Financial scenario modelling: a study of UK universities

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Abstract

Financial scenario modelling appears to offer the potential to help universities cope with an uncertain funding environment. By means of a questionnaire survey of UK universities, supported by interviews with members of finance departments, this paper explores the prevalence and construction of financial models used for scenario analysis. According to the findings, most universities undertake such modelling; but a minority do not, even though it is officially required. There is some variation in the purposes for which the models are constructed and in the sophistication of the approaches taken, but the overall impression is of a relatively straightforward approach, with spreadsheets generally viewed as having sufficient functionality to meet current strategic needs. There is no appetite for a standard template to be imposed or even offered by the funding councils. Sharing experience is likely to be a more welcome approach if growing pressures prompt finance departments to strengthen their modelling.

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Introduction

With increased scale, universities have become more sophisticated in their management, displaying similarities to large business corporations. This trend is often encouraged, if they are public universities, by government promotion of New Public Management (Hood & Dixon, 2016), in which targets, value for money, budgeting and financial controls loom large. More broadly, it can be argued that government interest in universities as tools of economic and social policy, coupled with a focus on austerity after the Global Financial Crisis, have led to the 'financialisation' of universities (Parker, 2012, 2013) and 'an increasingly dominant financial strategy imperative' (Parker, 2013, p.20). In such a context, Parker explains, 'we see financial management move from the margins of its traditional decision support role in higher education institutions, to centre stage' (Parker, 2012, p.263).

At the same time, governments have tended to make it more difficult for universities to plan. Subject to more frequent and less predictable policy interventions, universities seek diversified income streams, but are increasingly subject to competition. In the UK, even the core area of activity – domestic undergraduate recruitment – has become 'marketised' and hence subject to greater uncertainty.

Contingency theories of management accounting suggest that increased competition and uncertainty would lead to more sophisticated systems (Gordon & Narayanan, 1984; Chenhall & Morris, 1986; Gul & Chia, 1994; Baines & Langfield-Smith, 2003). In particular, uncertainty would be expected to drive investment in planning activity. However, with greater uncertainty, planning also becomes more difficult, and the predictions embodied in plans become increasingly prone to inaccuracy.

One complementary approach to dealing with an uncertain financial future is scenario modelling, as advocated by Wack (1985a, 1985b) and Chartered Global Management Accountant (CGMA) (2013). It is concerned not with forming a specific forecast but with helping managers to understand key business drivers and hence manage risk (Pierone, 2013).

Scenario models offer multiple views of a future that is not predictable with any degree of confidence (CGMA, 2015), enabling managers to conduct sensitivity ('what if') analysis. Differing sets of assumptions can be explored (Prowle & Morgan, 2005). Although much of the focus might be on contingency planning for downside risks, Makridakis, Hogarth, & Gaba (2009) recommend generating ideas and developing strategies that could neutralise sources of threats. Upside risk and how to respond if positive outcomes occur should also be considered. It is an established and widely used technique in large business organisations (Varum and Melo, 2010), suggesting that it might be useful for universities.

In building a financial model for scenario analysis, it is important to identify key variables and the relationships between them (Morrison & Mecca, 1988; Schoemaker, 1991). Prowle & Morgan (2005) emphasise resourcing uncertainties arising from government policy, inflation, tuition fees, overseas recruitment and third-stream income. It is also necessary to distinguish between fixed and variable cost behaviour, because a reduction in the volume of activity will not always result in a reduction in costs. Variables might be entered manually into the model or, where appropriate, pulled through from other systems, assuming the technological capability is present.

It should be acknowledged that scenario analysis has its critics (Hodgkinson, 2001; Hodgkinson & Sparrow, 2002; Mintzberg, 1994). Accounts of its deployment tend to be restricted to successful implementations such as those detailed by Wack (1985a, 1985b). Indeed, Mintzberg (1994, p.250) noted that 'The Wack account does not point out how commonly such exercises fail' and there does not seem to exist any systematic evidence that demonstrates a positive link between financial modelling and organisational success.

Nevertheless, if well deployed, financial scenario modelling does seem to be of *potential* value. Indeed, the funding councils in the UK have required the institutions they fund to undertake financial scenario modelling for some years (e.g. Higher Education Funding Council for England (HEFCE), 2011; HEFCE, 2016; Higher Education Funding Council for Wales, 2020; Office for Students, 2019; Scottish Funding Council, 2020). However, they do not prescribe the form that such modelling should take, and they have not published any information on what universities currently do.

