WHEN BUREAUCRACY MATTERS FOR ORGANIZATIONAL PERFORMANCE: EXPLORING THE BENEFITS OF ADMINISTRATIVE INTENSITY IN BIG AND COMPLEX ORGANIZATIONS

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Administrative intensity is arguably a major determinant of public service performance. Although a large administrative function might constitute a bureaucratic burden, it could also enable organizations to better coordinate key activities. In particular, administrative intensity may strengthen or weaken the performance effects of other key organizational characteristics, such as size and task complexity. To explore these ideas, we analyse the separate and combined effects of administrative intensity, organization size and task complexity on the research and educational performance of UK universities between 2005 and 2011. The statistical results suggest administrative intensity has a performance pay-off for big and complex organizations.

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INTRODUCTION

It has long been fashionable to suggest that bureaucratic public organizations are likely to perform worse than their 'leaner' and more flexible counterparts (Peters, 2001). Whether by generating excessive overheads, cumbersome reporting requirements or being unresponsive to stakeholders, organizations with a large central administrative component are thought to be unable to deliver services efficiently and effectively. Yet the administrative centre of an organization also constitutes a stock of human resources that can potentially be mobilised for the delivery of better services (Adler and Borys, 1996). In this respect, a high degree of central administrative intensity (the ratio of 'back office' resources to front-line resources) may be necessary to sustain high performance. In particular, the effects of an array of internal and external variables on performance may be contingent on administrative intensity. Although there have been a number of recent studies examining the determinants of administrative intensity and overheads in public organizations (e.g. Boon and Verhoest, 2014; Boyne and Meier, 2013; Rutherford, 2016; Van Helden and Huijben, 2014), surprisingly little is still known about whether and when bureaucracy matters for public service performance. Researchers have analysed the role that the central administration might play in buffering organizations from external forces (e.g. Andrews, Boyne, Meier, O'Toole and Walker, 2013; Meier and O'Toole 2009). Nevertheless, the possibility that central administrative intensity may lead to better performance by strengthening or moderating the effects of key internal organizational characteristics has yet to be thoroughly explored. To address this gap in the literature, we examine the separate and combined effects of administrative intensity, organization size and task complexity on the research and education performance of universities in the United Kingdom (UK) between 2005 and 2011.

By extending previous research on administrative intensity, we are able to highlight that not only is bureaucracy a function of other important organizational contingencies, but that it is a design feature that can have major implications for the effectiveness of public organizations. The central administrative function of an organization typically comprises those personnel with no direct role in service production, such as the senior management team, corporate services (e.g. finance, human resources, IT, marketing), and other workers providing services to the whole of an organization (Handel, 2014). The administration function is therefore distinguished from those functions responsible for the delivery of services (e.g. professionals and street-level bureaucrats in public organizations). Since the administrative function is an "overhead" that must be added to direct service costs (Van Helden and Huijben 2014), it is likely to have an influence on the performance of public organizations. Contingency theorists, in particular, draw attention to the ways in which the benefits of bureaucracy for organizational outcomes may be felt through its relationship with other internal characteristics, especially the sheer size of an organization and its internal task complexity (Van de Ven, Ganco and Hinings 2013). Large central bureaucracies may be required to better manage bigger and more complex organizations, and this, in turn, may result in a positive performance pay-off.

To investigate this issue, we carry out statistical analyses of the relationship between the administrative intensity of UK universities, their size and task complexity and measures of research and educational performance. First, we review prior research, which suggests that the relationship between administrative intensity and performance may take a variety of forms, before exploring the potential for administrative intensity to moderate the relationships between size and complexity and performance. Thereafter, we outline our statistical model and the measures of

organizational performance used for the analysis. We then present our findings, discuss the statistically significant effects that emerge, and draw theoretical and policy conclusions.

ADMINISTRATIVE INTENSITY AND ORGANIZATIONAL PERFORMANCE

The literature on administrative intensity in the public sector has tended to take the standpoint that a large administrative component constitutes a 'bureaucratic burden' on organizations (Boon and Verhoest 2014). According to public choice theorists, in particular, senior managers of public organizations create a large administrative function because the resources that they receive from government are rarely dependent upon the efficient production of services (Chubb and Moe 1990). However, despite popular antipathy towards 'bureaucracy' in public organizations (Downs and Larkey 1986), it is quite possible that administrative intensity is actually associated with better performance. Aside from the benefits of efficient and equitable decision-making conventionally associated with bureaucratic modes of organizing public services (Goodsell 1985), organizations with a strong administrative component may also be better placed to synchronize the many moving parts that are present within public bureaucracies (Van Helden and Huijben 2014).

Within the generic management literature, one of the main benefits of administrative intensity is generally thought to be the propensity for organizations with a bigger 'back office' to devote more time and resource to performance-enhancing activities. For example, Sine, Mitsuhashi and Kirsch's (2006) analysis of the performance of new internet companies between 1996 and 2001 reveals that new ventures with high levels of administrative intensity outperform their "leaner"

counterparts, because they have greater capacity for managing the initial phases of business start-up. Furthermore, a review of the determinants of service innovation in the public sector suggests that administrative intensity is a critical success factor (Walker 2013). However, to date, evidence on the benefits and costs of administrative intensity for public service performance is less clear-cut.

In an early study, Bidwell and Kasarda (1975) report a negative relationship between school district performance and administrative intensity. Subsequently, there has been much debate in the US, in particular, about 'bureaucracy' and school performance, which has drawn upon measures of administrative intensity to assess whether organizations with a bigger bureaucratic component perform better or worse (see Smith and Larrimer 2004). The evidence on this issue though has largely been inconclusive, indicating that the relationship may be nonlinear rather than linear in form. Indeed, Rutherford (2016) recently identified an inverted u-shaped relationship between administrative intensity and the educational performance of universities in the United States, suggesting that as administrative intensity rises, it may expand beyond its usefulness for supporting the core activities of the organization. Thus, there is good reason to expect that administrative intensity will, up to a point, be associated with better performance. Beyond that, performance will decline as the optimum ratio of back-office to front-line resources is exceeded. For these reasons, our first hypothesis is:

H1: Administrative intensity will have an inverted u-shaped relationship with organizational performance

Administrative Intensity and Performance in Big Organizations

Previous studies have not evaluated the potential for administrative intensity to condition the effects of key organizational characteristics on performance. To fully comprehend when bureaucracy matters for organizational performance, it is necessary to analyse the moderating effects that administrative intensity might have on key internal organizational contingencies, especially the size and task complexity of organizations (Van de Ven, Ganco and Hinings 2013).

