

INVESTMENT BRIEFING: **SCENARIO ANALYSIS**

Taking cycles into account

72 Pension funds need to take business cycles data into their ALM studies
Hens Steehouwer tells **David White**

The current focus on pension fund liabilities has put asset liability modelling (ALM) at centre stage in European pensions. For defined benefit schemes, ALM is a key part of risk management and long term strategic decision making. But are pension funds modelling the right things?

In current ALM projects, conventional economic scenarios such as the expected level of interest rates, inflation rates and equity returns are fed into the ALM model to help formulate a pension fund's investment policy and strategic asset allocation.

But are these economic scenarios providing investment committees with all the questions they need to ask before deciding on an investment policy? A major study by Hens Steehouwer, a consultant in the field of

ALM and scenario analysis at Ortec in the Netherlands, suggests that investment committees need to be given broader, more sophisticated economic scenario models to provide a framework in which they can make more informed investment policy decisions.

It is necessary to constantly keep improving scenario modelling, Steehouwer says, because scenarios are crucial to ALM projects and to the policy decisions that pension funds take as a result of them. "The outcomes of ALM models are highly sensitive to how the scenarios behave in a statistical sense – what kind of correlations and volatilities are in there, for example.

"There is also the less familiar concept of the dynamics of scenarios. An ALM project is for the long term, say

10 to 20 years, and what matters for long term ALM decisions are long term dynamics and volatilities."

Scenario analysts can respond to this extreme sensitivity in two ways, he suggests. The negative response is to recoil from the sensitivity altogether, and return to old fashioned round table decisions. The positive response is to recognise the sensitivity and proceed as carefully as possible along a path of constructing future scenarios.

"That was my original incentive – to improve the quality of scenario modelling as used for ALM purposes and thereby improve hopefully also the quality of the important decisions that are being based on those scenarios."

The first step towards better scenario modelling is to have a clear objective of what should be modelled, he says. "If you are modelling scenarios for the future, one way or the other you are making assumptions, and what is important about those assumptions is that they are clear, so that you can judge your model outcomes in the light of those assumptions."

Too often, scenario analysts will consider the issue of how to model before considering what to model. "This first step is of crucial importance in any scientific activity. First empirically study the object that you want to model before proceeding into statistical or theoretical modelling exercises."

"To do this you need a very thorough empirical investigation of how



Steehouwer: 'up to stylised 90 facts'

macroeconomic variables have behaved in the past, in the broadest sense of the word. Not only financial markets, but also national product prices and unemployment rates. Not only annual fluctuations but also long term fluctuations. So in short, we need to know how economies have behaved in the past as a starting point for making assumptions on how economies will behave in the future."

Until recently, there was no single complete and consistent database and analysis framework that could provide evidence of how economies have behaved in the past across a broad range of variables, a broad range of time periods and a broad range of horizons. Instead, most studies look at some variable for some country and some time period, using some set of techniques for analysing some aspect of the behaviour of the variable.

However, Steehouwer has studied between 10 and 15 important macroeconomic variables from three countries – the Netherlands, the UK and the US – over the past 200 years. He has encapsulated the findings in a series of almost 90 'stylised facts' (see box page 72), observed phenomena that have been found to be robust over a particular time period and country of origin for which they are observed.

To be able to analyse time-series data accurately and relatively quickly, the right techniques are required, he says. "Your empirical results are sensitive to the techniques that you use. If you use the wrong set of techniques you can find what are called 'spurious results' – something that is just an artefact of the procedure that the scenario analyst is using.

"So it is very important to use techniques that are as accurate as possible from a methodological point of view. You need to be as sure as possible that there is no false information coming out of your analysis. Furthermore the techniques need to be able to bring out the type of information you are looking for as easy and clearly as possible."

After a thorough investigation of all available methodologies, Steehouwer has chosen techniques that are drawn from the field of spectral analysis or the 'frequency domain.' These kind of techniques are widely used in the natural sciences but are

Why equities are 'a good hedge'

Hens Steehouwer's 'stylised facts' are the building blocks for the kind of scenario analysis that pension funds need for their asset liability models, and for everybody else interested in the behaviour of macroeconomic variables.

They are defined as "observed phenomena which are found to be robust with respect to the historical time period and/or the country of origin for which they are observed."

Analysing time-series by means of a frequency domain approach (see main article) can increase our understanding of the behaviour of macroeconomic variables. As an example of a stylised fact consider the inflation hedging capacities of equities for which it is not difficult to imagine the importance for long term asset allocation choices for pension funds.

Steehouwer points out in his extensive Phd study 'Macroeconomic Scenarios and Reality' that the economic intuition is that, unlike nominal bonds, equities are a claim on real assets and that their value should therefore in some way move in line with (expected) changes in the general price level.

