



**4most**  
EUROPE

Modelling economic scenarios for IFRS 9 impairment calculations

Keith Church – 4most (Europe) Ltd

AUGUST 2017



# Contents

Introduction

The economic model

Building a scenario

Results

Conclusions

# Introduction



From 2018, the IFRS 9 standard becomes reality and the firms affected will start accounting for expected credit losses rather than incurred losses.

This means recognising lifetime expected credit losses for all exposures that have objective evidence of impairment, all exposures that have significantly increased in risk since initial recognition and exposures that are expected to default in the next 12 months.

In addition, the standard demands that forward looking information is used and losses are accounted for now on the basis of what we believe will happen in the macroeconomic environment in the future.

**Looking at just one economic scenario is not enough;** there has been explicit guidance from the IASB that the expectation is that the IFRS 9 impairment allowance will be a probability weighted summation of a range of scenarios. This means that every organisation will need an internal economic outlook as well as variations with associated probabilities.

# Outline of the paper

This creates several challenges for the firms affected.

Most macroeconomic analysis applies probabilities in a way that is very judgmental. Is there a way of assigning probabilities to scenarios that are not arbitrary?

How can the scenarios associated with these probabilities be calibrated in a consistent manner so that the linkages between the variables is captured?

This paper outlines how a macroeconomic model can be used to

- 1) capture the linkages in the economy to give consistent outcomes across the key drivers of risk and
- 2) the historic residuals in model can be used to calibrate the scenario once the firm has determined where in the probability distribution the firm wishes its scenarios to sit.

# The economic model – guiding thoughts

The economic model used here is in the tradition that stretches back to the approach advanced by the Cowles Commission as far back as the 1930s. Model of this type are used by policymakers in central banks and finance departments and by organisations such as the IMF. The model used by 4-most to create IFRS 9 scenarios is benchmarked on that used by HM Treasury and the Office for Budget Responsibility to underpin its forecasts.

- Theory is used to guide the choice of variables in the model, not just statistical methods
- Examples of this theory might cover assumptions that firms maximise profits and that consumers are constrained by income and the accumulation of wealth over their lives.
- The model is structural in that it explains the modeller's view of the linkages between variables and how the world works. It is not a black box.
- The model is a simultaneous system. So a shock to consumer spending will affect GDP, which will then feed through into employment, aggregate incomes and back onto consumer spending.
- Models are a mixture of estimation and calibration. And given problems with economic data, economic theory will often be used to calibrate the parameters.

# The model – key characteristics

The model has 'classical' properties in the long run and 'Keynesian' properties in the short run

- 'Classical' in this context means that when we abstract from the business cycle, the path of GDP is determined by growth in the population of working age, the accumulation of capital (ie the equipment we use to produce output) and total factor productivity (the efficiency with which we use labour and capital).
- The normal business cycle shocks we might choose as IFRS 9 scenarios will not typically move the economy from this path (stress testing might be different). In the long run, the real wage (ie adjusted for inflation) will determine the equilibrium level of employment
- Only supply-side policies like spending on infrastructure or investing in education can shift the equilibrium in the long run.
- The Keynesian short-run property means that shocks to aggregate demand will temporarily affect real wages. This means employment (and unemployment) can vary from equilibrium positions.

# The model – key labour market relationships

The theory underpinning the determination of the natural rate reflects the influential work of Layard, Nickell and Jackman (1991), which is adapted below.

Prices ( $p$ ) are set as a mark-up on expected unit labour costs (expected wages ( $w^e$ ) multiplied by employment and divided by output, determined here by unemployment ( $u$ ). Prices will tend to rise as economics activity strengthens

$$p = \frac{emp}{gdp} w^e + \beta_0 - \beta_1 u \quad (\beta_1 \geq 0)$$

Wage reflect expected prices, productivity ( $p^e$ ) and pressure from unemployment. Wages come under downward pressure as unemployment rises