The link between size and organizational performance has been widely studied (Jung 2013). Economic theory suggests that size has a positive effect on performance because economies of scale allow the fixed costs of service production to be spread across more units of output. Examples of physical fixed costs in universities include buildings and technical equipment to support teaching and research. As these facilities are used more intensively, so efficiency rises (up to a point of maximum utilisation when further investment in extra space or kit is required, after which the benefits of scale begin again). Other positive effects of large size have been identified, including lower costs associated with purchasing power, favourable rates on funds for new investment, greater capacity for innovation, and the ability to hire talented senior managers who are attracted to the challenge and rewards of running big organizations (Jung 2013).

An alternative perspective on the link between size and performance is provided by public choice theory, which suggests that economies of scale are eventually counter-acted by bureaucratic congestion (Boyne and Meier 2013). However, this is an administrative intensity effect rather than a size effect *per se*. In this paper, we differentiate these potentially countervailing forces by examining each of them separately. Whereas most previous studies have taken large size as a proxy for

bureaucratic congestion, we regard a high level of administrative intensity as a more accurate indicator of the overload associated with bureaucratic 'empire-building'. This means that we are testing a 'pure' size effect that is purged of the effect of a bigger bureaucratic component. We therefore expect to find a positive effect of size on performance. Hence, our second hypothesis is:

H2: Organization size will be positively related to performance

Although we are arguing that size and administrative intensity have distinct effects on performance, it also seems likely that they have combined effects (Damanpour, Szabat and Evan 1989). In particular, organizations with a large back-office may have greater capacity to take advantage of economies of scale. In universities, a larger administrative function may be required to realise the potential efficiency gains of a large physical estate with multiple classrooms and highly specialised equipment that would not be fully utilised by a single research or teaching group acting in isolation. Similarly, a larger administrative team may be able to negotiate more effectively with external contractors and thereby exploit the potential purchasing power of big universities more effectively. Administrative support is also likely to be required to take advantage of the innovative capacity that is associated with organizational scale, for example by identifying replicable good practice in one sub-unit and spreading the benefits across other sub-units. We therefore expect that the presence of a large central bureaucracy boosts the positive relationship between organizational size and performance, and so, our third hypothesis is:

H3: Administrative intensity will enhance the performance of big organizations

Administrative Intensity and Performance in Complex Organizations

Task complexity is the core structural characteristic that Mintzberg (1979) associates with the archetypal professional bureaucracy, since in such organizations professional groups are arranged in discrete production units. Complex professional bureaucracies are frequently plagued by conflicts between the centre and the sub-units, as well as between the sub-units themselves (Egeberg, 1999; Mintzberg 1979). Cohen and March (1974) liken universities, in particular, to "organized anarchies" in which organizational priorities are unstable and unpredictable, connections between means and ends are weak, and the cast of characters involved in decisions is highly fluid. This tendency towards anarchy is likely to be exacerbated by the task complexity associated with a large number of organizational sub-units. A high degree of departmental fragmentation can create may entail the diversion of resources towards the day-to-day management of inter-departmental conflicts, and towards attempts to re-establish strategic and operational alignment. Weaker alignment between the parts of public organizations has been found to lead to lower levels of performance (Andrews, Boyne, Meier, O'Toole and Walker, 2012).

The empirical evidence on the impact of internal task complexity on organizational performance in the public sector is extremely sparse. Schmid's (2002) study of therapeutic boarding schools in Israel found no relationships between occupational complexity and several measures of performance. Whetten (1978) presents evidence of mixed effects on the performance of US manpower agencies; internal task complexity was positively correlated with agencies' productivity, but negatively correlated with employees' perceptions of effectiveness. Hence, on the basis of arguments and evidence on the effects of a proliferation of organizational

sub-units in general, and the specific impact of organizational anarchy across multiple departments in universities, the fourth hypothesis that we test is:

H4: Task complexity is negatively related to organizational performance.

The potentially negative effects of task complexity may be offset by adding to the administrative component in an organization. In particular, it is likely to be necessary to develop a scale of administrative function sufficient to meet the demands of coordinating more than one separate sub-unit, and this will be especially important for highly divisionalised professional bureaucracies (Andrews and Boyne 2014). Organizations with a large administrative component can draw upon a core of slack administrative capacity to manage an expansion in the number of sub-units. In fact, according to the "complexity-administrative growth hypothesis" (Rushing 1967), increased differentiation of organizational structures poses coordination challenges that can only be met through the expansion of the administrative function.

Since in complex organizations there is more pressure to devote administrative resources to overcoming the principal-agent dilemmas associated with securing goal alignment, it is likely that organizations with greater administrative capacity are able to overcome such coordination problems. Thus, when administrative intensity and task complexity combine so, too, do the prospects of service improvement, as senior management gains traction in its attempt to connect sub-units. These arguments lead to our final hypothesis, that:

H5: Administrative intensity moderates the negative relationship between task complexity and performance.

RESEARCH CONTEXT, DATA AND MEASURES

The data set for our analysis consists of 115 UK universities (90 located in England, 13 in Scotland, 10 in Wales and 2 in Northern Ireland). Since the 1980s, UK higher education institutions (HEIs) have been subject to research performance assessments (Research Assessment Exercises (RAEs), now the Research Excellence Framework or 'REF') coordinated by central government every six years or so. More recently, UK universities have also entered a more marketised educational environment where measures such as student satisfaction are regularly published and scrutinised, not only by potential university applicants but also by government. This shift to a more regulated and more competitive environment has meant that universities now invest more time and resources in developing strategies for improving research and educational programmes (Deem, Hillyard and Reed 2007). One consequence of this changing environment has been a widely reported rise in the numbers of managers in universities during the 2000s (Morgan 2010) – a trend also observed in the United States (Greene, Kisda and Mills 2010).

For the analysis, we include only those UK universities that provide a broad range of courses for undergraduates and postgraduates, and we exclude the Open University due to its unique role and organizational structure. We focus on "comprehensive" universities to ensure that our analysis is based on a set of broadly comparable institutions. That is, ones that provide both undergraduate and postgraduate education, and are not focused solely on research or on a single academic discipline. So, for example, the Institute for Cancer Research and London Business School are excluded from our analysis. All the dependent and independent variables necessary for the study are drawn from the Resources of Higher Education

data published annually by the Higher Education Statistics Agency (HESA), the central body responsible for providing statistics on the performance of the sector to central government.

Dependent Variables

Organizational performance in the public sector is complex and multidimensional (Boyne 2003). The different interests of various stakeholder groups affect every stage of performance measurement: which criteria to select, how these should be weighted, which indicators should be used, and whether scores on these indicators are evidence of strong or weak performance. We sought to capture outcomes relevant to two key external stakeholders: central government and students.

