shortage of gold, which exerted a downward pressure on prices. In the period from 1873 to 1896 there was a long decline in prices. Gold discoveries and improved technology produced the subsequent reversal in the trend.

Might this deflation have been foreseen? Was it anticipated? That is difficult to establish. There were certainly those at the time who warned that the shrinkage in the supply of high-powered money which would

result from abandoning silver and moving to gold would produce deflation. In addition there was the huge extension of primary production in the new world and, via the simultaneous transport revolution, the arrival of these products in north-west Europe. The prices of these primary products fell, and must have been expected to fall further. While these price falls were not the cause of the deflation they did influence some contemporaries and must have contributed to a weakening of pressure on prices. We can conclude that there must have been widespread expectation of price falls in the period. There were, as usual, different explanations for the deflation (real vs. monetary again) but there now seems little doubt that gold was the cause. New gold discoveries in the 1890s helped alleviate the gold shortage and prices began to rise again.

During the First World War when the standard was abandoned there was widespread and differential rates of inflation. At the end of the war there was an almost equally widespread desire to restore the monetary order of the late nineteenth century. Since Britain had been at the centre of that system attention focused heavily on British actions. The story of Britain's return to gold is well known. From soon after the war price expectations were clearly on a downward course. There was no other possibility. The intention had been clearly announced. (Mundell 2000) All parties were agreed on what was necessary, and the appropriate policies were introduced.

Soon after restoration was achieved in 1925, it became clear that there was still work to be done in Britain and high interest rates persisted over the next few years in order to protect the parity chosen – the one that had held in the nineteenth century. And so price expectations probably continued to have been negative.

Mundell (2000) has recently restated the view that this price expectation must have been much more widely held, indeed held by all those considering a return to gold. The United States had taken over Britain's role of major economy and had experienced inflation during the war. The Federal Reserve had then engineered a recession in 1920/21 that brought the dollar price level "60 percent of the way back to the prewar equilibrium". p.328. But that still left prices 40 percent higher than they had been, and gold reserves correspondingly lower. The

increased demand for gold as restoration was pursued would inevitably bring deflation. Mundell argues that this was understood at the time by the leading monetary economists. He cites Cassel, who had been explicit on the point even before Britain had returned to gold in 1925.

"The gold standard, of course, cannot secure a greater stability in the general level of prices than the value gold itself possesses. ... With the actual state of gold production it can be taken for certain that after a comparatively short time, perhaps within a decade, the present superabundance of gold will be followed, as a consequence of increasing demand, by a marked scarcity of this precious metal tending to cause a fall in prices." (Mundell p. 329)

So deflation was already expected in the 1920s. Mundell (p.329) goes on to say, "... the theory that deflation was caused by the return to the gold standard was not only predictable, but was actually, as we have noted above, predicted." Prices were to fall much more in the depression of the 1930s and Mundell goes on to say that the deflation was a consequence of not returning to the pre-1914 price level in 1920/21. That was not achieved until 1934 when the dollar price level was the same as it had been in 1914.

Further evidence of the mood of deflation can be found in Britain at the turn of the decade. In 1930, when prices had fallen sharply again after a decade of sluggishness, attention focused on measures that might be adopted to raise prices. When, for example, there was discussion of the introduction of a tariff in 1931 (a dramatic proposal given Britain's history as the great upholder of free trade), great play was made of the fact that this was a policy that would raise prices. That on its own was advanced as a powerful recommendation for the policy.

In other words, the whole climate of this period was one in which the expectation of price rises must have been exceptionally low and indeed expectation of price falls was quite likely. There seemed, certainly in Britain at least, little prospect of prices rising before the early 1930s.