$$w = p^e + \frac{gdp}{emp} + \gamma_0 - \gamma_1 u \quad (\gamma_1 > 0)$$

# The model – key labour market relationships

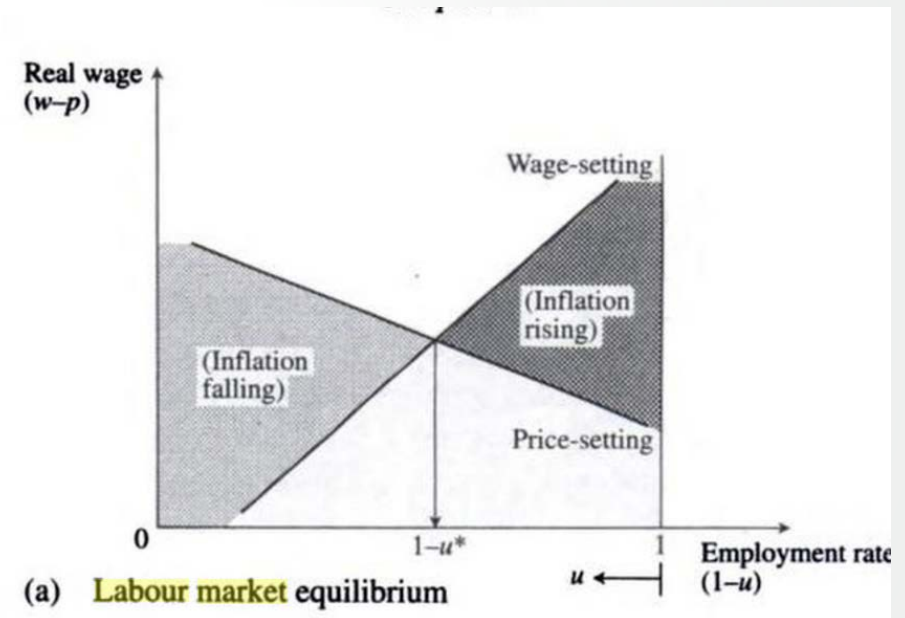
If prices and earnings are at their expected levels the system is solved by adding the equations together. Productivity drops out. The result is an equilibrium level of unemployment that does not depend on price or wage inflation. This is the natural rate.

$$u^* = \frac{\beta_0 + \gamma_0}{\beta_1 + \gamma_1}$$

At this rate there is no tendency for inflation to either rise or fall.

At low levels of unemployment (high employment rates) there is upward pressure on wages and prices. With high employment the effect is reversed.

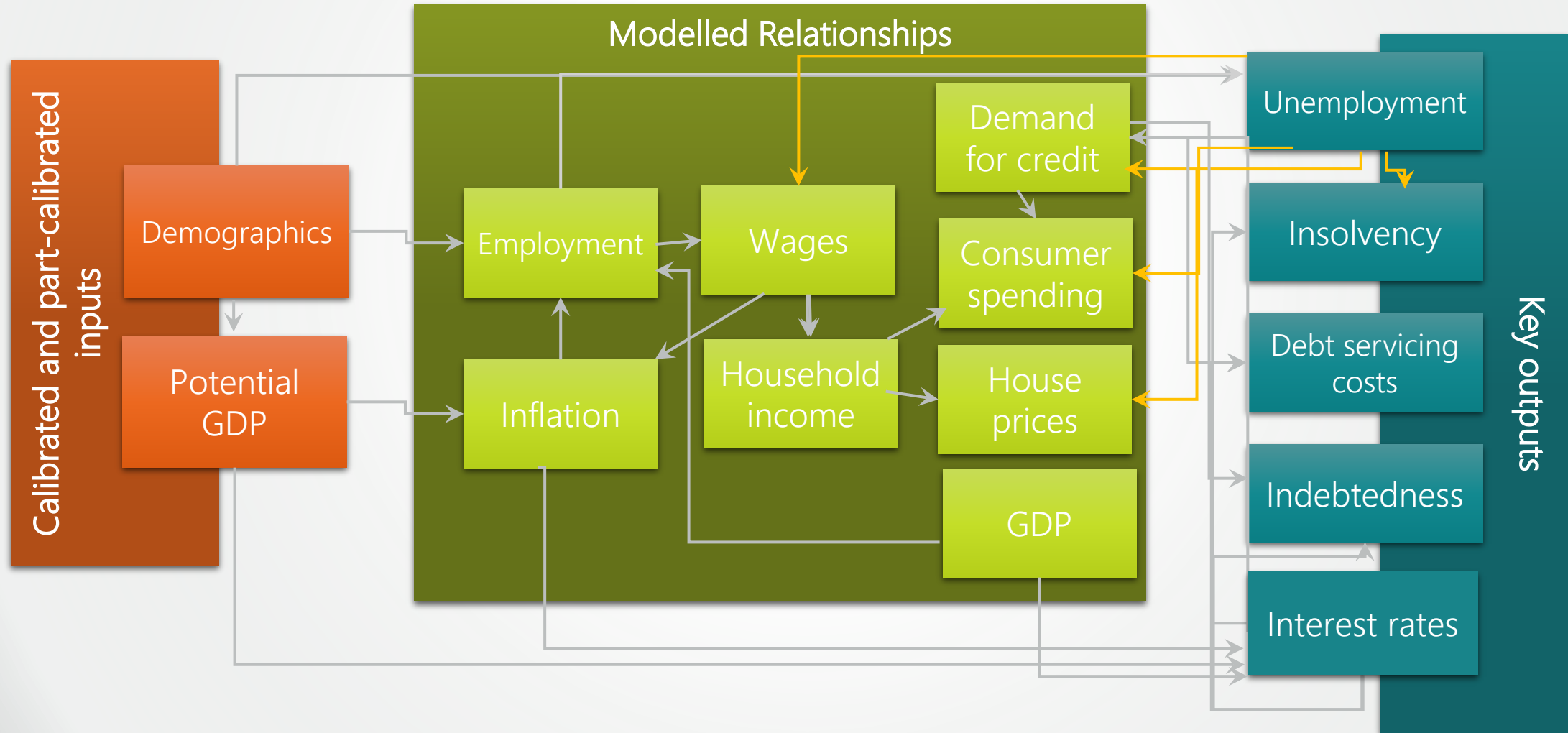
So a negative demand shock that hits employment will cut real wages, make workers more competitive and eventually create the conditions for unemployment to fall.



