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Chief executive pay in UK higher education: the role of university performance

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Abstract

Remuneration for chief executives in UK higher education—known as Vice Chancellors (VCs)—has been on an upward trend in recent years, and VCs have received criticism that their performance does not warrant such reward. We investigate the relationship between VC pay and performance (rooted in principal agent theory), taking into account an array of other possible determinants. Deriving measures of VC performance is difficult as VCs are agents for various principals, and each principal may be interested in a different aspect of performance. We consider three measures of VC performance here: managerial efficiency as measured by data envelopment analysis; performance in university rankings produced by the media; the financial stability of the university. We construct a comprehensive data set, covering academic years 2009/2010 to 2016/2017, a period of considerable change in the UK higher education sector including rapidly-rising undergraduate tuition fees. Our results show that, once other possible determinants of VC pay are taken into account, the main measure of performance which affects VC pay is the one based on media rankings. Thus the agents (VCs) appear to be rewarded for delivering against this performance benchmark which is likely to be of interest to a variety of principals. This result however varies by type of university suggesting that the labour market for VCs differs by mission group.

Keywords Efficiency · Performance · Executive pay · Higher education

1 Introduction

When the annual survey of UK Vice Chancellors' (VCs') pay is released each year, (see, for example, Baker 2017a), there follows growing criticism from politicians (Morgan 2017a), taken up by the media, of remuneration of VCs.[1] Recent figures show that in 2016–2017, average pay of UK VCs rose by over 3.5% on 2015–2016, bringing average remuneration to over £250,000 (Baker 2017a; Grove 2018a). Rises in VC pay, moreover, are more than the pay increases enjoyed by other university staff (Baker 2017a). The UK university sector is not

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[1] In the UK, the head of a university is normally referred to as 'vice chancellor'. This is equivalent to terms used elsewhere such as 'rector', 'provost' or 'president'.

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unique in this respect; rising VC pay is also observed in other countries including Australia, New Zealand and Canada, where salary levels suggest that UK VC pay is, in fact, relatively low by international standards (Baker 2017a; Shackleton 2017; Ross 2018a, b). Exceptional levels of remuneration of leaders are also observed in UK for-profit colleges where some individuals are paid more than the highest paid VC in the publicly funded higher education sector (Grove 2018b).

There are nevertheless accusations that UK VCs are paid 'too much' (Adams 2017), speculation that students' tuition fees have paid for the recent increases in VCs' salaries (Baker 2017b; Weale 2017), and suggestions that universities should provide a justification for paying VCs more than £150,000 with penalties for those institutions which fail to comply (Department for Education 2017; Morgan 2017b). The underlying premise of these criticisms is that VCs' performance does not warrant such reward.

The trajectory through to VC has traditionally been based on an academic track record, but recently there has been a growing debate around the premise that VCs are not academics but executives (Smith and Adams 2008; O'Meara and Petzall 2009). Recent changes in funding mechanisms have meant that the distinction between the university governing body having the strategic role, and the chief executive merely delivering that strategy, has altered; strategy and executive leadership are now fundamentally linked, and it is the VC who is more likely than the governing body to be making the necessary policy decisions. If VCs are indeed executives, then VC pay should be examined in the context of traditional executive pay theories.

Marginal product theory, which suggests that pay reflects the executive's marginal revenue, is unlikely to be of primary relevance in this context, since it assumes that the firm's objective is to maximise profit. In UK higher education, institutions in receipt of public funds are traditionally considered to be non-profit.

We turn instead to alternative executive pay theories and, in particular, to performance as the driving force for remuneration. The idea that pay might be related to performance is rooted in principal agent theory (Jensen and Meckling 1976; Hölmstrom 1979; Fama 1980; Jensen and Zimmerman 1985; Jensen and Murphy 1990; Conyon 2006), which assumes the agents (VCs) are delivering against targets set by the principals. In the private sector, these would typically be shareholders, but for universities the situation is complex as students, their parents, staff, the government and university councils, to name but a few, could all be considered principals. The theory predicts that agents' pay is related to their success at achieving the targets of the principals, but in the complex context of higher education, priorities across principals may not exactly align. Moreover, the greater the size and complexity of the organisation, the more difficult it is for principals to observe their agents' efforts and performance, and hence the greater the number of performance metrics which might be used.

The literature on executive pay in the private sector suggests that, over the last two decades, companies around the world are increasingly incorporating performance-related aspects to pay (Pepper and Gore 2015). Principal agent theory (and the relationship between performance and pay) is also likely to be highly relevant in determining the pay of UK VCs which is set by a remuneration committee comprising key figures in the university.[2] This committee uses performance metrics (consonant with principal agent theory) to set the individual's pay

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[2] Indeed, in the past over two-thirds of VCs in the UK are entitled to attend the meetings of their remuneration committee (Abrams 2017). This is not dissimilar to private companies where there is evidence that a substantial proportion of compensation committees have in their membership the executive director (Firth et al. 1999; Conyon 1994). Recent guidelines issued by the CUC, however, recommends that the head of the institutions should not be a member of the institution's remuneration committee (https://www.universitychairs.ac.uk/wp-content/uploads/2018/06/HE-Remuneration-Code.pdf).

(Baker 2017a), and these are likely to vary according to the institution's strategy and mission (Bachan and Reilly 2015; Baker 2017a).

The purpose of this paper is therefore to undertake an analysis of VC pay over the most recent period of higher education expansion and rising tuition fees in order to answer our primary question:

- Does VC performance in leading a university determine VC remuneration? In other words, is there evidence to support the relevance of the principal agent theory in determining executive pay in UK higher education?

In order to conduct such an examination, however, we need to be able to define what we mean by 'performance'. This is not easy; Bachan and Reilly (2017) suggest: '… it is difficult to define what exactly constitutes 'performance' in higher education. For example, it may be income generation, research/teaching quality, student enrolment, achieving institution goals or combinations of all of these.' (p421). Moreover, they conclude '… that measuring VC performance is difficult … that VCs face multiple principals, perform multiple tasks, and work as part of a team seeking to meet institutional goals and objectives. However, it is not unreasonable to suggest that good financial management and furthering the institution's mission should be rewarded.' (p421). In light of these observations, we therefore carefully choose and include in our model three measures of performance reflecting (respectively) managerial efficiency, university ranking and financial prudence, and these are explained in more detail below.

Performance is not the only possible determinant of VC pay. In order to avoid biased estimates from omitted variables, we therefore also include variables to reflect additional executive pay theories in the VC pay equation, such as human capital, structural, and tournament theories. Structural theory (Simon 1957) argues that executives receive highest pay where the structure of the organisation is most complex. Tournament theory (Lazear and Sherwin 1981; Rosen 1986; Ehrenberg and Bognanno 1990) suggests that chief executive remuneration can incentivise workers at all levels in the firm, thus pay is related to grade rather than marginal product. Human capital theory (Mincer 1974; Becker 1993) suggests that that chief executive pay is related to the qualities, qualifications and experience of the individual. Time and university effects are also explored. This paper therefore builds on the work of Bachan (2008) and Bachan and Reilly (2015, 2017), and extends the debate specifically around the role of VC performance in determining pay of UK VCs (*ceteris paribus*).

Criticisms of VC pay levels in the UK are not new but recur regularly (Goddard and Richards 1999; Fearn 2011). The context of recent criticism differs, however, in one important respect: VC pay has been rising over the period during which tuition fees have been increasing, and most recently the hike to £9000. There is therefore the suggestion that as students have been paying more for their university education, those tuition fees have been used to bolster VC salaries (Baker 2017b; Weale 2017). An analysis of VC pay is therefore timely.

The paper is original in several respects. We explore the effect on VC pay of three performance metrics. Our first measure of performance is an estimate of managerial efficiency for each year of the study derived using data envelopment analysis (DEA). We therefore look at the efficiency with which VCs maximise outputs from their given inputs, and this differs from previous studies which include variables relating to inputs *or* to outputs, but do not look at efficient usage of resources in producing outputs. DEA is an ideal way of capturing managerial efficiency in a production context where there are multiple inputs and multiple outputs, and it is novel in its application in a VC pay framework.

