THE 2009 RECESSION IN THE U.S.

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ABSTRACT

Nearly all pundits agree that the recession, which began in December 2007, will see a steep decline in U.S. output in 2009. In this paper we present a forecasting equation which performs well according to the standard econometric criteria and has a standard error of forecast which is a little better than the RMSE of CBO forecasts back to 1986. The forecast for 2009 is grim but not disastrous: we predict growth of -0.5%, more or less the same as 1981 and 2000, and about the same as the 20% most optimistic of the CBO's panel of blue chip forecasters. We use the forecast model to classify the seven worst recessions since 1955, finding that falls in the value of household financial assets are the most powerful causes in five of them, including the present. In addition, we look at the relationship between the housing market and the financial crisis. Perhaps counter-intuitive to some, we conclude that neither falls in house-prices nor mortgage-defaults are deflationary per se.

1. INTRODUCTION

Nearly all pundits agree that the recession, which began in December 2007, will see a steep decline in U.S. output in 2009. For example, the Congressional Budget Office (CBO) on January 8 forecast that U.S. real GDP would fall by 2.2% in the year ahead. This would be the largest calendar year-on-year fall since 1946[2]; before that, one would need to go back to the Great Depression for larger recessions. In their report the CBO give as well forecasts from about 50 "Blue Chip" economic groups. The consensus view is for a fall of -1.1%: this would be the largest recession since 1982. In its so-called "Stress Test," the Federal Reserve analyzed how the 19 largest U.S. banks would fare under two recession scenarios: the first run was based on a 2% decline in output for 2009, while the "severe, but plausible" scenario assumed a drop of 3.3%. The OECD went even further on March 31, forecasting U.S. output to shrink by a whopping 4% this year, without any growth in sight for the following year.[3] As one travels south down the opinions, views become wilder still. TIME Magazine's February 16 cover depicts a businessman drowning in a sea of words: "Debt," "Greed," "Capitalism," "Meltdown," "Regulatory failure," "Ponzi scheme," etc. etc.. We find 27.5 million Google hits for "the

[2] The recessions beginning in 1958, 1975 and 1982 had larger four-quarter falls (as distinct from calendar year falls) .
[3] Schmidt-Hebbel, 2009.

coming depression", 18 million for "crisis of capitalism", 11 million for "regulatory failure" and 2 million for "greed and capitalism." There have been two G20 meetings within the last six months to deal with the current economic crisis. Thus a topic which had, during the Great Moderation, become mere technicalities – in contrast to a heroic past of mighty struggles against inflation and unemployment (at least in the memory of elderly macroeconomists) – has suddenly returned to the front page, full of feverish speculation.

We are all agreed this has something to do with turmoil in the financial markets, but a recession is a macroeconomic event: what is the macroeconomic explanation of current problems? By "macroeconomic" here we mean the sort of thing one teaches in an elementary undergraduate course, more or less the Keynesian multiplier model and its elaborations. In this account the level of output is determined in the short-run by variations in expenditure caused by changes in consumption and changes in fiscal policy and investment. Monetary policy acts on the interest rate and thus investment. The venerable IS-LM model summarizes this approach.

The problem with finding such an explanation is that the two star variables, monetary and fiscal policy, are both extremely expansionary: the Federal Funds Rate (FFR) is approximately zero and the 2008 fiscal deficit was estimated in January by the CBO at 3.2% of GDP.

The most obvious factor pulling the other way is the fall in household financial assets associated with the fall in stock-prices, thus restricting consumers' ability to finance consumption. The University of Michigan Index of Consumer Sentiment experienced its largest year-on-year fall 2007/8 since these data began to be collected in 1952. Accordingly, one could say to the Macro 201 students that what we have here is most obviously an inwards shift of the IS curve. Those students who read the financial

press might ask about the housing market and credit conditions. One would tend to adopt the usual ploy of promising to discuss this topic later in the course, just as we shall discuss it later in this paper.

The above discussion has nominated a handful of observable factors to determine growth: the question we ask is whether they give a plausible account of the history of the U.S. business cycle, and, if they do, what they predict for the recession ahead. Thus our aim is to construct forecasts of real U.S. GDP growth over the next year, based on variables currently observable. These variables will be:

- an index of the stance of the monetary authorities;
- an index of the fiscal stance of the federal government;
- household financial assets;
- household labor income;
- inflation;
- the unemployment rate.

These variables are more or less what John Maynard Keynes and Milton Friedman would have come up with if they had been locked in a room and not allowed to emerge until they had agreed a forecasting set. It would not have taken too long: Friedman declared himself a Keynesian in the methodological sense in 1965. There might have been some discussion about the determinants of consumption. Keynes would perhaps have wanted a measure of consumer confidence to capture "animal spirits." We report below an experiment with this variable.

The next section presents a brief description of the evolution of each of these variables over the last 50 years. Section 3 gives the forecasting equation. It seems to perform well according to the standard econometric criteria. The root-mean-squared-forecast error of forecasts is a little better than the RMSFE of CBO forecasts back to 1986, though this is not quite a fair horse-race since our model is calibrated to the whole

experience, whereas CBO forecasts perforce employ data only up to the time of forecast.[4] The forecast for 2008-9 is grim but not disastrous: we predict growth of -0.3%, more or less the same as 1981 and 2000,[5] and about the same as the 20% most optimistic of the CBO's panel of forecasters.[6] We use the forecast model to classify the seven worst recessions since 1955, finding that falls in the value of household financial assets are the most powerful causes in five of them, including the present. In sections 4 and 5 we consider how our forecasts could get it wrong. Section 4 looks at the relationship between the housing market and the financial crisis. Perhaps counter-intuitive to some, we conclude that neither falls in house-prices nor mortgage-defaults are deflationary *per se.* In this section we consider briefly the causes of the great fall in stock prices and come to the conventional conclusion that the fall was a financial panic caused by the large losses of the investment-houses, themselves due to the prospect of wide-spread default on securitized mortgages. Section 5 considers current monetary policy. There are good reasons that, while monetary policy is about as expansionary as it can be, at least through conventional means, credit conditions are not as favourable as might seem from yields on government instruments. This is due to increases in counterparty risk-premiums, associated with carnage in the investment-banking industry, and expectations of deflation. Considerations of these issues suggest that our growth forecast should be revised downwards by a few tenths of a percentage point, to -0.5% say, but not much more.

[4] Data assembled from annual CBO Budget Reports. We calculate the CBO RMSE as 1.18% over this period versus 0.96% for our forecasts. The RMSE of the recursive residuals (i.e. using parameter estimates based on data up to the forecast date) for our model is 1.05%.

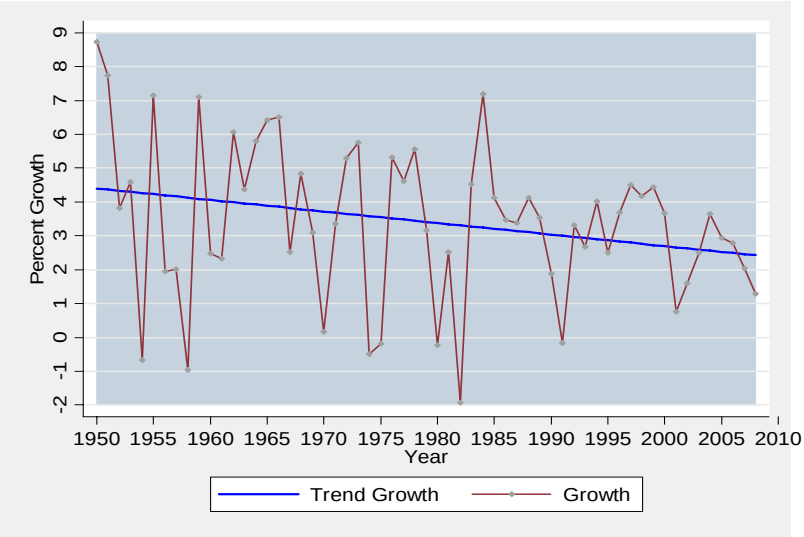
[5] We are ranking forecasts here, not outcomes. In fact 2001 turned out better than predicted in 2000. Forecasts are a better measure of the parlousness of the here-and-now than what subsequently happens – dumb-luck may always intervene.

[6] "Growth" here is the level of 2009 GDP compared to the level of 2008 GDP.

2. FORECASTING US REAL GDP GROWTH

2.1 *GDP Growth*. We shall calibrate the forecasts in annual data, 1955-2008. In fact we forecast growth relative to trend growth. We have chosen to model de-trended growth because we wish to interpret our forecasts as measures of macroeconomic disequilibrium and thus for them to be independent of growth associated with underlying growth in population and technological innovation. Figure 1 shows growth and trend growth, which we take to be linear during our sample period.

Figure 1: Growth and Trend Growth in Real GDP, 1950-2008



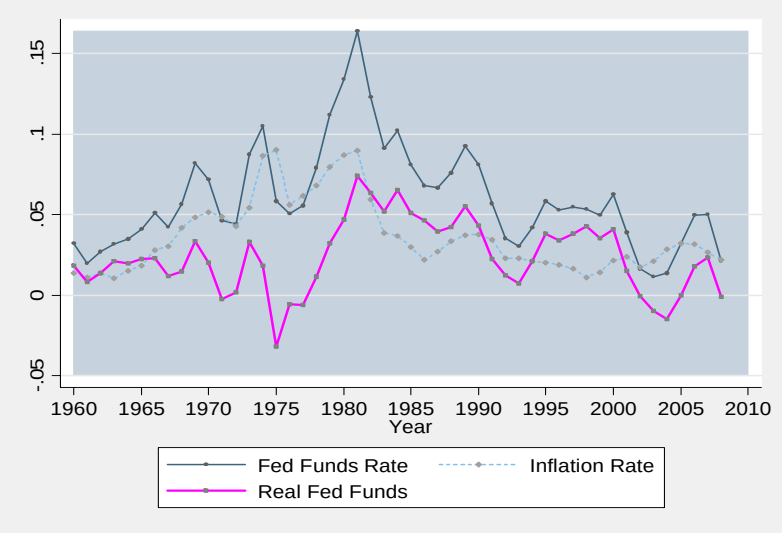
Trend growth was high on average (of the order of 4% per annum) in the '50s and '60s, declining to under 3% in current times The variance of growth about trend is noticeably smaller after the mid-'80s ("the Great Moderation"[7]); the largest events in the growth data are the severe recessions in the mid '70s and early '80s, and the mid '80s boom.