Source: Layard, Nickell and Jackman (1991)



# The model structure



# Model Equation example

The key equations in the model (consumers spending, investment, house prices, employment, wages and prices) are typically estimated using OLS. This is a pragmatic approach given the simultaneous nature of the model.

The consumers expenditure equation used by HM Treasury (and in our model) can be written:

$$\begin{aligned}\delta \log(C_t) = & -\mathbf{a_1 \cdot \log(C_{t-1})} + \mathbf{a_2 \cdot \log(RHHDI_{t-1})} \\ & + a_3 \cdot \delta \log(RHHDI_t) + a_4 \cdot \delta \log(RHHDI_{t-1}) \\ & + a_5 (\delta \log(GPW_t) - \delta \log(PCE_t)) \\ & - a_6 \cdot \text{diff}(UNUKP_t) - a_7 \cdot \text{diff}(R_{t-1})\end{aligned}$$

Where C is consumers expenditure, RHHDI is real disposable household income, GPW is gross physical wealth (essentially the value of housing assets, PCE is the price of consumer spending (to ensure it is real wealth in the equation), UNUKP is the unemployment rate and R the interest rate.

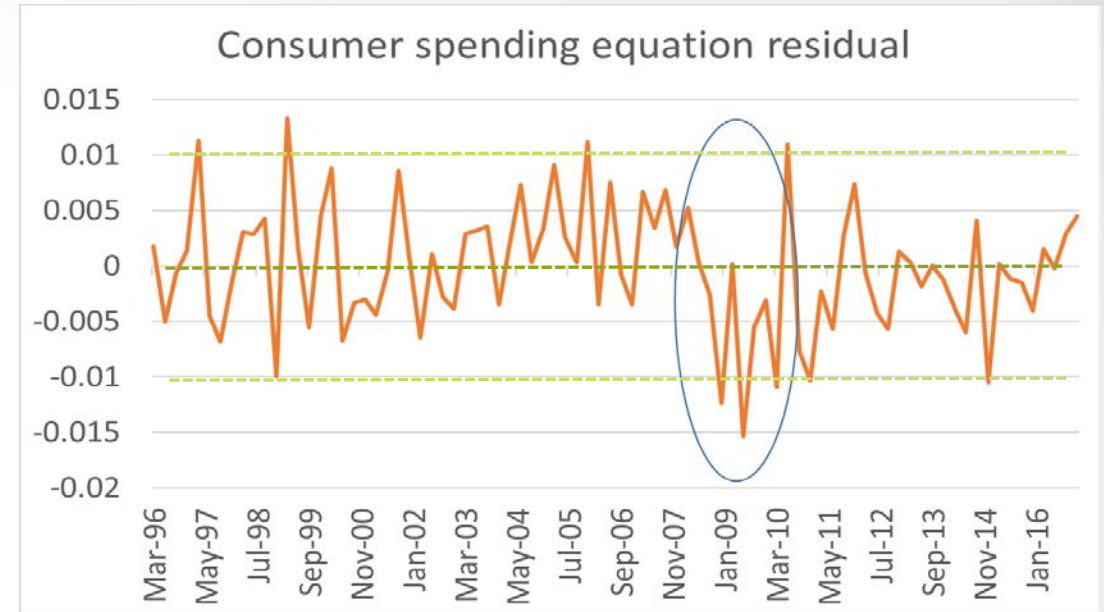
The **highlighted** term is the error correction term in this equation.

# Building the scenario – role of model errors

In a well specified equilibrium model, large residuals represent periods where the economy is shocked well away from the stable continuation of the equilibrium.

As an example, the residuals in the period through 2008/09 show that the actual consumer spending realised was much lower than would be expected given the performance of income and unemployment.

So, if we believe the model is well specified (which is reasonable given the predictive power and its use by HM Treasury) then these residuals represent exogenous shocks from the equilibrium which can be used to drive different scenarios



The equation is estimated in log space. A residual of 0.01 indicates a 1% error was made in the one-step-ahead forecast of consumers spending

# Building the scenario – analysis of errors

Given that we have identified that the residuals represent exogenous shocks to the economic model, and that these correlate with historic deviations from a stable economy, these can be used to produce the variations to the baseline economic forecast.

To do this, we can work out the dynamics of the residuals so that realistic shocks can be introduced and accurate probabilities be assigned to them. The following must be considered:

## Distribution

What is the shape of the residuals?