Second, we include a measure of performance based on university rankings published by media outlets. Media rankings, such as those produced by *The Times*, *Sunday Times*, *The*

Guardian, and *The Independent* (which publishes *The Complete University Guide*), are based on a composite index constructed from a variety of performance metrics. We incorporate the overall performance score produced by *The Complete University Guide* as our second measure of performance. Variables relating to the components of university rankings have been included in previous studies of VC pay, but the use of media rankings in such studies is limited; Tang et al. (2000), for example, include overall ranking in their study of the pay of chief executives in US universities.

Third, we include a measure of financial stability to see whether financial prudence is reflected in VC remuneration. The increasingly competitive environment in which universities now operate means that some universities are looking somewhat vulnerable. The inclusion of this measure in VC pay equations is entirely novel.

As a brief preview of our results, we find that university performance does indeed help to determine VC pay, thereby supporting the principal-agent theory of remuneration, but only in one respect. Of three possible measures of performance tested, the one based on overall university rating derived from *The Complete University Guide* is the most consistently important in determining pay. Managerial performance as derived using DEA is not an important determinant of VC pay. In addition, VCs in pre-1992 institutions are paid significantly more than those in post-1992 universities, all else being equal. Size of university and a higher percentage of staff in the top salary category both positively influence VC pay. An interesting finding of the analysis is that different factors determine VCs' salaries in pre- and post-1992 universities.[3] While performance is crucial for determining the pay of pre-1992 VCs, it is not for those in post-1992 institutions. Size and taking over as VC in a given year are relevant for post-1992 VCs, but not for their pre-1992 colleagues.

The paper is in seven sections of which this is the first. In Sect. 2 we provide a brief background of the UK higher education sector, and a literature review is provided in Sect. 3. The methodological approach to our empirical analysis is outlined in Sect. 4 with results presented in Sect. 5. We conduct some robustness checks in Sect. 6, and conclusions are drawn in Sect. 7.

2 The UK higher education context

The last three decades have seen considerable change in the UK higher education sector. Between 1987 and 1997, the age participation rate grew from 15% to 33% (Lunt 2008), and during this period, the 'binary divide' between universities and polytechnics was abolished as part of the Further and Higher Education Act in 1992. The Blair government committed in 1999 to a target 50% age participation rate in the subsequent decade, and this was confirmed in the Labour Party manifesto of 2001 (Lunt 2008). This expansion and changing composition of the UK higher education sector—a move from elite to mass higher education—inevitably put pressure on funding. The Dearing Report (NICHE 1997) recommended that students should contribute to the costs of their higher education, and in 1998 student tuition fees of £1000 were introduced. By 2006, these had increased to £3000. Following the Browne Report (Browne 2010), the government agreed to a tuition fee cap of between £6000 and £9000 and this was introduced in 2012, and accompanied by an increasingly complex student

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[3] The UK higher education sector comprises a variety of institutions including those which had degree-awarding powers prior to the abolition of the binary divide in 1992 (pre-1992 institutions), and those which did not (post-1992 universities).

loan system.[4] The combination of increased undergraduate fees, and uncapped undergraduate students' numbers subsequently led to an unprecedented level of marketisation in the UK higher education sector.[5]

Over the last two to three decades, UK VCs have therefore been operating in an increasingly competitive market (both domestically and globally), facing greater demands, and typically heading up bigger and more complex institutions (Whitchurch 2006; Bosetti and Walker 2010; Cutterham 2017). In 1994/95, figures from the Higher Education Statistics Agency (HESA) indicate that there were 1.5 m students studying at 182 higher education providers which had just under 115,000 (full-time and part-time) academic staff. By 2015/16 this had risen to 2.3 m students across 163 higher education providers with over 201,000 full-time equivalent staff. Performance indicators in higher education abound with regular research assessments (the latest Research Excellence Framework—REF—was in 2014, but this was preceded by various Research Assessment Exercises—RAEs), and more recently teaching assessment in the form of the Teaching Excellence Framework (TEF). Unexpected exogenous shocks in the form of, for example, Brexit, and unforeseen policy changes on student numbers and fees also pose significant challenges for VCs in UK universities. Funding is crucial to being able to maintain a competitive edge, yet sources of funding for universities are not as certain as they once were—indeed some universities are resorting to the bond market to obtain funding for investment in facilities and residences (Johnes 2016b).

In line with the structural theory of executive pay we would therefore expect rising remuneration with these increasing complexities and pressures, although studies exploring the link between expansion of universities and the professional managerial skills required to lead these are limited. In addition, little is known about the labour market for UK VCs. However, we do know that the average tenure of VCs has been falling in recent years,[6] and that the highest paid UK VCs earn less than their international counterparts in, for example, the USA and Australia (Blanchflower 2017; Ross 2018b), less than counterparts in the UK for-profit higher education and education sectors (Grove 2018b; Bennett 2019), and less than chief executive officers (CEOs) of private sector companies. We speculate that the labour market for VCs is likely to be an international one (as is the market for academics more generally), and that universities seeking VCs are likely to have limited numbers of applicants of the appropriate skills and calibre (Blanchflower 2017).

Against this backdrop, Jo Johnson (a former Minister for Universities and Science) recently called for justification of any VC pay exceeding £150,000—the current salary of the Prime Minister (Department for Education 2017). His successor (Sam Gyimah) continued to focus on VC pay, calling for VCs to be removed from their University's remuneration committee (The Guardian 2018), and recent guidance by the Committee of University Chairs (CUC) supports this recommendation.[7] This study, which aims to provide insights into the determinants of VC pay, is therefore important and timely, and will inform the on-going debate.

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[4] This applies to the situation in England. Note that funding systems differ between England and the rest of the UK i.e. Wales, Scotland and Northern Ireland.

[5] For more details on the current UK higher education sector please see https://www.universitychairs.ac.uk/wp-content/uploads/2018/06/HE-Remuneration-Code-Context.pdf.

[6] The peak length of tenure was about 6.5 years in the mid-1970 s compared to 5 years in 2016 (see https://www.hepi.ac.uk/2016/11/03/3665/).

[7] https://www.universitychairs.ac.uk/wp-content/uploads/2018/06/HE-Remuneration-Code.pdf.

3 Literature review

There have been a number of studies investigating whether performance of firms is a key driver of the pay structure of their chief executives (Chen et al. 2016).[8] On the one hand studies have shown a positive correlation between firm performance and average pay (Nickell and Wadhwani 1990; Nickell et al. 1994; Hall and Liebman 1998) and on the other, evidence suggests a weak correlation between executive compensation and firm performance (Murphy 1999; Joyce 2001). Principal agent theory argues that CEO pay is designed to attract, retain and motivate the managers, who are the agents, to focus their efforts on the objectives of the owners, who are the principals. Pay is therefore part of an optimal remuneration package where the behaviour of the CEO is difficult to observe and/or to monitor. The package often comprises two parts: a fixed (or base) element, and a variable (or bonus) element, with the latter depending on performance observed *ex post* (Bachan and Reilly 2015, 2017).

Despite the agency theory predictions, it has been argued that there is no consistent evidence of a link between pay and performance (Frydman and Jenter 2010). Instead, studies point out the importance of other determinants such as firm size. For instance, Tosi et al. (2000) applied a meta-analysis to show that firm size accounts for more than 40% of the variance in total CEO pay, while firm performance accounts for less than 5% of the variance.

Whether or not universities follow the same pattern with performance linked to a two-part pay package is open to debate. Recently it has been argued that leadership and managerial skills needed to run universities have become comparable with the skills needed to manage private sector companies (Cheng 2014), and hence the question also arises whether the VC pay package (comprising basic and bonus elements) is related to university performance, particularly in times when universities strive to achieve greater efficiency in the midst of extreme budgetary crisis. However, the structure of higher education is complex. Unlike private sector firms, HEIs do not have owners in the form of shareholders, and multiple principal agent relationships exist. This creates a lack of clarity around the organisation's goals, and the design of any optimal remuneration package is extremely difficult. VCs are therefore likely to be assessed on numerous parameters in contrast to the corporate CEOs, where the governing board, as a principal, may only be looking at budgets, capital spending, size or other structural characteristics such as inherited reputation to determine pay; but the university chief executive's pay will also be affected by, *inter alia*, staff research productivity and outputs, and students' satisfaction, academic achievement and performance in the labour market.