## **5. The Data**

Plainly the crucial variables in the Keynes and Fisher models are, respectively, the expected real rate and the realised real rate. The first

is defined in the normal way:  $Re_t = r_t - Ae_t$  where  $Re$  is the expected real rate over the expected length of the loan,  $r_t$  the nominal rate over that period, and  $Ae$  the expected inflation rate over the same period. The real rate for Fisher is slightly non-standard. In his model, problems emerge because an individual or firm has signed up to a nominal rate contract, expecting a certain inflation rate, but the actual rate of inflation turns out to be lower, even negative. Hence the real rate for Fisher at time  $t$  is as follows:

$R_t = r_{t-1} - A_t$ , where  $A_t < Ae_{t-1}$ ,  $R_t$  is the realised real rate,  $r_{t-1}$  the nominal rate when the loan was taken on,  $A_t$  the inflation rate, and  $Ae_{t-1}$  the expected inflation rate when the loan was taken on.

Some of these variables are, at any rate in principle, observable. These are:  $r_t$ ,  $r_{t-1}$ , and  $A_t$ . The others can be calculated from these three observable variables if we can somehow devise a measure for  $A_e$  – that is, for expected inflation. Before discussing sources for the other three variables, we consider this problem.

James Hamilton (1987) tackled this problem for the USA of the Great Depression. He first looked at pre-depression statements of expectations: indicative, but no quantitative help. Then he used time-series models to predict prices, and compared forecasts with actual price out-turns. Finally, he looked at commodities futures prices. He calculated the difference between one month and seven-month futures prices, and compared this with the difference between two one-month future prices, six months apart.

He found that the variability of the expected series was greater than that of the actual, and that the expected series was an unbiased (though noisy) predictor of the actual. On average, over each 6 month period the market expected 9.4% inflation; the comparable out-turn was -39%. This bears on prices in general, for knowledge of commodity prices helps predict the CPI. He concluded that the interaction of nominal rates with expectations of deflation (the Keynes effect) could not have contributed to the depression, for deflation was not expected. It is not clear whether or not this contradicts Mundell for he was discussing the need to restore the 1914 gold price over a fairly long period.

What of the Fisher effect? Fisher (eg 1933, pp 346-7) wanted price

rises because he thought they would help recovery. Friedman and Schwartz (1963) and Weinstein (1981) however, reject the claim that the National Industrial Recovery Act (NIRA) was beneficial through its effects on raising prices. As they point out, by raising prices it reduced the *real* increase in the money stock. According to Weinstein (*op.cit*) it reduced this real increase to zero, for as he points out from 1933 to 1935 prices rose by 14%, in the USA and so did the nominal stock of money. Friedman and Schwartz argue likewise for the years 1933-37. Increasing union and monopoly power led to increasing price levels. This restricted the room for real income growth within the money-set constraint to nominal income.

But this does not allow for the harmful effects on the real burden of debt, and on the financial system via deterioration in asset values (Bernanke, 1983) that might have been alleviated by the price rise. There is thus the possibility that the price rises might have been of benefit despite the monetary constraint.

## **6. Price Level and Price Level Change Expectations**

Price expectations are important in both Keynes's and Fisher's debt deflation theories. For Keynes, they could both affect interest rates (although he did not expect this channel to be of great significance), and work through intertemporal substitution leading to deferral of spending. Fisher, meanwhile, feared that falsified expectations, price falls being greater than expected, could raise the burden of existing debt. How did price expectations actually behave during this period? We have discussed earlier some qualitative assessments of this. Here we turn to simple quantification.

An efficient forecasting method (provided there is no change in the process generating the series to be modelled) is to use a time series model. We do this, acknowledging the limitation imposed by the modest number of data points, for both the price level (as measured by the GNP deflator) and for the year on year change of the price level (measured of course by the year on year change in the GNP deflator.) This is done for both our periods. The models are shown in an appendix. As will be seen,

they are both simple and fit well; this is to be expected given the small amount of variation in the series to be modelled.

Plots of actual and predicted series track closely together in each period. The level series move so closely together that no comment on them is necessary. The year-on-year change series do, however, merit comment. Looking first at the early period, although the series move along together, the "actual" series is much more variable. That is of course consistent with the extensively documented observation on the gold (and presumably other commodity) standards that long-run movements are constrained, but there is greater scope for short-run variability. This was known at the time, and thereby influenced expectations, as of course did actual experience of long-run stability. (See, for a comparatively recent discussion, Mills and Wood 1982).