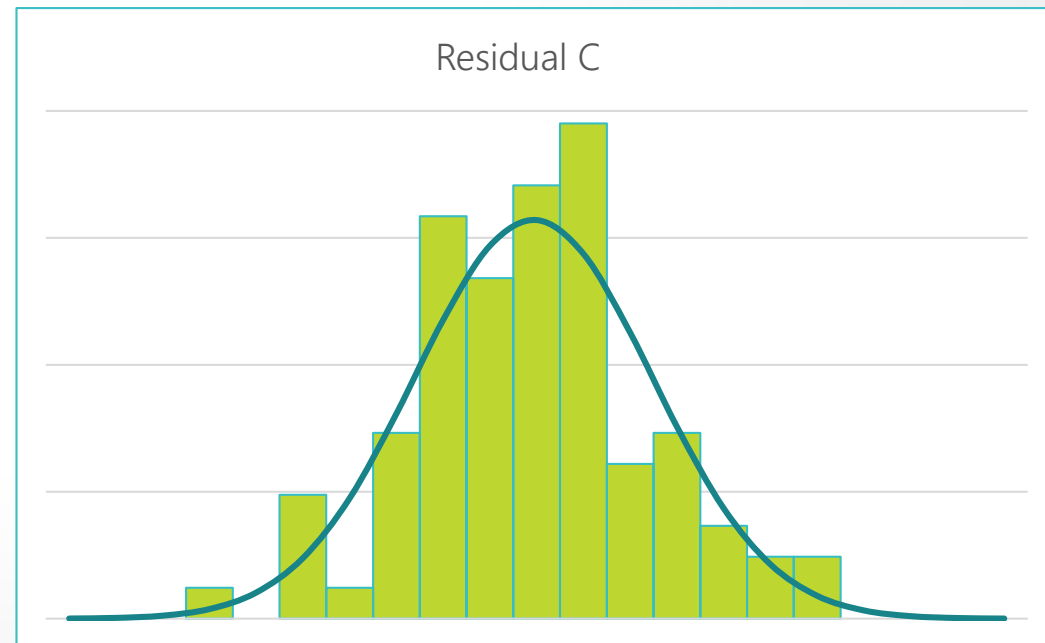
## Dependencies

Is the variance of the residuals constant?

- Autocorrelation
- Heteroskedasticity
- Correlation between residuals

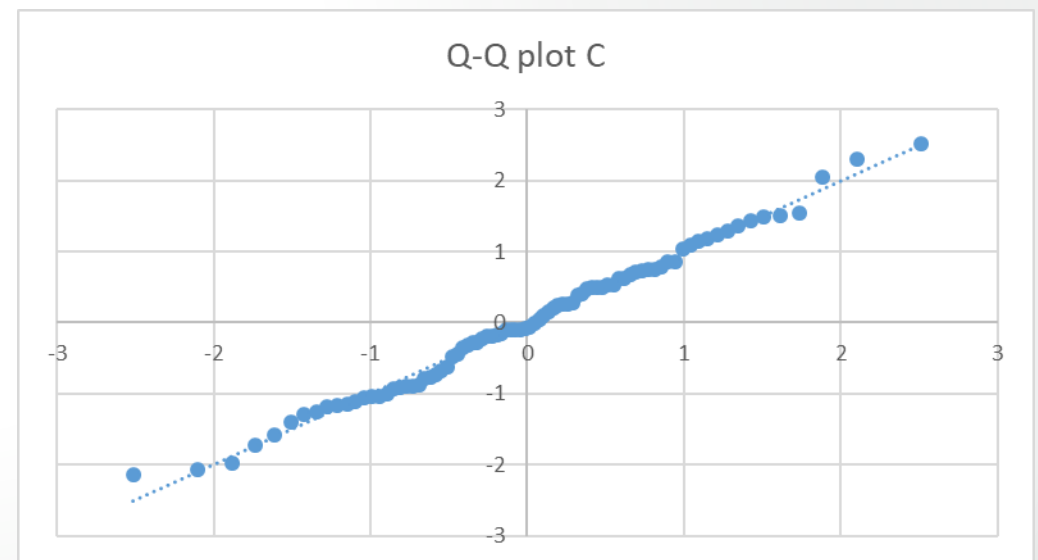
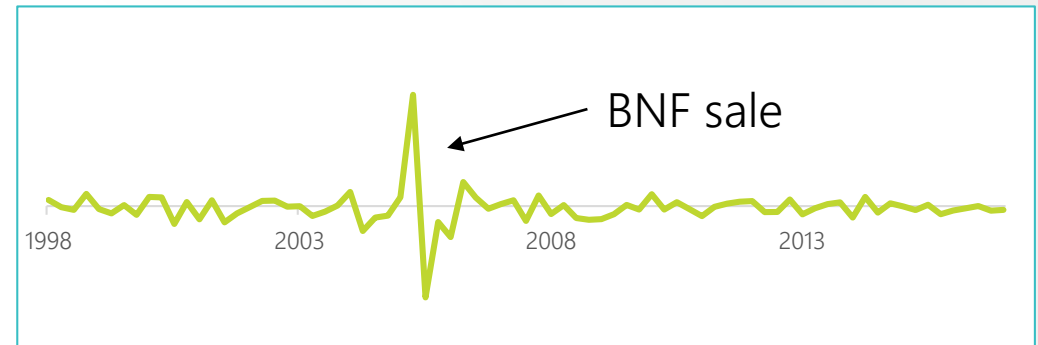
## Outliers

Which points don't represent economic shocks?