Empirical studies have searched for evidence for a pay performance relationship, even though the agency theory linkage may be difficult to identify because of lack of consistently applied performance measures across different institutions (Cheng 2014). There is evidence of a positive link for UK VCs between performance and total pay including bonuses (Dolton and Ma 2003), but the link may be weak (Bachan 2008; Tarbert et al. 2008). More recently Cheng (2014) finds no link between pay and performance of university presidents in the US.

Multiple performance indicators, for public higher education institutions (HEIs), have been suggested and used by different studies. Bachan (2008) include a comprehensive array of performance indicators including research and teaching quality, student attrition and students' participation in higher education. Bachan and Reilly (2015) extend this to include mission-based performance measures such as widening participation. Tarbert et al. (2008) also use

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[8] Studies of VC pay and chief executive pay more generally are summarised in an online Appendix: https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxqb2huZXNqaWxsc2fGd4OjJjN2NmNTIzOGMxN2NkMjY.

the mission-relevant university performance measures to study the impact on VC pay. Cheng (2014) uses several performance outcome indicators, namely: progress in applications and enrolment, admission standards, student graduation, faculty salary and welfare, fund-raising, administrative efficiency, and operating surplus. Dolton and Ma (2003) focus more on the financial and research performance of the university. Ehrenberg et al. (2001) find university presidents' salary increases are associated with improvements in their fundraising success as a measure of institutions' performance. Tang et al. (2000) suggest that 'subjective' academic reputation ranking may be considered as one of the best proxies of the performance. Three performance indicators derived from the UK Research Assessment Exercise, are utilised by Baimbridge and Simpson (1996)—the average weighted rating attained by each institution, the number of units of assessment, and the percentage of staff submitted as research active.

The use of numerous dimensions of performance indicators poses an apparent complexity when interpreting the performance measures, and hence the need to identify a meaningful aggregate performance index (Bougnol and Dulá 2006; Johnes 2016a, 2018). There is now a substantial literature applying DEA to higher education[9] mainly because DEA is applicable whether or not inputs and/or outputs are subject to any pricing mechanism. Several studies have applied DEA specifically to address the issue of multiple stakeholders in the higher education context starting with Sarrico et al. (1997). Sarrico and Dyson (2000) explore DEA to inform management in the midst of different stakeholders having different motivations to measure performance in the UK higher education sector, while de França et al. (2010) suggest the use of DEA optimisation separately on principal's and agent's objectives by focusing on the Brazilian not-for-profit federal university system. They find that the agency problem exists for a subset of those institutions.

Despite the considerable application of DEA to research questions relating to higher education, DEA has not been used in the context of VC pay, and particularly the relationship between pay and performance, although it has been used in the context of chief executive pay more generally (Chen et al. 2016). This is an interesting omission and seems to be an obvious area in which DEA could offer insights.

4 Data and methodology

We understand from recent guidelines issued by the CUC that it is legitimate for VC pay to vary with respect to the individual's performance. We therefore use a standard salary equation (below) to explore the role of university performance in affecting VC pay. Included in the equation are additional variables, many relating to alternative executive pay theories, in order to minimize bias from omitted variables:

$$\text{VC Pay} = f(\text{VC performance, other possible determinants})$$

(a) Performance (principal agent theory)

While CUC guidelines acknowledge that VC remuneration can vary in respect of the individual's performance, there is no indication of how performance might be measured.[10] We therefore adopt 3 possible measures of performance.

The first measure relates to managerial efficiency and can be seen as of particular interest to various possible principals including, in particular, the government, and the university's

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[9] For reviews see Liu et al (2013), Johnes (2015), De Witte and López-Torres (2015) and Thanassoulis et al (2016).

[10] https://www.universitychairs.ac.uk/wp-content/uploads/2018/06/HE-Remuneration-Code.pdf.

governing body. The measure is identified by applying DEA to an array of university inputs and outputs. DEA creates a best-practice frontier based on the specified inputs and outputs, and measures the efficiency of each university relative to that frontier. We use DEA efficiency (rather than alternative efficiency measures such as those derived from stochastic frontier analysis) as we have multiple inputs and multiple outputs, which DEA can easily handle, and the scores are measured relative to an observed frontier. The assumption is that each university's efficiency score is largely attributed to the VC leading the university. DEA provides an efficiency score which takes values between 0 and 1 with 1 representing highest efficiency.

Taking a DEA approach, and assuming that inputs x_k ($k = 1, ..., K$) are used to produce outputs y_m ($m = 1, ..., M$), then managerial efficiency of the firm or decision making unit (DMU) j at time t is defined as (Banker et al. 1984):

$$VRS_{jt} = \frac{\sum_{m=1}^{M} a_{mt} y_{mjt}}{\sum_{k=1}^{K} b_{kt} x_{kjt}} \tag{1}$$

where a_{mt} is the weight applied to output m in time t and b_{kt} is the weight applied to input k in time t. For each DMU in a given year, weights are found by maximising efficiency subject to the constraints that weights must be non-zero and universal. The efficiency score in Eq. (1) can be calculated on the basis of constant returns to scale and hence incorporates both scale and managerial effects, or, by adding a convexity constraint, on the basis of variable returns to scale. The latter efficiencies are deemed to represent managerial efficiency in isolation from scale effects, and so it is these variable returns to scale estimates we use to represent VC efficiency (VRS). We hypothesise that universities take students, staff and capital to produce teaching and research outputs. Thus, as inputs into the DEA model we include the number of full-time equivalent (FTE) students on postgraduate programmes (PGINPUT), the number of FTE students enrolled on undergraduate programmes (UGINPUT), the number of FTE academic staff (STAFF), the number of FTE non-academic staff (ADMIN), and expenditure on library and computing facilities (ACSERV). The outputs produced from these inputs include graduates from postgraduate programmes (PGOUTPUT), graduates from undergraduate programmes (UGOUTPUT) and income received from research grants and contracts (RESEARCH). A full list and definition of variables in this model (including sources) is provided in Table 1. The pros and cons of this model specification and the DEA methodology have been discussed in detail elsewhere and are therefore not reproduced here (see, for example, Johnes 2014).

Our second performance variable is the financial security index (FSI) produced by the Higher Education Statistical Agency (HESA) for each university in the UK. This indicator is based on four financial metrics namely:

- The last 2 years' average historical cost surplus as a percentage of total income
  Historical cost surplus is the surplus of income over expenditure from a HEI's annual audited financial statements. It is a measure of surplus and the denominator provides a standardisation to allow comparisons between HEIs.
- Days ratio of general funds to total expenditure
  General funds are balance sheet reserves that have been created from the past years' retained surpluses. Thus, high general funds will have been created by historically high surpluses or by retaining surpluses over a sustained period of time, or by a combination of the two. General funds are then measured against days of expenditure in order to provide a standardisation and compare institutions of different size.