Nor is there systematic empirical research on financial scenario modelling by universities. For example, as part of a review of scenario analysis literature, Varum & Melo (2010) identified the industries that had been addressed in articles published in peer reviewed journals since 1945; there were no references to universities. Furthermore, surveys of the management accounting practices of UK universities have not considered scenarios (Angluin & Scapens, 2000; Berry, Clements, & Sweeting, 2004; Lewis & Pendlebury, 2002). Some individual examples have been discussed in the literature. For example, Gee (1988) set out to design a financial model at the University of Salford that considered the relationship between price and quantity, and Richards, O'Shea, & Connelly (2004) reported on scenario planning undertaken at the University of Glamorgan. More recently, Morgan (2014) made some brief comments on modelling undertaken by individual UK universities. However, published research findings on financial scenario modelling are scant.

The aim of this paper is therefore to provide empirical findings on the scenario modelling practice of UK universities. In particular, it provides insights into the construction of financial models used for scenario analysis. The next section explains the research method.

Method

The research employed a questionnaire survey, supplemented by interviews. Given the lack of previous research literature, the questions on scenarios were based on textbooks and similar material and on the authors' own practical experience. Other sections of the questionnaire focused on annual budgeting, which is not considered in this paper, together with background information about the individual completing the questionnaire and their institution. The questions on scenario modelling asked about the following:

- Whether scenario modelling of income and expenditure is undertaken; and, if so
- The primary purpose(s) for doing so (to satisfy funding council requirements; for internal resource planning; for internal contingency planning; other)
- Key variables used in models (list of 20 items plus 'other'), with indication of importance (4-point Likert scale)

- Whether any items of income or expenditure are excluded from the model (6 items plus 'other')
- Whether a formulaic basis is used to link key variables (15 items plus 'other')
- System used for modelling (finance system; spreadsheets; off-the-shelf forecasting/planning tool; bespoke forecasting/planning tool; dedicated specialist software)
- Whether the modelling system is integrated with others (yes; no; sometimes)

The relevant questions, extracted from the questionnaire, are provided in the online Appendix.

The questionnaire was sent to all UK institutions that:

- had submitted a Finance Statistics Return (FSR) to HESA (Higher Education Statistics Agency),
- were listed on the Higher Education Information Database for Institutions ('HEIDI' is a benchmarking tool available to all UK higher education institutions. It offers subscribers bespoke comparison reports and data extraction facilities on a broad range of data which is added to through scheduled releases), or
- were members of the British Universities Finance Directors Group (BUFDG).

This population included 15 colleges of higher education that demonstrated some of the characteristics of a university in terms of funding, reporting requirements and financial management. Copies of the questionnaire were sent to appropriate named individuals obtained from the webpages of BUFDG, LinkedIn and university websites – or to the director of finance when a name could not be sourced.

163 questionnaires were distributed, with 84 usable questionnaires received, representing a response rate of 52 per cent. Statistical testing revealed no evidence of non-response bias. Responses are categorised according to institution type in Table 1.

INSERT TABLE 1 HERE

Job titles of those completing the questionnaire are summarised in Table 2.

INSERT TABLE 2 HERE

The questionnaire asked whether respondents would be willing to be interviewed; 71 answered positively. Interviewees were selected on the basis of their responses to the questionnaire and the need to cover a cross-section of institutions; 42 interviews had been conducted by the time 'saturation' (Marginson, 2004) was reached.

The semi-structured interviews, which covered a range of management accounting topics, averaged two hours in length. Scenario modelling was discussed with 40 of the interviewees, with reference back to their questionnaire responses where appropriate. Two interviewees had said in the questionnaire that they did not use it, although one did subsequently discuss plans to use it in the future.

Pilot study respondents indicated that they would be uncomfortable having their views recorded and would be less willing to participate, so extensive notes were taken, both during the interview and immediately afterwards. Where particular interviewees are quoted or referred to, they are referred to by a unique number, either OU*i* or NU*i*, indicating pre-92 and post-92 institutions respectively.

In the case of both the questionnaire survey and the interviews, confidentiality was assured, as an ethical commitment and to encourage more candid responses.

Findings

The presentation of the findings is structured around an analysis of the responses from the questionnaire survey, with insights from the interview data woven in at various points to help interpret the questionnaire findings and explore issues further.

Table 3 presents findings about whether scenario modelling is undertaken and, if so, what the primary purposes are considered to be.

