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REPORT

The Future of Property Forecasting

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Report

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Real estate professionals have long been involved in developing implicit forecasts of market values. Until the 1980s this was largely based on intuition. Since the market collapse of the 1990s, there has been greater emphasis on quantitative methods and formal modelling techniques. The rise of quantification has led to some convergence in views. Forecasters tend to use similar models, the same datasets and a standard set of statistical procedures. This means, of course, that most forecasts will be subject to similar sources of systematic bias. The failings of this approach and its pervasiveness within the industry have been the source of considerable critical comment in the recent past.

These techniques are not used in isolation. Most property forecasts are generated by combining econometric predictions with a more subjective market overlay process. There are many ways that errors might enter the forecasting processes used in real estate. Errors might enter the modelling process because the data used are inaccurate, the limited variables included do not cover all of the key drivers of the market, the statistical methods used to estimate relationships are not sufficiently sophisticated to deal with the complexity of the market or the assumptions made about future trends in key real estate and economic drivers are erroneous.

Errors might also be introduced through the market overlay process. Contributors to the IPF consensus forecast use this to capture the influence of mood and sentiment in their predictions. They also highlight that mood is difficult to assess and can be inaccurate and that there is no systematic basis for quantifying the way in which mood has influenced forecasts in the past. This raises the possibility that there might be considerable inconsistency in the way in which qualitative assessments of market conditions might impact on any particular 'house' forecast.

The purpose of this research is to explore current forecasting practice and to consider how forecasts might be improved. The researchers have sought to achieve this aim by undertaking a review of current practice, an investigation of the performance potential of 'standard' (based on current practice) and advanced econometric models and an investigation of the potential use of 'alternative' (non-econometric) behaviourally oriented techniques, including methods such as scenario planning and neural networks that draw on attitudinal and other survey data as key inputs. Finally, they use these latter two elements of the project to reflect on how forecasting practice might be strengthened.

The empirical focus of this study is the City of London office market. The City market/submarket presents a particular challenge for forecasters in that it tends to be influenced significantly by those investment flows that have been particularly difficult to capture in the past. This means that the market overlay process tends to be quite prominent in shaping views about future prospects. It was the view of the project team and the steering group that exploring how best to forecast the most challenging case is potentially more instructive than focusing on markets driven by a less extreme set of influences. The City market is also highly liquid and transparent and data availability makes it attractive for the purposes of econometric analysis.

The research team has sought to showcase two different types of econometric models: autoregressive integrated moving average (ARIMA) and error correction mechanism (ECM) approaches. These have been used to demonstrate the sensitivity of forecasts to changes in model structure, methods of estimation, data used and variables measured. The team has also undertaken a more qualitative, judgement-based 'experiment' (Scenario Forecasting Exercise) that invites forecasters to estimate future outcomes under different circumstances.

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The scenario exercise serves to illustrate the way in which a market overlay process introduces differences in views about macroeconomic and market-specific prospects, including investment flows. The exercise highlights the potential variation in the scale of overlay and demonstrates the difficulties associated with trying to avoid further distortions being introduced by the ways in which individual views enter the process.

The analysis shows, perhaps unsurprisingly given the similarities in inputs and model structures, that most of the variation in forecasts is derived from differences in the overlay process.

As a by-product of the research process, the researchers offer a range of forecasts for the next three years, derived using a variety of techniques. It would have been interesting to have tested all of these on historic data but it is impossible to explore the 'softer' influences of market overlay processes if participants are unable to suspend their knowledge of actual events. The tables below summarise the City office rent and yield forecasts for the next three years generated by different methods.

Table 1.1: City office rent forecasts 2013–2015 (% change)

Forecasting approach	2013	2014	2015
ARIMA	1.0	0.5	0.3
ECM	2.0	1.5	1.5
Scenario forecasting exercise (variable inputs)	0.7	0.5	1.2
Pessimistic economic scenario	-2.0	0.2	1.0
Optimistic economic scenario	3.8	3.9	3.8

Table 1.2: City office yield forecasts 2013–2015 (%)

Forecasting approach	2013	2014	2015
ARIMA	5.50	5.58	5.55
ECM	5.25	5.30	5.28
Scenario forecasting exercise (variable inputs)	6.20	6.10	6.20
Pessimistic economic scenario	6.50	6.30	6.40
Optimistic economic scenario	6.00	5.90	6.00

Assumes 5.25% starting yield.

The model-based rental estimates are calibrated using the ARIMA and ECM econometric techniques. The rental ECM forecasts are different from the mean scenario forecasts but are within the optimistic and pessimistic values. The yield model presented here also follows the form of an ECM. In the yield forecasts the econometric models produce quite different results from those forecasts that accommodate an overlay. There is no evidence of either strong upward or downward yield movements in any of the forecasts.

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The scenario-based estimates are based on the arithmetic mean of the survey responses. The model estimates are – as far as can be told – actually quite close to those produced in practice by the widely used econometric models. They overlap with some of the final forecasts produced in the scenario exercise. Most forecasters, however, use overlay processes to move away from the central model estimates, citing mood and sentiment as the main reasons for making such adjustments. It is interesting that, even when presented with optimistic and pessimistic scenarios, there is still considerable clustering in forecast values. It seems that forecasters, perhaps as a result of a strong 'mood' effect, tend to be very conservative. The overlay appears to introduce an 'anchoring' effect that reinforces the tendency towards grouping.

Only time will tell which of these estimates proves to be most accurate. The research can, however, offer some observations about the way in which forecast performance might be improved and forecast processes made more robust. Taken together, these two elements of this project suggest that potential improvements in future forecasts might come from both the qualitative and quantitative elements of the process. Modelling improvements might include:

- adopting more innovative econometric methods including investing in techniques that better capture structural breaks; and
- exploring new variables that might proxy changes in sentiment and mood in both rental and yield forecasts.

These might be combined with qualitative enhancements by:

- considering developing methods that allow greater appreciation of the different drivers of market overlay processes and provide a more systematic basis to capture the influence of this aspect of this process. The scenario exercise used here is intended to act as a simple exemplar of how this might be done;
- enhancing the feedback between overlay and modelling processes, for example, by using qualitative discussions as a basis to adapt model inputs; and
- using qualitative insights, including 'mood' adjustments as proxy measures for market sentiment, as inputs into formal models. This might help overcome the limitations of some of the existing measures.

There are several other process improvements that might be made. These include:

- engaging in greater reflection about the effectiveness of current practices. Considerable benefits might be gained from recording formal outputs, the size and direction of overlay influences and final outputs, with a view to revisiting these on a regular basis. Review and monitoring processes would help to develop a clearer appreciation of the sources of error in existing practices, as well as provide a clearer sense of the conditions under which current methods produce the best results. This is likely to shed light on simple changes in approach that would yield improvements in accuracy and/or consistency; and
- moving away from reliance on point estimates and towards the development of forecasts that offer a range of possible outcomes (that may even have probabilities assigned to them).

As might be expected, yield forecasting has proved much more difficult than rent forecasting. It is in this area that the majority of forecasters tend to rely most heavily on overlay and far less on models. This is a sensible response to the influence of behavioural factors, such as mood and sentiment on investment flows, but it is worth noting that the dependence on judgement and the limited nature of reflective practices mean that the gains from a more systematic set of procedures would be potentially greater in yield forecasting than in rent forecasting.

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No compelling evidence was found to suggest that techniques such as neural networks, cellular automata or evolutionary models help to overcome the inherent weaknesses of existing methods. The paucity of real estate data also limits the effectiveness of these approaches, possibly even more than it constrains econometric model development. These techniques have also been constrained by the tendency of the underlying models to be under-specified and, thus, have been unable to adequately capture the complex drivers of the market. In this context, an overlay process seems to be an appropriate response to the challenges associated with capturing difficult-to-quantify behavioural influences on the market.

Undoubtedly, the most appropriate forecasting approach will come from reflective practice and from a mixed-method design that draws together what the models can explain with deep market knowledge that seeks to systematically explore the 'softer' (non-rational) behavioural influences that cannot be statistically modelled. At present, the relative weight different 'houses' (forecasters) place on qualitative versus quantitative inputs varies and so do the ways in which they seek to ensure consistency of approach and to minimise errors. Most forecasters are broadly satisfied with the way in which the approach they use has evolved and feel better equipped, even in a very uncertain market, to take a position than they have been historically. Views vary on whether this reflects a degree of inappropriate complacency or whether it suggests that forecasts play such a limited part in decision-making that these processes do not merit any more investment (in terms of finance, time or research effort) than the current level. There is certainly widespread recognition of the inherent weaknesses of existing forecasting approaches. The researchers would strongly advise forecasters to establish methods that help systematise and add rigour to their qualitative overlay processes.