# Building the scenario – analysis of errors

- A. The biggest residuals line up with the biggest shocks, i.e. 2008
- B. One-off events which should not be considered for a statistical generator needed to be removed, e.g. the sale of BNF
- C. The majority of distributions are lognormal
- D. Generally shocks are positively correlated. Shocks happen in all variables simultaneously
- E. Big residuals are close together in time, but the direction is random

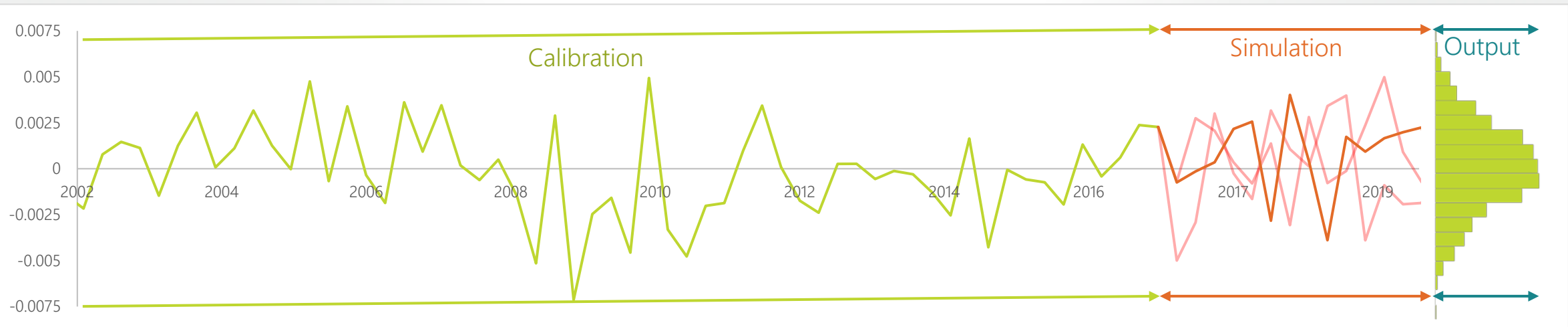


# Building the scenario – calibration of shocks

Using the key findings, we have produced a stochastic model which can produce realistic paths of the residuals, from which we can generate the paths and/or weightings of our IFRS 9 scenarios.

The approach:

- a) The latest economic behaviour is used as a seed to calibrate the current volatility
- b) Millions of possible scenarios are generated so a full distribution of the quantiles is generated
- c) There are two outputs we provide from this:
  1. An economic path associated with a particular percentile risk (e.g. 75%-ile stress)
  2. Estimating the optimal probability weighting for a given shock (e.g. -1% over 1 year to GDP)



# Results: severe downturn scenario (1% probability)



How should we choose the probabilities for our scenarios? We would argue that it should involve a quarterly assessment of the risks facing the economy (Brexit, consumer slowdown etc) and an assessment of where the economy sits in the cycle. (We might want to put a lower probability on the downside if we are in a downturn.)