Table 1 Variable definitions

Variable	Definition
(a) DEA model variables,	
PGINPUT	The total number of FTE postgraduate students (i.e. students on programmes of study leading to higher degrees, diplomas and certificates, including Postgraduate Certificate of Education (PGCE) and professional qualifications)[b]
UGINPUT	The total number of FTE first degree and other undergraduates. The 'other undergraduates' category includes qualification aims below degree level such as Foundation Degrees and Higher National Diploma (HND)[b]
STAFF	Number of FTE academic staff
ADMIN	Number of FTE non-academic staff
ACSERV[a]	Expenditure incurred on centralised academic services such as the library and learning resource centres, central computer and computer networks, centrally run museums, galleries and observatories, and any other general academic services (in £000 s)
PGOUTPUT	The number of higher degrees plus total other postgraduate qualifications awarded (including doctorate, other higher degrees, PGCEs and other postgraduate qualifications)[b]
UGOUTPUT	The number of first-degree and other undergraduate qualifications awarded[b]
RESEARCH[a]	Income received from research grants and contracts (in £000 s)

Variable	Definition and source
(b) VC Pay equation variables	
LVCSALBEN	Natural logarithm of VC salary plus bonuses (2016 values) Source: *Times Higher Education* VC Pay Survey, various volumes
VRS	DEA managerial efficiency Source: See text for details
OVERALL	Overall performance score from *The Complete University Guide*, divided by 100 Source: *The Complete University Guide*, various years
FSI	Financial security index divided by 100 Source: HESA
LSIZE	Sum of FTE undergraduate students and FTE postgraduate students Source: HESA
LSIZESQ	The square of LSIZE Source: HESA plus own calculation
PRE1992	1 if the university is a pre-1992 university, 0 otherwise
MERGER	1 if the university merged in that year, 0 otherwise Source: HESA
TOPSALCAT	Percentage of staff with salary in the top salary band Source: HESA
ACSTAFFSHARE	Total academic staff costs as a percentage of total expenditure Source: HESA
VCAGE	Age of VC Source: University Profiles, Who's Who, Wikipedia, Linkedin
VCMALE	1 if VC is male, 0 if female Source: University Profiles, Who's Who, Wikipedia, Linkedin
VCNEW	1 if a new VC takes over in a particular year for a given university Source: *Times Higher Education* VC Pay Survey, various volumes
VCNOPREVEXP	1 if VC has not been PVC or VC (or equivalent) prior to current role Source: University Profiles, Wikipedia, Linkedin

Table 1 continued

Variable	Definition and source
VCINDEXP	1 if VC has industrial experience prior to current role Source: University Profiles, Wikipedia, Linkedin
LONDON	1 if the university is located in London, 0 otherwise
SCOT	1 if the university is located in Scotland, 0 otherwise
WALES	1 if the university is located in Wales, 0 otherwise
Y2011	1 if the observation is in 2011/12
Y2012	1 if the observation is in 2012/13
Y2013	1 if the observation is in 2013/14
Y2014	1 if the observation is in 2014/15
Y2015	1 if the observation is in 2015/16
Y2016	1 if the observation is in 2016/17

Source: HESA

[a]These variables are deflated to 2016 values

[b]A full description of students included in these categories can be found in the HESA data documentation

- Days ratio of net liquidity to total expenditure, excluding depreciation
  Liquidity is the level of cash or equivalent liquid funds held in the balance sheet. Cash will have been generated by creating historic levels of surplus above those necessary for immediate investment needs. Consequently, it gives a level of resilience relative to unexpected demands on an HEI's resources.
- Long term borrowings as a percentage of total income
  Borrowings are the level of external debt in the balance sheet such as bank overdrafts or loans. High long term borrowings are often an indicator there has been a need for high investment e.g. in a HEI's estate. Again, this is measured relative to the size of the HEI by a calculation based on a percentage of total income.

Each of these four metrics is separately ranked, and the subsequent 4 rankings are then summed. A final ranking is produced from this sum, and this is the FSI. This measure of performance is likely to be of interest to various principals including the government who wishes to see public funds used prudently, and the university's governing body.

Our third performance variable is based on data from media rankings of universities. Specifically, we use data from *The Complete University Guide*, which bases its overall performance score (and hence rankings) on the following 9 dimensions[11]: student entry standards; student satisfaction; research quality; graduate prospects; student-staff ratio; academic services spend; facilities spend; good honours; and degree completion. It is the overall performance score (OVERALL) rather than the ranking which we include in our salary equation. The principals who are most likely to be interested in this measure include the university's students (including prospective students) and staff, as well as the university's governing body. This variable might be seen as a measure of 'reputation' as well as performance. The performance score is derived as a composite index of the ten underlying metrics and is transformed to a scale where the top score is 1000. In a robustness check (see Sect. 6) we examine the role of the underlying components in determining VC pay. Student satisfac-

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[11] Source: http://www.thecompleteuniversityguide.co.uk/league-tables/methodology/. Accessed 17th July 2017.

tion and student performance (i.e. achievement of good degree results), for example, might be of particular interest to principals and hence important determinants of VC pay.

(b) Additional possible determinants

Structural theory suggests that organisational complexity affects CEO pay, and so we include variables to reflect this aspect. The most obvious indicator of potential complexities is the size of university, and we therefore include the total number of students, both undergraduates and postgraduates, to reflect this aspect (SIZE). The natural logarithm of SIZE (LSIZE) and its square (LSIZESQ) are included; the former addresses the issue of outliers and non-normality of standard errors, while the latter addresses the issue of non-linearity.

Second, we note that universities in the UK have different historical backgrounds and missions which may lead to different sets and levels of complexity. In particular, pre-1992 HEIs are traditional universities which had university status prior to the Further and Higher Education Act of 1992. These institutions undertake teaching (undergraduate and postgraduate) and research in a whole range of subjects including (unlike other types of institution) medical and veterinary sciences. Universities not in this category (post-1992 institutions) include both former polytechnics which, by the provision of the Further and Higher Education Act, have, since 1992, been allowed to award their own degrees and use the title university, and former colleges of higher education, many of which have applied for university (and degree-awarding) status since 2003. The effect of university type on VC pay is uncertain a priori. On the one hand, VCs of the more research-intensive pre-1992 universities may face greater complexities than those leading other types of universities (Ehrenberg et al. 2001), and therefore a dummy variable reflecting this type of institution (PRE1992) would have a positive relationship with VC pay. Indeed, recent evidence suggests relatively high pay amongst VCs of Russell Group HEIs (Grove 2018c) which are a subset of the pre-1992 group. On the other hand, VCs of post-1992 universities might find the competition in the national and global higher education markets particularly intense which would mean their performance would need to be raised in order to compete, and hence our dummy variable PRE1992 would display a negative relationship with VC pay.

Third, we include a dummy to reflect merger activity which has taken place (MERGER), as leading an institution which has undergone merger is likely to offer more challenges and complexities than one which has not, all else being equal.

Tournament theory argues that the chief executive can be perceived as the winner of a prize which sends a signal to those working lower down in the hierarchy that by working hard they too can compete for the top prize. We do not have data on number of candidates competing for vacant VC posts (we would expect there to be a positive relationship between number of candidates and pay), and so we fall back on the internal pay structure of the organisation as an indicator of the influence of tournament theory on VC pay. This is in line with previous studies (see, for example, Dolton and Ma 2003; Tarbert et al. 2008; Bachan and Reilly 2015, 2017). We therefore include the percentage of staff in the upper salary bracket (TOPSALCAT) and hypothesise that the greater the percentage the higher the VC salary, thereby offering support for tournament theory. It is worth noting that during the period of this study there was a large increase in professorial pay in the run-up to REF 2014 (Grove 2013), and this may therefore increase the relevance of tournament theory in the context of VC pay.

Linked to this is Baumol's cost disease (Baumol and Bowen 1966) which might also affect VC salaries. Baumol observed rising salaries over time in jobs which experienced no increase in labour productivity and hypothesised that this occurs because of productivity gains in other sectors: salary increases in jobs where there are productivity gains will attract

candidates from sectors without those gains, unless salaries rise there as well. It is difficult to incorporate a variable to measure this effect but we include academic salaries as a percentage of total university expenditure as a proxy.[12] If Baumol's cost disease hypothesis holds, we might expect a positive relationship between this variable and VC pay. On the other hand, this variable might be a reflection of importance (or lack of importance) of certain activities. Thus, universities which are not particularly research intensive may have a high proportion of expenditure on academic staff salaries because they do not win a large amount of research grant income. Since we would expect VCs from universities with a strong research reputation to earn more than others, *ceteris paribus*, this variable may, in this case, have a negative relationship with VC pay.

The previous theories and related variables have covered performance and characteristics of the institution. We turn now to the characteristics of the chief executive him/herself. Human capital theory argues that pay is related to personal characteristics such as qualifications and past experience. We therefore include a number of variables in this category: the VC's age (VCAGE) to reflect experience; gender (VCMALE) to assess whether there is a gender pay gap amongst VCs; VCNOPREVEXP to reflect whether the VC previously held a pro-VC (PVC) or VC post (or equivalent) prior to this role; VCINDEXP to examine the possible effect of having industrial experience prior to the current role; and VCNEW, a dummy variable, to reflect a new VC taking over in a particular year for a given university. We hypothesise a positive relationship between VCAGE and VC salary (Alves et al. 2016), and VCNEW and VC salary; and a negative relationship between VCNOPREVEXP and VC pay. We remain open-minded regarding the effect on VC remuneration of gender and industrial experience.