2. INTRODUCTION

Real estate professionals have long been involved in developing implicit forecasts of market values. Until the 1980s this was largely based on intuition. Since the market collapse of the 1990s, there has been greater emphasis on quantitative methods and formal modelling techniques. The rise of quantification has led to some convergence in views as forecasters tend to use similar models, the same datasets and a standard set of statistical procedures. This means, of course, that most forecasts will be subject to similar sources of systematic bias. The failings of this approach and their pervasiveness across the industry have been the source of considerable critical comment in the current challenging market.

These techniques, of course, are not used in isolation. The majority of property forecasts are derived by combining the estimates from formal econometric models with a more qualitative 'market overlay'. The accuracy of the forecasts produced varies from institution to institution, across markets and over time. In a recent study, Matysiak et al. (2012) examined the performance of the IPF consensus forecasts. The report concluded that, in the short term, forecasters did on average about as well as naïve models and that performance was weaker in the longer term. The researchers observed that performance had improved in recent years and that, while there seemed to be a sound understanding of market fundamentals, forecasters appear to be less adept at dealing with the effects of investment flows. A natural extension of the Matysiak study is to ask how might these forecasts be improved and what are the limitations of the current approach.

To date there has been no systematic attempt to isolate the underlying weaknesses of property forecasts. There are numerous possible sources of error as econometric models may suffer from a lack of robustness that comes from inaccurate or inadequate data, the limited coverage of the variables included or from the inherent weaknesses of the statistical methods employed. Varying views on future trends in key market-specific demand and supply side variables can also have a major impact on forecasting outputs. Forecasts can be further derailed by errors in the assumptions made about macroeconomic conditions.

The way in which market overlay is introduced to moderate formal model outputs also varies considerably. In some cases this is the domain of a small number of individuals, while in others it is shaped by a discussion involving a fairly large group of participants with different roles and expertise. The overlay may lead to direct adjustment to outputs or to the re-estimation of model outputs based on altered assumptions about the market or the economy. The overlay is, of course, another potential source of error.

The purpose of this study is to explore current forecasting practice and to consider how forecasts might be improved. The research has sought to achieve this aim by undertaking a review of current practice, an investigation of the performance potential of 'standard' (based on current practice) and advanced econometric models and an investigation of the potential use of 'alternative' (non-econometric) behaviourally-oriented techniques, including methods such as scenario planning and neural networks that draw on attitudinal and other survey data as key inputs. Finally, these latter two elements of the project are used to reflect on how forecasting practice might be strengthened. As a by-product of the research process, a range of forecasts is also offered for the next three years, derived using a variety of techniques. It would have been interesting to have tested all these on historic data but it is impossible to explore the 'softer' influences of market overlay processes if participants are unable to suspend their knowledge of actual events. Consequently, only time will tell which approach proves to be the most successful.

2. INTRODUCTION

The empirical focus of this study is on the City of London office market. The City market/submarket presents a particular challenge for forecasters in that it tends to be influenced significantly by those investment flows described by Matysiak et al. (2012) as particularly difficult to capture. This means that the market overlay process tends to be quite prominent in shaping views about future prospects. It was the view of the research team and project steering group that exploring how best to forecast the most challenging case would be potentially more instructive than focusing on markets driven by a less extreme set of influences. The City market is highly liquid and transparent and data availability makes it attractive, therefore, for the purposes of econometric analysis.

3. EXPLORING ADVANCEMENTS IN ECONOMETRIC MODELLING APPROACHES

3.1 The state of the art and areas for improvement

Significant changes and developments in time series econometric analysis have impacted on how real estate markets are modelled and how forecasts can be constructed. As a starting point, researchers need to consider what they want to forecast (the Forecast Object) and, next, what data quantity and quality can be accessed. These questions remain pertinent to real estate more so than other areas in macroeconomics. For example, IPD data on unsecuritised real estate are influenced by data smoothing, which, in an investment context, underestimates risk.

It is possible to construct point forecasts (of a future value at a particular point in time) or an interval forecast (of future values over a given future period in time). A density forecast considers the probability of the forecast value and the distribution of values around the point forecast. For example, forecasts of GDP often include a range of values around a central point forecast. Modelling and forecasting trend was one of the early features of property forecasting. In more recent models this is useful as it may aid identification of long-run 'equilibrium' values, and, theoretically, markets should adjust towards some notion of equilibrium.

Advances in modelling of real estate markets now provide the basis for forecasting. Both reduced-form (where there is a single equation for rent or capital value that is then related to a range of independent variables) and structural equation (where there are separate equations for demand and supply sides of the market) models can be used as a basis for prediction. In structural equation models of real estate markets one would expect to see an absorption equation, reflecting user demand for space (written as a function of the cost of space and employment levels), a development equation, capturing supply of space (written as a function of replacement costs and expected profitability), and a rental adjustment equation (being affected by the difference between long-run vacancy rates and short-term observed vacancy rates), reflecting a process of adjustment towards some trend or equilibrium rental value in a specific market or sector (Wheaton et al. 1997; Hendershott et al. 2011). While the 'equilibrium' itself may change due to exogenous shocks or development levels, the adjustment equation serves at least two purposes: (1) to reflect that the market will still work to balance quantities demanded and supplied and (2) that this adjustment process can be protracted. Some research has also attempted to explicitly link investor demand to the model to capture this functional division of the market (Tsolacos et al. 1998).

Limitations to data availability mean than often such structural models cannot be estimated. Instead, reduced-form models are estimated in which rent (or capital value or yield) is written as a function of demand and supply side variables. These simpler models can also be used to explicitly model adjustment by estimating long- and short-run versions of these equations, which are linked by an error correction term that is similar to the adjustment parameter in the rental adjustment equation coming from the structural model variant (Hendershott et al. 2002; Ke and White 2009).

Developments in time series modelling require that long-run values are in a cointegrating relationship and that the variables used be tested for order of integration (or stationarity) so that the correct model can be estimated. These considerations have become standard, certainly in macroeconomic models and, increasingly, in real estate analysis (see Johansen 1988).

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Both structural and reduced-form models link variables endogenous in real estate markets (e.g., rents, capital values, yields, vacancy rates, development supply, etc.) to exogenous variables (e.g., GDP, employment levels and interest rates) that impact on the market. Predicting future values of endogenous variables requires predicting the values of exogenous variables. If this is possible, then forecasting future rents, for example, assumes that the coefficients in the models remain constant over the forecast period. However, extending a dataset usually results in changes to these coefficients and, thus, the forecasts would be inaccurate for this reason alone.

The external environment is unlikely to be stable and, hence, it is more reasonable to assume that coefficients would change. Sudden or large changes in exogenous variables reflecting unpredictable events will then have a significant impact on estimated relationships. Structural breaks will further add to systematic forecast inaccuracy. More recent developments in modelling (see for example Inoue 1999; Johansen et al. 2000), that identify breaks in a cointegrating framework, have not been extensively used in commercial real estate analysis.

Some researchers have used data-generating processes, such as autoregressive integrated moving average processes (ARIMA), to generate forecast values (Brooks and Tsolacos 2010). This has the advantage of not requiring forecasts to be made of potentially numerous exogenous or independent variables. Thus, a rent forecast would simply depend upon its own past history (and statistically generated error terms). Rent has a strong autoregressive element but these models are atheoretical and reduce to a forecast that is a constant rate of growth. In this case, forecast errors would be non-random. A variant on this approach is the ARIMAX model that adds additional explanatory variables. However, there is no consideration of forecast values relative to long-run trend or equilibrium values in this approach.

A related development has been the use of vector autoregressive (VAR) models in which there is more than one dependent variable and the independent variables include lags of the dependent variable from each of the equations in the VAR model. These can be used to generate forecast without the use of exogenous variables but, by their nature, have similar issues as ARIMA models.