The annual data on the performance of UK universities collected by HESA includes three measures that capture key aspects of universities' research achievements: the total value (£) of Quality Research (QR) funding allocated by central government to each institution; the number of PhDs awarded by each institution; and the total value (£) of research grants and contracts won. QR funding was determined by the RAE, which classified the performance of the staff within universities as 4* (world-leading), 3* (internationally excellent), 2* (recognised internationally), 1* (recognised nationally), on the basis of their research outputs. The actual amount that institutions received changed on an annual basis due to shifts in the criteria on which it is distributed (e.g. departments achieving the highest possible grade in two consecutive RAEs received additional funds mid-way through the most recent RAE cycle). Because the research performance measures are unscaled raw measures of output quantity they need to be set against some relevant denominator, to ensure that they do not simply reflect the size of any given institution. We utilise the

total cost of the academic staff as a denominator because it captures the amount of resources committed to achieving better research performance and because it is the approach the UK Higher Education Statistics Agency uses to compare the research performance of different institutions.

We measure the educational performance of UK universities using three different indicators. First, we use the average student satisfaction score (on a percentage scale of 0-100) achieved by the university as recorded in the National Student Survey (NSS). The NSS is an annual survey of all final year undergraduate students across the UK carried out by IPSOS MORI on behalf of central government. The response rate for the survey is about 75% of eligible students. Our second educational performance indicator is the percentage of leavers obtaining first degrees who, six months after graduation, are in employment or further study. This indicator is collected annually by HESA through the Destinations of Leavers in Higher Education (DLHE) survey. The response rate for the DLHE survey in 2007/08 was 80% of graduates. The third measure of educational performance is the continuation rate for full-time first degree entrants. This indicator is collected annually by HESA. Each institution calculates whether students who start in a particular year are still in higher education one year later. We do not divide the education performance measures by the resources spent on academic staff, because these indicators are already scaled and hence are comparable across different institutions.

Independent Variables

Our *administrative intensity* measure, constructed using HESA figures on staffing, is simply the ratio of the total number of employees involved in administrative duties within each university divided by the number of academic employees. Administrative

employees in each university are defined as: managers; non-academic professionals; student welfare workers, careers advisers, vocational training instructors, personnel & planning officers; media, public relations and marketing occupations; library assistants, clerks and general administrative assistants; secretaries, typists, receptionists and telephonists. Academic employees are those who are responsible for planning, directing and undertaking teaching and research.

The total headcount of the number of full and part-time staff employed by a university is used as the measure of *size* for the analysis. Although organizational size is a multidimensional concept (Kimberly 1976), we focus on absolute staffing levels as it provides a clear and transparent proxy for the operational scale of the disparate types of university within the UK HE system. Moreover, in the specific context of universities, staffing is firmly within the purview of senior management.

Task complexity is measured as the number of academic cost centres (key subject areas) for which each university returns expenditure data to HESA. The number of production sub-units has been used as a measure of complexity in previous studies (e.g. Blau 1970; McKinley 1987). There are 34 different academic cost centres, ranging from clinical medicine through to design and creative arts (see Appendix A). Even if in practice, specific cost centres are part of broader faculties of, for example, physical or social sciences, the presence of more broad subject specialisms in a university is likely to reflect significantly greater task complexity.

Control Variables

We include several measures that control for important organizational characteristics of UK universities. First, we include a measure of expenditure per head of staff to control for the level of resources in each university. Staff spending is anticipated to have a positive relationship with performance because it implies that an institution has invested in the human capital required to improve outputs (Crook, Todd, Combs, Woehr, and Ketchen 2011). We also add a measure of the budget surplus in the current financial year to control for the level of slack resources. A budget surplus implies that an institution has more spare capacity to make organizational improvements (George 2005). Next, to control for the task difficulty faced by universities we add a variable gauging the level of student disadvantage in each institution – measured as the percentage of students from neighbourhoods in the lowest quintile of higher education participation. A large literature highlights that there is a negative relationship between task difficulty and organizational performance (see Andrews 2010).

In addition, we include controls for institution type. In terms of the staffing structure, we measure the percentage of academics involved purely in education; the percentage of academics involved purely in research; and the percentage of all staff carrying out technical duties in support of specialist research: laboratory, engineering, building, IT and medical technicians. We anticipate that a higher proportion of educational specialists will have a positive effect on educational performance, but not for research, with the opposite being the case for research specialists and support staff (Johnes 1996). In terms of the scope of the educational provision on offer, we measure the total number of different undergraduate and postgraduate degree courses offered by each institution; and the ratio of undergraduate students to postgraduates.

Due to the additional complexity that they create, the number of courses is expected to be negatively related to performance. A large undergraduate population is expected to serve as a further measure of the teaching focus of institutions.

To control for reputational effects and institutional path dependency we also include a dichotomous variable coded one for all those institutions granted university status prior to 1992 and zero for those attaining it following the passing of the Further and Higher Education 1992 (which allowed polytechnics to become universities). Old and new universities have different missions, with old universities typically being more research-intensive and new ones being more teaching-focused. Hence, we anticipate that old universities will outperform new ones on our measures of research performance, while the new universities will do better on the measures of educational performance (see Johnes 1996). The descriptive statistics for all the variables included in the statistical models are shown in Table 1, and correlations are presented in Appendix B.

TABLE 1 HERE

METHOD

We employ an estimation strategy that identifies between-institutional effects rather than within-effects because to fully specify our statistical models it is necessary to include the measure of old/new university, which is a time-invarying variable. This measure makes a large and statistical significant contribution to the explanatory power of our models, so to exclude it would be to introduce omitted variable bias into our analysis. That said, for our between-effects approach, we calculate Seemingly

Unrelated Regression (SUR) estimates with clustered robust standard errors, which means we control for unit fixed effects within our analysis. At the same time, SUR estimations also correct for serial correlation in the standard errors, thereby reducing the potential for residual autocorrelation to bias the regression estimates (Cochrane and Orchutt 1949). Because SUR relies on a random effects estimator, inclusion of a lagged performance measure biases the coefficients for key independent variables downwards (Angrist and Pischke 2009), and so to avoid problems associated with 'Nickel bias' we estimate our equations without an auto-regressive term (for a similar approach see Rutherford 2016).

SUR is used to control for the possibility that the error terms are correlated across separate regression models (Martin and Smith 2005). The Breusch-Pagan test of independence rejected the null hypothesis of no relationship between separate Ordinary Least Squares equations modelling the independent effects of administrative intensity, size and complexity on performance ($p<.01$). This suggests that universities' achievements on each dimension of performance are correlated. The correlations between the residuals from the separate equations are presented in Table 2. There are strong positive correlations between the model predicting QR performance and the other models of research performance (.56 and .47). There is also a moderate positive correlation between the NSS model and the employment rate model (.23), and between the continuation model and the NSS (.31) and employment rate models (.31). This indicates that universities that do well on one of the measures of research performance are likely to do well on others, and that this applies, albeit to a lesser degree, for education performance. There is, though, less evidence to suggest that universities that perform well on research will also perform well in terms of education.