INSERT TABLE 3 HERE

Comparing the first two columns in Table 3, there is little difference between Pre-92 and Post-92 institutions, so in the remainder of the analysis this distinction will not be made. Most institutions (88 per cent) undertake scenario modelling (Panel A). However, this still leaves a significant minority (12 per cent) that said that they do not, which is surprising, given the funding councils' stipulation that they should do so. One interviewee commented that, although the Vice-Chancellor was keen for it to be done, there had been little progress, even though it 'would be easy enough to do' (NU20). Another interviewee explained that they were looking to begin when time permitted; it was 'on the wish list, but we need to get the basics right first' (OU4). Others questioned the benefit and made the point that if the 'base forecasts' used in the model were likely to be inaccurate then any modelling using these figures would also be inaccurate. Such a view confuses scenario analysis with forecasting.

When asked about the primary purposes of scenario modelling (Panel B), most respondents gave just one. However, some cited more (nine gave more than two), with an average of 1.6 each. The most common purpose, cited by three-quarters (74 per cent) of respondents, was contingency planning. More than two-fifths (43 per cent) cited internal resource planning, whereas less than a third (31 per cent) mentioned meeting the requirements of their funding body. That more than two-thirds did not cite the funding bodies might reassure them that the tool is embedded and taken seriously by most institutions. Nevertheless, four respondents did give this as their only reason for undertaking scenario modelling. Other data suggests that

those institutions take a relatively simple approach to scenario modelling, so perhaps it is a token gesture.

Some interviewees explained that they used their model to undertake sensitivity analysis in respect of re-running resource allocation or contribution models. One interviewee described how they had undertaken basic modelling such as the effect of a 10 per cent cut in funding and noted that: 'Despite the simplicity of the approach it does encourage engagement in the process and more focussed thinking' (NU7). Such an example fits with a tendency to concentrate more on possible bad news rather than opportunities. One interviewee explained that the process 'looks more at the downside than the upside' (OU7). Another interviewee noted that their use of scenario modelling tended to take the form of a 'funnel of doubt' (OU20). In this case, graphs were produced showing an optimistic and pessimistic outcome over the period of the planning horizon, the grey area between the two lines representing the funnel of doubt. These graphs had previously been shared with Higher Education Funding Council for England (HEFCE) to demonstrate potential risks.

The questionnaire then sought more detailed insights into the construction of the models and the key variables included. A list of 20 variables was provided, with the option of adding others. Respondents were also asked to indicate the perceived importance of the variables selected. In order to rank the relative importance of the variables to the respondents as a group, a simple weighting scheme was applied. High, medium and low importance were given a weighting of three, two and one respectively. The frequencies for responses and the results of the weighting procedure are shown in Table 4.

INSERT TABLE 4 HERE

Those variables given the highest priority were Home and European Union (HEU) undergraduate student numbers, overseas undergraduate and postgraduate student numbers, and staffing in terms of costs and numbers. These tend to be the largest items in institutions' accounts. However, it is not just size that matters: as interviewee OU7 commented, the 'key variables in the scenario model tend to be those that are volatile and difficult to forecast

accurately'. Overseas students have come to provide a significant source of income to UK universities, but their numbers can fluctuate because of competitive pressures and political changes, both domestically and internationally. Any forecasts are therefore subject to considerable uncertainty, and it makes sense to ensure that overseas students are reflected in scenario models. HEU undergraduate income has long been very important, but it became significantly more uncertain with the move away from a block grant system and the freeing up and then removal of student number caps in the marketisation of the sector. While its size would always have meant its inclusion in a financial model, the implications of possible variations mean that it is now likely to receive greater attention in sensitivity analysis.

On the expenditure side, staff costs are typically more than half of universities' income, so it is not surprising to find them featuring strongly. Where scenarios involving possible reductions in income are considered, their downward 'stickiness' is particularly significant for whether a university might slip into deficit and, if so, to what extent.

Other variables might still be very important to a minority of institutions, as indicated by the figures in the first column of Table 4. For example, the importance of research grants, part-time students, distance learning, franchise activity and student residences varies greatly between institutions, as does the uncertainty of the income associated with them.

The interviews provided insight into how the key variables used in scenario models differed according to the strength and reputation of the institution. For those with high demand for student places or strong research performance, 'undergraduate HEU students' and 'research income' were given lower importance as there was little variability between years. Some interviewees explained that the income from postgraduate and OS students was so small that there was little point in including them.