The forecasting performance of models of the real estate markets made in the middle part of the last decade shows significant forecast failings. Models from 2005 predicted stable and persistent growth of exogenous factors, such as finance and business services employment, and other drivers of occupational demand in office markets in the UK. Relatively few predicted even small changes in growth rates for the period 2006–2010, although these views emerged in overlay discussions. Formal model structures could not readily accommodate evidence of significant asset price inflation above fundamentals. It is only now that bubbles in values have come to be considered by model builders more routinely. The tendency of property markets to be mean-reverting (even where structural change produces a new ‘mean’ or long-run equilibrium value) is a factor that seems to have been difficult to capture.

Forecasting turning-points is important, given the observable mean-reverting nature of the market. These would naturally occur through the multiplier–accelerator interaction in the absence of any other effects. However, these are rarely considered. Models also need to differentiate between cyclical and structural changes. Further, it may be the case that cyclical change can impact on longer-term structural performance (such as in ARCH-M models). Thus, the complexity and uncertainty of future events will render forecasts systematically biased even when good-quality data and large sample sizes are available with which to construct models.

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In summary, there would appear to be a tendency for real estate models to be a little slow in accommodating new econometric advancements. The survey of forecasters suggests that few of the models in practice use the very latest methods for capturing cyclical effects and/or structural changes. Given that simpler model forecasts tend to be robust over only very short periods, this may be one of the weaknesses of contributors to the IPF UK Consensus Forecasts. The commonalities in modelling approaches used are also a source of forecast convergence.

3.2. A simple model of City office rents

In this section of the report a number of alternative models are developed as the basis for forecasting office rents. The simplest model is based upon a data generating process (DGP) with an autoregressive integrated moving average (ARIMA) representation, in which forecast values are affected by past values of the variable in question plus past values of error terms that would be generated from an estimation procedure, such as ordinary least squares (OLS) regression. The best-fitting model for the City of London office market took the form of an ARIMA (2,1,1) model, which in equation format is:

Equation 3.1:

$$y_t = \mu + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \varepsilon_t - \theta_1 \varepsilon_{t-1}$$

Table 3.1 shows the results from this model. The explanatory power of the model is quite high, explaining over 93% of the variation in rent.

Table 3.1: ARIMA model for City of London offices

Variable	Coefficient	Std. error	*t*-statistic	Prob.
Constant	4.262457	0.222794	19.13179	0.0000
AR(1)	1.425314	0.203916	6.989696	0.0000
AR(2)	-0.566294	0.206750	-2.739031	0.0114
MA(1)	0.612401	0.188065	3.256328	0.0034
R-squared	0.939823	Mean dependent var.		4.361496
Adjusted *R*-squared	0.932301	S.D. dependent var.		0.369020
S.E. of regression	0.096016	Akaike info criterion		-1.717046
Sum squared resid.	0.221256	Schwarz criterion		-1.526731
Log likelihood	28.03865	Hannan–Quinn criter.		-1.658865
F-statistic	124.9409	Durbin–Watson stat.		1.886220
Prob(*F*-statistic)	0.000000			

Sample (adjusted): 1982–2009.
Included observations: 28 after adjustments.
Convergence achieved after 9 iterations.
MA Backcast: 1981.

When this model was applied in a forecasting context (2010–2015), it was found that its predictive performance was very poor and within-sample forecasts diverged from actual economic outcomes.

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3.3. An alternative model of City office rents

As an alternative to the DGP in the section above, error correction mechanisms (ECM) were examined as a basis for rent model construction and forecasting. The theoretical benefit of these models is that they explicitly highlight the market's role to remove demand and supply imbalances resulting in a market equilibrium. Appendix A sets out this model in detail. The variables used in the rent model for the City of London were finance and business services (FBS) output, to capture demand, and stock to reflect supply. While it is possible to use gross value added (GVA) or local gross domestic product (GDP) as alternative demand side variables, FBS performs better statistically. Table 3.2 presents the results for the long-run model. The coefficients have the expected signs; a priori, the model performs reasonably well in terms of explanatory power.[1]

Table 3.2: Long-run model for City of London office rents

Variable	Coefficient	Std. error	*t*-statistic	Prob.
Constant	49.32468	5.349869	9.219791	0.0000
Finance and business services output	0.401878	0.162943	2.466364	0.0215
Stock	-4.536948	0.618970	-7.329831	0.0000
R-squared	0.800819	Mean dependent var		4.344489
Adjusted *R*-squared	0.783499	S.D. dependent var		0.377966
S.E. of regression	0.175866	Akaike info. criterion		-0.530018
Sum squared resid.	0.711367	Schwarz criterion		-0.384853
Log likelihood	9.890229	Hannan–Quinn criter.		-0.488215
F-statistic	46.23655	Durbin–Watson stat		0.509528
Prob(*F*-statistic)	0.000000			

Sample (adjusted): 1984–2009.
Included observations: 26 after adjustments.

The forecasting performance of this model was better than the ARIMA model. However, with the ECM the future values of the exogenous demand and supply side variables had to be forecast. This was done by using the Hodrick–Prescott filter that separates short- and long-run influences on variables. These results were compared with current views in the final section of the report.

3.4 Modelling office yields

Property cycles are not only a function of rental change and lags in the development process. Changes in property yields and, thus, capital values are an integral part of adjustment processes (Barras 1994). Yields are a function of expected rental growth and interest rates (or the required rate of return). Modelling UK yields at an aggregate level, various authors (including Hetherington 1988 and Key et al. 1994) emphasise the importance of the link with the bond market (the risk free rate). Subsequently, UK and US authors (McGough and Tsolacos 2001, Evans 1990, Ambrose and Nourse 1993 and Viezer 1999), using lag structures, also recognise the links to the stock market.

[1] The short-run adjustment (error correction) model linking to this long-run model is presented in Table A1.

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Previous studies test the forecasting ability of property yield models. They relate yields to rental growth, gilt yields and the all-share index and estimate three types of models: a vector error correction mechanism, an autoregressive integrated moving average model (ARIMA) and a regression of yields on lagged rents and lagged yields, which includes an autoregressive component (McGough and Tsolacos 2001). This research finds that no single model performs best over the time periods tested and suggests that careful attention needs to be paid to the determinants of yields.

More recent studies also apply an error correction framework. This is justified by arguing that prices can, at least temporarily, deviate from their long-run equilibrium values due to the presence of transactions costs or transitory inaccurate expectations on the part of market participants. It is suggested that the "difference between the actual and equilibrium prices could reflect the underlying forces operating to return the market to equilibrium" (Hendershott and MacGregor 2005, p. 305).

The model for yields takes the following form:[2]

Equation 3.2:

$$\ln IY = \gamma_0 + \gamma_1 \ln GY + \gamma_2 \ln RT + \gamma_3 \ln \Delta RRVI + \gamma_4 \ln \Delta RRVI_{DEV} + \gamma_5 \ln LEP + \gamma_6 \ln LEP_{DEV} + u_t$$

where IY is the initial yield, GY is the gross redemption yield on long dated gilts, RT is a proxy for market liquidity, being the local market's transactions expenditure value divided by the UK's transactions expenditure value, delta RRVI is the change in rent, LEP is the log of the inverse of the FTSE price/earnings ratio. RRVI dev and LEP dev are deviations from the equilibrium for rent and stock market dividend yield variables.

Table 3.3 presents the yield model for the City of London office market. Signs on variables are, as predicted, a priori. There is a negative relationship between the yield and rental value growth. Greater liquidity reduces the yield and there is a positive relationship between real estate and debt yields.

Separating long- and short-term components from the yield via the Hodrick–Prescott filter, the trend value for the office yield can be identified. In order to forecast this yield, either an attempt to forecast the exogenous variables in Equation 3.2 can be made or the yield trend can be simulated via a DGP such as ARIMA. Doing the latter via an ARIMA (3,1,2) process results in an equation model with an adjusted R^2 of 99.9%. Figure 3.1 plots the residuals for this model.

[2] This follows from Hendershott and MacGregor (2005) and Dunse et al (2007).