2.2 *Monetary Stance*. That the monetary authorities have the ability to affect the level of output over some time-horizon is fairly uncontentious, though why this should be so has been controversial for 40 years at least. Keynesians base an explanation on some form of price rigidity so that changes in the nominal interest rate cause changes in the real interest

[7] see, e.g., Stock and Watson (2003), Bernanke (2004).

rate and hence investment. Monetarists tend to retain price-flexibility and base the explanation on informational errors associated with monetary expansions and contractions. Whatever the theoretical framework, our aim is to construct forecasts of growth and, as an index of the monetary stance of the Federal Reserve, we shall take the real FFR i.e. the FFR relative to the inflation rate (of the GDP deflator). The FFR has been the principal target of the Federal Reserve over our period, except when monetary aggregates were preferred for a brief period in the early '80s. Using a version of the real rather the nominal interest rate is attractive since the real interest rate is the link between monetary policy and investment expenditure in the conventional IS-LM model. Figure 2 displays the relevant data

Figure 2: Real and Nominal Federal Funds Rate

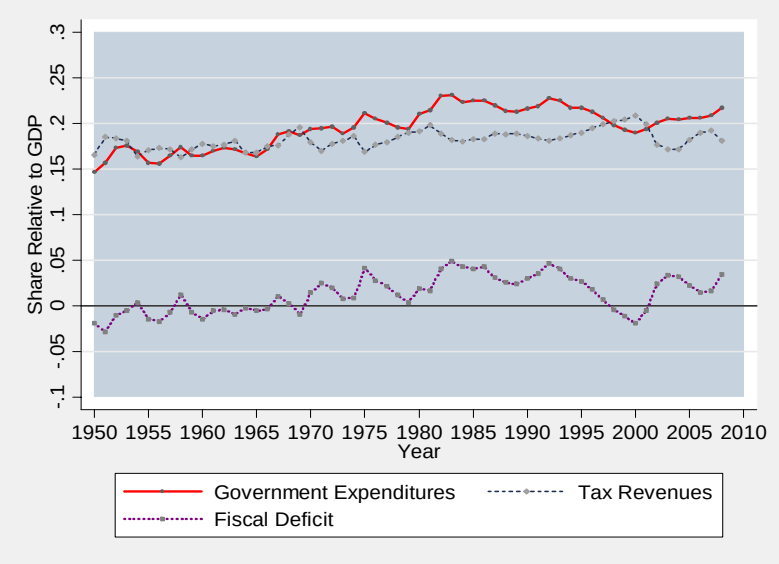


The FFR is the annual average of daily rates and inflation is year-on-year (from the year before) growth in the GDP deflator. The real FFR averages about 2.3% between 1960 and 2008, and shows some tendency to revert to its mean. Two periods of monetary laxity stand out, 1975-7 and 2002-4, though 1971-2 is also noteworthy. The most striking period of monetary contraction began in 1979 and lasted for more than a decade: it was not until 1991 that the real FFR fell below the sample mean. This contraction is usually

associated with Paul Volcker's chairmanship of the Federal Reserve (1979-87). The monetary stance as we write, with the FFR close to zero, and inflation running at about 0%,[8] is as expansionary as any time back to 1975.

2.3 *Fiscal Stance*. The proposition that output is demand constrained, so that an increase in government outlays will lead to an increase in the level of output, is at the heart of the Keynesian model; similarly that an increase in taxation works in the other direction. The difference between these, the fiscal deficit, is often taken to be a measure of fiscal stance.[9] Below we report forecasts for the change in the unadjusted fiscal deficit (as a proportion of GDP). The paths of the federal fiscal deficit and its two components are given in Figure 3.

Figure 3: Federal Fiscal Stance



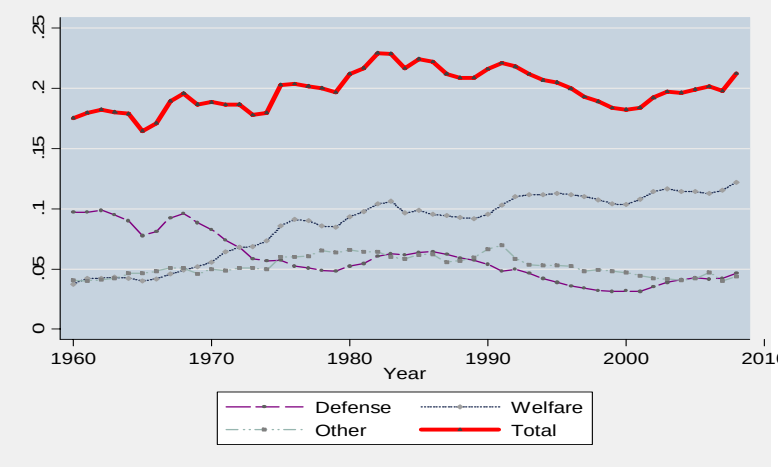
[8] CPI inflation is running at -0.4%, the first year-on-year deflation since 1955. However, this is largely due to the fall in energy prices: core inflation was 1.8% in March 2009.

[9] This is not quite right because the implication that a $1 increase in government purchases is equivalent to a $1 reduction in taxation will only hold if the entire tax cut is consumed: if some part is saved, then only the residual adds to demand. In principle, a better measure would be obtained by weighting tax-revenue by the appropriate marginal propensity to consume, but nominating a value for this parameter is problematic. It is certainly true that the *average* propensity to consume in recent times has been close to unity but, on the other hand, Ricardians would argue that the marginal propensity to consume out of tax cuts is zero, *ceteris paribus*. Of course, our aim is not to settle a question of high theory, but merely to construct plausible forecasts of future growth, based on current observables.

Government spending shows a trend increase of about seven percentage points of GDP from 1960 to 1980, a sharp jump in the early '80s and no particular on-going trend after that. One can observe a strong cyclical component after the late '60s: the local minima of the government spending path correspond precisely to troughs in the unemployment cycle, except for 1984. The tax proportion shows no obvious global trend. Between 1970 and 1997, the Federal Government was constantly in deficit. There is a marked tendency for Republican administrations to lower the tax proportion, especially in the first term, and for Democratic administrations to increase them. Thus the regimes of Presidents Nixon, Ford, Reagan, and both Bushes all saw initial falls in the tax share, whereas the tax share rose monotonically during the presidencies of Johnson, Carter and Clinton. Partisans may argue that fiscal restraint was necessary after the accumulated deficits of the preceding administrations.

Further insight into the underlying causes of the path of expenditure can be gained by consideration of its components. Figure 4 decomposes spending into military (plus international affairs), welfare (health, Medicare, and income and social security), and other expenditure (plus debt interest) for fiscal years.

Figure 4: Components of Federal Outlays



Military spending declined on trend from about 10% of GDP in 1960 to about 5% in current times, but increases occurred during the Vietnam War, the conflicts in West Asia, and President Reagan's period of office. One also observes the steady decline of about 3% of GDP between 1987 and 2001 – the so-called "Peace Dividend." Federal welfare spending increased by about 8% of GDP over the period, rather more than the fall in military spending. Of this, about 6% is attributable to the "Great Society" legislation of President Johnson and continued initiatives under President Nixon, and about 2% to a slow upwards drift from the mid '70s to the present. Observe as well the pronounced cyclicality of welfare spending, accounting for the cyclicality in aggregate spending we have observed above.

In summary, though the U.S. has not pursued active fiscal policy to stabilise the business cycle to the extent of the British and others, a combination of military exigencies and the different ideologies of conservatives and liberals over tax policy has lead to considerable variation in fiscal stance over the past 50 years.

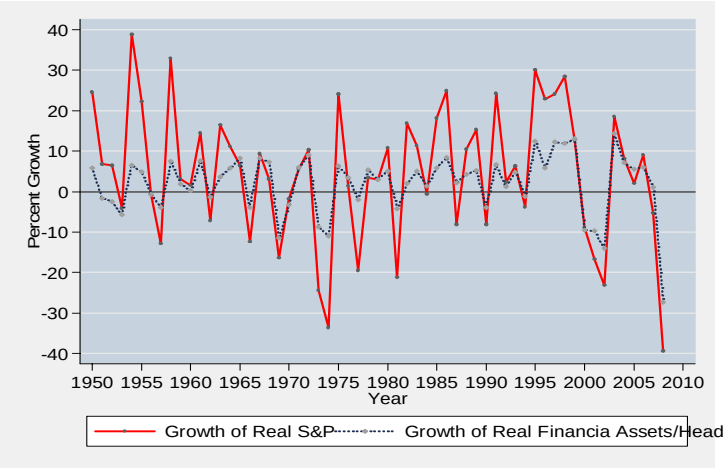
The 2008 fiscal deficit as estimated by the Congressional Budget Office at 3.2% is only slightly less than the 2003 level which is the highest back to the early '90s. Thus the current deficit should be considered to be at a high level, compared to recent U.S. experience (though not compared to European levels).

2.4. *Components of Wealth: Financial Assets and Labor Income*. The simple Keynesian view where consumption is determined by current income has been undermined by the modern insight that forward-looking households will form in each period a lifetime consumption plan (Modigliani and Brumberg, 1954; Ando and Modigliani, 1963). The appropriate budget constraint is that the present value of the planned consumption stream is equal to the household's wealth. This is itself equal to the household's current assets

net of liabilities plus the present value of the household's current and future labor income.

Figure 5 shows the behaviour of household real financial assets net of liabilities as well as the S&P 500 (both end-of-period). Stock prices determine directly a proportion of the value of household financial assets. The two series tend to move together, the variation in financial assets being somewhat damped.

Figure 5: Annual Rates of Change in Net Financial Household Assets/head and the Real S&P 500

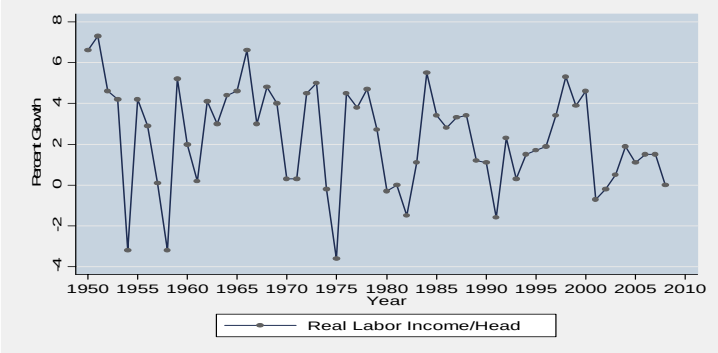


The latest fall in the S&P, about 40%, is surpassed among 12-month falls since 1871 only by the falls in the first half of 1932 and in 1937/8. Since 1871, there have been seven January to January falls in the S&P over 30% (1908, 1918, 1921, 1932, 1938, 1975, and 2008): thus the fall we have recently witnessed should be considered quite rare, more or less a 25-year event. The fall in real financial assets per head is easily the largest witnessed since the War.

Figure 6 shows the growth rate of real per capita labor income[10].

[10] Some might question the use of a component of real GDP in forecasting real GDP itself. However, note that it is not *current* real labor income that is used to forecast below, but rather its *lag*. We estimate a forecasting equation, not a structural or causal relationship.

Figure 6: Growth Rate of real Labor Income per Head



One observes the pro-cyclicality of these data, also the marked trend decline in the growth rate of labor income.

2.5 *Inflation*. In most (but not all) economic models, the *level* of inflation, provided it is uniform over goods and constant over time, will have no implications for the level of output (the neutrality of money proposition). There are, however, many caveats that would allow the current level of inflation to have predictive power for future growth. It is well-established that the general public is inflation-hating and it is part of the remit of the U.S. government, and the Federal Reserve in particular, to produce a low level of inflation. Thus high inflation carries with it the likelihood of a policy response that may have an output cost. Typically this will be a monetary contraction, but more exotic policies have been tried, such as the price-controls introduced by the Nixon administrations. More generally, a high level of inflation is likely to be interpreted as a sign that the economy is not functioning as it should and that some unpleasant reckoning lies ahead.

We have emphasised the negative effects of inflation on output but one should note that the Phillips Curve literature finds that inflation or inflationary shocks increase output, at least in the short-run. Thus one can find theories to accommodate both positive and negative effects of inflation on output.

The path of inflation in the GDP deflator is given in Figure 2 above. Apart from a bump in the mid '70s, it increased quite steadily from 1960 to a high of 9% per annum in 1981. Thus this period can be characterized as having seen levels of inflation rates that were higher at each peak of economic activity than during the previous peak. It then fell rapidly to less than 3% in 1985, and has not ventured above 4% since then. This fall in inflation is usually attributed to tight monetary policy during Volcker's period at the Federal Reserve. One can observe two notable increases in inflation since 1985, albeit at a lower level than formerly: a peak in 1989 of 3.7% and a peak in 2005 of 3.2%. The latter episode is often attributed to expansionary monetary policy during and after the recession of 2001.