In the later period, there are no years when the difference between actual and predicted rates of change is sufficiently large to be statistically significant. But if we look at the larger deviations, we find actual exceeding predicted values in 1924 and 1925; predicted exceeding actual in 1931 and 1932; and spikes of actual above predicted in 1937, and in 1939.

The first of these deviations occurs during the period of monetary squeeze before the return to the gold standard; the second the period of relaxation after leaving gold; the third we can not explain; and the fourth corresponds to the outbreak of war. The first two are of interest because they go exactly the wrong way for debt deflation! (This point is developed further when we examine real interest rates.)

## **7. Real Interest Rates**

Price expectations lead on to real interest rates. We consider the behaviour of four different series for real interest rates in each of the two periods: a real short rate and a real long rate, first calculated according to the "Keynes method", taking account of expected inflation, and then according to Fisher, taking account of actual inflation.

To illustrate, we have an annual observation for interest rates, calculated by averaging monthly data (Caple and Webber). We also have an annual GNP deflator. For the "Keynes series", for example, a 1900

interest rate is taken and subtracted from it, is the change in the GNP deflator expected from 1900 to 1901. That would give our 1900 "Keynes real rate". For the Fisher series, the 1900 interest rate is taken and subtracted from it, is the change in the deflator between 1899 and 1900. What was important to Fisher, however, is not so much the behaviour of that series as the behaviour of that series relative to what was expected. To deal with that, we compare the Keynes and Fisher series, and, as what would produce deviations is the behaviour of prices relative to price expectations, also look again at our price expectations series in this fresh context.

In the earlier period, the volatility year by year of the price level produces volatility in real rates by all measures. The key point is that there is no sustained rise in either version of the real rate. It is notable, though, that in the years of deflation, real rates were higher than in the later 1890s, and somewhat higher than in the first decade of the twentieth century. In the inter-war period, however, once the immediate post-war volatility was over, interest rates move little, both measures drifting gently downwards.

The "Keynes" and "Fisher" series do not display systematic differences in either period, as is to be expected, for price expectations differ little from price behaviour in either period.

A fair summary would be that there is evidence of the deflation being in the UK systematically associated with unusually high interest rates in our first deflation, but none in our second - in contrast with the US experience; and that there is no evidence of unexpectedly high real interest rates arising from a succession of unexpected price level falls.

## **8. Expectations and the Bond market**

It has become common practice when investigating price expectations to examine the long-term bond market. The Fisher equation relating the real rate and expected inflation to the nominal rate is used, and, in the US and the UK, both countries with index-linked long-term government securities, there is now a well-developed set of approaches for calculating inflation expectations over various holding periods.

There were no index-linked bonds in either of the periods we examine; in view of the behaviour of prices to which people were accustomed (and which we have indicated above) it would have been hard to persuade prospective buyers that there were any benefits to be had from purchasing such securities. Nevertheless, it is possible to make some deductions about price expectations – at least those held by participants in bond markets – from the behaviour of bond yields in the two periods we examine, and that task is the focus of this section of the paper.

We first consider the earlier period, and then the inter-war years. The earlier period, 1870-1913, is that for which the Gibson Paradox was first named (by Keynes, 1930) and in which it was first identified, by A.H. Gibson. We summarise our own and some work by others on the paradox to see what can be said about price expectations.

The paradox was that there appeared to be an association between the price level and a nominal interest rate. Various explanations have been advanced. Irving Fisher (1896; 1907; 1930) proposed one based on the Fisher equation relating real and nominal interest rates, and this explanation was later given support by the work of Friedman and Schwartz (1982). They argued that because a move from one fully anticipated inflation rate to another would, even with the real return on physical capital unchanged, alter the nominal yield on nominal assets, the appearance of a relationship between nominal yields and the level (as opposed to the rate of change) of prices could be produced. This relationship would appear if inflation expectations adjusted to inflation with a lag, so that the longer inflation persisted (and thus the higher the price level rose), the higher would the nominal yield rise. Price expectations in this explanation of the paradox thus rise (and fall) with prices.