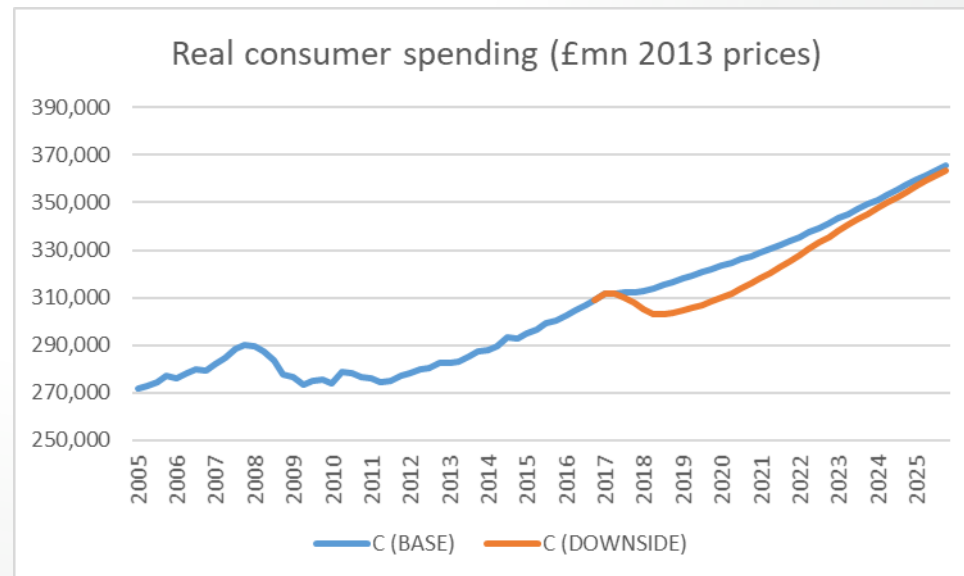
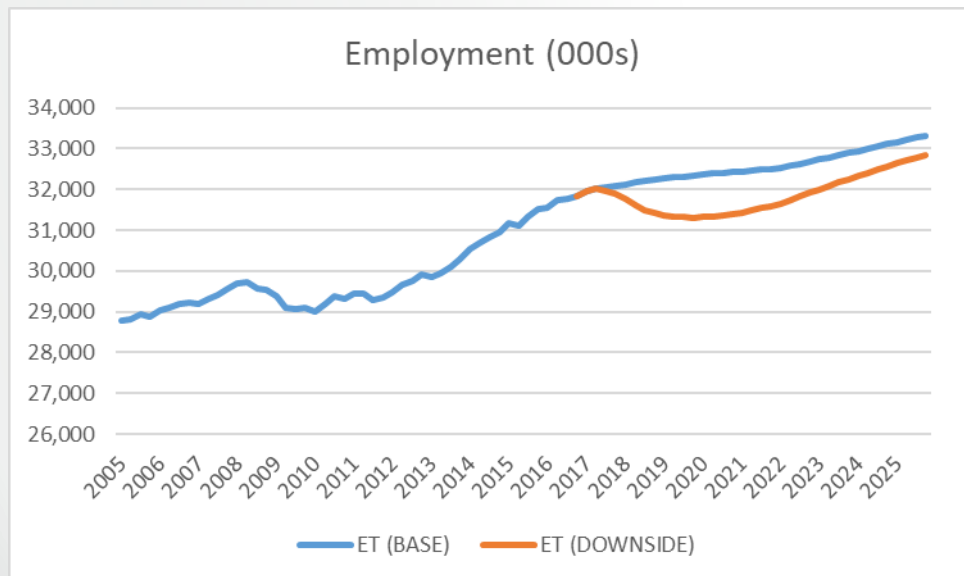
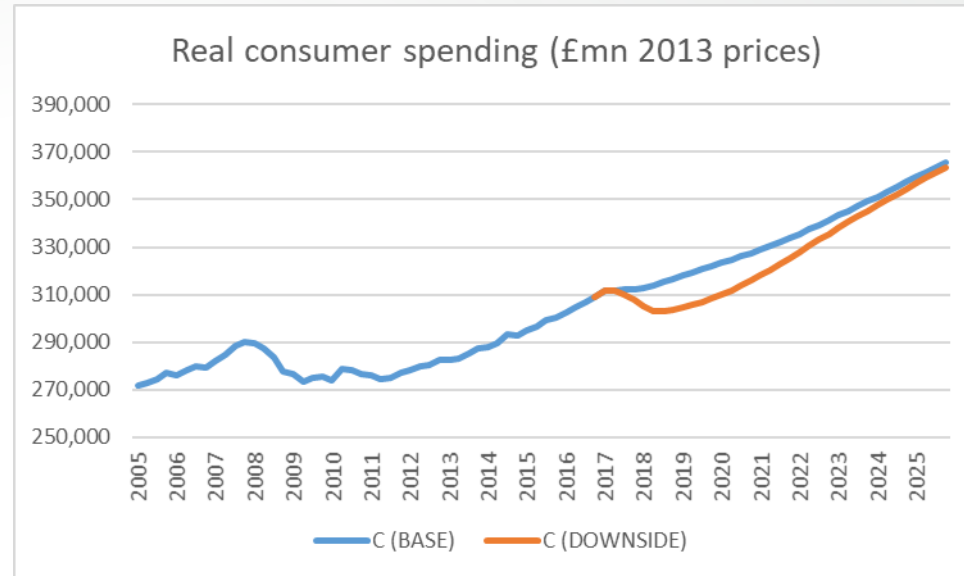
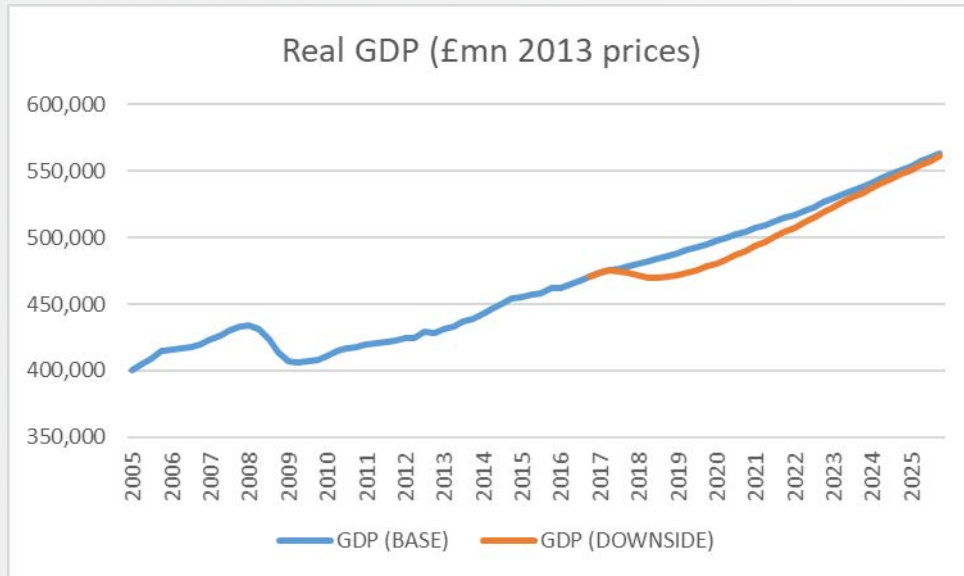
Here, a severe downside scenario is created looking at the left hand tail of the residual distributions (some judgement is used in choosing the path as well as statistics in this example).