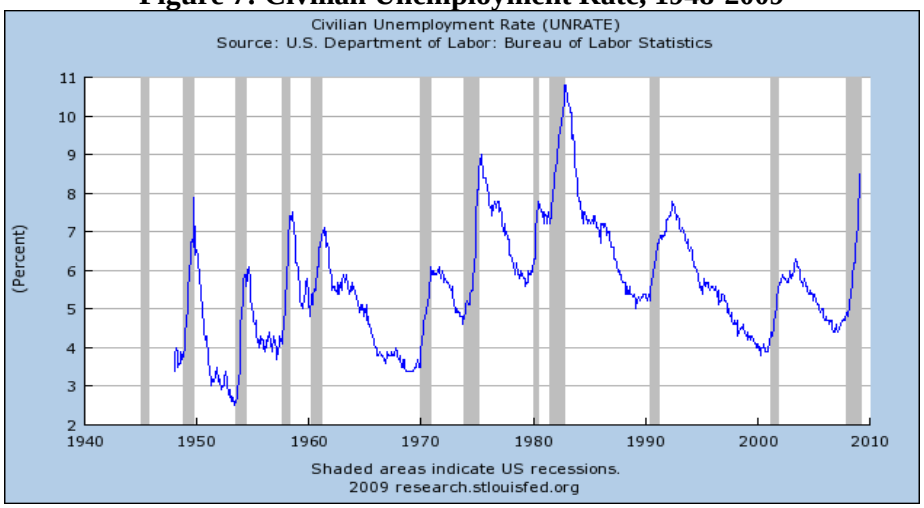
2.6 *Natural Adjustment to Equilibrium*. The final predictor we consider is the unemployment rate, considered as a measure of macroeconomic disequilibrium. In the absence of macroeconomic disturbances, one might expect disequilibrium to be eliminated as prices adjust by natural means, given sufficient time. Thus, if the unemployment rate is high, future growth should be high, *ceteris paribus*. Proponents of stabilisation policy, Keynes included, typically argue that such forces exist, but act unconscionably slowly.

Figure 7 presents the behaviour of the U.S. civilian unemployment rate for the post World War II period. The figure is taken from the Federal Reserve's FRED data base, and shaded areas indicate recessions as determined by the business cycle dating committee of the National Bureau of Economic Research.

The dominant features are:

- fairly violent oscillation about a low mean up to about 1960;
- a decade-long fall in the 1960s;
- a trend increase in the 1970s with unprecedented (post-war) unemployment in the middle of the decade;
- a massive unemployment-recession in the early 1980s, followed by a decade-long recovery.

Figure 7: Civilian Unemployment Rate, 1948-2009



The two completed recessions after the early-'80s are diminishing echoes of that experience, with sharp increases in unemployment, followed by a long decline. The current increase in unemployment is of longer duration than either of these and comparable to the unemployment-recessions of the 1970s and '80s. The record sustained monthly post-war increase in the unemployment rate was for 17 months between July 1981 and December 1982. As we write in May 2009, unemployment has been rising for 13 months.[11] Thus, if the situation does not improve, we would break new ground by the middle of the year.

3. THE FORECASTS

3.1 *The Forecasting Equation*. Table 2 sets out forecasting equations for GDP growth relative to trend, based on the variables we have discussed in the previous section. [12]

[11] For these calculations we count draws (non-decreases) as increases.

[12] To clarify, the equations are of the type $\hat{y}_{t+1} = f(x_{1t}, x_{2t}, ...)$.

The regression R^2 is high for a rate-of-change dependent variable and the F-statistic for the whole regression is 15.1, significant at any conventional level. All variables have the expected signs.

Table 1: Forecasting Equations for Growth and Unemployment, 1955-2008

	Real GDP growth rate rel. to trend
Constant	-3.146 (3.4)
Federal Funds Rate, real	-0.182 (2.1)
Federal Fiscal Deficit rel. to GDP, change	0.556 (2.5)
Financial Assets/head real, growth rate	0.150 (5.1)
Labor income/head, growth rate	0.230 (2.1)
Inflation rate	-0.362 (4.1)
Unemployment rate	0.669 (4.2)
Standard error of regression	1.303
R^2	0.66
Durbin-Watson	1.74

Note: absolute t-values in brackets.

An decrease in the interest rate by 100 basis points leads to a forecast of about one fifth of a percentage point higher growth, while an increase in the fiscal deficit by one percentage point predicts about a half of a percentage point higher growth, all else equal. The financial assets variable is very strong: a 10% increase predicts an increase in growth by 1.5 percentage points. Labor income is a moderate predictor. A high inflation rate is bad for growth. The unemployment rate variable is in accord with the existence of strong equilibrating natural forces in the economy. We have tried a number of extra predictors in this equation, corresponding to various conjectures about what might be important extra causes of the business cycle. The following were found to be weak (t-statistic for real GDP growth relative to trend equation only):

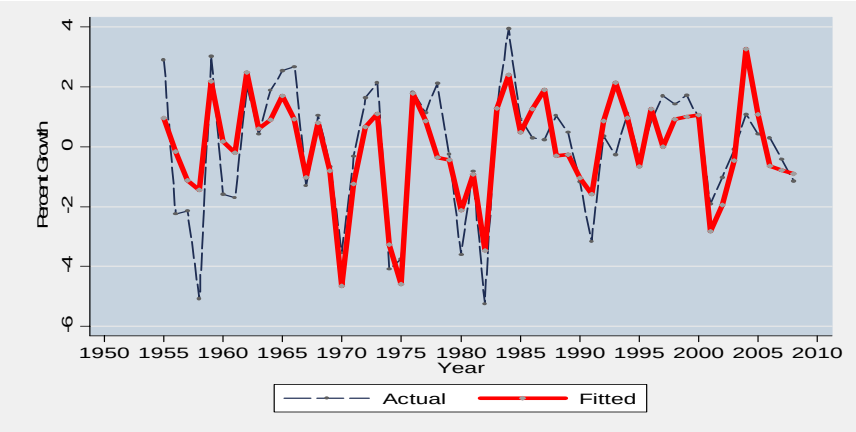
- the growth rate in the real price of energy[13] (*t*-stat = -0.5);
- the growth rate of the tax and import price wedge (*t*-stat=0.3);
- the growth rate of real stock-prices (*t*-stat = 0.7);
- the growth rate of real house-prices[14] (*t*-stat = 0.9);
- the stock of residential housing relative to GDP (*t*-stat = -0.7);
- the growth rate of consumer confidence (*t*-stat= 1.0);
- the spread between Baa and Aaa corporate bonds (*t*-stat = -1.0);
- the spread between the 10-year T-bill rate and the FFR (*t*-stat = 0.3)
- the lagged growth rate of real GDP growth relative to trend (*t*-stat = -0.2).

3.2 *Statistical Properties of the Forecasting Equation*. Figure 7 graphs the actual and fitted from the growth forecasts in Table 1. Overall, the forecasts capture the general character of the observed business cycle. Two sets of econometric tests of the forecasting model are pertinent. First, one wants to know if the errors are serially correlated, as this might suggest omitted variables or a misspecified functional form. The latter is especially dangerous when, as here, forecasting out-of-sample with variables at the limits of their range of variation. Second, one would like to examine the stability of the parameters over the sample, in particular at the end where we make our forecast. For both we have used the standard suite of tests. Neither the Q-test nor the Breusch-Pagan test suggests any evidence of serial correlation. The ARCH LM test of serial correlation of error variance is easily passed as are the White tests of heteroskedasticity. The Ramsey RESET test of general misspecification has a *p*-value of 0.6. With regard to parameter stability, the Chow test with the sample split midway gives an *F*-statistic with a *p*-value of 0.39; Chow forecast tests with breaks at 1998 and 1988 are easily passed as well. Both the CUSUM and the CUSUM of squares statistics lie within two-standard-error bands over

[13] See Hamilton, 1983, 2003, 2009, for the view that oil prices have played a major role in most recessions, including the current one. However, on this see also Kilian (2008).
[14] See OECD, 2009, for the contention that a quarter of all recessions in the world since 1960 were caused by house-price busts.

the whole sample. We find that the recursive residuals have *p*-values smaller than 0.05 only twice.[15]

Figure 7: Actual and Fitted Values from the Growth-relative-to-trend Forecasts



In summary, the equation seems to forecast well in sample. Failure to forecast reasonably well in 2009 would seem to require a shift in equation parameters to an extent that has not been observed in the past and would thus be consistent with the fairly widespread view that the current recession is of a nature that the U.S. has not experienced since the end of World War II.

3.3 *Forecasting Output Behaviour during the 2009 Recession Year*. Figure 8 gives the path of forecasts of future growth. The economy is predicted to grow 2.7% below trend growth and total growth is predicted to be about -0.3% year-on-year for 2009 as a whole. This is approximately equal to the forecasts of growth obtained in 1981 and 2000; worse forecasts were obtained in 1969 and 1974.

Figure 8: Forecasts of Next-Year's Growth

[15] We will not reference the various tests here, but the interested reader can consult a standard econometrics textbook, such as Gujarati and Porter (2009).

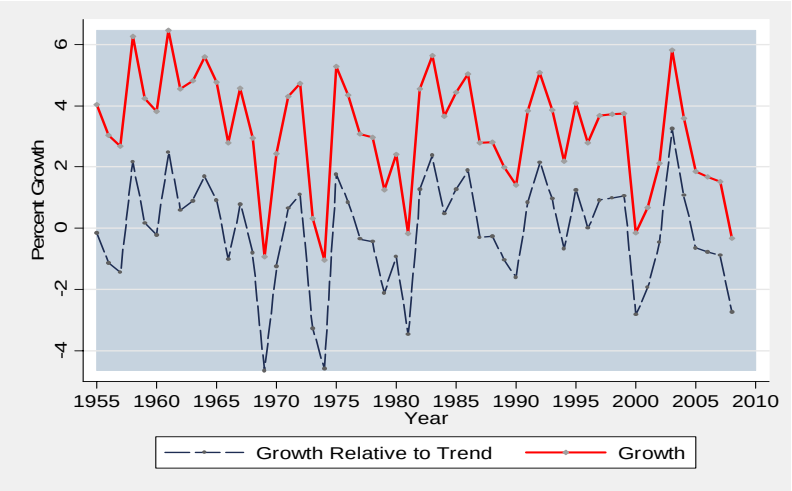


Table 2 sheds some light on what exactly causes this pessimistic, if not disastrous, prediction, and compares it to other forecasts of post-war recessions.

Table 2: Contributions to Seven Grim Futures

	Money	Deficit	Financial Assets	Labor Income	Inflation	Unempl. rate	Ranks
1969	-0.2	-0.7	-2.0	0.4	-0.4	-1.6	FUD
1973	-0.2	-0.7	-1.6	0.6	-0.6	-0.6	FD
1974	0.2	0.0	-1.9	-0.6	-1.9	-0.2	FI
1979	-0.1	-0.4	0.2	0.1	-1.6	0.0	I
1981	-0.9	-0.2	-0.9	-0.5	-2.0	1.2	IFM
2000	-0.3	-0.5	-1.7	0.6	0.6	-1.2	FU
2008	0.4	1.0	-4.5	-0.5	0.6	0.4	F

The top row indicates the predictors in the order of Table 1: thus "Money" refers to the real Federal Funds Rate etc. The table gives the contribution of each of the predictors to the seven lowest forecasts of growth over our sample period, relative to sample means. Column 8 ranks the predictors by magnitude of contribution when these are negative and larger than 0.7 in magnitude.[16]

It is particularly striking that, of the seven worst predictions of recessions since 1955, falls in the value of financial assets have been the strongest factor five times and runner-up once in 1981. Inflation was important three times up to the Volcker period.