Few institutions prepared detailed documentation as to the thought processes behind the inclusion of certain variables or the reasoning for the size of the changes modelled. Lack of such documentation had been criticised by the internal auditors at one institution (NU15).

As expected, some items were excluded from scenario models as they offer little of value in understanding movements in income and expenditure under different assumptions; see Table 5.

INSERT TABLE 5 HERE

In constructing a financial model, it can be helpful to build links between some of the variables and to have more detailed sub-models for important variables, the outputs of which are pulled through to the main model. Table 6 presents the relevant findings from the questionnaire.

INSERT TABLE 6 HERE

The more common practices tend to reflect the importance of variables shown in Table 4. Thus, there were sub-models for staff costs and student fee income, and connections were made between income and staffing costs. Students and staffing were also linked through the use of a formula for staff-student ratios. Bursaries/scholarships as a proportion of student numbers was another common link. On average the number of linkages between variables was five, indicating that models had some degree of sophistication in terms of making associations between movements in income and expenditure.

More than half the respondents' models could reflect different inflation rates, depending upon the type of income or expenditure, which can be important if particular prices do not follow the general rate of inflation in the economy. Given their importance, it is particularly useful to consider how staff costs might increase. At least three factors are important: the increase in actual salary levels, which over the long term tends to be higher than general price inflation; the increase in pension contributions and National Insurance on-costs, which has been very significant in recent years; and incremental drift in salaries, which can become particularly significant if staff turnover or the recruitment of new (generally cheaper) employees fall for any reason.

Although there was evidence of some usage of formulae and sub-models, in the vast majority of cases (76 per cent) models were not integrated with other systems; they were standalone exercises. The interviews suggested that any linkages tended to be straightforward, such as drawing on finance, staff or student data.

Finally, Excel was by far the most commonly used software (84 per cent of respondents). It is widely available, familiar to finance staff, easy to use, and contains considerable functionality – sufficient to meet the apparent needs of universities. Most of those interviewed had not had any formal training in financial modelling, so they did not use specialist software. One interviewee explained that their finance system had the sophisticated capability to draw data from their accounting ledgers and from external sources such as the student number system and HR system, but queried: 'Why would you use it when spreadsheets have all the functionality you need?' (OU9). Similar comments were offered by another interviewee, who also said that the module capable of doing so in the finance system would not be used to produce scenario models: 'A complex mathematical model is not required. It would be too unwieldy. For it to work properly the student number modelling would have to be dynamic. It would be a horrible model.' (OU16)

Another interviewee commented regarding a more complex model: 'people say they need it, but they don't use it' (OU21). Nevertheless, a few interviewees demonstrated models that were quite complicated. The more sophisticated models tended to be based on the HEFCE Annual Accountability Return (or devolved equivalent), so that the effect of changes to key numbers (usually identified in a table of critical assumptions) could be seen on income and expenditure accounts, balance sheets and cash flow statements. However, these models usually still contained only simple formulae to link the differing statements together. Most interviewees indicated that simplicity was key due to a lack of time to develop models further and the need to present understandable results. As interviewee OU8 commented, a balance is required between modelling that is too simplistic to give a realistic picture but too complex to be understandable.

Interviewees explained that the scenario figures presented to senior staff and governing bodies were based on the central finance department's own assumptions. One interviewee (NU5)

explained that the institution used an approach which involved constructing income and expenditure accounts under three conditions. A ‘base’ model was produced, which reflected the expected outcome. This was restated under two different sets of assumptions to show a ‘worst’ and ‘best’ case scenario. Typically, these models reflected changes to the likely recruitment of both HEU and overseas students, alterations to research income and changes to significant aspects of expenditure, such as pay inflation, on-costs and numbers employed. Differing elements of non-pay costs were also varied. Of particular importance was the resulting surplus or deficit figure as the institution was about to undertake a significant redevelopment of its campus which would necessitate funding from a combination of new loans and internal resources. This approach has similarities to the practice of the University of Edinburgh, which utilises four scenarios: baseline/current (do nothing); expected; optimistic; and pessimistic (McKenzie, 2016).

Discussion

In this section, we provide some broader commentary on the findings and consider the potential for developing a standard template for the sector. We begin by looking again at overall usage.