TABLE 2 HERE

To control for cross-equation correlations, SUR transforms the standard errors so that they all have the same variance and are no longer correlated, which thereby provides results that represent, in effect, a "pure" model of each organization's achievements on each performance measure.

Inclusion of dummy variables for each year of the analysis (minus one) further minimized the threat of serial correlation (Stimpson 1985). Aside from the collinearity generated by inclusion of the reciprocals of administrative intensity, and the interactions between administrative intensity and size and task complexity, the average VIF score for the independent variables is about 2.3. The results are therefore unlikely to be seriously distorted by multicollinearity. To further investigate whether collinearity might be a problem, we re-ran our estimations using mean-centred variables, which revealed virtually identical results (available on request). We do not present these mean-centred estimates because our discussion of the findings relies on the interpretation of the substantive effects of the independent variables, which is best facilitated by using the raw data.

To control for the possible effect of outliers, all variables included in the SUR models are winsorized at the top 1% and bottom 99% percentiles. Winsorizing refers to 'pulling in and replacing extreme scores in a data set with less extreme values' (Erceg-Hurn, Wilcox and Keselman 2013: 396). When winsorizing, the extreme values are changed to the next largest non-outlying data point, which helps maintain Type 1 error control, generating more statistically significant results when real effects exist in the population (Erceg-Hurn, Wilcox and Keselman 2013). Cook's Distance

statistics suggested that between one and five percent of the observations are outliers, depending on the model. Hence, winsorizing the data at the top and bottom 1% and 99% represents a robust yet comparatively conservative approach to managing the outliers in our dataset.

STATISTICAL RESULTS

Table 3 presents estimates of the separate effects of administrative intensity, organization size and task complexity on our measures of research performance and student outcomes. While we tested for both linear and non-linear administrative intensity effects (i.e. with and without a squared term), due to space limitations we only report the results for the squared term if it is statistically significant. Hence, only the "best-fitting" linear or nonlinear estimates of the administrative intensity-performance relationship are shown. Following that, in Table 4, we present estimates incorporating interactions between administrative intensity and organization size within the models for the best-fitting estimates displayed in Table 3. Then, in Table 5, we show the results of adding interactions between administrative intensity and task complexity to the models.

TABLE 3 HERE

The models presented in Table 3 explain 70-90% of the variation in the research performance of UK universities, but somewhat less of the variation in educational performance – 42% (employment rate) to 60% (continuation rate). The coefficients for the control variables are largely as expected. In particular, old universities perform better than new institutions on all six performance measures – a

finding that comports with prior research (Johnes 1996). As per our expectations, institutions with a higher proportion of staff employed on research only contracts perform better on research (see also Johnes 1996) and, perhaps surprisingly, have higher educational performance. The measure of research-only staff may be a proxy for the strength of the intellectual climate, which in turn has benefits for both teaching and research. As anticipated, universities that spend more money per staff member appear to do well on research performance. However, they seem to do worse on educational performance. This may be because the highest salaries are paid to 'research stars' who devote less time to enhancing undergraduate outcomes. In accordance with our expectations, institutions with a large number of degree courses, and a high ratio of undergraduates to postgraduates, perform worse on most performance measures. Likewise, universities with a higher proportion of disadvantaged students tend to perform less well, which is consistent with prior evidence that 'task difficulty' is a constraint on organizational outcomes.

The coefficients for administrative intensity are in the anticipated direction and achieve statistical significance for four of the performance measures: QR, grants, PhD performance and the student employment rate. These results lend support to our first hypothesis regarding the inverted u-shaped relationship between administrative intensity and organizational performance, and corroborate previous research (Rutherford 2016). Further analysis revealed that the tipping point for the benefits of administrative intensity to turn negative was above the mean level of intensity (0.46) for: QR funding (0.49); grants performance (0.54); and the employment rate (0.53). The tipping point for PhD performance was marginally below the mean (0.45). Overall, these results suggest that administrative intensity tends to bring a positive performance pay-off, but that above one standard deviation above the mean (0.52)

that pay-off turns negative. Seventeen universities had an average administrative intensity during the study period of 0.52 or more.

To ensure that the bureaucratic congestion effects we identify are the product of administrative rather than scale diseconomies, we tested for non-linear size effects on performance. Since we found an inverted u-shaped relationship for only one performance measure (the student continuation rate), we have some confidence that the non-linearity in the administrative intensity-performance relationship that we observe captures the phenomenon of bureaucratic overload. Nevertheless, we find linear negative relationships between administrative intensity and student satisfaction and the student continuation rate. These results suggest that students are happier with their education when resources are allocated to the front-line rather than to back-office functions.

The findings for size indicate that big universities mostly have better research performance and a higher student continuation rate, which accords with our second hypothesis. However, small universities have higher levels of student satisfaction – a finding that comports with evidence on the relationship between community size and satisfaction more generally (Mouritzen 1989). At the same time, size seems to make no difference to students' employment prospects. The sign for the task complexity coefficient is significantly negative for all three measures of research performance. However, it appears to be related to better student employment and continuation performance. Hence, we observe mixed support for our fourth hypothesis regarding the problems posed by task complexity. It is conceivable that the unexpected results here reflect the benefits of academic specialization for students. Firms which provide more differentiated products and services may be better able to target and market what they produce to a wider range of potential buyers (Porter, 1980). Universities

that provide a wider range of courses may similarly be fitting more of their students for the diverse employment opportunities in the graduate labour market.

It is possible that the relationships we observe are a product of reverse causation. To further test the robustness of the separate effects that we identify, we carried out Granger tests to ascertain whether administrative intensity, size and complexity determine performance, or vice versa. These tests revealed that there was no statistically significant relationship between the lagged performance measures and administrative intensity, organization size or task complexity. Likewise, it is possible that reverse causation is responsible for the relationship between staffing spend and QR and grant funding. Again, we carried out Granger tests, finding limited evidence of reverse causality.

In addition to carrying out these tests, we undertook further analysis to understand the extent to which administrative intensity (and its effects) may be driven by other factors that may impact performance. In particular, previous research has shown that organization size and task complexity are important determinants of administrative intensity – albeit they tend to exhibit a complex non-linear relationship with it (see Andrews and Boyne 2014; Rutherford 2016). From this perspective, it is clearly important that we include size and complexity alongside administrative intensity in our models estimating organizational performance. That said, the correlations between size, complexity and administrative intensity are comparatively small (see Appendix B), suggesting that these inter-relationships have a limited impact on our findings – something confirmed through supplementary mediation analysis (available on request).