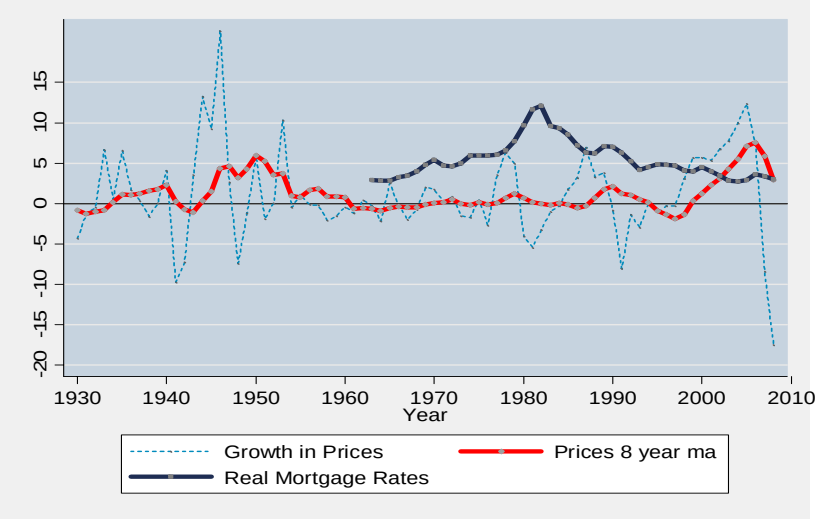
[16] The letters in column 10 refer to the names given to the variables in the first row of the table.

Money was important only in 1981. The deficit has not been an important negative factor in recent times; changes in labor income have never been particularly influential. The forecast of 2008 is dominated by the unprecedented fall in the value of financial assets. However the expansionary monetary and fiscal stances, as well as a contribution from low inflation, pull in the opposite direction. Thus investors have taken a glum view of the future, which is combated to some extent by expansionary monetary and fiscal policy of the federal authorities.

4. THE HOUSING MARKET AND THE CRISIS OF 2008

4.1 *The housing market*. In this section we shall discuss the housing market and its role in the crisis of 2008. A major aim is to identify factors that might lead to modification of the forecasts obtained above. Figure 9 describes the evolution of house-prices and mortgage rates.

Figure 9: House-Prices and Mortgage Rates



The real price of housing grew from 1998 to 2006 without a set-back.; by the end of 2006 it had grown at an average rate of over 7% for the last eight years. This was the largest sustained growth in house-prices at least since the 1890s and probably of all

times. By 2002, the average (over eight years) historical real return on holding a house exceeded the real yield on new mortgages for the first time. When this situation is extrapolated into the future, then buying a house or a bigger house on a mortgage enables one to live rent-free while enjoying an increase in wealth from capital gains net of borrowing costs.

The causes of this increase are controversial. Many believe that the increase was some sort of speculative bubble (i.e. a self-sustaining increase in prices unrelated to fundamental values) perhaps initiated by monetary laxity 2001-4. Against this explanation, one can see in Figure 9 that the recent upwards march of house-prices began in 1998. Correlates of the increase are difficult to come by. In annual data 1950-2008, we find the rate of growth of real house-prices is highly serially correlated ($\rho = 0.7$) but is not Granger-caused by any of: the real FFR, the mortgage rate, the stock-market, the growth rate of the number of households, the growth rates of real per capita GDP, labor income and consumption, and the unemployment rate. There is however some evidence of causality from the net stock of residential structures relative to GDP, wherein a high level of housing acts negatively on prices. The causality appears to be two-way: an increase in real house-prices acts positively on the stock of housing relative to GDP. In this regression one also finds mild evidence that the real FFR negatively on the stock of housing. Note the implication that, if housing bubbles exist, they should automatically self-destruct as an increased supply of houses acts negatively on their price.

Whatever the underlying cause, the sustained increase in prices sent two unambiguous signals about houses to the market: to builders to build them and to households to buy them. With regard to the former, Figure 10 shows that residential investment increased steadily from 1991 to a peak in 2005, with a marked acceleration from 2002. An explanation that had interest rates as the major cause of the building boom

would seem to have difficulties with explaining why non-residential investment was falling or flat over this period: however, interest rates most likely contributed to the boom, as noted above.

Figure 10: Components of Investment Relative to GDP

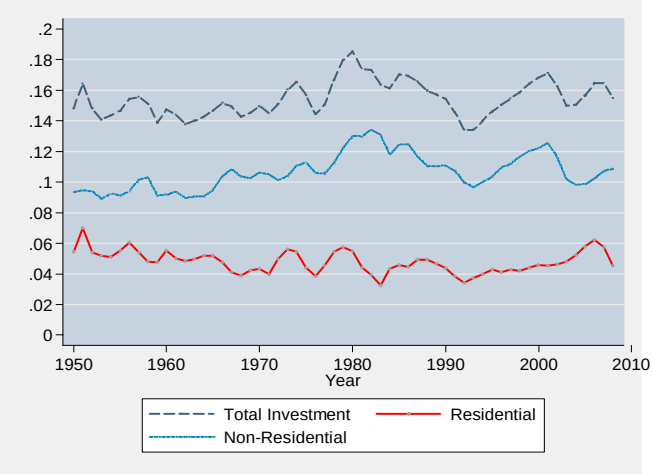


Figure 11 shows the effects on stocks relative to GDP. By 2006, the housing stock was at an historic high compared to GDP.

Figure 11: Residential and Non-Residential Assets relative to GDP

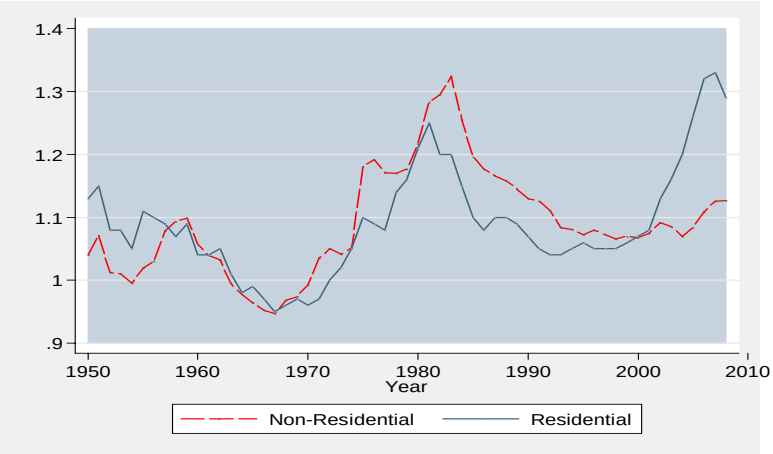


Table 3 gives a somewhat different perspective on housing construction 2002-08. In all, 9.9 million extra homes were built, but fully-occupied houses increased by only 52% of this, 48% standing vacant. This 48% vacant splits into 14% for seasonal occupation (vacations typically), 8% for rent, 10% for sale, and 16% otherwise vacant. Clearly no

price-bubble could withstand such vacancy rates. It seems fair to say that the U.S. faces 2009 with a large over-supply of houses and that the building industry will be depressed for a number of years.

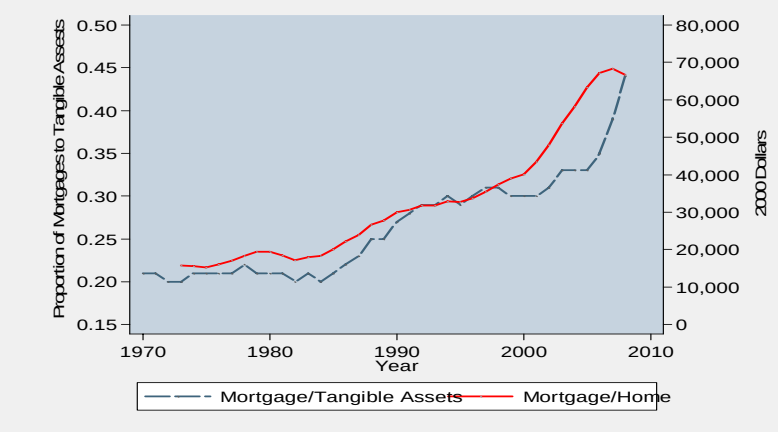
Table 3: Houses Built 2002-8 and Usage

	Change 2002-08	% of total increase
Total houses	9.9	100
Fully occupied	5.2	52
Not occupied	4.7	48
of which:		
Seasonal	1.4	14
For rent	0.7	8
For sale	1.0	10
Other vacant	1.5	16

On the other side of the market, the boom saw a large increase in household mortgage debt: see Figure 12.

From 2002 to 2006, the average house mortgage increased by about thirty thousand year 2000 constant-price dollars, and mortgages relative to the value of tangible assets grew from 0.31 to 0.35. Following the fall in house-prices, mortgages relative to tangible assets rose to 0.45 in 2008.

Figure 12: Measures of Mortgage Exposure



This large increase in mortgage debt is generally taken to be the source of the current financial crisis. It is clear underwriting standards were relaxed over the course of

the boom as loans were made to increasingly riskier borrowers (sub-prime, Alt-A mortgages, Option ARM mortgages). With the end of the boom, foreclosure-starts on all loans rose from 0.46 per 100 loans in 2006 to 0.75 in 2007 to 1.09 in 2008. In principle all of these loans corresponded to negative equity. The problem in the mortgage market was transmitted to the financial markets generally by the relatively modern practice of *securitization* wherein individual mortgages are bundled together as a single security; the arcane practices of modern financial engineering then transform these bundles into securities of great complexity. The resulting mortgage–backed securities (MBS) were widely sold within the U.S. and around the world. John Taylor concluded in November 2008 "We didn't know which banks were holding them 14 months ago, and we still don't know where they are. This risk in the balance sheets of financial institutions has been at the heart of the financial crisis from the beginning."

There may be villains in this story, but there need not be. Securitization of mortgages reduces idiosyncratic risk and thus interest rates, and presumably can take some of the credit for the increase in home-ownership rates of the last 30 years. Some relaxation of underwriting standards will inevitably accompany deepening of home-ownership: the foreclosure rate rose steadily on trend from about 0.25% in the early '70s to its level of 0.46% in 2006. The real problem is that the sustained increase in prices 1998-2006 is surely likely to have created large populations of potential borrowers and potential lenders who were willing to extrapolate the increase into the future. When the capital gain on houses is greater than the cost of funds, any pair of individuals from these populations can initiate a mutually profitable transaction, even if the borrower cannot meet a single mortgage payment: they will thus seek each other out as consenting adults, two-by-two. From this perspective, the rise of such securities as sub-prime mortgages merely describes how these transactions were implemented.