There are plausible reasons (such as contingency planning) why any university might voluntarily choose to undertake scenario modelling, but for some years it has, in any case, been officially required in the UK by the various funding councils. In spite of this, our findings revealed that some institutions (12 per cent) did not construct the relevant models. The compliance figure of 88 per cent appears to suggest some improvement since the National Audit Office (NAO) found that only 64 per cent of institutions (in England) complied in 2009 (NAO, 2011). However, if non-modellers were less likely to respond to our survey, the level of non-compliance could be even higher than our reported figure of 12 per cent. It is surprising that the funding councils appear to have allowed a minority of institutions not to comply. Perhaps they are institutions that a funding council deems to be financially strong and so is not concerned about.

The funding councils have also expressed an expectation that institutions should clearly specify their key sensitivities (incorporating supporting figures) in their commentary on their

financial forecasts as part of the Annual Accountability Return process. However, our findings suggest that many of those that had undertaken the required modelling did not disclose specific figures to their funding council. Most interviewees stated that they simply described the method used. The primary reason given was a reluctance to demonstrate to a funding body how institutions might be able to manage with significant funding cuts, for fear of encouraging such a reduction. On the other hand, one institution that did share details of its scenario modelling figures with HEFCE explained that: 'It's sensible to do this so that HEFCE can have confidence that planning is being undertaken properly within the institution' (NU18). This institution generated low surpluses and was perhaps keen to demonstrate effective financial management, knowing that it would be monitored.

The NAO had concluded that HEFCE's 'ability to model the impact of changes on the sector would be enhanced by more complete data on scenario planning' (NAO, 2011, p. 26). Perhaps the failure of so many institutions to supply figures from which a funding council might be able to build up a picture helps to explain why others were permitted not to do any modelling at all; on their own, their numbers would not enable the picture to be completed, and a funding council could always insist that modelling take place if it became concerned about the financial soundness of a particular institution (cf. the quotation from NU18 above). Perhaps this is why Madeleine Atkins, then Chief Executive of HEFCE, was able to say that: 'While there may be significant uncertainty and financial challenge for the sector in the medium term, we are reassured by the way institutions appear to be responding through their scenario planning and the development of contingency plans.' (HEFCE, 2017)

Although some institutions did not undertake the scenario modelling required by their funding council, the vast majority did so, and it seems reasonable to conclude that they derive some benefit from the activity. However, this is not true of all. As noted earlier, four said that the only reason for constructing a model was to satisfy the funding council requirement. Their other responses showed a tendency to take a basic approach to modelling, with fewer variables considered important and less use of formulae to link variables together.

However, it should be acknowledged that many of the other respondent institutions could also be characterised as taking a basic approach. For example, it was unusual to find institutions

using sophisticated software which would permit an integrated model for scenario building with dynamic links to other systems. Instead, relatively simple models were built using Excel, with a small number of formulae and sub-models.

A lack of modelling sophistication is not necessarily a problem, though; a simple model, used appropriately, might meet a particular institution's needs. Indeed, models were generally considered satisfactory by respondents. For example, although he had been involved in using relatively sophisticated budgeting techniques such as zero-based budgeting and activity-based budgeting, one interviewee commented that 'there shouldn't be a need for detailed scenarios where good financial management is in place' (NU11). A few interviewees, though, thought their approach could be improved, for example expressing the view that models were not always well structured. One commented that it 'would be helpful to have sector guidance' (OU8) and another remarked that 'Understanding what others do on scenarios would assist us' (NU15). However, there is little or no sector guidance in this area and, although it is clear from our findings that a range of practices exist, there is no systematic sharing of models used.

Given the paucity of guidance from the funding councils and a lack of awareness of what other institutions do, it might be the case that some finance staff developing their own model are not realising some of the potential open to them. For example, while the earlier tables showed considerable commonality of practice around certain items (e.g., particular variables or formula links), even then there were some institutions that did not use them. Furthermore, the tables revealed some more unusual practices that might be helpful to other institutions. One way of prompting awareness of possibilities would be to produce a standard template for financial scenario modelling. This could build on the practice, reported by a number of interviewees, that they used the HEFCE Annual Accountability Return template as a basis for determining the level of detail to be used when conducting their own 'what if' modelling exercises.

The potential for developing a standard template was discussed in the interviews. Technically, there appears to be no reason why a standard financial scenario model could not be constructed for use by the sector. There are a number of key variables which seem to be applicable to all universities, even though they vary in their income diversification (Garland,

2020) and cost structures. The principal benefits of a standard template would be that time and effort could be saved within the central finance department in constructing a model, errors of omission of variables would be less likely, and there would be some reassurance about the model's legitimacy.