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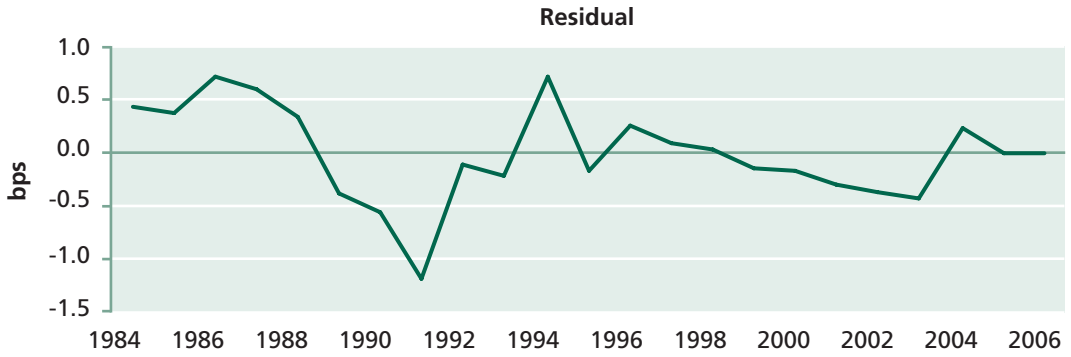
Table 3.3: Yield model for City of London offices

Variable	Coefficient	Std. error	*t*-statistic	Prob.
Constant	-2.293153	1.023307	-2.240924	0.0379
Gross redemption yield	1.349415	0.184802	7.301955	0.0000
Rental value growth	-0.738808	0.076591	-9.646091	0.0000
Rental deviation	1.011533	0.155684	6.497328	0.0000
Market total expenditure	-0.709606	0.092665	-7.657767	0.0000
Real dividend	0.320272	0.173754	1.843252	0.0818
Real dividend deviation	-0.684095	0.092183	-7.421016	0.0000

R-squared	0.857170	Mean dependent var.	1.870639
Adjusted *R*-squared	0.825431	S.D. dependent var.	0.226846
S.E. of regression	0.094780	Akaike info criterion	-1.684860
Sum squared resid.	0.161698	Schwarz criterion	-1.438014
Log likelihood	24.37589	Hannan–Quinn criter.	-1.622779
F-statistic	27.00609	Durbin–Watson stat.	2.534547
Prob(*F* -statistic)	0.000000		

Dependent variable: IY_LON.
Method: least squares.
Sample (adjusted): 1984–2006.
Included observations: 23 after adjustments.

Figure 3.1: Yield trend residual



The residual, measured in terms of basis points (note the values are quite small in relation to the actual and fitted values), shows some autocorrelation, particularly around the property boom and bust of the late 1980s and early 1990s. This may reflect bubble components to prices when property was over-priced in the boom and under-priced in the subsequent slump.

4. ASSESSING THE POTENTIAL FOR BEHAVIOURALLY-ORIENTED INSIGHTS

4.1 Current approaches and possible ways forward

Section 3 highlighted the way that the theories and methods associated with mainstream (orthodox) economics have been used to develop formal forecasting models. The models used in practice today have clearly evolved considerably since the late 1980s and early 1990s, when the earliest property forecasts were developed. Econometricians continue to refine the statistical techniques and data used as they pursue greater accuracy. However, this endeavour ignores entirely the view held by non-mainstream (heterodox) economists, who contend that the problem of inaccurate forecasting is not a function of the techniques or the data but, rather, it is a consequence of the inadequacy of over-arching theory. Many heterodox economists, including behaviouralists, institutionalists and evolutionary theorists, challenge the assumption that decisions are made by rational individualistic economic agents.[3] They would argue that decisions are actually heavily influenced by the social and cultural context within which they are embedded. In other words, investors are influenced by colleagues and allow issues such as mood and sentiment to disproportionately shape their views. Decision-making is far removed from a rational, technical exercise.

The intellectual roots of many of these alternative views can be found in the writing of Thorstein Veblen. Veblen's work can be seen to influence the emphasis institutional economists place on habits, norms and culture in shaping market processes and outcomes. He also makes reference to evolutionary-type changes and implies that markets exhibit Darwinian tendencies, reflecting the influence of both hereditary (often discussed in relation to path dependence) and selective adaptation (institutional change) (McMaster and Watkins 2012). This institutional-orientation can be found in numerous contributions to the real estate literature (McMaster and Watkins 2012). These include advocacy of a systems theory approach that allows structural changes to the economy and market to emerge gradually through adaptations to individual behaviour and institutional structures (Trevillion 2002) and numerous attempts to develop models that emphasise the role of institutions and the inter-play between structure (e.g. macro-economic change) and agents (e.g. the processes employed by professionals – for a review see Ball (1998).

These theoretical influences are also evident in much of the emergent 'behavioural turn' in various fields of applied economic analysis, including housing. This movement provides a direct challenge to the reliance on rational individuals as the building block for one's view of how the world works. It suggests that predictions should not be made about the future based on the assumption that individuals will undertake a benefit–cost calculus before making a financially driven choice. Rather, it would contend that individuals lack the cognitive power and information base for such a course of action. Furthermore, individual's choices will be distorted by their perceptions (which may be incorrectly formed) and emotions, even in professional real estate settings. In most walks of life, individuals take calculative short cuts that might lead to non-rational outcomes and are often likely to satisfice – settle for second best – rather than optimise in the standard economic sense.[4]

[3] The authors acknowledge that this is a crude simplification and that there are heterodox schools of thought including New- and Neo-institutionalism and the New Behavioural Economics that retain an atomistic ontological position. The focus here, however, is largely on approaches that have a social constructionist orientation.

[4] This is associated with the Nobel Prize-winning work of Herbert Simon.

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This theoretical distinction is important in that, if the assumption that behaviour will not always be based on a calculation of the optimal outcome is dropped, then the use of techniques that assign probabilities to outcomes that might be perceived to be rational should be questioned. This means, of course, that in applied research, econometrics might be abandoned and, instead, methods sought that capture opinions that might be held more because of the influence of social norms or habits, emotions, mood or sentiment rather than as the outcome of perfectly informed cost-benefit calculations. Consequently, heterodox analysts tend to use surveys and interviews to capture attitudinal data. These might be constructed to elicit stated preferences (e.g. on willingness to pay) or to measure market sentiment. In the context of forecasting, the most commonly used methods are opinion surveys, such as the RICS Housing Index, where respondents are asked to provide estimates of the likely change in particular indicators. Interestingly, debates about the validity of this sort of approach have tended to focus on the methods used to combine (average out) contributions. As far as can be determined, there have been no published attempts to compare the forecasts produced from this qualitative approach with those derived from other methods or with actual outcomes.

There have been some attempts, however, to locate attitudinal data within structured processes. Scenario planning, for instance, offers a framework within which 'experts' can be asked to predict future outcomes based on different information sets. This method has been criticised for being excessively descriptive but advocates argue that it provides a rigorous basis from which to develop a range of predictions. It also provides a basis from which to reflect on the way in which different potential sources of error may enter the process (a theme returned to in Section 4.2). The quality of the predictions is, of course, highly dependent on the extent to which the relevant information sets can be effectively defined and understood. In economic forecasting, it remains the case that predictions will be flawed if the wider circumstances (e.g. growth rates, interest rates, inflation levels, etc.) provide a poor approximation of actual outturn.

There are several more formally structured models that are viewed as being more closely aligned with a world-view that emphasises decisions are social and culturally embedded. These include neural networks and self-organising maps, methods that involve the use of artificial intelligence to extrapolate from past experience. The extrapolations do not use coefficients like standard econometric methods. Rather, algorithms can be written to identify near neighbourhoods (e.g. past periods that resemble future circumstances) as a basis for prediction. The perceived benefit of this sort approach is that it can recognise that behavioural responses are often conditioned by past experience and that there is an element of path dependence that shapes future market outcomes. The applied literature, however, is less compelling than the theory. In a rare commercial property application, O'Roarty et al. (1998) used neural networks, specifically case-based reasoning, to identify comparables for valuations. Although the results are promising, this study does not demonstrate conclusively that this approach improves on alternative methods, such as expert opinion or mass appraisal methods. This approach has also been applied much more widely in other contexts. Housing analysts (Kauko 2003), for instance, have used self-organising maps (a variant on the neural networks method) to identify comparable neighbourhoods as a means of predicting the impact of location on house prices in the absence of detailed datasets. This technique has also been used to analyse bond ratings (Shin and Han 2008). Again, the results are not compelling. The constraints on further take-up of these approaches appear to be that the techniques are difficult to use, their benefits are poorly understood and the outputs are thought to offer little in terms of improved accuracy.