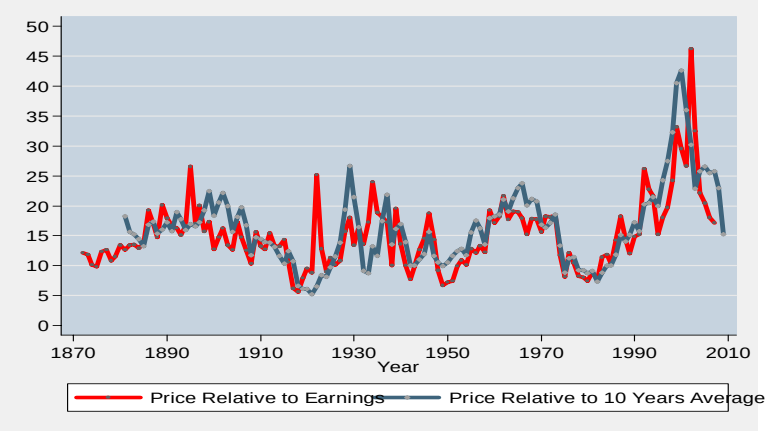
4.2 *The stock-market*. Between December 2007 and December 2008 the value of financial assets net of liabilities held by U.S. households fell by about $11 trillion or about 31% of household financial net assets at the end of 2007.[17] Since net financial household assets might comprise about 8% of total wealth (including the present value of labor income)[18] this of itself would indicate a 2.4% fall in consumption (in a permanent income world). While our forecasts take the path of financial assets as given, in the interest of completeness we shall offer some discussion of the causes of this massive fall in financial wealth. There are difficulties with blaming toxic debt. Assume defaults for a quarter of the 25% of U.S. mortgages currently with negative equity, that 75% of them are securitized, and that 50% of their value is recovered after foreclosure. Then the loss to the institutions holding MBS would be of the order of $250 billion, only about 0.7% of the value of net financial assets at the end of 2007. The loss would be equivalent to raising the rate of corporate tax from its current level of about 30% to 30.5%, in the sense that both would reduce the market value of firms by 0.7%. Changes in corporate tax rates an order of magnitude larger have occurred in the past without causing financial crises. For example, the rate of corporate tax was raised by about six percentage points in 1951 and another 1.25 points in 1952 without any major effect on stock prices.

One possibility is that the stock market was overvalued at the end of 2007. Figure 13 gives the price-earnings ratio for the S&P 500, for both current earnings and a 10-year average of earnings. We concentrate on the latter measure, which has a sample average of 16.3 and is strongly mean-reverting (ADF p-value = 0.02). One can see that the p/e ratio has now about returned to this average following a period from about 1995 when it was

[17] Household balance sheet data are taken from FRB *Flow of Funds Accounts of the United States*, 14 March 2009.
[18] Assumptions: HHA are 2.4 times GDP (average 2000s value), labor's share in GDP is 70%, the tax-rate net of transfers is 18% (2007 value), labor income grows at 2% per annum and is capitalized at 4%.

substantially greater. From this viewpoint, stock-prices now stand in their historic proportion to long-run earnings.

Figure 13: Price/Earnings Ratios for the S&P 500



In a regime of constant growth of earnings, the p/e ratio is equal to $1/(\rho - n)$ where ρ and n are the real discount rate and expected growth rate respectively.[19] The implied sample mean for $\rho - n$ is thus about 6%. Under balanced growth in the Koopmans-Cass model, $\rho = n + \delta$, where δ is the subjective rate of time-preference: a high rate of growth requires high interest rates to divert consumption to investment. In these circumstances, the steady-state p/e ratio is $1/\delta$, which is a behavioural parameter, independent of the underlying growth rate of the economy. The mean-reverting nature of the p/e ratio is strikingly consistent with this account. However the dependence of the real interest rate on the growth rate is a result for the closed economy, which the U.S. is increasingly not. Examination of British and other inflation-adjusted securities and U.S. long-dated Treasury bills suggests that world long real interest rates fell by between 100 and 200 basis points over the course of the '90s. It is also true that earnings grew very rapidly from 1995 to 2007. If one were to lower the real interest and increase the expected

[19] The assumption is the price of a security is the present value of its earnings.

growth rate of earnings each by one percentage point, then the equilibrium p/e ratio would be 25, approximately its value at the beginning of 2007. In this account, which we find persuasive, changes to real interest rates and earnings growth have induced a shift in the mean of the p/e ratio: there was thus no need for the large price adjustment occurring at the end of 2008.

This seems to leave us with just another financial panic. Pricing the stock-market requires nomination of the mean and variance of the growth rate of earnings, essentially conjectures about the future. In normal circumstances such conjectures can be fairly reasonably based on what has happened in the past. However, the unprecedented spectacle of the insolvency or humiliation of great investment-houses surely suggested that the corporate economy was entering a new regime. Possibilities that would normally be considered as outlandish then become worthy of consideration. For example, in December 2008, the bond market seemed to be considering the prospect of a return to the '30s, as we shall document below. In these circumstances, averaging over possible outcomes indicates a move to riskless assets both because expected returns have fallen and because risk has risen. Indeed, if there is no systematic method for attaching specific numbers to probabilities of events, the minimax strategy of complete liquidation of one's equity position becomes increasingly attractive. Thus prices must fall to bargain-basement levels to persuade the public to hold the stock of equities. In fact, when investors play minimax over a collection of possible future market prices, the current equilibrium market price is the worst-case price, for only then are investors indifferent between being in the market and the liquidate-all option; any investor in the market for a price above the worst-case price could not be playing minimax.

The preceding discussion raises three questions about the forecasting model:

- The value of household financial assets at the end of 2008 was about $11 trillion less than at the end of 2007 and the value of tangible assets was about $3 trillion

less. Our forecasting model already incorporates financial assets: should it incorporate tangible assets (mainly houses) as well?

- Delinquencies and foreclosures on mortgages have increased; will this be contractionary?
- Nobody is quite sure who owns the toxic debt: what will be the macroeconomic effects of the resulting increase in risk?

4.3 *Demand effects of an increase in house-prices*. There is contention that the boom in house-prices led to an increase in consumption, financed by tapping the increased equity in the family home – people remortgaged their houses to buy Hummers and Plasma TVs, so the story goes. This is also known as the house-as-an-ATM theory of consumption. The theory implies an opposite effect on demand when prices fell. From a general equilibrium perspective, however, it is not clear why this should be so. Consider the inter-temporal budget constraint of household *i*:

$$NHA_i + p_H H_i = PV(c_i) + PV(p_{hs} hs_i)$$

where *NHA* is net non-housing assets (including the present value of labor income), *H* refers to quantities of housing owned, *c* is the stream of non-housing consumption[20] and *hs* is the stream of housing-services consumed. The prices p_H and p_{hs} refer to prices of houses and housing-services (rents or implicit rents) respectively. Assume households have preferences over consumption goods and housing-services and, in aggregate,

$$Hp_H = PV(p_{hs} hs)$$

i.e. the value of the housing stock is equal to the *PV* of the stream of rents it generates. We take the supply of houses fixed at *H*. The budget constraint takes the aggregate form

$$NHA = PV(C)$$

[20] For the remainder of this section "consumption" means non-housing consumption. As measured in the national accounts, consumption includes an estimate of the consumption of housing services.

The aggregate non-housing budget constraint is thus independent of house-prices. Current non-housing consumption of the representative household depends only on *NHA*, and not on the path of house-prices, however these come about, since, for such a household, the flow of housing services is constant over time.

Though this deduction is elementary, it is odd that very few macroeconomists seem prepared to come out of the closet and state baldly that the baseline economic model predicts non-housing consumption is independent of the path of house-prices. By baseline economic model we mean the representative-agent-PIH framework where agents choose a path of consumption subject to an inter-temporal budget constraint, borrowing and lending at the market interest rate. Our own view is that this framework is the first port-of-call in considering a macroeconomic question and one goes to it to get the baseline prediction. It is true that the model is a simplification and that there may be macroeconomic phenomena that it cannot explain, in particular those arising from distributional effects and capital-market imperfections. We turn to these next.[21]

We have analyzed a Koopmans-Cass model with current utility taking the form $u(c_i, hs_i) = \log c_i + \alpha \log hs_i$ where α is a parameter measuring the taste for housing. We allow the initial endowment of housing and other assets to vary across households, as well as the inter-temporal discount rate for future utility δ_i. Note that δ_i the marginal (and average) propensity to consume out of wealth in this model. We find aggregate (non-housing) consumption is given by

$$C = \sum_i \delta_i NHA_i + \frac{\alpha}{\alpha + 1} NHA\, Cov(\delta_i, \pi_i^H - \pi_i^{NHA})$$

[21] For a discussion of most of the points to be raised below, see Mishkin, 2007. Mishkin is determinedly in-the-closet with regard to the baseline model. He emphasises the demand effects of house-price bubbles, as we shall discuss below.

where the two terms in π stand for the household's portfolio holding of houses as a proportion of all houses in the first case, and non-housing assets as a proportion of all such assets in the second case The price of houses is endogenous: one finds that $p_H = \alpha NHA / H$. The second term in the consumption function will vanish if δ_i does not vary over households (as in the representative agent model) or if households hold the market portfolio of assets ($\pi_i^H = \pi_i^{NHA}$). It is however natural to take the covariance term as negative, since the patient (low δ_i) will tend to be rich (since they accumulate wealth at rate $\rho - \delta_i$) and the rich tend to be long in houses.

Since house prices are endogenous, one is not at liberty to vary them exogenously but one can consider the effect of an increase in prices caused by a shift in preferences towards housing i.e. an increase in α. Given that the covariance term is negative, such a shift in preferences would be accompanied by a *fall* in consumption. The logic is that the benefits of an increase in the price of houses flow to those who are long on housing: but this group has a lower marginal propensity to consume. The improvident are too busy trying to find the rent to think about Hummers. Note that, with stable preferences, an increase in house prices can arise in this model only if non-housing assets increase. Whether or not it is possible to sustain empirically the argument that the value of non-housing assets drove the price-boom is beyond our present scope.[22]

There are arguments for a connection between house prices and consumption that attack the Koopmans-Cass prediction that the propensity to consume out of wealth is independent of the household's present circumstances. Consider a household with wealth comprised largely of future labor income which would like to consume more but has no

[22] Let us note however that the consequences of a general increase in confidence in the future can easily lead an observer to give credence to the house-as-ATM-model. Following such an increase, households want more of both houses and Hummers. So the price of houses is bid up and, fortuitously, this provides collateral for the loan to buy the Hummer. An observer can conclude that house-prices went up and this led to extra consumption; the observer mistakes effect for cause.

collateral for loans. In these circumstances the household consumes all its net current income. Such a household will have already consumed all of the equity in any house it owns; an increase in house-prices will increase equity and thus enable increased consumption. What this overlooks is that the increase in house-prices will reduce the consumption of those who have similar future prospects but no home, since their rents will increase.[23] On balance, if this class is largely comprised of people at the beginning of their careers, it is surely likely that those without a home will outweigh those with a home.[24] A related argument is that an increase in house-prices guarantees the retirement income of householders and thus reduces their incentive to save: they plan ultimately to sell the family home and buy or rent a smaller property. This planned reduction in the quantity of housing services consumed creates a surplus which can be spent on current consumption. However the increase in wealth of this household from an increase in house-prices is offset by reductions in the wealth of those to whom the family home will be ultimately sold. Only if these households do not yet exist in the domestic economy will there be an increase in current consumption. As in the Ricardian debate, the net effect can turn on the extent to which households seek to guarantee the living standards of their dependent children, and could go either way.

Price bubbles imply results more in line with the house-as-an-ATM theory.[25] Write the aggregate budget constraint in the form

$$NHA + \left[p_H H - PV(p_{hs} hs) \right] = PV(C)$$

The term on the left in brackets is the difference between the market value of the housing stock and the present value of the stream of rents it generates. Previously we assumed this was zero but one can take it as a plausible measure of a housing bubble. An increase in

[23] Note that "rents" here refers to current and future rents.
[24] This reservation would seem to apply as well to models that have some households confronted by higher interest rates because of low collateral, as in Aoki *et al.*, 2002.
[25] See Barlevy, 2007, for a general review of the theory of bubbles in asset prices

the value of a bubble unambiguously increases wealth to be set against consumption.[26] The ratio of household tangible assets to GDP appears to have been about 20% above trend in 2005 – assume this was all a bubble. Since tangible assets are about two units of GDP and the average marginal propensity to consume out of wealth might be of the order 0.02, the bubble would have added to consumption about 0.8% of GDP in 2005.