There are potentially regional differences in UK labour markets which might impact VC pay (Baimbridge and Simpson 1996). London, for example, is known to be a high-cost area and salaries add a London weighting to accommodate this. Location in regions on the periphery such as Wales and Scotland may exert downward pressure on salaries. Devolved governments to Scotland and Wales mean there are also differences in the funding provision for universities in these countries which might also have a knock-on effect on VC pay, although the effect is not clear a priori. We therefore include three regional dummies, LONDON, SCOT, and WALES, to reflect location in London, Scotland and Wales respectively.

We include year dummies to assess whether there are any year effects once all other possible factors have been taken into consideration. We know that VC salaries in the UK have been rising over time (Baker 2017a; Grove 2018a), and explore whether this is still the case once variables underpinning VC pay are taken into account.

(c) Model specification

Our pay data cover a 7-year period from 2010/11 to 2016/17 and are derived from a variety of sources. *The Times Higher Education* is the source of data on VC pay which was converted to 2016 real values using the standard Retail Price Index (RPI).

Remaining variables cover the period from 2009/10 to allow for explanatory variables to be lagged. Institutional data and internal pay structure data are derived from HESA. University performance is from *The Complete University Guide*, and data on VC characteristics are gathered from university profiles, Wikipedia, Who's Who and LinkedIn. To construct our data set, we excluded university colleges, postgraduate-only institutions, and specialist medical, art, music and drama provisions. After such exclusions, 149 higher education institutions remain.

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[12] We thank an anonymous referee for this suggestion.

Given that we have panel data, we use a random effects (RE) approach to estimate the following equation:

$$
\begin{aligned}
LVCSALBEN_{ijt} = {} & \alpha + \beta_1 VRS_{ijt-1} + \beta_2 OVERALL_{ijt-1} + \beta_3 FSI_{ijt-1} + \beta_4 LSIZE_{ijt-1} \\
& + \beta_5 LSIZESQ_{ijt-1} + \beta_6 PRE1992_j + \beta_7 MERGER_{ij} \\
& + \beta_8 TOPSALCAT_{jt-1} + \beta_9 ACSTAFFSHARE_{jt-1} \\
& + \beta_{10} VCAGE_{it} + \beta_{11} VCMALE_i + \beta_{12} VCNEW_{it} \\
& + \beta_{13} VCNOPREVEXP_i + \beta_{14} VCINDEXP_i \\
& + \beta_{15} LONDON_i + \beta_{16} SCOT_i + \beta_{17} WALES_i + \beta_{18} 2011 \\
& + \beta_{19} 2012 + \beta_{20} 2013 + \beta_{21} 2014 + \beta_{22} 2015 + \beta_{23} 2016 + \mu_{ijt}
\end{aligned}
\tag{2}
$$

where L denotes natural logarithm and $VCSALBEN_{ijt}$ is the annual pay including bonuses for the i th VC in the j th institution at time t. We check the robustness of our results to the definition of salary and use annual pay (excluding bonuses) when undertaking robustness checks in Sect. 6.

The definitions of all the explanatory variables are reported in full in Table 1. We note two important considerations. First, time-varying right hand side variables are lagged (as in, for example, Firth et al. 1999). This is because it is assumed that VC pay is more likely to be related to past than current values, and that recent performance is of more relevance than historical performance. This also has the advantage that possible endogeneity issues are avoided. Second, we use RE (as in Dolton and Ma 2003) as we are interested in the effects of some time-invariant variables which would not be revealed with, for example, fixed effects (FE) estimation. RE, however, assumes that there is no correlation between the VC (random) effects and the independent variables included in the equation. We consider alternative estimation methods when undertaking robustness checks in Sect. 6.

The descriptive statistics relating to the variables included in the panel data estimation are provided in Table 2. VC salary varies considerably as expected (see Fig. 1 for further illustration), and the explanatory variables demonstrate the diversity of the UK higher education sector in all dimensions. VCs themselves are aged around 59 on average, are largely male (80%); very few have no previous experience relating to either VC or PVC roles (22%) and VCs do not typically have industrial experience (only 32% have). An analysis of between and within variation for the non-binary explanatory variables (see Table 3) suggests much more variation between VCs (given time) than within VCs (over time). This is much as one would expect a priori.

A correlation matrix is presented in Table 4. This suggests that multi-collinearity should not be a particular problem when interpreting the results in the next section.

5 Results and discussion

The results from applying RE to the estimation of equation (2) are reported in Table 5. We consider first of all the results of the estimation applied to all observations in the sample. The overall R^2 suggests a moderately strong explanatory power, and aligns with the results obtained in previous VC pay studies (Tang et al. 2000; Bachan 2008; Tarbert et al. 2008; Cheng 2014), but is perhaps generally a little weaker than for studies of CEO pay (Chen et al. 2016; Smirnova and Zavertiaeva 2017).

Table 2 Descriptive statistics of the VC pay equation variables

Variable	N	Mean	SD	Min	Max
(a) Continuous variables					
VCSALBEN	1076	249,770	70,904	104,260	719,000
VRS	968	0.843	0.128	0.451	1.000
FSI	1216	3.298	1.200	0.300	6.270
OVERALL	907	6.109	1.524	2.740	10.000
SIZE	1069	12.002	9.189	0.160	79.064
TOPSALCAT	1064	14.664	11.825	0.000	100.000
ACSTAFFSHARE	1065	30.075	5.921	1.284	43.867
VCAGE	945	58.987	5.310	45.000	74.000

Variable		N		0	1
(b) Categorical variables					
MERGER		1079		1073	6
PRE1992		1229		870	359
VCMALE		1079		212	867
VCNEW		1079		948	131
VCNOPREVEXP		1036		799	237
VCINDEXP		1037		706	331
LONDON		1229		945	284
SCOTLAND		1229		1086	143
WALES		1229		1168	61
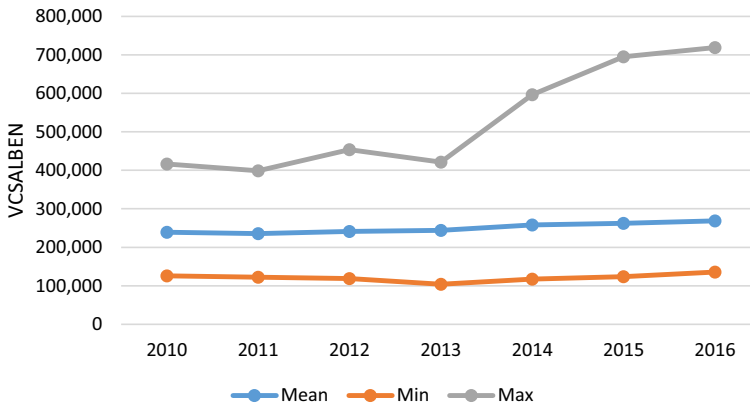
Fig. 1 Minimum, maximum and mean salary and benefits by year

In terms of performance we find that, once other possible variables are included, VC pay is determined by neither the managerial efficiency measure as reflected by our DEA model of efficiency, nor by the financial security index produced by HESA. In fact, the only measure of performance which appears to be related to VC pay is the overall performance score produced by *The Complete University Guide* and from which their university rankings