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Of course, it is rather simplistic to suggest that forecasters should make a choice between mainstream economic theory (with its quantitative associations) and heterodox ideas (that allow qualitative methods to introduce 'softer' judgements to enter the process). Rather, many commentators strongly advocate a pluralist approach, supported by numerous commentators (Guy and Henneberry 2002, Adair et al. 2003 and Adams et al. 2005). It is argued that different methods should be used for different research tasks and their insights should be combined to enhance understanding. The approach used in practice looks much like a sensible, pragmatic pluralism. In the main, even though there has not been a great deal of thought given to the purity of the method, it combines the use of 'standard' qualitative methods (e.g. focus groups) to derive an overlay with the point estimates from pure quantitative methods to produce a hybrid outcome. In a small number of cases, the overlay process resembles a semi-structured scenario planning exercise and the end result is a series of possible outcomes. The application of this pluralist approach is explored in more detail in the next section.

4.2 The influence of overlay – a scenario exercise

As previously noted, the majority of real estate forecasts combine the outputs from formal models with a market overlay process. The extent to which outputs are mediated by expert knowledge varies considerably between institutions and over time. The researchers undertook some initial discussions with practitioners, which revealed that the degree to which overlay is taken into account in developing forecasts has rarely been a source of reflection or debate and that the precise impact of the overlay process is not well understood. This part of the research seeks to understand the nature of overlay processes and the extent to which qualitative adjustments play a part in the forecast process. Specifically, two issues are considered: in what way, and to what extent, does the overlay process introduce differences/variations in forecasts and how might it be ensured that overlay improves forecasts consistently.

This element of the project relies on two main sources of information. Firstly, a short questionnaire was sent to IPF Consensus Forecast contributors asking them to share information, in confidence, about how their forecasts are derived (see Appendix B). This approach elicited six responses, which provided a clear sense that forecasters tend to use a combination of qualitative and quantitative methods, as well as serving to provide initial guidance on the inputs that enter the process and forecaster's perceptions of the weaknesses associated with current practice. Secondly, the researchers undertook a further six in-depth interviews with volunteers from the Consensus forecasting community in which they were asked to engage in what was described as a scenario exercise (see Appendix C). This exercise was informed by the first-stage survey and was designed to help 'unpack' the influence of the overlay process on forecasts and to provide a basis for reflections on how qualitative inputs might help improve forecast accuracy. Four respondents participated in both the survey and the scenario exercise.

4.2.1 Results of the scenario exercise

The initial survey revealed that forecasters use information about the wider economy and property market performance, which come from relatively few sources. Indeed, as Matysiak et al. (2012) observed, the reliance on a small number of sources is one of the reasons that forecasters' views tend to converge. The survey indicates that differences in view are more likely to emerge as a result of the structure of the model and the method of estimation used (see Section 3) or from the overlay process than from variations in assumptions about the future economic climate. The survey also revealed that model structure and methods of estimation used tend to split into several clusters. This is a result of the tendency to source property-specific forecasts from a small number of external providers. Those forecasters who develop models internally add little to the variety in this area of practice. Most variation occurs in the overlay process, which, not surprisingly, tends to be unique to each institution.

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The scenario exercise sought to test these general observations further. The exercise was designed to comprise two sections. In the first part, participants were asked to provide details of their assumptions about a range of macroeconomic variables and to provide forecasts for City office rents and yields. The data requested covered the next three years. The macroeconomic variables selected were not those shown statistically to be the most likely to drive office market models (such as FBS employment). Rather, they were national-level indicators of the general health of the economy: GDP, unemployment, interest rates, the sterling index and inflation. The intention was to gauge the organisation's view of the health of wider UK economy. GDP, unemployment and inflation were seen as standard general indicators of the strength and direction of travel of the economy while interest rates (specifically the inter-bank lending rate) were included to provide some opportunity to reflect on the relative potential of bonds and the sterling index was intended to provide a guide to views about the relative strength of the UK with respect to international markets. Most respondents reported that their economic view was shaped by externally sourced forecasts. When comparing these with each other and with the overview of economic forecasts provided by the Treasury (HM Treasury 2012), it was clear that there was considerable convergence (in fact three responses were identical) and that most views were very close on all indicators. As expected, there was rather more variation in the property forecasts (see Table 4.1).

Table 4.1: Forecast change in macroeconomic and City office outcomes

2013	Mean (%)	Min (%)	Max (%)
GDP	1.40	1.30	1.50
Office rents	0.70	-1.00	1.60
Office yields	6.20	5.25	6.60
2014			
GDP	2.05	2.00	2.10
Office rents	0.50	-1.50	1.60
Office yields	6.10	5.25	6.60
2015			
GDP	2.25	2.20	2.30
Office rents	1.20	0.50	1.60
Office yields	6.20	5.00	6.60

Assumes 5.25% starting yield.

These results would appear to confirm the sense that the differences arise, not from divergence in opinion about wider economic prospects, but from slight variations in either the property-specific models (data, model structure or statistical methods) and/or the market overlay process.

The second part of the exercise was designed to act as an experiment to explore the extent to which forecasters might adjust their views when faced with a change in economic circumstance. The exercise confronted all participants with circumstances that were either worse (the pessimistic scenario) or better (the optimistic scenario) than their initial assumptions. The researchers were interested in both how far respondents were willing to adjust their positions and in the differences in the extent to which they would

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alter these views. It was anticipated that the respondents would all consider both the facts (they were given identical information about general macroeconomic conditions) and the 'mood' in the market (as conveyed by the terms 'optimistic' and 'pessimistic'). The variables chosen again allowed reflection on the economic circumstances, the relative position of real estate versus other assets and the relative position of the UK economy. The economic scenarios were intended to be plausible and internally consistent. These were based on the most optimistic and pessimistic views reported by the Treasury (HM Treasury 2012) in their comparison of independent economic forecasts.

On average, predicted rents for 2013 were lowered by 2.7% under the pessimistic scenario and raised by 2.1% under the optimistic scenario. For 2014 and 2015, the adjustments under pessimistic outcomes were typically small, 0.3% and 0.2%, while the adjustments under optimistic circumstances were quite large, at 3.4% and 2.6%. This suggests that, despite the tendency to take a moderate (near midpoint) view on the economy, most forecasters translate this into property market forecasts that are near the bottom in the medium term and, consequently, even under a much worse scenario, the downgrade is moderate. The extent to which views would be revised would be far more significant if the best economic circumstances envisaged by independent forecasters were to emerge. This reveals some interesting tendencies. Firstly, the best case is close to the Treasury view but forecasters do not appear to place much faith in the most bullish messages emerging from official sources. Secondly, the tendency to locate property market outcomes near the bottom, even in moderate circumstances, might be interpreted as an indication that mood or sentiment has led forecasters to tend to downgrade their views and to break the link between economic fundamentals and predicted property market outcomes. The fact that this emerges most strongly when looking at predictions two and three years ahead might imply an innate risk aversion (possibly conditioned heavily by recent experience). This was a tendency exhibited by all participants. This impression is reinforced by the need to significantly upgrade forecasts when confronted with rather better economic conditions.

There was more variation revealed in the extent to which adjustments were made under different scenarios than there had been in the analysis of assumptions about the economy or in the initial forecasts of rents and yields provided. The qualitative adjustments are larger than would be produced by the econometric models were the same revisions also to be made to the macroeconomic assumptions. This may simply be because participants felt there was little at stake in the exercise and this allowed them to comfortably propose extreme positions. The researchers would contend, however, that it suggests the sorts of judgement calls that enter the overlay process provide a far greater source of adjustment, and arguably error, than any other input. It is also the largest source of differentiation between forecasts than any other element of current practice.

There are some caveats to this assertion. There is no doubt that this exercise might have generated quite different results if it had been conducted under different economic and market conditions. Several participants observed that more qualitative overlay processes are most important in volatile circumstances and where, as in the recent past, economic forecasts have been continually revised in small increments in response to large news items. In more 'normal' circumstances, where rents and yields tend to be more predictable, there is less emphasis on overlay and any adjustments made tend to be relatively small.