The problem we see with the bubble theory of consumption is not that a large part of the house-price boom was sustained by buying pressure from those who extrapolated price increases into the future, but rather that the capital-gains expected by this class of traders would not in practice have a large effect in the demand for other goods. If a home-owner plans not to sell, then price increases have no effect on the wealth to be set against consumption of other goods. The increase in the perceived wealth of bubble-traders follows from the presumption that they can unwind their position ahead of a return to fundamentals. They are thus required to have taken a gamble on house-prices, financed perhaps by leveraged loans, and then to have bought Hummers etc. in anticipation of a killing. This would be bold stuff, but surely not typical, even of bubble-traders.

In summary, there is no compelling theoretical reason to expect a change in house-prices of itself to lead to increased or reduced consumption of other goods. In the simple baseline case, there is zero net effect. In the case of liquidity-constrained households, the net effect depends on the proportion of such households owning a house. In the case of households planning ultimately to reduce consumption of housing, the net effect may well be zero, once account is taken is taken of those to whom the house will be sold.

Greenspan and Kennedy (2007) have written an influential paper analysing the uses of equity withdrawn from houses, either when they are sold or as a result of re-

[26] Note that the introduction of exogenous bubbles enables one to consider the effect of increases in house-prices holding constant preferences and non-housing assets, as we were unable to do in the Koopmans-Cass model.

financing.[27] They find that equity withdrawal at the peak of the boom (2001-2005) was used to finance about a 1% increase in personal consumption expenditures, compared to the average 1991-2000 (Table 2, page 19). Although they specifically exclude interpretation of these results as bearing on the general level of consumption, the findings have been widely seen as evidence for the house-as-ATM theory. This interpretation is dubious. Firstly about two-thirds of equity withdrawal comes at the sale of houses, hardly an ATM transaction. Houses are sold for reasons which are themselves likely to influence consumption of other goods. If a larger house is bought, this indicates an increase in the consumption of housing services, the choice of which would normally be accompanied by the choice of increased consumption of other goods. Both might follow from the prospect of increases in income (e.g. an expanding business or a return to the workforce).[28] This argument applies, perhaps with less force, to re-financing: the precipitating cause may influence consumption directly. Of its nature the sample excludes those home-owners who do not sell or re-finance and, *a fortiori*, those households not owning a house. The inclusion of these would water-down the effect on aggregate consumption. Indeed, exclusion of those short on housing in principle removes from consideration the group with the countervailing negative income effect from an increase in house-prices. Rents as a proportion of average hourly earnings were on average 8% higher 2001-2005 than 1991-2000, suggesting a substantial negative effect on consumption for that third of American households not owning a house.[29]

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[27] The paper also contains a useful review of the general literature on the relationship between housing wealth and consumption. This literature seems fairly inconclusive, with results in support of most opposing views.

[28] Similar omitted variable bias undermines a great deal of empirical work on PIH models, particularly that which seeks to measure MPCs out of different sorts of wealth. This is because PIH-wealth should contain the present value of future labor income. This unmeasured variable will usually be an order of magnitude larger than financial or housing wealth, and strongly correlated with them in most frameworks.

[29] HUD for rents, BLS for earnings. There is no trend in this ratio since the millennium. Presumably increased house-prices pull in one direction, excess supply of rental accommodation pulls in the other. HUD data show that in 1995 only one in four new rental apartments took longer than three months to fill; by 2007, this had risen to one in two.

The discussion so far has been concerned with the effects of house-prices on consumption, but another avenue for them to influence demand is via residential investment, i.e. the construction of new homes. At first sight it seems obvious that house-building arising from an increase in prices will add to demand, but account must be taken of reduced output in other capital-goods industries, in particular non-residential construction. Table 4 compares residential and non-residential construction over the period of the largest increase in house-building, 2001-2005, and the subsequent collapse.

Table 4: Components of construction as a per cent of GDP

	Residential	Non-residential	Total
Change 2001-2005	0.9	-0.8	0.1
Change 2005-2007	-1.5	0.4	-1.1

Between 2001 and 2005, housing investment increased by 0.9% of GDP, but this was accompanied by a fall of 0.8% in non-residential construction, so the net effect was close to zero. One can also observe crowding-in of non-residential investment 2005-2007 which increased its share of GDP, despite the looming recession.

Our own empirical evidence is summarized as follows:

- We find in annual data 1950-2008 that the lagged growth rate of real house-prices is not a significant predictor of the growth rate of real per capita consumption and its components of durables, non-durables and services (controlling for the lagged growth rates of per capita real financial assets and labor income, and allowing for an AR(1) residual). The best result was obtained for non-durables where house-prices were positively signed with a *p*-value of 0.24.
- Over the same period, the lagged growth rate of real house-prices is not a significant predictor of the growth rate of real investment or investment as a proportion of GDP. In both, house-prices are in fact negatively signed, with *t*-statistics about -0.7.
- The rate of growth of real house prices is not a statistically significant predictor of growth, as noted at the end of section 3.1.
- The forecasting equation seems to fit quite satisfactorily over the boom (see Figure 7). Estimated up to 2000, one finds the parameters virtually unchanged, and a Chow forecast *F*-test for the remainder of the period has a *p*-level of 0.73. There appears to be no missing determinant of growth over the house-boom.

The last experiment is important as it indicates that, with regard to growth, there was nothing *sui generis* about the mid-2000s, such as period-specific price-bubbles: the evolution of wealth and monetary and fiscal policy seems able to give a satisfactory account on its own.

4.4 *Macroeconomic Effects of Mortgage-Defaults*. It has been estimated that, at the end of September 2008, 18% of homes with mortgages had negative equity and another 5% were within a 5% fall in house-prices from that situation. (First American CoreLogic Negative Equity Report.) Since the Case-Shiller U.S. Composite-20 index fell another 6% by December, roughly a quarter of mortgages were on houses with negative equity by the end of the year. Not all of these will default due to a variety of causes such as the non-marketed psychic benefits of a given house and location, the stigma attached (not least the effect on credit ratings), and perhaps residual ethical scruples about paying one's debts. Nevertheless, the existence of such a huge stock of obligations - $2.5 trillion, say – all of which could be profitably renounced is quite unnerving. What would be the macroeconomic effect of large-scale defaults? We shall argue that these would be expansionary, if anything.

Consider a household with an income of 10 per annum and a house worth 100, on which it has a mortgage of 100. (Table 5 illustrates the balance sheet.) We assume a PIH world with a constant real interest rate of 10%. Creditor-households consume only non-housing goods. Debtor-households consume housing services, calculated as rental value, equal to the interest income of the house's price, and non-housing consumption goods. It is changes in the latter that is of interest in considering the effects of defaulting on mortgages.

In the original state, the household consumes 10 units of housing, this being the rental value of its house. Nothing is left over for non-housing consumption. All consumption is done by the owners of the mortgage, 10 units in total. Now consider a fall in house prices by one half so that the household now has negative equity of 50 units. If the household continues to honor its obligations, nothing changes: the household still pays all its income to the mortgage-holder. The household's net-worth falls to 50. It does indeed consume 10% of this, made up of 5 units of housing consumed (the rental rate on the new value of the house of 50 units) plus zero units of other goods.

Now consider what happens when the household defaults on the mortgage. The household has to live somewhere, so it rents the original property (false moustaches may be of use here). The household's net worth is now 100 units, compared to 50 units if it were not to default. It consumes 5 units of housing and 5 units of non-housing goods per period. The owners of the mortgage now own the house from which they get 5 units of income, which they consume. The original household is better off from defaulting, even than in the *status quo ante*; its increased consumption of non-housing goods comes at the expense of the mortgage holders. Whether or not the household defaults, aggregate non-housing consumption is 10 units, just as it was before the fall in house-prices. Defaulting will have no deflationary effect on aggregate demand. In fact, it would be expansionary if one were to assume that creditors were savers.

Table 5: A Balance Sheet for Negative-Equity Households

	CREDITORS	DEBTORS		WHOLE ECONOMY
STATUS QUO ANTE	**Net assets**	**Assets**	**Liabilities**	
	100 (mortgage)	100 (house)	100 (mortgage)	
		100 PV(lab income)		
Net Worth	100	100		200
$-values of:				
Income	10	10		20
Debt service	0	10		
Consumption of housing	0	10		10
Consumption of goods	10	0		10
Total consumption	10	10		20
AFTER FALL IN HOUSE PRICES				
Non-defaulting households	**Net assets**	**Assets**	**Liabilities**	
	100 (mortgage)	50 (house)	100 (mortgage)	
		100 PV(lab income)		
Net Worth	100	50		150
$-values of:				
Income	10	10		20
Debt service	0	10		
Consumption of housing	0	5		5
Consumption of goods	10	0		10
Total consumption	10	5		15
Defaulting households	**Net assets**	**Assets**	**Liabilities**	
	50 (house)	0	0	
		100 PV(lab income)		
Net Worth	50	100		150
$-values of:				
Income	5	10		15
Debt service	0	0		
Consumption of housing	0	5		5
Consumption of goods	5	5		10
Total consumption	5	10		15

Governments may consider policy directed at preventing defaults by subsidies to reduce negative equity. If these are fully funded by current and future taxation, then the effect is to transfer some goods-consumption from creditors to debtors, depending on the incidence of taxation. When creditors have a higher propensity to save, the maximum expansionary effect is achieved by everyone defaulting, provided that the subsidies are not so large as to establish positive equity.

Now assume the creditors are foreign, i.e. foreigners hold the mortgage. In this case consumption of goods in the domestic economy is zero units before the fall in house-prices and after as well if the household does not default. If the household defaults, consumption of goods rises to 5 units: in this case the fall in house-prices is expansionary. FRB economists estimate that foreigners own about 29% of securitized non-conforming residential mortgages as of June 2007 (Beltran *et al*., 2008)

In summary, the existence of widespread negative equity and prospects of default have no contractionary effect on the macroeconomy when mortgages are domestically-held. When creditors have higher propensities to save, defaults are in fact expansionary; when some proportion of mortgages are foreign-held, defaults are unambiguously expansionary.

5. CURRENT MONETARY CONDITIONS AND THE REAL ECONOMY

5.1 *The Real Interest Rate*. To forecast the effects of monetary policy we have used the FFR relative to current inflation in the GDP deflator. Here one has in mind a chain in causation from nominal interest rates to real interest rates to investment to GDP, via the standard Keynesian mechanisms. The real interest rate is the appropriate relative price of an investment decision entailing current borrowings to purchase investment goods used to produce goods sold in the future. Thus to assess the returns to borrowing one should correct the currently observed nominal interest rate by the expected change in prices between now and when goods are brought to market. In most circumstances the current inflation rate is a plausible proxy for the (typically unobserved) expected inflation rate. At the beginning of 2009, the FFR and the short-term interest rates on treasury bills were around zero, while GDP inflation 2007/2008 is about 2%. At face value, therefore, it is cheap to borrow but below we shall review some evidence that expectations of inflation may be less than this, even negative, thus implying greater real costs of borrowing.

Another short-coming of our measure of monetary stance is that it takes no account of counterparty risk i.e. the chance that the borrower will default on the obligation to repay. The FFR refers to over-night rates between banks where the chance of default is very low - not the case when one considers the instruments employed by corporations to finance business operations, in particular investment. This distinction is especially warranted in current times.