**Scenario design:** The shock is spread over four quarters. The residuals shocked here are those for consumer spending, business investment, employment and house prices.

The simultaneous nature of the model means second round impacts are captured as are lags seen in economic responses. For example, the shock to house prices affects, physical wealth, then consumer spending, then GDP, then unemployment, then house prices...

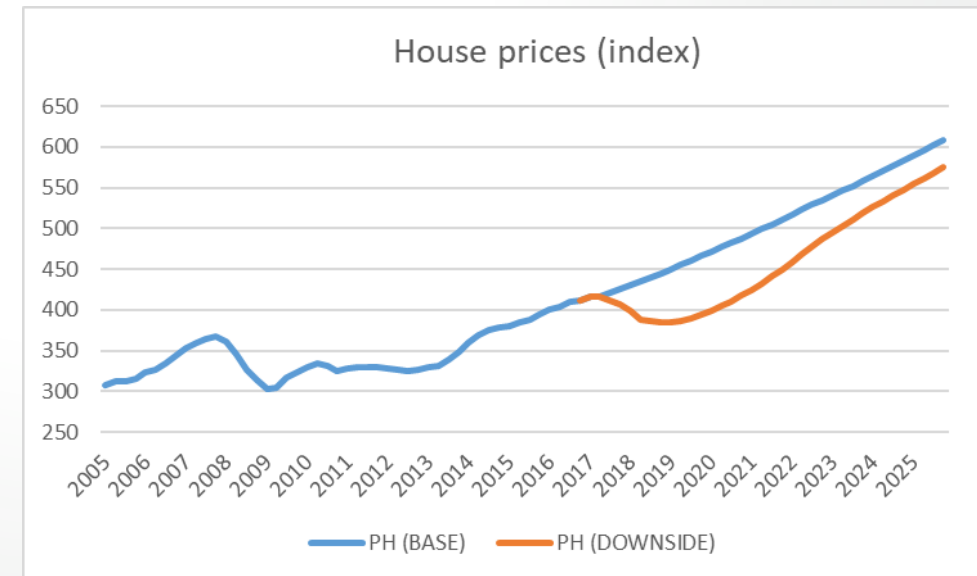
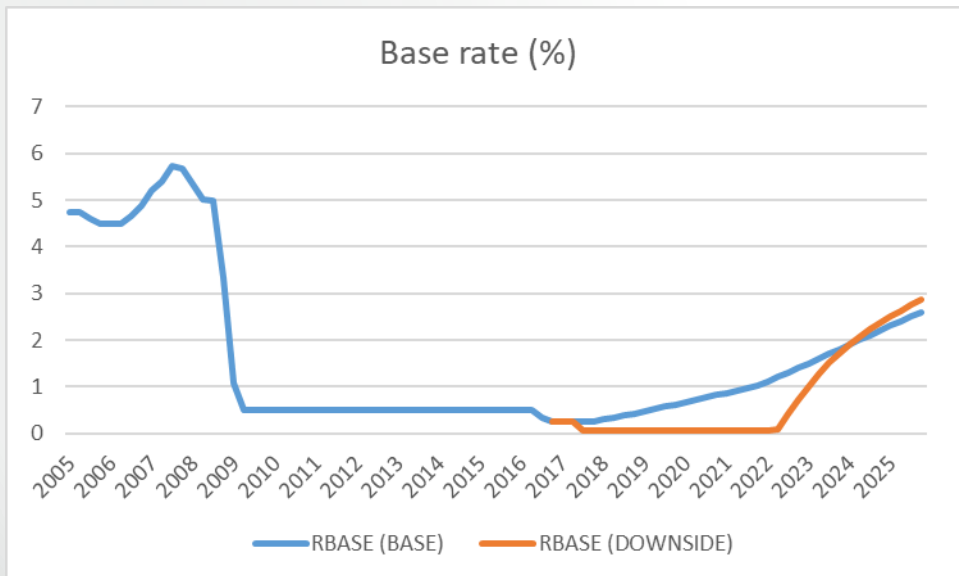
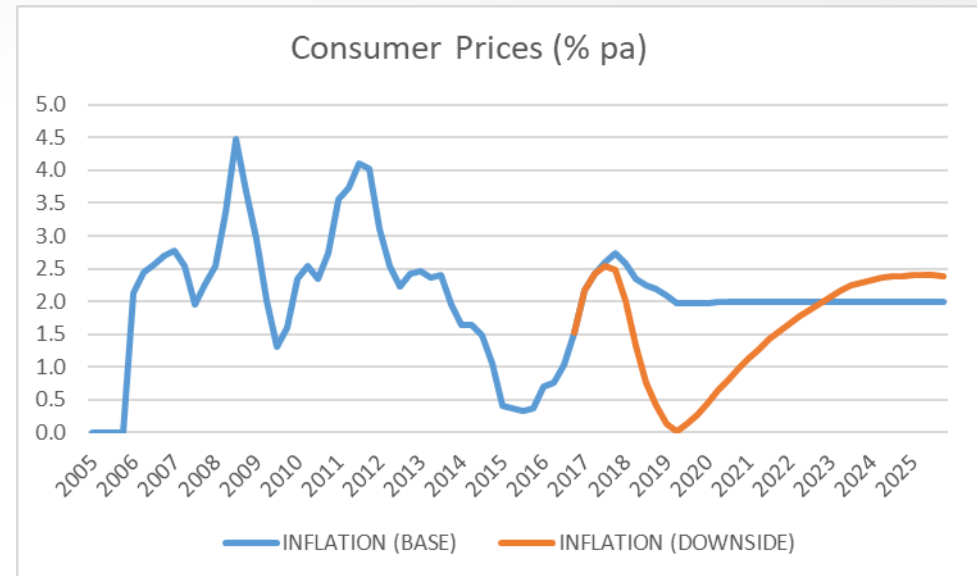
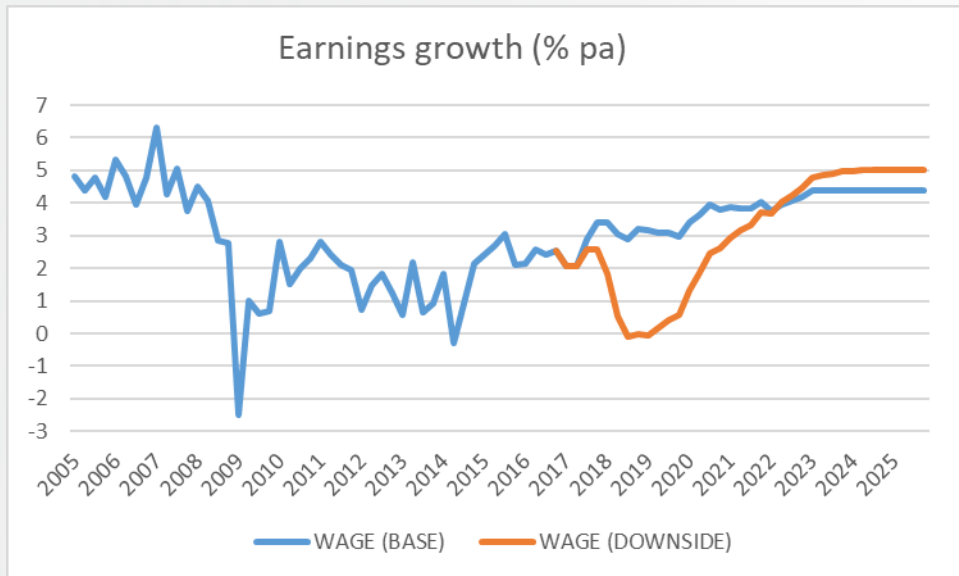
Given the model is a set of simultaneous equations, an iterative solution technique (as pioneered by Gauss-Seidel) is used to solve the model. The set of equations is solved repeatedly until the result of the current iteration is the same as that of the last. Then the algorithm moves onto the next time period.