To fully explore when bureaucracy matters for organizational performance, it is necessary to analyse the combined effects of administrative intensity, size and

complexity on performance. Table 4 shows that for QR funding, research grants and student employability the interaction between administrative intensity and organization size is positive and statistically significant, suggesting that administrative intensity enhances the positive effects of size on these measures of university performance. Administrative intensity also seems to boost performance by partially offsetting the negative effect of size on student satisfaction, but appears to make no difference to the relationship between size and PhD awards or the student continuation rate.

TABLE 4 HERE

To fully understand interaction effects it is necessary to calculate the marginal effects on the dependent variable at varying levels of the key independent variables (see Brambor, Clark and Golder 2006). Graphing the slope and confidence intervals of the marginal effects is an especially effective way to present this information. Accordingly, Figures 1-6 provide a graphical illustration of the moderating influence of administrative intensity on the relationship between size and university performance during the study period.

FIGURES 1-6 HERE

The centre line in figures 1-6 illustrates the predicted values of performance on the basis of administrative intensity and organizational size, controlling for the other variables in our model. The dotted lines represent the upper and lower

confidence intervals for those predicted values. The area above the upper bound and below the horizontal zero line indicates a statistically significant relationship. The figures offer a reasonable amount of support for our third hypothesis: there is a positive interaction between size and administrative intensity for QR performance, grants performance, NSS scores and the employment rate, but a negative interaction for the student continuation rate. Size and administrative intensity appear to have no combined effect on PhD performance.

Substantive interpretation of the figures suggests the following: i) that the size-performance relationship for QR funding and grants is enhanced by any kind of increase in the proportion of administrative staff – the point at which the lower confidence interval touches the zero line is beyond the lower range of administrative intensity; ii) that the negative relationship between size and student satisfaction is eradicated when just over fifty percent of university staff are administrative employees (about one standard deviation above the mean); iii) that size has a positive relationship with the student employment rate once administrative intensity reaches sixty percent; and, finally, iv) that administrative intensity weakens the benefits of organization size for student continuation – the point at which it eradicates those benefits is beyond the range of our data (about seventy per cet). These findings largely provide support for the idea that administrative intensity enhances the relationship between organizational size and performance. To explore whether a similar pattern of findings is observed for universities with a large number of departments, we now turn to examine the moderating influence of administrative intensity on the task complexity-performance relationship.

TABLE 5 HERE

Table 5 highlights that the interaction between administrative intensity and task complexity is positive and statistically significant for all three measures of research performance, but none of the measures of educational performance. Hence, complex universities with large numbers of administrative employees seem to have a research performance advantage over those with few administrators, confirming our argument that the benefits of a large administrative function may be especially important in organizations with a highly complex structure.

FIGURES 7-12 HERE

Figures 7-12 indicate that administrative intensity appears to moderate the negative relationship between complexity and QR, grants and PhD performance, providing strong support for our fifth hypothesis in the area of research performance. The negative complexity-performance relationship for QR and grants performance is eradicated for universities in which about forty-five percent of staff are administrative employees (nearly one standard deviation above the mean). For PhD performance, the negative effects of complexity are overturned at a similar level. For QR and grants performance, when about fifty-five percent of employees are administrative staff the relationship between complexity and performance actually turns positive. A similar pattern appears to exist for PhD performance, but the point at which the lower confidence interval touches the zero line (0.75) is beyond the range of the data. The interaction graph for the complexity-employment rate relationship indicates that from about the mean level of administrative intensity upwards (0.45), a larger

administrative function adds further value to the benefits of multiple departments for students' employment prospects.

In sum, the findings presented in figures 7-12 provide support for arguments regarding the benefits of administrative intensity for complex organizations. The results highlight that a large administrative function strengthens the research performance of complex universities. They are also suggestive of the possibility that a large cadre of administrators can make a positive contribution to the employment prospects of students beyond that attributable to disciplinary specialization within universities. Taken together, these results suggest that administrative intensity is especially valuable for complex organizations in dealing with external regulatory forces (such the RAE/REF) and external market pressures (winning research grants, recruiting PhD students, and placing their students in employment). Hence, a large central bureaucracy may help faculty members to navigate complex bureaucratic grant application processes and assist departments in the development of effective doctoral training programmes and careers advice provision.

By contrast, administrative intensity makes little difference to the link between complexity and the internal pressures associated with achieving student satisfaction and retention. It is conceivable that bureaucratic support may be redundant in these instances because they are mainly a product of the professional expertise and autonomy of teaching staff. That said, we did investigate whether there might be circumstances in which central administrative support may be especially beneficial for students by testing whether administrative intensity moderates the (largely) negative relationship between student disadvantage and outcomes. This analysis revealed that administrative intensity moderated the negative relationship between disadvantage and two measures of education performance – student satisfaction and student

continuation (results available on request). Overall, then, our results are consistent with arguments that administrative intensity is needed to 'buffer' organizations from the external environment (Meier and O'Toole 2009).

CONCLUSION

Our study suggests that administrative intensity, organization size and task complexity have statistically significant independent and combined effects on organizational performance. There appears to be a predominantly inverted u-shaped relationship between administrative intensity and the performance of UK universities. At the same time, organizational size has a largely positive relationship with performance, but the task complexity-performance relationship is somewhat more mixed. Administrative intensity enhances both the size-performance and complexity-performance relationships for certain dimensions of performance, especially those associated with research outcomes.

Overall, our findings provide support for the arguments we develop about the ways in which bureaucracy matters for big and complex organizations. In this regard, the study confirms that contingency theory continues to be a valuable approach to understanding the design of high-performance organizations (Van de Ven, Ganco and Hinings, 2013). More practically, the pattern of evidence from our analysis suggests that big and complex public organizations can benefit from devoting additional resources to administration. Our evidence therefore supports three working assumptions: (a) administrative intensity can produce positive performance outcomes, up to a certain point; (b) big organizations can benefit from a bigger central bureaucracy; and (c) universities with a large number of departments can also capture additional performance benefits by increasing investment in administrative capacity.

That said, university managers are faced with a series of complex design choices when considering the appropriate scale of administrative operations.

A heuristic for visualising the potential implications of these choices is shown in Figure 13. The figure highlights that the potential coordinative gains from increasing administrative intensity in big and complex institutions (the movements from points X to Z, and Y to W) may be offset by the more general losses associated with bureaucratic congestion *per se* (the movement from point A to B). Of course, when seeking to harness the benefits of greater administrative capacity, senior university managers also need to take into account a host of other relevant considerations, particularly external opportunities and threats.