This is not, however, the only explanation that has been offered. Both Wicksell (1907) and Keynes (1930) suggested a real explanation - nominal rates on nominal assets were pulled down by a downward drift in the natural rate of interest, reflecting a decline in the marginal physical productivity of capital. This occurred in the first half of the period, and was replaced in the second half by a rise as the American west was further

developed. Price level movements were in turn induced because the market rate lagged behind the natural rate.

Harley (1977) supports a 'Fisherian' explanation, arguing that 'the money market adjusted to price expectations, and there was little effect on real interest rates'. Further, that 'the decline in the market rate of interest in the 1870s can be fully accounted for by price expectations and is fully consistent with a monetary explanation of price trends.' (p.73)

Next we come to Friedman and Schwartz (1982). They support Fisher's explanation partly by noting that the studies which rejected the explanation actually included in their data set periods when the paradox did not occur. Also they rejected the Wicksell-Keynes explanation (by use of their own series for the real rate of interest), and they found shorter lags than Fisher on price expectations. Their explanation of the end of the Gibson Paradox is derived from the same analytical framework: there was a change in the monetary standard, which produced greater incentive to forecast future price movements.

Finally, on the Gibson Paradox years we come to Mills and Wood. After an exhaustive survey and testing all of the available explanations of the paradox, they found that while decisive confirmation of Fisher was not possible, decisive rejection of all other explanations was. What is the significance of that in the present context? As noted above, the Fisher explanation requires that price expectations track along with prices. Our simple time-series model (inevitably simple in view of data availability) tells us that they did. So the present section confirms that finding, and thus confirms that falling prices were expected in this XIXth century period of deflation.

Next we come to the inter-war years. As with the closing decades of the nineteenth century, in the interwar years our (again simple) model of price expectations tracks the gentle course of the price level. Is this consistent with the behaviour of bond yields? At the time, discussion of the behaviour of yields was not at all concerned with inflationary expectations. Rather, when discussion took place at all, it was mainly in 1932, and was of the effects of the stock conversion expected in that year. We therefore briefly set out the details of that operation, and give a flavour of the discussion surrounding it, before returning to the actual behaviour of yields.

The conversion was of War Loan 1929-47, which bore a 5% coupon, into "3 1/2% 1952 or after". By March 1932, there was about £2,100 m. of the stock outstanding. (This was more than a quarter of the whole national debt, or about 50% of 1932 national income.)

Plans for the conversion were first discussed in 1930. By April 1931 yields had been steady for about eight months, and plans for a conversion were drawn up. These were, however, abandoned in the turbulence of first the Austro-German banking crisis, and then of Britain's leaving the gold standard. In 1932 conditions changed rapidly. Bank rate fell from 6% to 3% and Treasury Bill rate to just below 2%. Plans for a conversion into a 3% stock were then made. There was a massive publicity campaign; special incentives were offered to convert; and financial institutions which held the stock were lent on. The conversion was achieved.

That, then, is the background. How did interest rates behave? All the movement in the bill series is associated with the defence and subsequent abandoning of the gold standard. In the consol yield, there is almost no action apart from around the time of the stock conversion. Capie, Mills and Wood (1986) confirm that to be the case. A simple time series model of the consol yield was constructed, and intervention analysis was used to see if there was any change in the series which required explanation.

There appears to have been a small but statistically significant step in the consol yield at the time of the conversion. What can be said about price expectations from this? Neither inflationary expectations nor the behaviour of the real rate would seem to fit the bill. Not only is neither of these likely to produce a step change, but the Treasury was committed to monetary easing, so expectations of inflation, if affected, should have risen, and 1932 was the trough of the recession (so rising resource use should have raised the real rate). Capie, Mills and Wood (op.cit) suggest the step was due to the fact that the successful conversion allowed tax reductions – one objective of the operation – and so allowed a fall in the before-tax rate of return observed in the market.