Table 3 Within and between variation for explanatory variables

Variable	Mean	SD	Min	Max	Observations
VCSALBEN					
Overall	249,770	70,904	104,260	719,000	N = 1076
Between		68,709	122,482	563,214	n = 256
Within		29,692	126,590	634,141	bar = 4.203
VRS					
Overall	0.843	0.128	0.451	1.000	N = 968
Between		0.117	0.506	1.000	n = 240
Within		0.066	0.582	1.175	bar = 4.033
FSI					
Overall	3.298	1.200	0.300	6.270	N = 1216
Between		1.088	1.380	6.247	n = 270
Within		0.516	1.388	5.766	bar = 4.504
OVERALL					
Overall	6.109	1.524	2.740	10.000	N = 907
Between		1.554	2.855	9.962	n = 219
Within		0.441	4.423	7.457	bar = 4.142
SIZE					
Overall	12.002	9.189	0.160	79.064	N = 1069
Between		8.944	0.178	75.789	n = 257
Within		1.449	-3.555	30.396	bar = 4.160
TOPSALCAT					
Overall	14.664	11.825	0.000	100.000	N = 1064
Between		10.876	0.000	95.980	n = 257
Within		3.210	-39.914	41.867	bar = 4.140
ACSTAFFSHARE					
Overall	30.075	5.921	1.284	43.867	N = 1065
Between		5.675	2.255	42.532	n = 256
Within		2.075	18.731	52.617	bar = 4.160
VCAGE					
Overall	58.987	5.310	45.000	74.000	N = 945
Between		5.175	46.000	73.000	n = 211
Within		1.641	55.654	62.154	bar = 4.479

are produced. This is an interesting finding and we speculate that the ease of observation of and public spotlight on this variable might explain this result. In addition, this is likely to capture the interests of multiple stakeholders. Further investigation of the components from which the score (OVERALL) is calculated[13] reveals that it is entry standards (as measured by UCAS tariff entry score of new undergraduate students) and good honours (the percentage of first degree graduates achieving a first or upper second class honours degree) which are the components significantly related (positively) to VC pay. These results cause us to speculate further that it is university reputation rather than performance driving VC pay (which is in

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[13] These results are not reported in detail; but are available on request.

Table 4 Correlation matrix

	VCSALBEN	VRS	FSI	OVERALL	PRE1992	MERGER	SIZE	TOPSALCAT
VCSALBEN	1.000							
VRS	0.202	1.000						
FSI	0.073	0.171	1.000					
OVERALL	0.526	0.016	− 0.013	1.000				
PRE1992	0.442	− 0.049	− 0.130	0.674	1.000			
MERGER	0.104	0.094	− 0.015	0.112	0.089	1.000		
SIZE	0.432	0.391	0.222	0.279	0.300	0.146	1.000	
TOPSALCAT	0.516	0.038	− 0.129	0.726	0.663	0.052	0.323	1.000
ACSTAFFSHARE	0.110	0.050	0.119	0.042	− 0.001	0.131	0.196	0.220
VCAGE	0.230	0.214	0.012	0.164	0.177	0.063	0.074	0.164
VCMALE	0.044	0.200	0.037	0.001	0.012	0.034	0.169	0.088
VCNEW	0.066	0.061	0.033	0.009	0.019	− 0.025	− 0.027	0.021
VCNOPREVEXP	0.066	− 0.151	− 0.097	0.111	0.127	− 0.040	− 0.099	0.150
VCINDEXP	− 0.026	− 0.087	0.003	− 0.041	0.006	− 0.012	− 0.010	− 0.064
LONDON	0.039	0.223	0.026	− 0.057	− 0.048	0.159	− 0.045	0.084
SCOTLAND	− 0.126	− 0.210	− 0.064	0.015	− 0.245	− 0.027	− 0.142	0.079
WALES	− 0.045	0.021	− 0.078	− 0.071	0.122	− 0.016	− 0.074	0.007

Table 4 continued

	ACSTAFFSHARE	VCAGE	VCMALE	VCNEW	VCNOPREVEXP	VCINDEXP	LONDON	SCOTLAND	WALES
VCSALBEN									
VRS									
FSI									
OVERALL									
PRE1992									
MERGER									
SIZE									
TOPSALCAT									
ACSTAFFSHARE	1.000								
VCAGE	0.098	1.000							
VCMALE	0.106	− 0.020	1.000						
VCNEW	− 0.022	− 0.160	− 0.032	1.000					
VCNOPREVEXP	− 0.105	0.026	− 0.143	− 0.053	1.000				
VCINDEXP	0.018	− 0.048	− 0.157	− 0.040	0.168	1.000			
LONDON	0.120	0.162	0.096	0.017	0.082	− 0.076	1.000		
SCOTLAND	0.164	− 0.071	− 0.072	− 0.068	− 0.030	0.023	− 0.172	1.000	
WALES	0.011	0.064	− 0.022	0.053	− 0.084	0.029	− 0.100	− 0.084	1.000

Table 5 Results

Dependent variable	All		Pre-1992		Post-1992	
LVCSALBEN	Estimated Coef	Robust SE.	Estimated Coef	Robust SE.	Estimated Coef	Robust SE.
VRST-1	0.013	0.057	0.017	0.100	− 0.034	0.066
FSI t-1	0.009	0.007	0.001	0.013	0.009	0.009
OVERALL t-1	0.022**	0.009	0.057***	0.014	0.018	0.012
PRE1992	0.082**	0.040				
MERGER	0.036	0.022	− 0.016	0.029		
LSIZE t-1	0.375**	0.166	− 0.116	0.638	0.407**	0.200
LSIZESQ t-1	− 0.049	0.034	0.041	0.116	− 0.053	0.043
TOPSALCAT t-1	0.003**	0.002	0.004**	0.002	0.002	0.002
ACSTAFFSHARE t-1	− 0.001	0.002	− 0.009**	0.004	0.001	0.003
VCAGE	0.004*	0.002	0.004	0.004	0.004	0.003
VCMALE	− 0.034	0.030	− 0.021	0.052	− 0.025	0.038
VCNEW	0.073	0.075	− 0.087	0.114	0.290***	0.070
VCNOPREVEXP	0.007	0.020	− 0.035	0.032	0.034	0.023
VCINDEXP	− 0.024	0.019	0.026	0.019	− 0.035	0.027
LONDON	0.026	0.029	0.088	0.064	0.020	0.038
SCOT	− 0.017	0.032	− 0.044	0.049	− 0.011	0.038
WALES	− 0.072***	0.027	0.009	0.050	− 0.133	0.072
2011	− 0.013	0.009	− 0.015	0.012	− 0.023**	0.011
2012	0.007	0.015	− 0.003	0.024	0.004	0.017
2013	0.028*	0.015	− 0.005	0.023	0.035*	0.021
2014	0.046***	0.018	− 0.012	0.027	0.060***	0.022
2015	0.081***	0.021	0.027	0.029	0.095***	0.028
2016	0.108***	0.021	0.028	0.029	0.127***	0.026

Table 5 continued

Dependent variable	All		Pre-1992		Post-1992	
LVCSALBEN	Estimated Coef	Robust SE.	Estimated Coef	Robust SE.	Estimated Coef	Robust SE.
CONSTANT	11.390***	0.267	12.080****	0.840	11.319***	0.330
# of VCs	149		58		92	
# of observations	603		239		360	
R-sq (within)	0.470		0.433		0.442	
R-sq (between)	0.452		0.459		0.332	
R-sq (overall)	0.465		0.383		0.384	
Wald chi-sq	655.37***		804.42***		1011.77***	

***Significant at 1%; **significant at 5%; *significant at 10%

line with the results and interpretation of Tang et al. 2000), but further work is required to explore this more.

Turning now to the other variables in the equation, we find that size has a significantly positive relationship with VC salary (LSIZE is significant, but LSIZESQ is not). This therefore suggests that greater organisational complexity is a positive driver of VC pay. In addition, having a higher proportion of highly paid staff positively affects VC pay, as might be expected. It is worth noting that the 2014 REF resulted in many universities enticing, with high salaries, professors with excellent research outputs into their organisations to boost their REF submission. This may well have had a knock-on effect of raising VC salaries.

VC age is the only VC characteristic affecting remuneration (positively), and this is only at the 10% significance level. These results are in line with previous findings (Bachan 2008; Bachan and Reilly 2015, 2017). There appears to be no evidence from our initial estimations that VC remuneration varies significantly by previous experience or gender.