Economists have extensively tested this hypothesis and found that the evidence is ambiguous. Eugene Fama and William Schwert

for example were one of the first to find that US stock prices are negatively correlated to current and lagged inflation. Other research has lent weight to the idea that equities are, in fact, a poor hedge against inflation.

Bruno Solnik summarised the case for a negative correlation by saying that "there is a consistent lack of positive association between stock returns and inflation covering several countries".

However, Steehouwer notes that most of the reported negative correlations relate to the short term. The long term results were rather different. Other researchers who looked at two centuries of UK and US data have found a positive correlation between five year equity returns and inflation or, in general, when longer horizons were considered.

Steehouwer therefore decided to make a split between analysing the short and long term relation between equities and inflation.

Using the frequency domain filtering approach (see main article) it is easy and natural to define the business cycle fluctuations as the short term fluctuations and the long wave and other long term swings as the long term fluctuations.

The results showed that the corre-

lations were consistently negative in the short term but consistently positive in the long term. The short term results make sense in terms of the business cycle, he says, "We know that consumer prices lag the business cycle in the national product by approximately two to four years."

"We also know however that equity prices lead the business cycle by approximately one year. It is then not hard to imagine that these very different phases imply a negative short term conventional correlation between equities and consumer prices.

"In short, the negative short term relation between equities and consumer prices is a direct consequence of their specific lead/lag relations in terms of the business cycle."

The positive correlations confirm the indications in the literature of the existence of a positive long term correlation between equities and prices.

Steehouwer says that "the conclusion must be that, in the short run, equities are a poor hedge against inflation because of the substantial phase differences between equities and consumer prices in terms of business cycle fluctuations. In the long run equities do provide a good hedge against inflation as economic intuition tells us."

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not that well known in the economic sciences, despite their very appealing properties, provided that you apply them correctly.

Spectral analysis, in a macroeconomic sense, is a different way of looking at how variables like interest rates behave over time. It provides another dimension – the frequency domain – which enables the scenario analyst to ‘decompose’ an economic time series into cyclical fluctuations with different frequencies. A simple example would be an economic time series which consists of a 50 year fluctuation, a 10 year fluctuation and a five-year fluctuation.

“Spectral analysis enables you to assess the importance of the different types of fluctuations – for example, in terms of their impact on volatility,” says Steehouwer. “You can decompose the total volatility of a time series into various frequencies which provides a very natural way of thinking about economic developments in terms of trends, long term swings, business cycles, seasonal fluctuations, etc. If there is one thing we know for certain about economic variables, then it is that they move up and down. So why not analyse them with techniques that are directly focussing on this fluctuating behaviour? Spectral analysis also allows for decomposing correlations across different frequencies and to make a distinction between what are true co-movements between variables and what are (phase) shifts in time.”

Although business cycles are a familiar concept in the field of macroeconomics (see box page 73), they have been overlooked by ALM scenario modelers in the sense that they are not included explicitly in the models, says Steehouwer. “The business cycle wasn’t a target in itself for my investigation, it is just one of the important things you soon discover when you start looking at empirical data in the right way,” he says.

“What’s very surprising is that if you start looking at two centuries of data across three countries then those business cycle dynamics haven’t been that different across time. The only thing that really changes across time is volatility.”

The reasons for business cycles have been hotly debated. Much depends on the length of the cycle, Steehouwer suggests. “The business

cycles, Kitchin and Juglar, have a cycle of five to 10 years so if you study them over two centuries you have a lot of observations and there can be little debate about whether this is a true economic phenomenon or not.”

There is now a consensus among economists and investors that business cycles are a key factor, he says. “The data show that about 90% of the annual volatility around us in terms of investment returns, changes in interest rate and growth of national product come from those business cycles, so they are extremely important.”

There is far less consensus on the true nature of long-term cycles like the Kondratieff long wave. “With a duration of around 50 years, these cycles can only be observed four times over 200 years, so it remains a ‘yes/no’ discussion.”

What is important, says Steehouwer, is that pension fund investment committees should be aware of business cycle and long wave type of fluctuations, and be able to take a view on them. “They need to be able to ask ‘what do we think about this? Is it a regular phenomenon which we ought to include in our scenarios, or is it something specific from the past which we ought not to include?’”

This level of awareness is some way off, he says. “What’s happening mostly in the investment committees is that people only discuss the expected values of a certain variables – the expected level of interest rates, inflation rates and the equity-risk premium. These are certainly important, but many more scenario properties also have an impact on the model outcomes and deserve explicit consideration.”