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4.2.2 Towards a more consistent behavioural input into forecasting

The interviews generated several interesting reflections on and concerns about the nature of the overlay process. One issue related to the relative weight given to overlay in different forecasts and at different points in time. There were two clear extremes on this issue. At one end of the spectrum was the respondent who described a strongly model-based approach in which overlay discussions often led to a re-specification of model inputs and the development of an alternative set of formal forecasts. At the other extreme, the respondent was one who typically used the model outputs as a starting point for discussion but would often make quite large judgement-based revisions that were driven largely by up-to-the-minute market intelligence and a sense of the collective 'mood' within the professional community. This sometimes reflects the different ways that forecasts are to be used. Those who publish forecasts tend to rely on models where the assumptions and methods can be made explicit as, even if it is clear that the forecast is likely to be inaccurate, the numbers can be readily justified.

A second issue that emerged related to the extent to which overlay processes could or should be systematised and/or made consistent. At a very micro level, one participant suggested that the overlay discussions and resultant revisions to forecasts might reflect the attendees at the meeting where the forecast was discussed and even the time of day that the meeting was held. There was a clear suggestion that were the research to explore the impact of overlay in some form of controlled experiment that held all variables constant (including the economic position, market fundamentals, sentiment, the participants and, even, their recent caffeine intake) it was unlikely that the extent to which forecasts might be revised would be consistent or systematic. Others felt strongly that the process was actually far less ad hoc. Several respondents suggested that the seemingly ad hoc nature of the discussions was often mediated by exploring alternative – particularly downside - scenarios and others pointed again to their practice of recalibrating models based on this more qualitative input.

Interviewees were invited to discuss the extent to which they thought overlay processes improved forecast accuracy. Two respondents explained that they recorded the difference between initial model-based outputs and final, overlay- informed forecasts. Although they advised that they rarely revisited this information, one observed that in the recent past the overlay revisions had actually increased the error – the initial model outputs had, in fact, been correct. On balance, however, it was thought that overlay processes tended to improve forecasts and that this had been strongly evident in recent difficult and rapidly changing circumstances.

This conviction quite clearly influenced views of the way forward for forecasting. The respondents were all strongly of the opinion that a combination of quantitative and qualitative inputs was the best way to forecast. There were no advocates of entirely quantitative or entirely qualitative methods, although there were differences in view about the relative importance of the different outputs.

There was a broad consensus that the current approach is not badly flawed. All respondents had a clear sense of the ways in which errors might enter into forecasting procedures and they had an appreciation of the potential for inconsistency. They were, in the main, broadly satisfied with the way in which their practices had evolved and the way they had developed mechanisms to control the potential distortions that might enter from the quantitative and qualitative parts of the process.

5. CONCLUSIONS AND RECOMMENDATIONS

Typically, property forecasts are generated by combining econometric predictions with a more subjective market overlay process. There are many ways that errors might enter the forecasting processes used in real estate. Errors might enter the modelling process because the data used are inaccurate, the limited variables included do not cover all of the key drivers of the market, the statistical methods used to estimate relationships are not sufficiently sophisticated to deal with the complexity of the market or the assumptions made about the trends in key real estate and economic drivers are erroneous.

Errors might also be introduced as a result of the market overlay process. IPF Consensus Forecast contributors describe the importance of mood and sentiment in their thinking. They highlight that the persuasiveness of 'softer' influences is not easy to assess and can be difficult to measure with any accuracy and that there is no systematic basis for quantifying the way in which mood has influenced forecasts in the past. This raises the possibility that there may be considerable inconsistency in the way in which qualitative assessments of market conditions might impact forecasts.

This research has attempted to find ways in which improvements might be made to property forecasts. In order to do this, the researchers have sought to explore the quantitative (econometric) and qualitative (market overlay) elements of the process. The exploration has been based on reviewing literature on real estate forecasting, on the application of forecasting methods in related fields, such as housing and finance research, and on in-depth discussions and surveys of existing practice. They have also sought to showcase two different types of econometric models, used to demonstrate the sensitivity of forecasts to changes in model structure, method of estimations, data used and variables measured, and have undertaken a more qualitative, judgement-based 'experiment' that invites forecasters to estimate future outcomes under different circumstances. This scenario exercise serves to illustrate the way in which a market overlay process introduces differences in opinion about macroeconomic and market-specific prospects, including investment flows. The exercise highlights the potential variation in the scale of overlay and demonstrates the difficulties associated with trying to avoid further distortions being introduced by the ways in which individual views enter the process. The analysis shows, perhaps unsurprisingly given the similarities in inputs and model structures, that most of the variation in forecasts is derived from differences in the overlay process. Tables 5.1 and 5.2 summarise the City office rent and yield forecasts for the next three years generated by different methods.

Table 5.1: City office rent forecasts 2013–2015[5] (% change)

Forecasting approach	2013	2014	2015
ARIMA	1.0	0.5	0.3
ECM	2.0	1.5	1.5
Scenario forecast exercise (variable inputs)	0.7	0.5	1.2
Pessimistic economic scenario	-2.0	0.2	1.0
Optimistic economic scenario	3.8	3.9	3.8

[5] ECM econometric model uses the HP filter to forecast values of exogenous variables. The model assumes no spatial substitutability between London office submarkets and includes a dummy variable to capture the financial crisis from 2008 to 2010. As the dataset used ends in 2010, the values for 2011 to 2015 are all forecast values.

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Table 5.2: City office yield forecasts 2013–2015 (%)

Forecasting approach	2013	2014	2015
ARIMA	5.50	5.58	5.55
ECM	5.25	5.30	5.28
Scenario forecast exercise (variable inputs)	6.20	6.10	6.20
Pessimistic economic scenario	6.50	6.30	6.40
Optimistic economic scenario	6.00	5.90	6.00

Assumes 5.25% starting yield.

The model-based rental estimates are calibrated using ARIMA and ECM econometric techniques. The rental ECM forecasts differ from the mean scenario forecasts but are within the optimistic and pessimistic values. The yield model presented here also follows the form of an ECM. In the yield forecasts the econometric models produce quite different results. However, there is no evidence of either strong upward or downward yield movements in any of the forecasts.

The scenario-based estimates are based on the arithmetic mean. Clearly, given the small sample, these predictions can be distorted by a single extreme value and it may be better to look at the median than average of values. The model estimates appear to be quite close to those produced in practice. They overlap with some of the range of final forecasts produced in the scenario exercise. Most forecasters, however, tend to use overlay processes to move away from the model estimates, citing mood and sentiment as the main reasons for making adjustments. It is interesting to note that, even when presented with optimistic and pessimistic scenarios, there is significant clustering. The overlay introduces an 'anchoring' effect that reinforces the tendency of forecasts to be clustered. In the medium term, forecasts tend to break from fundamentals and exhibit a large degree of pessimism. Much larger adjustments need to be made to overlay-influenced estimates under an optimistic economic scenario than would be made to model outcomes when re-calibrated on the basis of the same information.

Which of these estimates is the most accurate will only be proven with the passage of time. Some observations may be offered, however, about the way in which forecast performance could be improved and forecast processes made more robust. Taken together, the two elements of this project suggest that potential improvements in future forecasts might come from both the qualitative and quantitative elements of the process. Modelling improvements may result through:

- adopting more innovative econometric methods, including investing in techniques that better capture structural breaks; and
- exploring variables that might proxy changes in sentiment and mood in both rental and yield forecasts.

These might be combined with qualitative enhancements by:

- considering the development of methods that allow greater appreciation of the different drivers of market overlay processes and that provide a more systematic basis to capture the influence of this aspect of the process. The scenario forecasting exercise used within this research is intended to act as a simple exemplar of how this might be done. This would encourage participants to analyse and be explicit about the key influences and assumptions to their processes and introduce some measurement of the relative importance of qualitative adjustment under different assumptions;

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- enhancing the feedback between overlay and modelling processes; and
- using qualitative insights, including mood adjustments, as inputs into formal models.

Several other process improvements that might be made, including:

- engaging in greater reflection about the effectiveness of current practices. There might be considerable benefits from recording formal outputs, the size and direction of overlay influences and final outputs, with a view to revisiting these on a regular basis. Such review and monitoring processes would develop a clearer appreciation of the sources of error in existing practices and of the conditions under which the methods used would produce the best results. This is likely to shed light on simple changes that would yield improvements in accuracy; and
- moving away from reliance on point estimates and towards the development of forecasts that produce a range of possible outcomes (that may even have probabilities assigned to them).

It should be noted that yield forecasting has proved a much more difficult exercise than rent forecasting. It is in this area that the majority of forecasters tends to rely most heavily on overlay and less so on models. This is a sensible response to the influence of behavioural factors such as mood and sentiment on investment flows. The reliance on judgement and the lack of reflective practices mean that the gains from a more systematic set of procedures would be potentially greatest in this area.