Location of university is important in determining level of pay in only one case: VCs located in Wales have significantly lower salaries than VCs in other locations by around 7%. Salaries in the later years of the period are significantly higher than those in the base year (2010), and this is in line with the findings of Bachan and Reilly (2017) who also find that salaries have been increasing over time after taking into account various factors of pay. Whether this is related to the rise in student fees over the period, increases in executive pay more generally, or the increasing marketisation of higher education and its consequent impact on VCs, is open to speculation.

We note that VCs in pre-1992 HEIs have significantly higher pay, on average, than those in post-1992 universities, holding all else constant. This adds support to our hypothesis that reputation (pre-1992 HEIs tend to be established, research-intensive universities) is an important factor in determining the remuneration of VCs. We investigate further whether factors affecting pay differ by institution types by estimating the model for two sub-samples, namely, the pre-1992 and post-1992 universities. The pay of VCs in the pre-1992 universities is related to performance as measured by the overall performance score in *The Complete University Guide*, to the proportion of staff in the top salary category, and to the share of university expenditure taken by the academic staff bill. The variables OVERALL and TOPSALCAT have the expected positive signs, while ACSTAFFSHARE is negatively related to VC pay. We speculate that a low value of ACSTAFFSHARE occurs when universities are particularly research-intensive and their expenditure is taken up (more proportionately) by research-related costs. The pre-1992 universities likely vary substantially in terms of ACSTAFFSHARE with a low value indicating a strong research reputation. The observed negative relationship therefore offers further possible evidence that (research) reputation positively affects VC pay.

In contrast, the pay of VCs in the post-1992 set of universities is not related to performance at all. Instead it is positively related to both size and whether the VC is new to the institution. While VC salary appears not to have changed significantly over time in pre-1992 institutions, it has risen significantly in later years in post-1992 universities. It appears that pre- and post-1992 institutions are operating in different labour markets for their VCs. Not only is the pay of VCs in pre-1992 HEIs higher than those in post-1992 universities, the factors which affect remuneration are also distinct to each market. These distinctions between pre- and post-1992 universities are interesting and warrant further investigation in future work, with particular focus on the flexibility of VCs to move between universities of different types.

6 Robustness checks

In this section, we undertake a number of robustness checks to assess the sensitivity of our results to specification and/or estimation methods. Throughout the analysis we have defined VC pay as salary plus bonuses as reported by the *THE*. The results (see equation 1 in Table 6) remain remarkably robust to the replacement of salary plus bonuses by salary only: the variable OVERALL is still the only performance variable with a significantly positive relationship with VC pay. Other variables significant in the equation are largely the same as in previous estimations.

When managerial efficiency is calculated on the basis of a DEA model which incorporates university expenditure, there is again little change in the conclusions drawn (see equation 2 in Table 6). OVERALL continues to be the only performance measure significant in determining VC pay. Similar consistency of results is observed when we use logarithms of all the performance variables (see equation 3 in Table 6).

When we use FE estimation rather than RE (equation 4 of Table 6), we find that OVERALL continues to be the only performance variable which is significantly positively related to pay. There are some slight differences, though, in the additional variables with a significant relationship with VC pay. University size is no longer significant, while VC age has a strong positive relationship with pay. VC salary also appears to be falling over time, taking into account all other variables, and this is in contrast to other results in Tables 5 and 6.

Most previous literature has used RE or FE to estimate the VC pay equation. One exception to this is Cheng (2014) who employs an Arellano Bond estimation method for estimating a salary equation for university presidents in the US. The Arellano Bond estimation method allows for the possibility of autocorrelation in the data. We apply Arellano Bond and present the results in Table 7. The results in this case are not altogether consistent with those from other estimations and specifications. The only performance variable with a significantly positive relationship with VC pay is the FSI variable which is clearly at odds with all the other estimations so far. Moreover, while pre-1992 universities typically have significantly more highly paid VCs than post-1992 ones, university size, proportion of staff in the top salary category, location in Wales and VC age are not significant variables in determining VC pay in the Arellano Bond model. Instead, location in London (as expected) has a significantly positive effect on VC pay.

Quite why the results of this estimation method are out of line with results of other estimation methods used here is open to debate. First we note that the approach inevitably reduces the number of observations (partly because of the inclusion of the lagged dependent variable). It is also worth noting that the lagged dependent variable is not significant at conventional significance levels, although the AR(1) autocorrelation test is just significant at the 5% significance. Therefore, evidence to support the use of Arellano Bond here is unclear, and the results should therefore be treated with a degree of caution.

We undertake a final sensitivity check by estimating the equation, respectively, in levels only and with lags of 2 periods (see Table 8). It is worth pointing out that our a priori expectation is that there is a lag between performance (and other variables) and VC pay, but that this lag is likely to be only one period rather than more than that as stakeholders are probably most interested in recent performance. Our results indicate that OVERALL is the only significant measure of performance when the equation is estimated in levels; however, no performance variable is significant when lags of two periods are taken. To the extent that VC performance is important, then, it is current and recent performance which are more important than earlier performance.

Table 6 Robustness checks I

Dependent variable	1		2		3		4	
LVCSAL (equation 1) LVCSALBEN (equations 2–4)	Estimated Coef	Robust SE.	Estimated Coef	Robust SE.	Estimated Coef	Robust SE.	Estimated Coef	Robust SE.
VRSt-1	0.040	0.074	− 0.008	0.072	0.007	0.045	− 0.003	0.062
FSIt-1	0.005	0.007	0.009	0.007	0.026	0.019	0.007	0.010
OVERALLt-1	0.026**	0.009	0.022**	0.010	0.127**	0.053	0.030**	0.012
PRE1992	0.059*	0.035	0.081**	0.040	0.084**	0.039		
MERGER	0.035	0.021	0.035	0.022	0.037	0.023	0.039	0.024
LSIZEt-1	0.407***	0.141	0.374**	0.166	0.371**	0.168	0.503	0.506
LSIZESQt-1	− 0.057*	0.030	− 0.049	0.034	− 0.048	0.034	− 0.085	0.095
TOPSALCATt-1	0.003*	0.002	0.003**	0.002	0.003**	0.002	0.005**	0.002
ACSTAFFSHAREt-1	− 0.001	0.002	− 0.001	0.002	− 0.001	0.002	− 0.002	0.003
VCAGE	0.004*	0.002	0.004*	0.002	0.004*	0.002	0.067**	0.033
VCMALE	− 0.034	0.027	− 0.034	0.030	− 0.034	0.030		
VCNEW	0.045	0.076	0.073	0.075	0.073	0.074	0.106	0.078
VCNOPREVEXP	− 0.011	0.021	0.007	0.020	0.007	0.020	0.004	0.026
VCINDEXP	0.006	0.020	− 0.025	0.018	− 0.025	0.018	− 0.031	0.024
LONDON	0.025	0.029	0.027	0.029	0.031	0.030		
SCOT	− 0.034	0.033	− 0.018	0.033	− 0.017	0.032		
WALES	− 0.074***	0.021	− 0.071***	0.027	− 0.073***	0.027		
2011	− 0.017**	0.009	− 0.014	0.009	− 0.013	0.009	− 0.078**	0.032
2012	0.008**	0.014	0.007	0.014	0.007	0.015	− 0.122**	0.058
2013	0.028**	0.016	0.029**	0.014	0.028*	0.016	− 0.166*	0.096
2014	0.037**	0.019	0.048***	0.017	0.047***	0.018	− 0.211*	0.125
2015	0.050**	0.022	0.082***	0.021	0.082***	0.021	− 0.240	0.157
2016	0.064**	0.023	0.109***	0.022	0.108***	0.021	− 0.276	0.188

Table 6 continued

Dependent variable	1		2		3		4	
LVCSAL (equation 1) LVCSALBEN (equations 2–4)	Estimated Coef	Robust SE.	Estimated Coef	Robust SE.	Estimated Coef	Robust SE.	Estimated Coef	Robust SE.
CONSTANT	11.291	0.237	11.404***	0.271	11.303***	0.282	7.735***	1.906
# of VCs	149		149		149		149	
# of observations	603		603		603		603	
R-sq (within)	0.323		0.470		0.474		0.458	
R-sq (between)	0.492		0.451		0.442		0.071	
R-sq (overall)	0.460		0.465		0.459		0.119	
Wald chi-sq	1003.77***		668.96***		626.66***			