Based on an extensive testing of current scenario models and confronting them with the almost ninety ‘stylised facts’ he found, Steehouwer proposes a new approach to scenario analysis. One aim of this new approach is to provide a framework that investment committees can work with, says Steehouwer. “If you have to talk about cross correlations people are not able to say something about that. But if you pose the questions ‘what do you think about the duration of the business cycle, or what do you think about the lead/lag relationship between different variables, then hopefully it becomes easier for those people to say something about what they expect of the changes in those dynamic developments.”

“By putting more economic intuitive structure in the scenario modelling, non-modelling experts will also be able to more easily formulate how the economy will behave. The new framework allows investment committees to formulate their views in economic instead of statistical terms which opens the door for further increasing the quality of the scenarios.”

Another advantage of the more dynamic approach to scenario modelling is that it gives scenario analysts clues about the way things change, he suggests. “Business cycle dynamics have been remarkably stable, but that

Key to business cycles

The concept of business cycles is relatively modern phenomenon. In the 19th century business cycle were perceived as temporary economic crises. In the 20th century economists began to chart the regularity with which these crises occurred and to regard them as predictable rather than random.

Different economic cycles have different durations – that is the length from trough to trough or peak to peak. There are four main economic cycles determining business activity:

The Kitchin cycle in consumer goods is a short-term cycle averaging 40 months. The cycle, proposed by Joseph Kitchin in 1923, was deduced from commodity prices and bank clearing interest rates during the period 1890-1922 for the US and the UK.

Since the last war there has been a Kitchin cycle of four years in western Europe and 40 months in the US.

The Juglar cycle in capital formation lasts for seven to 11 years. The cycle is based on fluctuations in prices, interest rates and other financial variables. The cycle was proposed by Clément Juglar, an

economist and statistician, who studied the fluctuations in prices and interest rates in the 1860s. He determined there were boom-and-bust cycles of prosperity, crisis, liquidation and recession

The Kuznets cycle of construction is a cycle of 15 to 20 years. Simon Kuznets, an economist, researched the US real estate cycle, for which he was awarded the Nobel Prize. The Kuznets cycle was derived from analysis of population changes, building construction, capital formation and income.

The Kondratieff cycle or ‘long wave’ of 45 to 60 years is based on studies of price trends and raw material production levels in capitalist countries. Nikolai Kondratieff a Russian economist, hypothesised that capitalist economies fluctuated with peaks every 45 to 60 years.

In Kondratieff’s theory, capitalism regenerated itself after long periods of economic decline. Towards the end of the 1920s he used his theory to predict the depression in the US. He also predicted the US recovery, for which he was exiled.

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doesn’t mean that everything has always been exactly the same. There have been gradual changes along the way.”

One way of detecting these changes is to look at different time periods; for example the period before the first world war, the inter-war period and the post war period are to detect changes. Another way is to make a ‘rolling window’ analysis, for example by looking at the post-war period to see what gradual changes there have been during the past decades and to provide input on formulating views on what these changes might mean for the (scenario) future.

One finding that has emerged from these ‘rolling window’ analysis is for example that business cycle correlations between different countries have increased, Steehouwer says. “This means that business cycles are increasingly synchronising between the different countries.”

Looking ahead, Steehouwer suggests that the new approach to scenario modelling will be able to meet the demand for scenarios that incorporate both long and short horizons: “Consistent and good quality long and short term scenario modelling is difficult using the current approaches. In the new approach you can consistently extend inwards from long term to business cycle, from seasonal to monthly fluctuations and if needed even to daily volatility.”

Extremely put, with the new approach, it will be possible for example to construct transparent and good quality daily scenarios with a horizon of 30 years, he says. “It will be able to bring together the long term ALM

type of scenarios and the very short term risk management type of scenarios.”

Consistent long and short term scenario modelling does not demand a single restrictive modelling approach, however. The beauty of the new approach is that it allows the scenario analyst to model the different elements separately, Steehouwer says. “What is important is that you are able to use different historical time periods and different observation frequencies for different economic phenomena, and if needed even different type of models. So it would for example be possible to use annual data for the post-war data to model business cycles, and daily data over the past two years to model daily volatility.”

Yet Steehouwer issues an important caveat about the new techniques. They do not imply that economic developments can suddenly be predicted very accurately.

“The danger of these types of techniques is that people start to think about them in a too deterministic way, in the sense that if we know how those cycles behave we can exactly predict what will happen in the future.

“It is still a statistical approach which models economic uncertainties in terms of scenarios. But it will provide a framework in which hopefully it will be easier for pension fund investment committees to say something about what they expect to happen to the economy. In that sense, the new scenario framework can help a pension fund to make better informed decisions.”

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