# Results: key variables





# Results: key variables



# Conclusions: pros and cons of alternative approaches



Method	Pros	Cons
Judgment	<ul style="list-style-type: none"><li>• Easy to implement</li><li>• Flexible</li><li>• Prioritises management judgement</li></ul>	<ul style="list-style-type: none"><li>• Difficult to audit</li><li>• Not really linked into stress testing</li></ul>
Vector Autoregressive Models	<ul style="list-style-type: none"><li>• Proven track record for forecasting</li><li>• Easy to estimate</li></ul>	<ul style="list-style-type: none"><li>• Lack of structural description of economy can make it hard to interpret results</li><li>• Similarly the data driven approach not typically easily adaptable for stress testing and 'what if' analysis.</li></ul>
Macroeconomic model	<ul style="list-style-type: none"><li>• Provides a structural explanation of the economy that helps explain results to senior management</li><li>• Opportunity to gain greater understanding of how economics affects the business</li><li>• Model can be audited by internal and external governance</li><li>• Opens up use of statistical methods such as Monte Carlo analysis to calibrate shocks</li></ul>	<ul style="list-style-type: none"><li>• High maintenance overhead</li><li>• Noisy economic data means still need judgment in calibrating the scenarios</li></ul>

# Conclusions



Firms affected by IFRS 9 need to incorporate forecasts into their provision calculation. This will bring increased scrutiny from auditors.

The added complication of incorporating forecasts threatens to add unwanted variance to provision estimates if not handled carefully.

Using an economic model can help ensure consistent projections are obtained as key linkages are included. Access to the model also makes it easier to understand and challenge the results.

And the economic model also provides a platform for lining the severity of the scenario to its probability. At the moment this issue is often glossed over by economists. This paper has attempted to find a path that removes some of judgement from the process.