Equation 1: as Table 5 but with VCSAL as dependent variable

Equation 2: as Table 5 but where VRS is calculated using the VRS DEA model

Inputs: PGINPUT, UGINPUT, TOTALEXP

Outputs: RESEARCH, PGOUTPUT, UGOUTPUT

Equation 3: as Table 5 but where logarithms of VRS, FSI and OVERALL are used

Equation 4: as Table 5 but with FE estimation

***Significant at 1%; **significant at 5%; *significant at 10%

Table 7 Robustness checks II—Arellano Bond estimation

Dependent variable	1	
LVCSALBEN	Estimated Coef	Robust SE.
LVCSALBENt-1	0.023	0.118
VRSt-1	− 0.028	0.048
FSIt-1	0.017**	0.007
OVERALLt-1	0.006	0.015
PRE1992	0.452***	0.091
MERGER	− 0.046	0.057
LSIZEt-1	0.486	0.774
LSIZESQt-1	− 0.131	0.146
TOPSALCATt-1	− 0.002	0.002
ACSTAFFSHAREt-1	0.002	0.003
VCAGE	− 0.028	0.028
VCNEW	− 0.115	0.082
VCNOPREVEXP	0.009	0.022
VCINDEXP	− 0.009	0.016
LONDON	0.226**	0.096
SCOT	0.003	0.058
WALES	0.138	0.087
2012	− 0.317**	0.142
2013	− 0.245**	0.118
2014	− 0.199**	0.087
2015	− 0.143**	0.061
2016	− 0.068**	0.032
CONSTANT	13.351***	2.062
# of VCs	117	
# of observations	377	
Arellano-Bond AR(1) autocorrelation test, p value	0.045	
Arellano-Bond AR(2) autocorrelation test, p-value	0.173	

***Significant at 1%; **significant at 5%; *significant at 10%

The analysis and robustness checks consistently indicate that managerial performance as derived from DEA is not a significant determinant of VC pay. Instead, university ranking is the most consistent performance determinant of VC remuneration. In the UK higher education sector, it appears that remuneration committees are more influenced by published (and public) performance indicators (and possibly indicators of reputation) than by other measures such as the financial security index or the managerial efficiency of VCs in transforming their inputs into outputs such as graduates (at all levels) and research.

7 Conclusion

We undertake this in-depth examination of the determinants of VC pay in UK higher education with a view to exploring the following:

Table 8 Robustness checks III

Dependent variable LVCSALBEN	Estimated Coef	Robust SE
(a) Estimation in levels		
VRS	0.088	0.056
FSI	0.003	0.008
OVERALL	0.039***	0.009
PRE1992	− 0.030	0.029
MERGER	0.014	0.040
LSIZE	0.159	0.173
LSIZESQ	− 0.006	0.037
TOPSALCAT	0.005	0.002
ACSTAFFSHARE	0.000	0.003
VCAGE	0.006***	0.003
VCMALE	− 0.015	0.034
VCNEW	0.050**	0.023
VCNOPREVEXP	− 0.011	0.017
VCINDEXP	0.004	0.015
LONDON	0.032	0.030
SCOT	− 0.035	0.036
WALES	0.015	0.093
2011	− 0.028**	0.012
2012	0.004	0.017
2013	− 0.002	0.019
2014	0.031	0.019
2015	0.067***	0.023
2016		
CONSTANT	11.338***	0.247
# of VCs	152	
# of observations	584	
R-sq (within)	0.430	
R-sq (between)	0.470	
R-sq (overall)	0.475	
Wald chi-sq	683.67***	
(b) Estimation with lag 2		
VRS_{t-2}	− 0.033	0.063
FSI_{t-2}	0.001	0.008
$OVERALL_{t-2}$	0.000	0.000
PRE1992	0.049	0.025
MERGER	0.103**	0.049
$LSIZE_{t-2}$	0.149**	0.165
$LSIZESQ_{t-2}$	− 0.004	0.034
$TOPSALCAT_{t-2}$	0.004*	0.002
$ACSTAFFSHARE_{t-1}$	− 0.002	0.002
VCAGE	0.005*	0.003

Table 8 continued

Dependent variable LVCSALBEN	Estimated Coef	Robust SE
VCMALE	− 0.038	0.040
VCNEW	0.137*	0.079
VCNOPREVEXP	0.023	0.024
VCINDEXP	− 0.021	0.018
LONDON	0.020	0.036
SCOT	− 0.044	0.035
WALES	− 0.099***	0.030
2011		
2012	0.024**	0.011
2013	0.035***	0.013
2014	0.067***	0.016
2015	0.111***	0.023
2016	0.140***	0.021
CONSTANT	11.723***	0.255
# of VCs	129	
# of observations	460	
R-sq (within)	0.500	
R-sq (between)	0.374	
R-sq (overall)	0.413	
Wald chi-sq	4850.14***	

- Does VC performance in leading a university determine VC remuneration? In other words, is there evidence to support the relevance of the principal agent theory in determining executive pay in UK higher education?

The work is original in that it looks at a variety of measures of VC performance including a DEA measure of managerial efficiency. We therefore include three possible measures of performance: a DEA measure of managerial efficiency at transforming inputs into outputs; the performance score used by *The Complete University Guide* to derive their university rankings; and the financial security index produced by HESA. On the basis of data collected over a period from 2009/10 to 2016/17, we find support for principal agent theory, but the only measure which is significant in the VC pay equation is the performance score from *The Complete University Guide*.

A raft of robustness checks undertaken to establish the rigour of the results confirms this result in all but one case. Only when an Arellano Bond estimation method is used do we find that performance measured by the financial security index is the significant performance determinant of VC pay. But these particular results should be treated with a degree of caution because the lagged dependent variable is not significant, and the AR(1) test is only marginally significant at the 5% significance level. What is very clear, however, is that managerial efficiency, as measured by DEA, is consistently not a significant determinant of VC pay.

Another consistent result is that the pay of VCs in pre-1992 universities is typically higher than that of VCs in post-1992 HEIs, all else being equal. Further exploration of pre-1992 and post-1992 subsamples suggests that university ranking is only significant in the former case. When the components of the overall performance score are examined, it is entry score

and good honours degrees which are the most important components in determining VC pay. We therefore hypothesise that it is more the reputation of universities, rather than their actual performance, which determines pay.

In line with previous studies we find that VC pay appears to have risen significantly in recent periods, particularly in post-1992 universities. This coincides with rising student fees, but it is difficult to conclude on the basis of this relatively short time period covered by the analysis that the two are related. Indeed, the period also coincides with the lifting of the student numbers cap in the UK and hence a period of increasing marketisation and competition in UK higher education, making the VC role a particularly challenging one.

In addition to university performance and HEI type, there is evidence that size, proportion of staff in the top salary category, VC age and location in Wales are all determinants of pay (only the last having a negative relationship).

The subject of VC remuneration is a highly topical one, and the nature of funding in higher education (with substantial support from the public purse) makes this work particularly policy-relevant. We conclude from our results that the call for institutions to justify any VC's pay exceeding £150,000—around the current salary of the prime minister—is somewhat arbitrary; unlike VCs' salaries, the prime minister's salary is not subject to competitive labour market pressures, and the £150,000 figure does not capture the considerable additional financial benefits (present and future) that the post of prime minister carries. Our results indicate that performance and other determinants are significant in determining pay, and therefore support the conclusion of the 2011 Hutton review of fair pay in the public sector (Hutton 2011) which suggested: 'Government should refrain from using the pay of the prime minister or other politicians as a benchmark for the remuneration of senior public servants, whose pay should reflect their due desert and be proportional to the weight of their roles and their performance.'

On the basis of evidence presented here, VCs' pay, like chief executive pay, appears to be determined by the demands of the role, organisational environment, and the performance of the individual. It is well-known, however, that being a chief executive in the corporate world brings with it responsibilities and increasing accountability. As VC reward increasingly mirrors CEO pay, the issue of accountability will inevitably also need to be addressed in the higher education sector.

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