What does this tell about price expectations? After the step of the stock conversion there was a gentle drift down – again, as was found for

our earlier period, consistent with expectations of gently falling prices and, therefore, with our model of expectations. As, too, in the XIXth century, price expectations moved sluggishly so that interest rates and the price level moved closely together. Yields and prices started to rise again in 1935. So, as in the 1890s, only a little more so, price movements were gentle and, so far as we can tell, were expected.

## **9. Bond Rate Spreads**

Some authors have suggested how 'debt-deflation' might by other routes affect the real economy, and have gone on to suggest ways by which the presence of debt deflation might be indicated, and its extent measured.

One route was outlined by Eichengreen and Grossman (1997): "By 'debt-deflation', we mean a fall in the prices of either assets or goods and services that raises the real value of net debt, thereby worsening the net wealth position of non-financial borrowers and discouraging them from consuming and investing." ( p.68). As they go on to point out, "Measuring the debt burden poses difficulties for historical research". (p.69). They therefore followed, "... the procedure of Calomiris and Hubbard (1989) and Mishkin (1991) and focus on the information content of interest rate spreads." (*op.cit.*, p.69)

There are criticisms of that approach, but before turning to them, how do Eichengreen and Grossman justify it? They base their justification on adverse selection. Lenders reduce this by requiring collateral from borrowers. As the value of collateral falls (in a deflation) required interest spreads will rise, as another way of compensating lenders for the risk they bear. Hence, they argue, widening spreads over a risk-free rate are produced by debt-deflation, and worsen recessions by progressively restricting borrowing and investing.

For the British experience it is well known that commercial banks lent extensively without security. It is true that in the closing decades of the nineteenth century the banks increasingly required some security. Yet even by 1914 more than one half of all loans were given on the strength of no more than a personal guarantee. (Capie and Collins)

What are the objections to that approach? They were cogently and forcefully set out in Schwartz (1997). The spread, she argues, reflects both liquidity and expectational forces. This yield spread usually varies procyclically. Why? This can be produced simply by the liquidity of lower quality debt falling in recessions, as default is more likely. Hence, widening spreads are a normal cyclical phenomenon, not a symptom of debt deflation. Further, as Crafts (1997) observes, if the debt deflation discussed works through households' balance sheets, then "...I am rather doubtful that the interest rate spread between commercial paper and the discount rate will be closely related to the relevant changes in household debt positions." (1987, p, 97). But, as he admits, data on household balance sheets are not readily available.

We carry out a similar exercise, following several previous authors who, albeit somewhat sceptical of the value of bond spreads as an indicator of a debt-deflation process at work, have nevertheless examined them in view of the difficulties attached to testing debt-deflation theories. (Eichengreen and Grossman are an example of this group.) We share their scepticism, but also their willingness to see what, if anything, can be extracted from the measure.

Before doing so, though, there is another problem to be faced when studying the UK – the lack of a significant and active corporate bond market. To what can we relate the government bond yield in the absence of corporate bonds? We have chosen to use the dividend yield on the UK "top 100" equity index for the comparison. That comparison is, of course, open to the objection that we are comparing a nominal yield (that on consols) with an income stream which can move to compensate for inflation. The comparison is, however, in our view justifiable in this period because of the stability of the price level and of the modesty of the year-on-year rate of change of the price level.

One further point remains to be noted. There is not a suitable index of dividend yields before 1900. Accordingly, we start the comparison at that date, and run it through to 1939.

What does the comparison reveal? First, the spread was *wider* before the First World War than in almost any year after it – and the years running up to 1914 were years of stability. Second, there are two big, short-lived,

spikes in the series. The first occurred during the immediate post-war boom of 1919/20, and the second during the not much longer-lived return to gold. Although perhaps surprising in view of the criticism the return to gold has received, we would offer essentially the same explanation for both episodes. The first period was of actual boom, the latter of expected boom – for many welcomed the return to gold as signalling the return of pre-1914 style stability. (See, e.g., Capie, Mills and Wood). Thereafter the spread is narrow, not even reaching pre-First World War levels in the run up to the Second World War.