Consider the identity

$$r - \pi^e = m + (r - m) - \pi^e$$

Here r is the nominal interest rate on some form of commercial debt, π^e is the expected inflation rate, and m is the interest rate on some (assumed) riskless monetary instrument (the FFR or treasury bill rate). The LHS is the real cost of borrowing to implement some business plan. The three terms on the right are each determined in principle by different mechanisms. The first is set by the monetary authorities; the second is the risk premium attached to the commercial instrument over the riskless return and corresponds naturally to counterparty risk; the third, inflationary expectations, represents an opinion of the borrower, who is presumably required to take a view of the future functioning of the macroeconomy over the appropriate time period. The first two terms are easy to measure, but the third presents difficulties. We first discuss risk premiums.

5.2 *Risk Premia on Some Commercial Instruments*. Figure 14 gives risk-premia for three-month commercial paper, relative to the three-month Treasury bill rate, 2007-8. Over the two years, both increased from about 25 basis points to about 100 points, indicating that the implicit probability of default had increased by about four times by the end. One can observe as well the increased probability of default on financial paper over much of 2008

(see Figure 14). Note that over this time the yield on Treasuries fell by about 5 percentage points, so the effect of risk is small in comparison to the level change.

Figure 14: Risk-Premia for 3 Month Commercial Paper, 2007-8

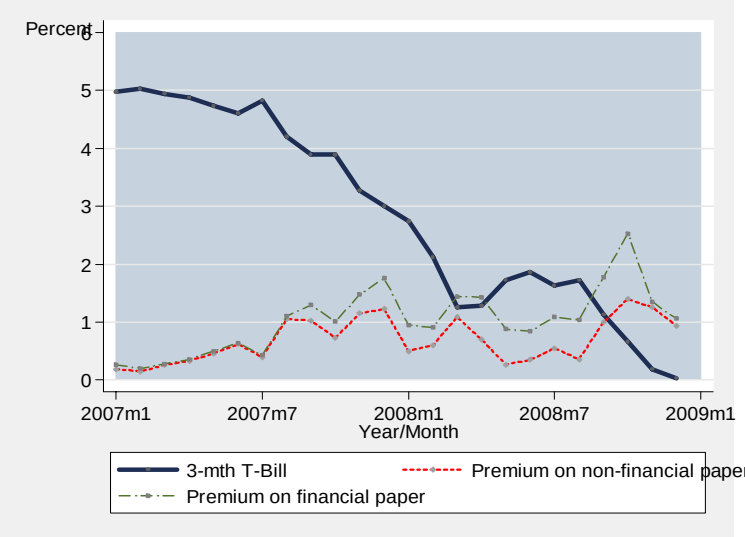
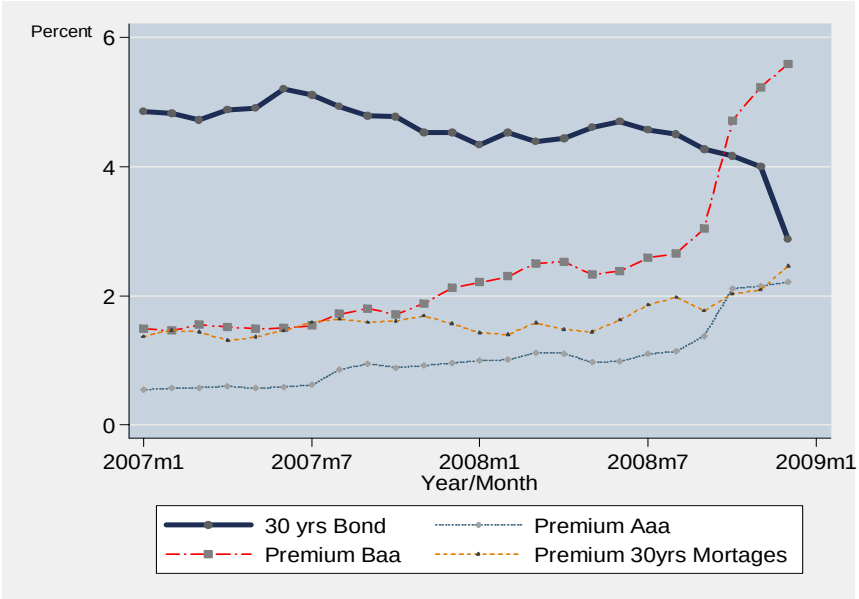


Figure 15 gives a corresponding graph for 30-year loans: Moody's Aaa and Baa Corporate bonds and the 30-year mortgage rate. In this case, the risk-free security is taken to be a 30-year Government Bond (constant maturity).

Figure 15: Risk-Premiums on 30-year Loans



At the beginning of the period, the Aaas and Baas had premiums of about 0.5% and 1.4% respectively; by the end both had increased by a factor of about four. The mortgage premium about doubled. The Treasury bill rate decreased by about 200 points over the two years which is greater in magnitude than the increase in the risk premium for the Aaas and mortgages, but less than the increase in the risk premium on the Baas.

5.3 *Expectations of Inflation*. Expectations of inflation are the third term on the right in the identity in Section 5.1 and we shall consider three methods of estimation for short-term inflation:

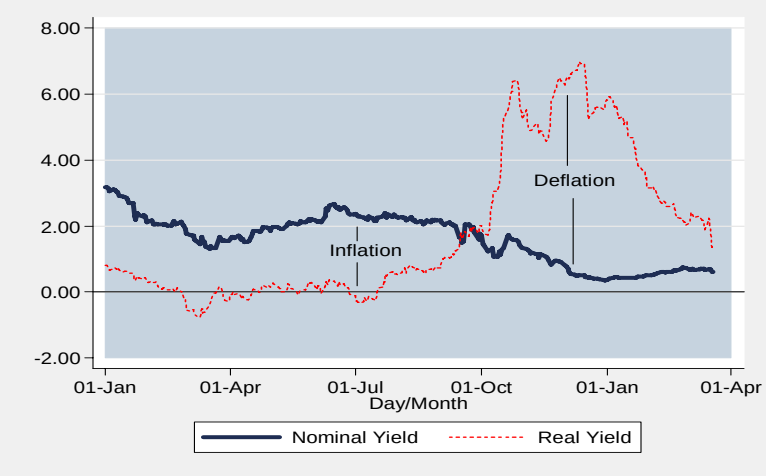
- yields in the inflation-adjusted Treasuries market;
- forecasts from distributed-lag regressions;
- surveys.

5.3.1 *Expectations of inflation from the bond market.* The yields on inflation-adjusted securities measure in principle an average of short-term (instantaneous) real interest rates expected to prevail from now until the maturity of the security. Most currently available have too-distant a maturity to measure short-term interest rates, except for the 5-Year Treasury Inflation-Indexed Note due in April 2010, which currently enables estimation of average real interest rates over the next 12 months. Figure 16 shows how the yield on this security has evolved over the last year in daily data; it gives as well the yield on a conventional one-year Treasury (constant maturity) bill.

Through most of 2008, the real yield varied around zero; it increased steadily through August and September to about 2%, and in October shot up to over 6%; it then varied around 6% until the end of the first week of 2009 whereupon it began a march south – by late March 2009 it yielded a little more than 1%. The difference between yields on the inflation-adjusted and the conventional is an approximation to short-term inflationary expectations, in particular towards the end of the period when the maturities

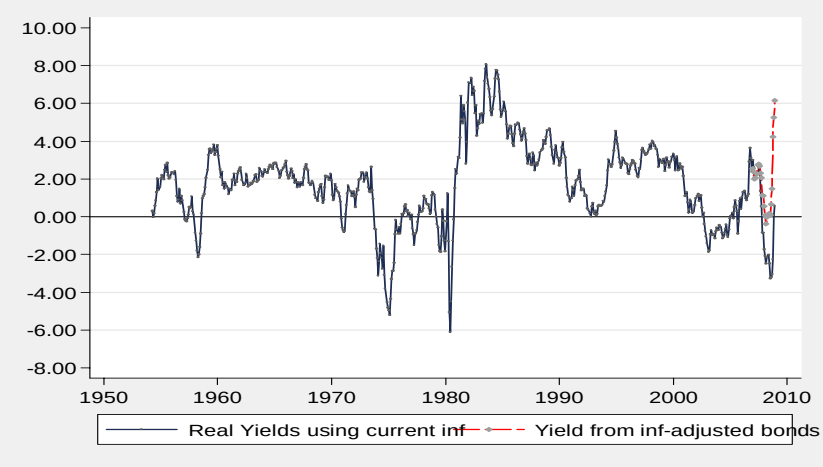
begin to coincide. One sees that over the fall of 2008 the market appeared to expect a decline in prices of between five and six per cent over the next year; by late March this expectation had fallen to about 0.7%.

Figure 16: Real and Nominal Yields on One-Year Treasury Bills, 2008-2009



Real yields of 6% on short-term debt are extremely high. To place them in context, Figure 17 gives monthly real yields on one-year Treasuries monthly from 1954. We do not have ex-ante real rates over the full period (index-linked date only from 1997 in the U.S.) and for most of the period we calculate real rates from nominal rates using current observed inflation rather than expected future inflation. Nevertheless, one sees that real rates of this order have been experienced over the past 60 years only in the Volcker years in the early '80s. If the real rates of late 2008 were to have persisted, it seems likely that there would be a catastrophic fall in investment expenditure.

Figure 17: Real Yields on 1-Year Treasury Bills, 1954-2008, Monthly



Inflation-adjusted Treasuries are tied to the All Items CPI so that the implicit inflation expectations are with respect to this index. This fell at an annual rate of about 13% in the last quarter of 2008, attributable, in part, to the large fall in the price of oil from the middle of the year. The fact that inflationary expectations for the following year were less than half observed CPI-inflation presumably reflects the market's view that the fall in oil prices would not last long (in fact there has been no trend since early December) and that the wages and salaries component of the CPI would be subject to considerable inertia, come what may. Even so, predictions of inflation of the order of -6% seem to incorporate the possibility that the economy was facing a general deflation similar to the early '30s. The CPI fell by 7% in 1931 and then by about 10% in both 1932 and 1933, so one could arrive at an expected deflation of about 6% if one believed that the economy had, say, a 50% chance of encountering the conditions of the Great Depression in the year ahead and a 50% chance of business-as-usual.

Table 6 gives bond-market predictions of inflation between different periods, obtained from inflation-adjusted yields over different horizons.

Table 6: Bond-Market Predictions of Inflation between Different Periods

	From date over next yr	Between 1 and 5 yrs	Between 5 and 10 yrs	Between 10 and 20 yrs
Jun-08	2.2	2.6	2.4	2.6
Dec-08	-5.7	1.1	0.7	1.5
Beginning Feb-09	-2.7	1.3	1.7	1.8

The inflation predictions in June were pretty flat: around 2.5% from then on. By December, the markets were predicting a large imminent deflation, followed by rates of about 1% over the subsequent nine years, rising to 1.5% between 10 and 20 years hence. By the beginning of February 2009, the predictions of deflation over the next year had fallen to -2.7%, followed by low inflation. Two things stand out. First, the market backinged away from the December forecast of a 6% deflation. Second, these market forecasts seem to embody the implausible implication that current events carry information about very distant inflation. All of this illustrates the volatility of expectations in current times.