No compelling evidence was found to suggest that techniques such as neural networks, cellular automata or evolutionary models offer any significant improvement over existing techniques. The paucity of real estate data limits the effectiveness of these approaches, possibly even more than it constrains econometric model development. These techniques are also limited by the quality of the outputs, as well as by the tendency of the model to be under-specified and unable to adequately capture the complex drivers of the market. Some sort of overlay process seems to be an appropriate response to the challenges associated with capturing difficult-to-quantify behavioural influences on the market.

The best solution will almost certainly derive from a more reflective set of forecasting practices and from the development of a mixed-method approach that draws together what the models can explain with deep market knowledge that seeks to systematically explore the ‘softer’ (non-rational) behavioural influences that cannot be statistically modelled. The relative weight different ‘houses’ (forecasters) place on qualitative versus quantitative inputs varies and so do the ways in which they seek to ensure consistency of approach and to minimise errors. Most forecasters are broadly satisfied with the way in which the technique they use has evolved and feel better equipped, even in a very uncertain market, to take a position than they have been historically. Views vary on whether this reflects a degree of inappropriate complacency or whether it suggests that forecasts play such a limited part in decision-making that these processes do not merit any more investment (in terms of finance, time or research effort) than the current level. This might also explain the relatively low levels of engagement with the various aspects of this project.

APPENDIX A – MODELS

Beginning with the basic ECM approach and following Hendershott et al (2002), demand for property as a function of rent and economic activity is considered:

Equation A1

$$D = \lambda_0 R^{\lambda_1} EA^{\lambda_2}$$

where D is demand, R is rent, EA is economic activity, $\lambda_1 < 0$ is the price elasticity and $\lambda_2 > 0$ the income elasticity. By definition, this demand equals the supply of occupied space $(1 - v)SU$, where SU is supply and v is the vacancy rate. Equating demand and occupied supply, taking logs and solving for ln R gives:

Equation A2

$$\ln R = -\gamma_2 \ln\lambda_0 + \gamma_1 \ln EA + \gamma_2 \ln SU + \gamma_2 \ln(1 - v)$$

where $\gamma_1 = -\lambda_2 / \lambda_1 > 0$ and $\gamma_2 = 1 / \lambda_1 < 0$.

If vacancy rate data are generally not available, then to account for the normal vacancies that would exist in equilibrium, $\gamma_2 \ln(1 - v^*)$ are added and subtracted from the right side of (A2) and v^* (the equilibrium vacancy rate) is treated as a constant, obtaining:

Equation A3

$$\ln R = -\gamma_0 + \gamma_1 \ln EA + \gamma_2 \ln SU + err$$

where $\gamma_0 = \gamma_2 [\ln(1 - v^*) - \ln\lambda_0]$ and err $= \gamma_2 [\ln(1 - v) - \ln(1 - v^*)]$. Lacking data on v, its impact is embedded in the error term.

The reduced-form rent equation can be set within an ECM framework. The residual from the estimated long-run relationship, Equation A3, is:

Equation A4

$$u_t = \ln R_t - \hat{\gamma}_0 - \hat{\gamma}_1 \ln EA_t - \hat{\gamma}_2 \ln SU_t$$

which is the difference between the observed and estimated long-run log rental values. If these variables are co-integrated, this error is stationary and can be used in the short-run dynamic model as an adjustment process.[6]

[6] Formally:

'A series with no deterministic trend and which has a stationary and invertible autoregressive moving average (ARMA) representation after differencing d times, but which is not stationary after differencing $d - 1$ times, is said to be integrated of order d. The components of a vector x_t are said to be cointegrated of order d, b, if x_t is $I(d)$ and there exists a non zero vector α such that $\alpha^T x_t$ is $I(d - b)$, $d \geq b > 0$. The vector α is called the co-integrating vector. In this reasearch's models, co-integrating relationships are sought among variables that are individually integrated of order one, so the deviation from the equilibrium relationship is integrated of order zero, that is, it is stationary.' (Banerjee et al. 1993)

APPENDIX A – MODELS

The short-run model is the first difference of Equation A3 with the addition of the error correction term. To this basic model, the lagged value of real rental change is also added because the rent series are autoregressive:

Equation A5

$$\Delta R_t = \alpha_0 + \alpha_1 \Delta EA_t + \alpha_2 \Delta SU_t + \alpha_3 u_{t-1} + \varphi \Delta R_{t-1}$$

where Δ represents log differences. Thus, real rent adjusts to short-run changes in the causal variables and also to lagged market imbalances as measured in Equation (A5). In the estimations, it is expected that α_0 will be approximately zero, α_1 will be positive, α_2 and α_3 will be negative, and φ will be between 0 and 1. $\alpha_3 = 0$ means no adjustment; $0 > \alpha_3 > -1$ means partial adjustment; $\alpha_3 = -1$ means full adjustment; and $\alpha_3 < -1$ means over-adjustment. From a forecasting perspective, knowing where the long-run trend path lies will be important as adjustment (from the short-run) will, a priori, be towards that path, even if it too changes.

The discussion above arises out of the need to explain rental adjustment processes. Following Hendershott (1995, 1996), adjustment takes the following form:

Equation A6

$$(R_t - R_{t-1}) / R_{t-1} = \lambda(v^* - v_{t-1}) + \beta(R_t^* - R_{t-1})$$

where the change in rent from period $t-1$ to period t is a function of the difference between the equilibrium and actual vacancy rate last period, and the difference between the equilibrium and actual rent last period.

Forecasts may be built upon autoregressive integrated moving average (ARIMA) models. ARIMA is the same as ARMA when the order of integration of the relevant time series is zero. The ARMA is a general model that takes the form:

Equation A7

$$y_t = \mu + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \ldots + \gamma_p y_{t-p} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \ldots - \theta_q \varepsilon_{t-q}$$

where y is the variable of interest. This is an ARMA (p,q) process with p autoregressive (lagged dependent variable) terms and q lagged moving average terms. An ARIMA (p,d,q) process differs only in the number of times the variable has been differenced (d). Rent or capital value are normally found to be integrated of order one and hence $d = 1$ as the series would have to be differenced once to make it stationary (give it a time-invariant mean value). ARMA models relate to vector ARMA models in which more than one variable is examined. If the MA component is removed then they lead to VAR models that are the basis for Granger-causality tests. Some authors (e.g., Litterman 1979) argue that unrestricted VAR models would provide a better forecast than structural equation models.

APPENDIX A – MODELS

Table 3.2 in the main text shows the long-run model for City of London office rents. The short-run error correction model is presented in Table A1.

Table A1: Short-run error correction model for City of London office rents

Variable	Coefficient	Std. error	*t*-statistic	Prob.
Constant	-0.040983	0.033291	-1.231053	0.2326
Change in finance and business services output	0.879423	0.552169	1.592671	0.1269
Change in stock	-1.413521	0.671624	-2.104632	0.0482
Error correction	-0.336750	0.102412	-3.288195	0.0037
One-period-lagged change in rent	0.369818	0.106542	3.471081	0.0024
R-squared	0.842308	Mean dependent var.		-0.028322
Adjusted *R*-squared	0.810770	S.D. dependent var.		0.160055
S.E. of regression	0.069625	Akaike info. criterion		-2.314536
Sum squared resid.	0.096952	Schwarz criterion		-2.070761
Log likelihood	33.93170	Hannan–Quinn criter.		-2.246923
F-statistic	26.70744	Durbin–Watson stat.		1.881084
Prob(*F*-statistic)	0.000000			

Sample (adjusted): 1985–2009.
Included observations: 25 after adjustments.

In this model, the error correction term is correctly signed, a priori, and significant. The change in stock is also significant at the 5% level.

APPENDIX B – SURVEY OF IPF CONSENSUS FORECAST CONTRIBUTORS

Researchers at Nottingham Trent and Sheffield Universities are currently working with IPF on research that considers the future of property forecasting. The first phase of this project requires that we develop an overview of the methods currently used within the industry. The survey that follows should take no more than FIFTEEN minutes to complete. All responses will be completely anonymised. The information provided will not be shared with anyone outside of the academic project team.

Q1. Do you currently consult forecasts based on formal economic/econometric models?