Accordingly we conclude that, to the extent that the spread indicates a debt-deflation process at work (and we have noted our reservations about this) it shows no evidence of such a process working during the inter-war years in Britain.

Another channel is the effect of leverage on firms' investment spending. This has been proposed and tested by Calomiris, Orphanides, and Sharpe (1997), following work by Calomiris and Hubbard (1989) and Hubbard and Keycap (1992). They argue that it is necessary to test the effects at the firm rather than the aggregate level, and that the effects may be asymmetric. Their reasons are as follows. First, aggregate debt/assets may not be a good indicator of the representative debt /asset ratio of firms. Leverage may be important only for cyclically sensitive firms, and its effects would thus not show up in aggregate data. And third, (they worked on post-Second World War data) there were too few aggregate observations as the US had experienced only six recessions. As for asymmetry, they argue that capital constraints do not bind so long as a firm's sales are growing, but when sales drop debt service becomes a problem, so expenditures – particularly investment spending – are cut back. The approach is interesting, but the data to pursue it in our time periods do not exist.

## **10. Inter-temporal substitution**

There is one final channel to explore. According to Keynes, falling prices could lead to further falls in prices if some consumption and investment decisions were deferred. One, albeit casual way of doing this, is to look at house prices and equity price changes.

The 1930s saw a major house-building boom. Houses were bought not only by prosperous professionals, but by a much wider group, including skilled manual workers. Various house price series are available. None even purports to cover the whole country, or to represent the entire market.

Accordingly we report both a building cost and a house price series. Before doing so, though, we should remark that there were substantial regional price divergences (these are shown subsequently) and also substantial variation within cities. This intra-city variation was a systematic one; prices fell in the "inner cities" relative to the new suburbs, as not only did the new houses in the suburbs have attractions such as electric light, but the suburbs were seen as healthier and therefore more attractive places to live. There was thus a systematic relative price change. This should be borne in mind, as the price series we report are essentially for newly-built (suburban) houses. These comprised, it should be said, a substantial part of the stock of housing; between 1919 and 1939 the stock of dwellings went up by about 30%. The first series is Maywald's building cost index. After a sharp rise during the War and in the post war boom, costs fell, and then drifted gently from an index level of just above 100 in 1922 to a low point of just above 80 in 1933. They climbed gently thereafter. The average cost of dwelling houses fell from £700 in 1923 to just over £500 in 1932, and was more or less stable thereafter. It must be noted, though, that houses got somewhat smaller over the period; no series which adjusts for this is available. The "Chamberlain" subsidy of £75 per house was introduced in late 1923; this seems to have produced a fall in the average house price despite a modest rise in building costs that occurred at the same time. Of course, the average price had a range of variation around it; and it showed substantial regional variation.

The inter-temporal substitution effect gets essentially no support from these data. There are no prolonged periods of falling house prices coinciding with years of recession and sluggish house sales. Thus there are few, if any, data here to support the deflation story. And even if there had been, it is hard to see how inter-temporal substitution could account for a prolonged recession; few items of expenditure can be postponed

for many years, and if real interest rates drop the incentive to postpone is of course reduced.

## **11. Conclusions**

In this paper we have examined, as much as the data allow, how the debt deflation theories of Keynes and Fisher contribute to an understanding of the behaviour of the British economy in either the final quarter of the nineteenth century or in the recession of the early 1930s. For Keynes's theory, the key is to see whether there is any evidence that price change was expected; and for Fisher, in contrast, one must see whether *unexpected* price change produced problems through any of the channels he or his followers listed. We also note arguments of Mundell on whether these price changes were anticipated.

After considering some qualitative views on price expectations we use some simple time series modelling techniques to produce price expectation series. (We also draw on some earlier work we did on expectations in the bond market which provided some support for the current work.) These expectations, in turn, are used to construct a variety of short and long-run interest rate series that accord with the views of Keynes and Fisher. On both prices and interest rates the evidence that emerges is that there is little difference between the actual series and the predicted series. We therefore conclude on this basis that deflation transmitted no adverse effects to the real economy through the channels suggested by these models.