However, this idea was not popular with interviewees. One who had doubts about the usefulness of a standard template commented that: 'There are too many variations between institutions. Russell Group institutions can be very different to new universities' (NU18). It is certainly true that the importance of different revenue streams and costs varies greatly between institutions, but a template that covered all the likely categories of income and expenditure could work as a starting point. Items that were irrelevant to a particular institution (for example, if they did not offer distance learning or operated no residences) could simply be removed. On the other hand, if a particular category happened to be very important, it could be broken down into further detail or sub-models could be added. For instance, a research-intensive university might wish to model the gain or loss in research income by type of funder, whereas another with relatively little research activity might be content to undertake sensitivity analysis at the level of total research income only. Alternatively, given that teaching income is such a major funding stream for virtually all institutions, a template just focused on its various components and drivers might be useful. This could provide a base on which an individual institution could develop a more comprehensive model to suit its particular situation.

However, it is not just a model's variables that are relevant to standardising approaches; different institutions will vary in their need and capacity to link their model to other systems. Perhaps, rather than a template, other ways of sharing ideas and good practice should be considered. In line with NU15's interest in what happens elsewhere, case studies of successful implementation could be published, perhaps via BUFDG or Universities UK. The opportunity to learn from each other, especially about some of the more sophisticated possibilities, might be particularly useful if a financial crisis – for example, caused by the COVID-19 pandemic – or increased competition led to an increased emphasis on financial management in uncertain times.

It is still possible that a funding body or regulator might introduce a standard template, especially if it wanted to use individual institutions' analyses to aid its own oversight of the sector. This already happens in further education in the UK, where institutions are obliged to use a rigid approach for scenario modelling set by the Education and Skills Funding Agency. However, discussion with interviewees indicated a common view that the imposition of a model would not be welcome, and a voluntary model would be unlikely to be used. One interviewee's opinion was that 'A rigid and inflexible model used by the whole sector would cause more problems than it solves' (NU5). Assuming that such an intervention does not happen, it will be interesting to see how financial scenario modelling develops in the years to come, especially if senior managers or governing bodies perceive an increased likelihood that their institution could suffer financial distress.

Conclusion

Sound financial management is essential for universities to fulfil their functions. Scenario analysis allows finance staff and senior managers the potential to explore the financial implications of possible future states of the world, helping them to cope by understanding key issues and developing contingency plans. This study provides the first systematic empirical research on financial scenario modelling by universities.

The UK evidence suggests that there is some variety of practice, but that most models are relatively basic Excel spreadsheets with a limited number of formulae and links to other systems. Most respondents appeared to be satisfied with the current approach taken, although some wondered if they could do better. Future challenges for higher education, in the UK and worldwide, might prompt a more sophisticated approach, perhaps by developing current models further or by using specialist financial modelling software. However, there was no appetite for a sector-wide standard template, especially if imposed by the funding bodies. We suggest that an alternative way forward might be through the sharing of case studies of good practice, perhaps via BUFDG or Universities UK.

As a first empirical contribution on the topic, the study necessarily has limitations. We focused on the existence and construction of financial models for scenario analysis with UK university finance staff. Insights into practice in other countries would be interesting. Moreover, future

research could examine how the outputs of the models are actually used – or ignored or resisted – by managers outside the finance function. Evidence of actual positive impact – or not – would be valuable. However, finding a positive link between an organisation's engaging in a particular management accounting technique and being financially successful is notoriously challenging, even in the corporate sector. For example, it is necessary to control for the noise from many other variables, where the effectiveness of modelling is likely to be affected by its interaction with other tools and techniques. There is also the possibility of reverse causation, where financially weaker organisations invest in more sophisticated tools in an attempt to solve their problems; we found evidence of this in our interviews. Finally, the independent variable should not be a simple binary variable; rather, it is how modelling is implemented and used that is important. More feasible – and useful – might be in-depth case studies of successful implementation of particular models in their contexts, from which other organisations could learn and adopt or adapt as appropriate (cf. Wack, 1985a, 1985b).

Given the stresses and uncertainty that universities are facing in so many parts of the world today, a sound understanding of what financial scenario modelling might have to offer is likely to become more important in the years to come. At least it should be considered a potentially useful weapon in an institution's management armoury.