FIGURE 13 HERE

Despite the strengths of our analysis, the limitations of our study raise questions about the ways in which bureaucracy matters for organizational performance that are worthy of further systematic analysis. Firstly, we have studied an organizational population known to have comparatively high levels of administrative intensity – higher education institutions. It would be important to investigate whether the relationships we identify here are observed in other large professional bureaucracies, such as hospitals or local governments, which are known to have smaller central bureaucracies (e.g. Andrews, Boyne, Meier, O'Toole and Walker, 2013). Secondly, our analysis is focused on only two (albeit critically important) aspects of university performance – research and teaching. Future research could examine the role that administrative intensity, size and task complexity play in shaping other important aspects of university activity, such as social innovation and

regional economic development. Finally, it is highly likely that administrative intensity may influence the relationship between other organizational factors, such as strategy, structure and process, and performance. Thus, more work needs to be conducted to uncover the full range of circumstances in which bureaucracy matters.

To sum up, our evidence shows that bureaucracy may bring important benefits for organizational performance in the public sector. Administrative intensity appears to be a burden only at above-average levels, and even then it may offer net benefits to large and complex public organizations.

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Table 1 Descriptive statistics (2005/06-2011/12)

	Mean	Min	Max	S.D.
Dependent variables				
QR/ per £1,000 academic staff spend	214.57	.49	872.46	210.02
Grants/ per £1,000 academic staff spend	417.94	4.40	2359.17	484.94
Phds/ per £1million academic staff spend	.86	.02	2.27	.58
NSS	81.77	68	92	5.38
Student employment rate	90.98	79.9	97.4	3.48
Continuation rate	91.65	80.6	98.6	3.87
Independent variables				
Administrative Intensity	.46	.34	.66	.06
Total staff	2963.47	340	9610	1866.77
Departments	18.89	6	29	4.72
Control variables				
Total expenditure per head of staff *(£'ooos)*	59.42	33.22	100.07	12.98
Budget surplus *(£'ooos)*	4539.80	-10237	36021	7378.80
Students from disadvantaged groups	10.23	2.4	25.7	5.37
% academic staff (teaching only)	24.19	0	75.19	17.63
% academic staff (research only)	15.09	0	63.25	15.22
% technical support staff	6.37	2.16	14.28	2.33
Degree courses	90.96	24	184	31.02
Undergraduate/ postgraduate ratio	3.83	.72	14.88	2.14
Old/New Universities	.47	0	1	.50

Table 2 Correlations for SUR models

	QR performance	Grants performance	PhD performance	NSS	Employment rate
Grants performance	.56				
PhD performance	.47	.20			
NSS	.13	.22	.01		
Employment rate	.01	.07	-.03	.23	
Continuation rate	.16	.10	.10	.31	.31

Table 3 Administrative intensity, size, complexity and performance

Independent variable	QR performance	Grants performance	PhD performance	NSS	Employment rate	Continuation rate
Administrative intensity	2182.305**	1892.513*	9.2761**	-5.6771+	55.7482*	-7.2083**
	(534.925)	(1023.772)	(2.3893)	(3.1720)	(24.8107)	(2.3878)
Administrative intensity^2	-2251.298**	-1743.844+	-10.3672**	---	-54.7482*	---
	(572.943)	(1089. 218)	(2.4412)		(25.7980)	
All staff	.0266**	.0863**	.00003	-.0004*	.0002	.00046**
	(.004)	(.0086)	(.00002)	(.0002)	(.0002)	(.0001)
Departments	-2.6604**	-2.8610+	-.0199**	.0077	.1289**	.0678*
	(.866)	(1.6456)	(.0056)	(.0514)	(.0384)	(.0345)
Budget surplus	-.0004	-.0015	-1.32E-06	-6.83E-06	-5.81E-06	.00002
	(.0004)	(.0013)	(1.78E-06)	(.00003)	(.00002)	(.00002)
Students from disadvantaged groups	-1.4058**	3.5229**	-.0099**	.0419	-.0718*	-.1880**
	(.4439)	(1.0626)	(.0031)	(.0350)	(.0338)	(.0288)
Expenditure per head of staff	.1018	2.2655**	.0020	-.1301**	-.0950**	-.0627**
	(.2833)	(.6221)	(.0017)	(.0221)	(.0154)	(.0143)
% academic staff (teaching only)	.2522	.5940+	.0020*	-.0193	-.0190+	-.0075
	(.1623)	(.3164)	(.0010)	(.0115)	(.0100)	(.0099)
% academic staff (research only)	6.3538**	21.456**	.0070**	.1702**	.0478*	-.0940**
	(.5110)	(1.0444)	(.0028)	(.0267)	(.0201)	(.0205)
% technical support staff	1.883	8.0566**	-.0172*	.1365	-.0145	-.1078
	(1.3979)	(3.1044)	(.0084)	(.0920)	(.0680)	(.0785)
Number of degree courses	-.9928**	-2.8461**	.0024**	-.0094	-.0263**	-.0232**
	(.1753)	(.4119)	(.0010)	(.0103)	(.0071)	(.0063)
Undergraduate/	-2.8610**	.3967	-.0132*	-.4074**	-.1459*	-.0374
postgraduate ratio	(.9452)	(1.9639)	(.0068)	(.0829)	(.0702)	(.0561)
Old university	174.3479**	124.9891**	.6498**	3.9656**	.8717+	1.3451**
	(10.0981)	(18.5437)	(.0548)	(.5324)	(.4650)	(.4159)
Constant	-417.3224**	-632.494**	-1.4090*	92.5204**	82.3810**	100.4524**
	(118.8999)	(230.7927)	(.5694)	(1.8774)	(6.0081)	(1.5365)
Chi^2-statistic	6842.40**	8032.34**	1461.01**	684.28**	422.48**	872.76**
R^2	.923	.933	.718	.543	.424	.603
N	575	575	575	575	575	575

Note: significance levels: +p ≤ 0.10; *p ≤ 0.05; **p ≤ 0.01 (two-tailed test). Standard errors in parentheses. Coefficients for year dummies not shown.

Table 4 Administrative intensity x size and performance

	QR performance	Grants performance	PhDs performance	NSS	Employment rate	Continuation rate
AI x S	.0990**	.2327**	.00003	.0047**	.0025**	-.0006
	(.0244)	(.0538)	(.0001)	(.0013)	(.001)	(.0008)
Chi^2-statistic	7075.79**	8360.63**	1461.33**	707.47**	431.96**	873.73**
R^2	.925	.936	.718	.552	.429	.603
N	575	575	575	575	575	575

Note: significance levels: +p $\leq$ 0.10; *p $\leq$ 0.05; **p $\leq$ 0.01 (two-tailed test). Standard errors in parentheses. All equations include the variables shown in Table 3.