YES ☐ NO ☐

If YES: go to Q2
If NO: go to Q4

Q2. Do you develop in-house models or do you 'buy' forecasts from an external source?

If external, what source (or sources) do you use?

Q3. Do you adapt model forecasts (e.g based on experience, internal market intelligence etc) before forming your internal view of market prospects?

YES ☐ NO ☐

If YES: could you explain what information you consider and how this process works?

Q4. In the absence of formal models, how do you develop your forecasts? Could you briefly explain the process (highlighting whether this based on individual or collective views; what sources of information are most important; whether there is a formal or informal procedure followed)?

Q5. Would you be willing to spend thirty minutes talking (face-to-face or by telephone) to a member of the research team about how you develop your in-house forecasts?
If so, could you insert contact details below?

THANK YOU FOR YOUR HELP

APPENDIX C – SCENARIO FORECASTING EXERCISE

Introduction

Researchers at Nottingham Trent and Sheffield Universities have been appointed by IPF to undertake an examination of the Future of Property Forecasting. The project brief sets the challenge of exploring the ways in which econometric and other more qualitative methods might be used independently or in combination to enhance forecasting practice. This questionnaire is designed to begin to elicit views on the extent to which wider 'softer' (market overlay) influences are used in forecasting at present. It is also intended to provide a set of forecasts that can be compared with those generated by formal econometric models. All responses will be anonymised. Individual forecast will not be revealed to any other parties.

Exercise 1

Previous IPF funded research has observed that Consensus Forecast contributors tend to take similar positions on future positions because they make the same assumptions about economic fundamentals. We would like to explore this. Could you set out your current view on economic and property market prospects over the next three years? We understand that you may not consider all of the variables included in the table. Please feel to provide a partial response by filling in the parts of the table that you feel are relevant to your forecasts.

Table C1: Economic assumptions and City office market forecasts

	GDP %	Interest rate %	Inflation CPI %	Claimant unemployment (millions)	Sterling index (Jan 2005=100)	City office rent	City office yield
2013							
2014							
2015							
Please use this box to add any explanatory comments you feel might be helpful:							

APPENDIX C – SCENARIO FORECASTING EXERCISE

Exercise 2

Tables C2, C3 and C4 set out different economic scenarios based on the current views of several city analysts. We have set out optimistic and pessimistic views. If you and your team were confronted with these scenarios, what would this mean for your forecasts of City office rents and yields for the next three years? Could you enter your view on likely property outcomes under different scenarios set out for each year.

Table C2: Scenario-based forecast for 2013

2013	GDP %	Interest rate %	Inflation CPI %	Claimant unemployment (millions)	Sterling index (Jan 2005=100)	City office rent	City office yield
Pessimistic	-0.4	1.40	2.9	1.93	76.7		
Midpoint	1.4	1.00	2.2	1.66	80.5		
Optimistic	3.0	0.98	1.4	1.50	88.2		

Please use this box to add any explanatory comments you feel might be helpful:

Table C3: Scenario-based forecast for 2014

2014	GDP %	Interest Rate %	Inflation CPI %	Claimant Unemployment (millions)	Sterling Index (Jan 2005=100)	City Office Rent	City Office Yield
Pessimistic	0.9	2.10	3.7	1.91	74.7		
Midpoint	2.5	1.80	2.0	1.55	85.0		
Optimistic	3.2	1.64	1.3	1.35	90.0		

Please use this box to add any explanatory comments you feel might be helpful:

APPENDIX C – SCENARIO FORECASTING EXERCISE

Table C4: Scenario-based forecast for 2015

2015	GDP %	Interest rate %	Inflation CPI %	Claimant unemployment (millions)	Sterling index (Jan 2005=100)	City office rent	City office yield
Pessimistic	1.5	3.15	4.0	1.81	72.2		
Midpoint	2.6	2.50	2.0	1.45	84.2		
Optimistic	3.2	2.10	1.5	1.08	90.0		

Please use this box to add any explanatory comments you feel might be helpful:

Discussion Points

Should time permit, the research team would welcome the opportunity to discuss several issues that have emerged in the course of the research project. This includes inviting you to reflect on:

1. your underlying processes/practices;
2. the way in which changes in mood or sentiment and detailed sector-specific knowledge is used to adapt forecasts;
3. the extent to which making qualitative adjustments may have impacted on the accuracy of your forecasts;
4. the degree to which the weight placed on less formal (qualitative) adjustments may vary in different market/economic conditions.

THANK YOU FOR YOUR PARTICIPATION

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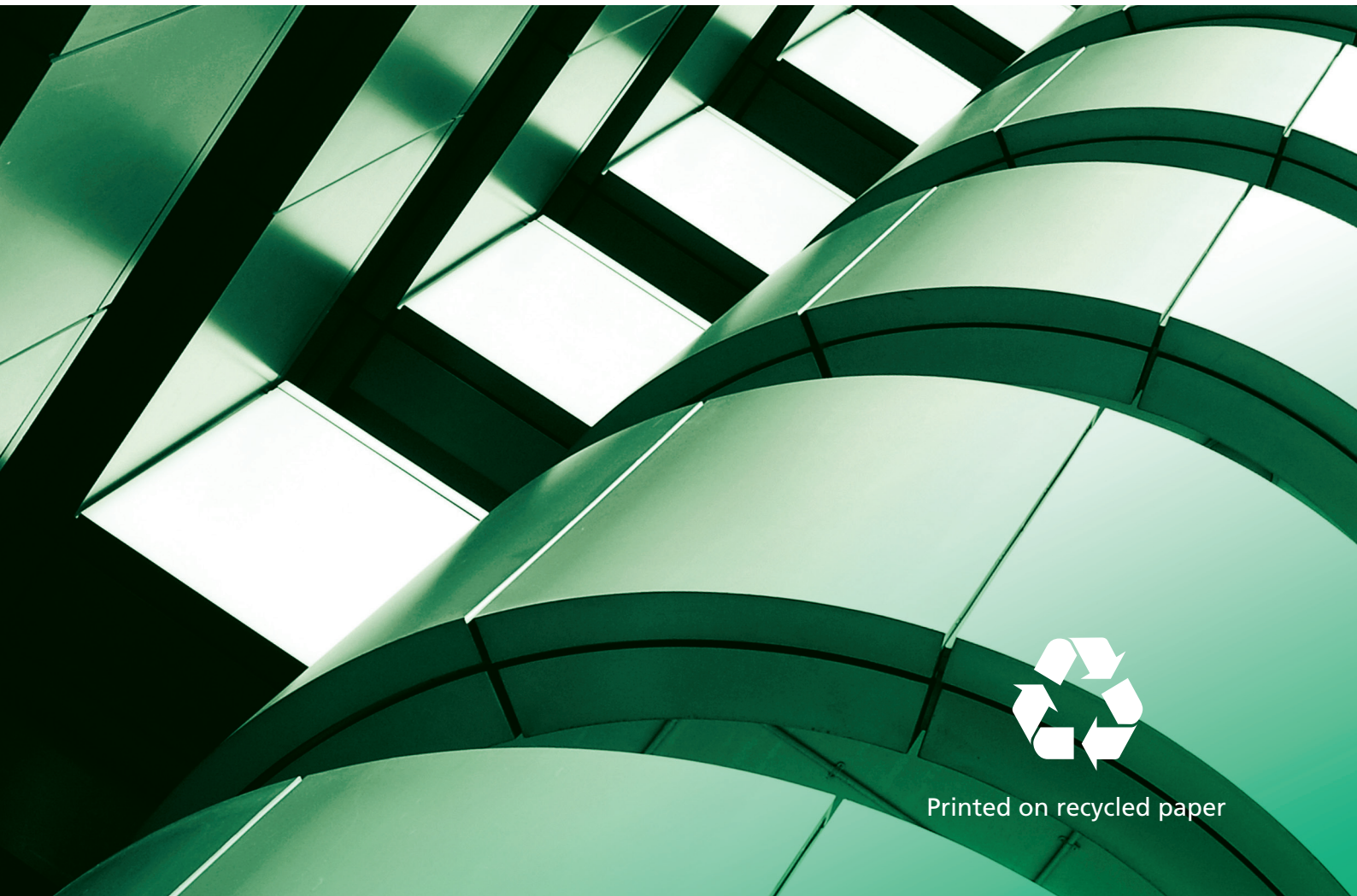

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