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Table 1. Questionnaire respondents and interviewees

	Population (number)	**Population (%)**	**Responses (number)**	**Responses (%)**	**Pilot interview**	**Non-pilot interviews**
Pre-1992 universities	79	48.5%	40	47.6%	9	11
Post-1992 universities	69	42.3%	40	47.6%	8	14
Colleges of higher education	15	9.2%	4	4.8%	0	0
Total	163	100.0%	84	100.0%	17	25

Table 2. Respondents' job titles

Job Title	**Frequency**	**Percentage**
Director of Finance	29	34.5%
Deputy Director of Finance	14	16.7%
Head of Management Accounting/Management Accountant	9	10.7%
Associate or Assistant Director of Finance	7	8.3%
Head of Finance	3	3.6%
Faculty Accountant	2	2.4%
Financial Controller	2	2.4%
Director/Head of Financial Planning	2	2.4%
CFO	2	2.4%
Other	14	16.7%
Total	**84**	**100.0%**

Table 3. Extent and purposes of scenario modelling

	Pre-92 institutions	**Post-92 institutions[a]**	**Total**
Panel A			
Extent of practice			
Scenario modelling undertaken	36 (90%)	38 (86%)	74 (88%)
Scenario modelling not undertaken	4 (10%)	6 (14%)	10 (12%)
Total usable responses	40	44	84
Panel B			
Primary purpose[b]			
To meet funding council requirements	10 (28%)	13 (34%)	23 (31%)
Internal resource planning	16 (44%)	16 (42%)	32 (43%)
Internal contingency planning	28 (78%)	27 (71%)	55 (74%)
Other	2 (6%)	7 (18%)	9 (12%)
Total purposes cited	**56**	**63**	**119**
Purposes per respondent	**1.6**	**1.7**	**1.6**

Notes

a Institutions that became universities in 1992 or later, plus colleges of higher education.

b Figures in parentheses in Panel B indicate percentage of institutions citing a particular purpose. Some indicated more than one purpose.

Table 4. Analysis of variables used in models

	Importance			Weighted	Rank
	High	Medium	Low	mean	
Staff costs	62	6	1	2.84	1
Student numbers (HEU undergraduates)	61	5	3	2.80	2
Student numbers (OS undergraduates)	46	17	3	2.50	3
Student numbers (OS postgraduates)	42	16	7	2.36	4
Staff numbers (Headcount or FTEs)	43	11	9	2.32	5
Non-pay expenditure	34	25	9	2.30	6
Student numbers (Home & EU post-graduates)	34	18	12	2.14	7
Student tuition fee rate	31	23	8	2.10	8
Funding Council income	27	25	14	2.07	9
Depreciation/capital expenditure	22	28	14	1.94	10
Research grants	17	22	25	1.71	11
Enterprise and innovation activity	10	28	25	1.59	12
Student numbers (part-time)	16	20	22	1.57	13
NHS funding	19	12	16	1.39	14
Other income	4	25	33	1.36	15
Student numbers (distance learning and franchise)	12	20	18	1.34	=16
Student residences income	8	27	16	1.34	=16
Provisions for income not linked to student numbers	9	19	26	1.30	18
Interest payable	6	18	27	1.16	19
Interest receivable	3	7	39	0.89	20
Other	5	0	0	0.21	21

(N = 70)

Notes
The mean score for the importance of each item is calculated by using the weights: High = 3; Medium = 2; Low = 1. The total for each variable is then divided by 70, the total number of respondents to this particular question.
HEU = Home and European Union; OS = Overseas (i.e. non-EU)

Table 5. Items excluded from models

	Responses	% of those undertaking modelling
FRS 17[a] pension costs	33	45%
Transfers to reserves	21	28%
Committed but not yet expended costs	12	16%
Restructuring costs	9	12%
Non-recurrent expenditure on self financing activities	8	11%
Interest on short term loans	4	5%
Other (Exceptional items including accelerated depreciation)	2	3%

(N=50)

Note:

a Financial Reporting Standard 17 on the accounting treatment of retirement benefits, now covered by FRS 102.