5.3.2 *Inflation Expectations from Statistical Forecasts*. An alternative to the bond-market approach is to make statistical forecasts of future inflation. We construct regression forecasts of 12-monthly inflation based on current values plus 12 lags of monthly inflation in the CPI all items index, the CPI less energy index and the GDP deflator,[30] together with the unemployment rate, fitted in monthly data, from January 1957 to December 2008. This formulation caters for different dynamic adjustment in the prices of energy, non-energy raw materials and value-added, together with an allowance for changes due to macroeconomic disequilibrium. We find forecasts in December 2008 of future inflation in the CPI and the GDP deflator are about minus and plus one half a per cent per annum respectively, in contrast to the inflation-adjusted bond forecast of CPI

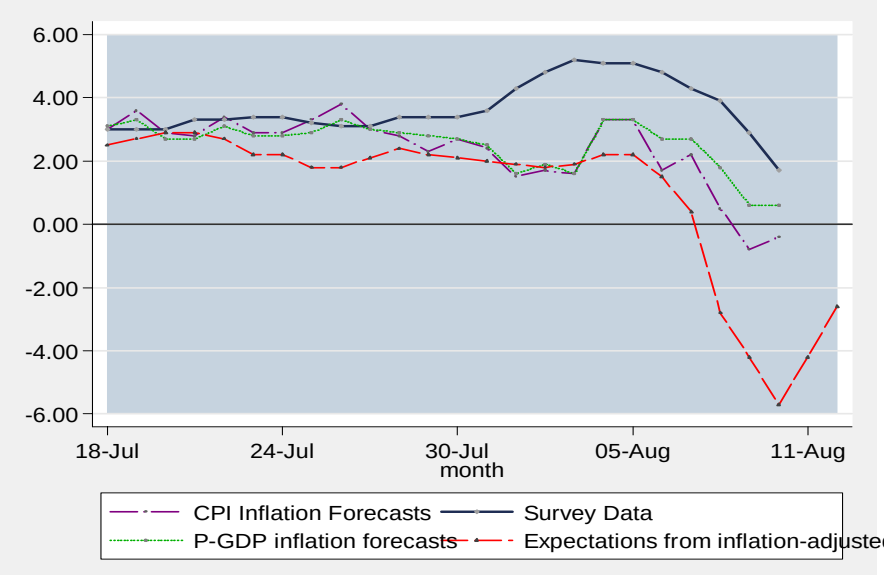
[30] Interpolated from quarterly data.

inflation of about -6%. Thus it would seem the market forecasts were taking into account the possibility of behaviour not previously experienced in these data, since they disagree so violently with the regression predictions based on this experience.

5.3.3 *Inflationary Expectations from Surveys*. As a third measure of expected inflation, we take the median expected price change from the University of Michigan survey of consumers.

Figure 18 graphs the bond-market forecasts, the (two) regression forecasts, and the surveyed forecasts, from 2007 to the present. Throughout 2007 all measures were in rough agreement that future inflation would lie between 2% and 4%; all measures increased towards the middle of 2008, in particular the surveyed expectations; by late 2008 all measures had reduced estimates of future inflation. By December, the regression forecasts of inflation in the CPI and the GDP deflator had fallen to about minus and plus one half a per cent respectively, the surveyed expectations were about 2%, and the bond-forecasts were about -6%. Since then, as we have discussed, the bond forecasts have returned to less extreme levels.

Figure 18: Measures of Future Inflation



5.4 *Is It Currently Cheap for Investors to Borrow?* How one answers this depends on the view one takes of future inflation. Figure 18 presents different possibilities for the short-run. Though time will tell which of these forecasts is most accurate, the point is that all represent plausible methods of forming a forecast and it is possible that significant groups of investors will belong to each of the camps.

Table 7 sets out the components of the real interest rates of a number of instruments in December 2008 according to the decomposition given in Section 4.1. Column one gives the yield on the appropriate riskless asset, 3-month treasury-bills for the short-maturity securities and 30 year government bonds for the long-maturity securities. Column 2 gives the risk premium for each security, computed as the margin of the yield over the riskless asset. The real yields are calculated for separate assumptions about inflationary expectations. For the short-term securities we consider the alternatives from Figure 12: 1.7%, -0.5% and -2.7%., As average inflationary expectations to maturity for the long-dated securities, we consider both the 20-year bond-market forecast (1.5%) and the average annual CPI inflation rate since 1919 (3.0%). Column 5 gives the percentile of the December real yield in the distribution of real yields observed since 1964. The instruments were selected to indicate problems that firms might be encountering in financing their activities, both in the short- and long-term. The fifth row gives a weighted average over all credit-market liabilities of the non-financial corporate sector (value weights: see the data appendix for details of the construction).

Table 7: Percentiles in the Distributions of Real Yields in December for Selected Securities

	Yield on T-bills	Risk premium	Inflationary expectations	Real yields	Percentile
3-mth financial paper	0.03	1.06	-2.7	3.79	83
	0.03	1.06	-0.5	1.59	45
	0.03	1.06	1.7	-0.61	14
3-mth non-financial paper	0.03	0.94	-2.7	3.67	82
	0.03	0.94	-0.5	1.47	43
	0.03	0.94	1.7	-0.73	15
Aaa corp bonds	2.87	2.21	1.5	3.58	15
	2.87	2.21	3	2.08	6
Baa corp bonds	2.87	5.59	1.5	6.96	71
	2.87	5.59	3	5.46	50
Average corp interest rate	2.87	2.38	1.5	3.75	27
	2.87	2.38	3	2.25	7

If expectations of inflation are calculated by regression forecasts or taken from consumer surveys, then borrowing short is cheap in the sense that real interest rates are then smaller than the median of observed values; if, on the other hand, one takes bond-market forecasts, then borrowing is dear in that only about 20 per cent of observed values have ever been higher. Long borrowing is rather different. For Aaa corporate bonds, current borrowing costs are at only the 15th percentile even under bond-market expectations of inflation; for these securities the position in the distribution is much less sensitive to the expectations assumption than for the shorts. For Baa bonds, the key thing to note is that the risk-spread between them and Aaas had increased in December to 3.38%, levels not seen since the ‘30s. For these securities, borrowing is currently quite dear with bond-market expectations, and about average under the alternative assumption. The bottom row presents the analysis for the average corporation. One sees that borrowing is cheap under bond-market expectations and very cheap if expectations of average future inflation in the long-term are the sample average. In summary, it’s cheap for sound firms

to borrow and for the average firm; more risky firms will find it relatively expensive to borrow for investment.

5.5 *The Current Monetary Stance and Its Implication for Growth*. The aim of this section has been to consider whether our index of monetary stance, the FFR relative to the current inflation rate, is an adequate reflection of the credit conditions facing firms in the current circumstances. If this were so, then monetary policy would be at its most expansionary level for 30 years. Consideration of Table 6, in particular the real interest rate faced by the average corporation, suggests that, from this perspective, monetary policy is only mildly expansionary. Thus since a very expansionary policy adds 0.4% to the growth rate in the calculations of Table 2, and an average policy adds 0% by construction, one is inclined to revise down the growth estimate by about 0.2%. In this case, our forecast for U.S. growth in 2009 is -0.5%.

5. CONCLUSION

We have constructed a forecasting model of future growth depending on the set of variables suggested by elementary macroeconomic theory and used it to forecast growth 2008/9. The model predicts a growth rate of -0.3% for the year ahead. We argue however that this forecast does not do justice to the current rise in counterparty risk and expectations of deflation, and suggest that the forecast be revised down a little, perhaps to -0.5%. This would be bad enough but is more optimistic than most current forecasts.

One aspect of the current recession is that the U.S. carries into it a large over-supply of housing, attributable to the price boom and low real interest rates in the mid-2000s. A distortion of the national capital stock caused by monetary laxity is the explanation of recessions most favoured by Austrian economists. We find however in Section 3.1 that the size of the housing stock relative to GDP is only a weak predictor of

growth, controlling for our other predictors. This suggests that resources can be re-allocated away from the building sector without too much trouble.

Are there signs the worst is over? As we write in May 2009, the unemployment rate is increasing steadily. Consumer confidence is low, though shows no trend since mid-2008. Retail sales are flat. There are some positive signs (or "green shoots" in the words of Ben Bernanke). Manufacturers' new orders of capital equipment are low but increased by about 6% in the first three months of 2009. Housing starts rose in March to levels not seen since 2007. The S&P 500 fell by 25% in the first two months of 2009 but has since recovered just about all of that. The bond market no longer predicts a severe deflation, implying that the real cost of borrowing is improving. The risk-premium between Aaa and Baa bonds has fallen by about 75 basis points from its level in December 2008. The fiscal position is now very expansionary. Despite the large monetary expansion, inflation shows no signs of increasing. Perhaps the most hopeful sign is the BEA's preliminary GDP estimates (April 29, 2009) showing, despite a fall in (annualized) real GDP of 6.3%, a rise in real consumption of 2.2%, due mainly to purchases of consumer durables.

If the past is anything to go by, the U.S. should in fact grow in the year ahead. Define an *n*-quarter recession as *n* consecutive quarterly falls in real GDP. The new BEA release shows we are now in a three-quarter recession. There have been seven two- or three-quarter recessions in the U.S. since 1947. See Table 8.

Table 8: Recessions and Subsequent Growth

Two- or three-quarter recessions	Year-on-year growth from end
1949Q1-1949Q2	2.2
1953Q3-1954Q1	1.3
1957Q4-1958Q1	1.6
1980Q2-1980Q3	2.2
1981Q4-1982Q1	-1
1990Q4-1991Q1	0.7
2008Q3- ?	?

The period 1953Q3-1954Q1 is the only other three-quarter recession since the War. If the worst is over, the evidence of recent times suggests the U.S. economy should grow in 2009. Only once did the economy experience a year-on-year fall in GDP after the end of a recession, in 1982, which saw arguably the most ferocious monetary squeeze of all times as the year unfolded.

Is there a missing factor that will drive the economy down through 2009? One possibility is animal spirits. The players in the economy seem to be nervous and uncertain about the future. Witness the extraordinary recent behaviour of inflationary expectations in the bond market discussed above. In these circumstances it is attractive to defer expenditures, particularly investment expenditures (including perhaps the purchase of consumer durables), and await developments. Such behaviour deepens the recession and can itself add to uncertainty as its effects are felt. We have reported an experiment with consumer confidence in the forecasting equation, finding it to be only marginally significant. Yet, if forecasts were to be based on the model with this variable included, our baseline forecast for growth would fall from -0.5% to -1%. This is because, though the estimated parameter is small, so large has been the fall in confidence in 2008 that the total effect is large. Thus there is only limited evidence that our measure of animal spirits predicts future growth but, if it does, then things will be quite bad in 2009. In a similar vein one could note that the forecasting equation has a standard error of 1.3%, which implies that our 95% confidence interval has, at one end, quite handsome growth and, at the other end, a complete catastrophe: the unforecastable component of the business cycle is very large. With many of our predictors at the limits of their range of variation, one could see such prosaic factors as non-linearities become important. These are not

particularly satisfactory conclusions, but they are the best that one can do. For what it is worth, there are over 17.5 million Google hits for "green shoots" as we write.

DATA

Components of the national accounts and capital stocks were taken from NIPA tables at the Bureau of Economic affairs website. In general, to turn nominal variables into real, we use the GDP deflator from this source. Household balance sheets were taken from the Federal Reserve Board Flow of Funds Accounts of the United States at the site www.federalreserve.gov/releases/z1/Current/data.htm. The value weights to construct the average corporate interest rate in Table 6 were also taken from this source. Monetary and interest rate variables were taken from the FRED site at the Federal Reserve at St Louis as well as measures of consumer confidence and inflationary expectations. New orders of capital goods, the production of business equipment, and retail sales data were taken from this site. Stock-prices etc. are from Shiller's data at www.econ.yale.edu/~shiller/data. This site also gives house-price indices back to 1890. All other housing data were taken from the HUD site www.huduser.org/periodicals/pdrperio.html .

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