Table 5 Administrative intensity x complexity and performance

	QR performance	Grants performance	PhDs performance	NSS	Employment rate	Continuation rate
AI x C	30.4084**	67.0459**	.1500**	.7895	.4015	-.1843
	(8.7551)	(18.8715)	(.0533)	(.5973)	(.5953)	(.4045)
Chi^2-statistic	6973.63**	8193.67**	1492.52**	688.35**	423.91**	873.32**
R^2	.924	.934	.722	.545	.424	.603
N	575	575	575	575	575	575

Note: significance levels: +p $\leq$ 0.10; *p $\leq$ 0.05; **p $\leq$ 0.01 (two-tailed test). Standard errors in parentheses. All equations include the variables shown in Table 3.

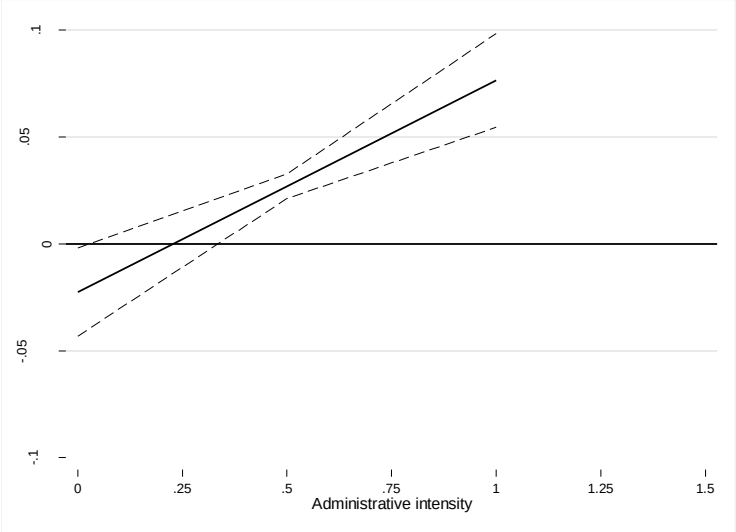


Figure 1 Marginal impact of size on QR performance contingent on administrative intensity

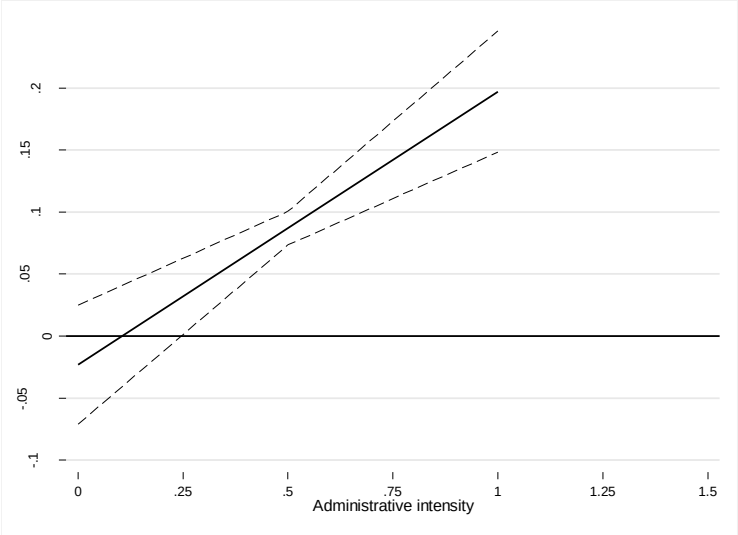


Figure 2 Marginal impact of size on grants performance contingent on administrative intensity

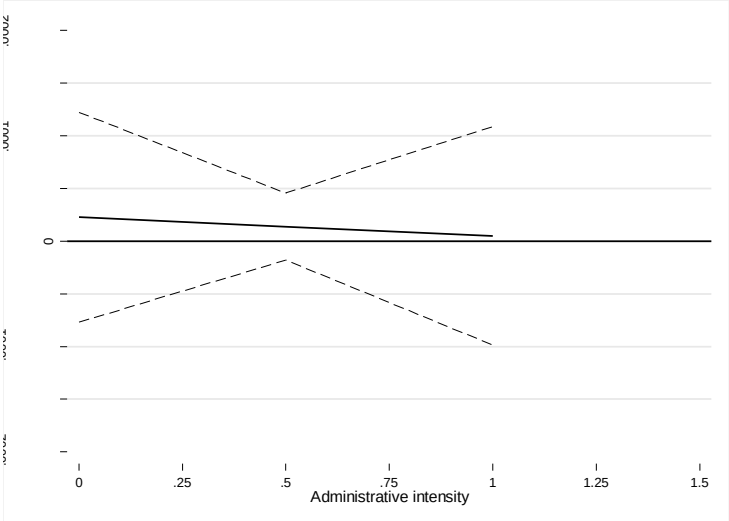


Figure 3 Marginal impact of size on PhD performance contingent on administrative intensity