Another way of examining the issue is, at least in theory, to consider the changing behaviour of bond rate spreads. This is beset with problems and these are even greater for the British than for the US economy at this time because of data scarcity. Nevertheless, improvising, we did the exercise and again found little or no evidence of deflation transmitting adverse effects. Finally, we consider the possible role of inter-temporal substitution and found no support for that hypothesis either.

In summary, these periods of falling prices do not appear to have brought the calamitous effects that are sometimes thought to be the

consequence of deflation. The various strands of evidence brought together here suggest also that there was in the UK little disturbance of the financial markets, and no evidence of financial instability. It is true that in the deflation of 1929 to 1932 falling prices and rigid money wages did produce unemployment. Yet even that was relatively short lived, and there followed a great boom from 1932 to 1937/38.

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APPENDIX 1 – DATA

The interest rate employed is the yield on Consols, which has been used almost exclusively as the measure of the long-term rate of interest in this period. Series for short rates also exist, of course, but these are not as well suited to the examination of hypotheses about, or depending upon, the Fisher effect. The usual Consol yield series, given in Capie and Webber (1985: table III.10) for example, has, as both Harley (1976) and Capie and Webber (1985: 316-20) point out, traditionally been miscalculated for the years 1880 to 1903. This miscalculation leads to an overestimation of the true yield for two reasons. The price of Consols in this period rose above par, thus increasing the possibility of redemption at par and decreasing the true yield, and the details of Fisher's conversion of the National Debt in 1889 affected the way in which Consol yields were calculated. We therefore employ a revised Consol yield series, that given in the appendix to Harley (1977), although related work reported in Capie, Mills and Wood (1991) has used both this and the traditional series in similar exercises and found little difference in the results so obtained.

The output series used is Feinsten's (1972) compromise estimate of GDP, and hence his implicit GDP deflator is used as the price series. While there has been some discussion recently over the reliability of this output series – see the interchange between Greasley (1986, 1989) and Feinstein (1989) and the discussion in Crafts, Leybourne and Mills (1989a) – it would still seem to be the best that is currently available.

Annual observations for all series are available from 1870 to 1913, except for M3, whose initial (1870) observation is missing. Details and descriptive discussion of the data and univariate analysis of the individual series is to be found in Capie, Mills and Wood (1991). In particular, it is found, using a variety of methods, that the logarithms of both money series, output, and prices are all integrated processes of order one, ie  $I(1)$ , while the interest rate itself is  $I(1)$ , findings that are confirmed by Taylor (1989).

## APPENDIX 2

**Level of GNP Deflator**

The GNP deflator was analysed over the two periods 1870 - 1914 and 1919 - 39 using standard Box-Jenkins time-series procedures and appropriate models for describing the trend determined. Because of the differences in the underlying trends for the two periods, there was no single model suitable for both periods. The appropriate models determined are both autoregressive processes, i.e. the basic model is of the form:

$$X_t = \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \dots + \alpha_p X_{t-p} + Z_t$$

where  $X_t$  is the observed GNP deflator in year  $t$ ,  $\alpha_i$ 's are unknown parameters and  $Z_t$  is an error term assumed to have mean 0. The above expression describes an autoregressive process of order  $p$ , that is, an AR( $p$ ) process.

The order of the AR processes was determined by Akaike's information criterion (AIC). If  $k$  is the order of the current model, then

$$\text{AIC}(k) = -2\ln(\text{maximised likelihood}) + 2k$$

The value of  $k$  that minimises  $\text{AIC}(k)$  is chosen as the order of the AR process.