Table 6. Formulae and sub-models used to link key variables

	Responses	% of those undertaking modelling
Separate sub-model for staff costs	45	61%
Separate sub-model for student fee income	43	58%
Depreciation and interest payable based on capital spend	43	58%
Differing inflation rates for income and expenditure	41	55%
Staffing costs as a proportion of income	40	54%
Staff student ratios	36	49%
Separate modelling of incremental drift for salaries	36	49%
Scholarships/Bursaries according to student numbers	33	45%
Interest receivable based on cash flow projections	29	39%
Research or other income per FTE staff	23	31%
Non-pay costs as a proportion of income	22	30%
Student number FTEs as a proportion of head count	19	26%
Estate running costs as a proportion of space occupied	10	14%
Residences income as a proportion of the student population	8	11%
Non-pay costs as a proportion of pay costs	8	11%
Other	3	4%

(N=70)

Online Appendix. Relevant questions extracted from the questionnaire

PTO

SECTION F: SCENARIO PLANNING

F1. Do you undertake scenario planning (sensitivity analysis) when forecasting your income and expenditure?

Yes [ ] No [ ]

F2. What is the primary purpose for undertaking scenario planning? (*please tick all that apply*)

To meet Funding Council requirements [ ] Internal contingency planning [ ]
Internal resource planning [ ] Other (*please specify*) [ ]

_____

F3. Do you employ the same scenario model which is updated annually or do you create a new model each year?

Same model [ ] New model [ ]

F4. What key variables do you use in your scenario models? (*please tick one box per row in terms of importance*)

	High	Medium	Low	Not important
Student numbers (Home & EU undergraduates)	[ ]	[ ]	[ ]	[ ]
Student numbers (Home & EU postgraduates)	[ ]	[ ]	[ ]	[ ]
Student numbers (Overseas undergraduates)	[ ]	[ ]	[ ]	[ ]
Student numbers (Overseas postgraduates)	[ ]	[ ]	[ ]	[ ]
Student numbers (Part-time)	[ ]	[ ]	[ ]	[ ]
Student numbers (Distance learning and franchise)	[ ]	[ ]	[ ]	[ ]
Student tuition fee rate	[ ]	[ ]	[ ]	[ ]
Student residences income	[ ]	[ ]	[ ]	[ ]
Provisions for income not linked to student numbers	[ ]	[ ]	[ ]	[ ]
Funding Council income	[ ]	[ ]	[ ]	[ ]
Research grants	[ ]	[ ]	[ ]	[ ]
Enterprise and innovation activity	[ ]	[ ]	[ ]	[ ]
NHS funding	[ ]	[ ]	[ ]	[ ]
Interest receivable	[ ]	[ ]	[ ]	[ ]
Other income	[ ]	[ ]	[ ]	[ ]
Staff costs	[ ]	[ ]	[ ]	[ ]
Staff numbers (Head count or FTEs)	[ ]	[ ]	[ ]	[ ]
Non-pay expenditure	[ ]	[ ]	[ ]	[ ]
Depreciation/capital expenditure	[ ]	[ ]	[ ]	[ ]
Interest payable	[ ]	[ ]	[ ]	[ ]
Other items (*please specify)*				

_____

_____

F5. Do you use a formulaic basis to link any of the key variables? (*please tick all that apply*)

Staff/student ratios	[ ]
Student number FTEs as a proportion of head count	[ ]
Staffing costs as a proportion of income	[ ]
Non-pay costs as a proportion of income	[ ]
Non-pay costs as a proportion of staffing costs	[ ]
Research or other income per FTE staff	[ ]
Separate modelling of incremental drift for salaries	[ ]
Separate sub-model for staff costs	[ ]
Separate sub-model for student fee income	[ ]
Differing inflation rates for income and expenditure	[ ]
Scholarships/bursaries according to student numbers	[ ]
Depreciation and interest payable based on capital spend	[ ]
Interest receivable based on cash flow projections	[ ]
Residences income as a proportion of the student population	[ ]
Estate running costs as a proportion of space occupied	[ ]
Other (*please specify*)	[ ]

_____

F6. Do you exclude any items of income or expenditure from the model? (*please tick any that apply*)

FRS 17 pension costs	[ ]
Committed but not yet expended costs	[ ]
Non-recurrent expenditure on self-financing activities	[ ]
Interest on short term loans	[ ]
Restructuring costs	[ ]
Transfers to reserves	[ ]
Other (*please specify*)	[ ]

_____

F7. What system do you use for scenario planning?

Finance system (e.g. a module within your finance system)	[ ]
Spreadsheets / manual processes	[ ]
Off-the-shelf forecasting/planning tools	[ ]
Bespoke forecasting/planning tools	[ ]
Dedicated specialist software (*please specify*)	[ ]

_____

F8. Do you operate an integrated model for scenario planning? (i.e. data is drawn from direct links to other systems to gather details of staff, students, space, etc.)

Yes [ ] No [ ] Sometimes [ ]