The models derived are as follows:

- Period 1919 - 39

$$Y_t = 0.99968(0.2408)Y_{t-1} - 0.45561(0.3233)Y_{t-2} + 0.11982(0.2408)Y_{t-3} + Z_t$$

where

$$Y_t = X_t - X_{t-1},$$

implying that:

$$X_t = 1.99968X_{t-1} - 1.45529X_{t-2} + 0.57543X_{t-3} - 0.11982X_{t-4} + Z_t$$

- Period 1870 - 1914

Again setting:  $Y_t = X_t - X_{t-1}$ , the actual model fitted is

$$Y_t = 0.09046(0.3008)Y_{t-1} + 0.02707(0.3008)Y_{t-2} + Z_t$$

implying that:

$$X_t = 1.09046X_{t-1} - 0.06339X_{t-2} - 0.02707X_{t-3} + Z_t$$

Hence predictions for the period 1919 to 1939 are based on the previous 4

years observations while predictions for 1870 to 1914 are based on the previous 3 years observations. The standard errors of the parameter estimates are given in parenthesis.

### **Rate of Inflation**

The rate of inflation, estimated by year on year rates of change in the GNP deflator was similarly analysed, resulting in the following time series models:

- Period 1870 - 1939

$$X_t = 0.60651(0.0958)X_{t-1} + Z_t$$

- Period 1870 – 1913

$$X_t = 0.27316(0.1467)X_{t-1} + Z_t$$

- Period 1921 – 39

$$X_t = 0.46006(0.2093)X_{t-1} + Z_t$$

Hence for the rate of inflation, predictions are simply based on the previous year's observation.

## APPENDIX 3

### **A note on the course of some price series**

The main features of movements in aggregate prices have been given in the text. It is only the aggregate price level, and the annual rate of change in that, which we model. However, we describe here the course of some individual commodity prices, together with some asset prices as found in residential properties and equities. Commodity prices for the period 1870 to 1914 all reflect the well-known trend of falling in the first part of the period followed by some modest recovery in the second part, though it is clear there was quite a bit of difference in the extent of the fall and rise across commodities. For example, to take just two, coal and metals were relatively flat throughout against the more obviously tumbling grain prices. Between the wars, the trend was generally downwards for most commodities, and they moved more closely together.

On asset prices, there are houses and equities but the limited data allow only much shorter period description. House price data are available for the interwar years but not before that. These are interesting in that they show a steady if gentle decline for residential housing from 1923 (105 approx.) to 1938 (75 approx.). The sharpest movement came in 1931. Deflated costs show the same pattern. There was considerable regional difference but not always of the kind that might have been thought – see correlation table. Data on equities are also limited. An equity price index for the late nineteenth century was reported in Capie and Mills. Although limited in coverage it showed some cyclical pattern around a flat trend in the first part of the period, followed by a step up to similar fluctuation around another flat trend in the second part of the period. Data are slightly more plentiful for the period after 1920/25. The first few years showed a strong upswing from the base of 100 to over 140 in 1929. But that collapsed after that point and reached a low point in 1933 at 80. There followed a strong recovery to 1937, then a loss of these gains so that the period ended where it began.

Interest rates reflect some of the course in these variables but not entirely. It is long rates that are of particular interest for this exercise. These are given only brief comment here since they are given separate treatment in a discussion of the Gibson paradox – a topic that has predominated in this area in the late nineteenth century. Short rates for both periods are represented by both Bank Rate and prime bank bill rate. Bank Rate oscillated around a mean of 3.5 per cent in the period 1870-1914. In the interwar years it began in a higher range and fell to the fixed (“cheap money era”) of 2 per cent in the 1930s. A better

indicator of the market rate is found in the prime bank bill rate which was much more volatile. In the first period it shows more of the long-term pattern of a gentle 'U' shape. Between the wars it again shows much more movement but a very similar pattern to that of the Bank Rate. But as can be seen, it fell to below 1 per cent for most of the 1930s.

Long rates are captured in the yield on consols. For the first period these show clearly that 'U' shape with a particularly exaggerated 'U' in the 1890s. After the immediate post-war adjustment period (1919-21), the yield on consols remained at about 4.5 per cent without much deviation from 1922 to 1931. It then fell steeply, reaching a low of less than 3 per cent in the mid-1930s before drifting up to about 3.7 per cent in 1937.