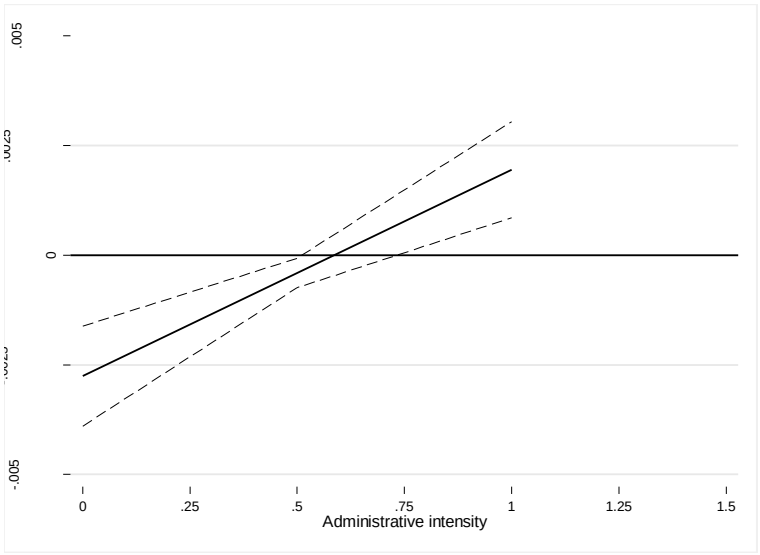


Figure 4 Marginal impact of size on NSS contingent on administrative intensity

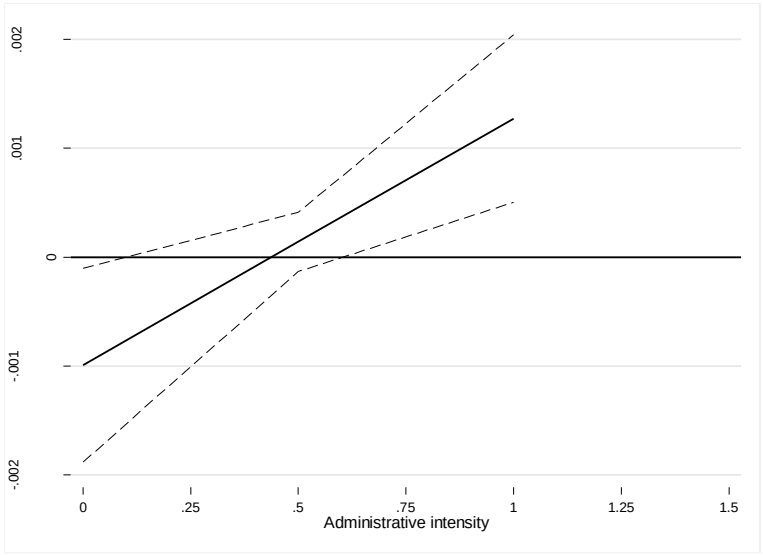


Figure 5 Marginal impact of size on employment rate contingent on administrative intensity

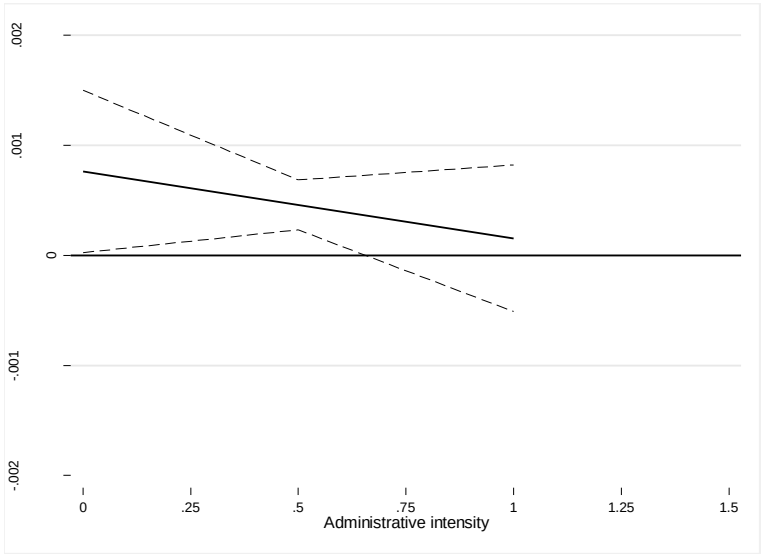


Figure 6 Marginal impact of size on continuation rate contingent on administrative intensity

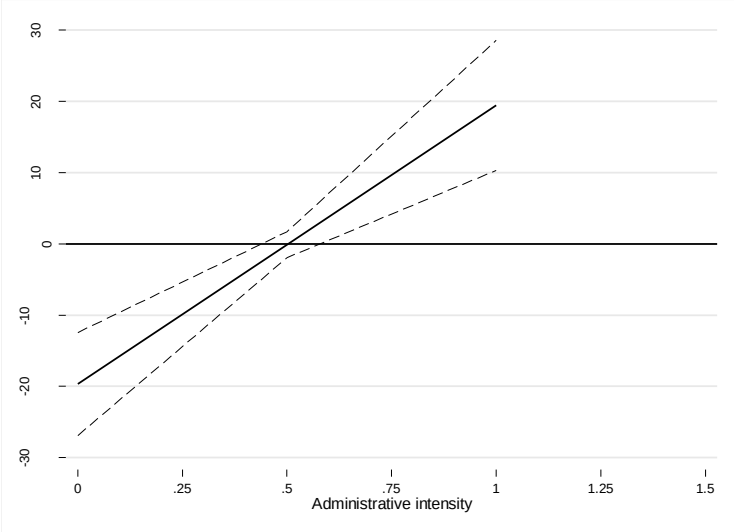


Figure 7 Marginal impact of departments on QR performance contingent on administrative intensity

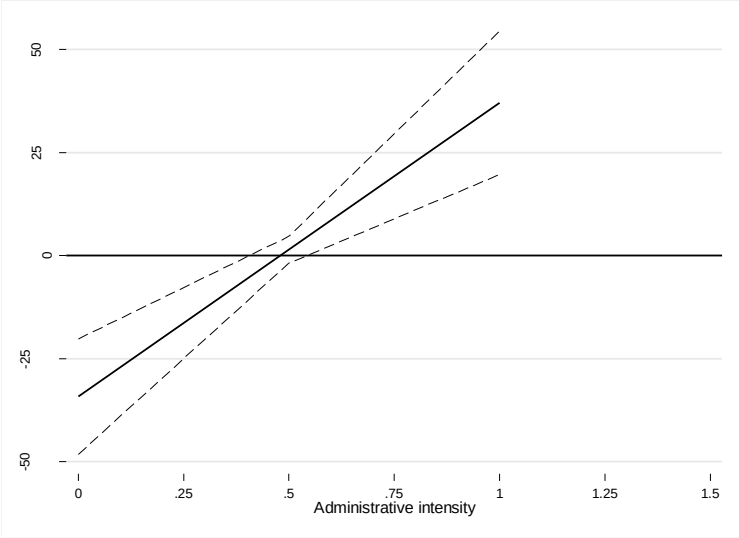


Figure 8 Marginal impact of departments on grants performance contingent on administrative intensity

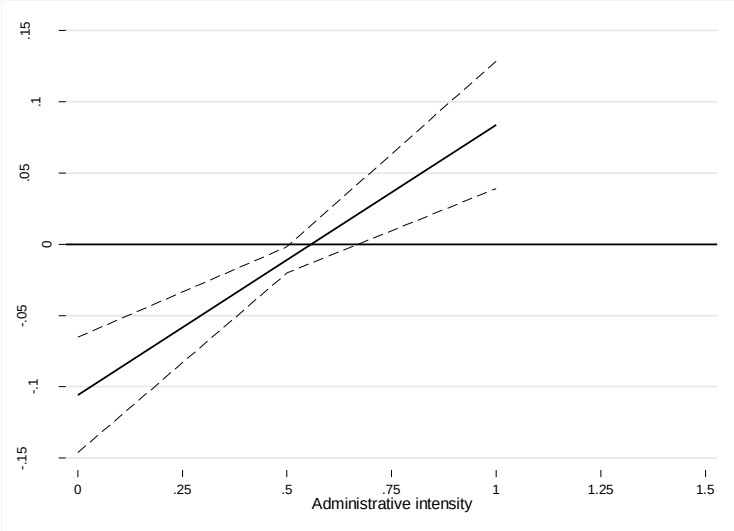


Figure 9 Marginal impact of departments on PhD performance contingent on administrative intensity

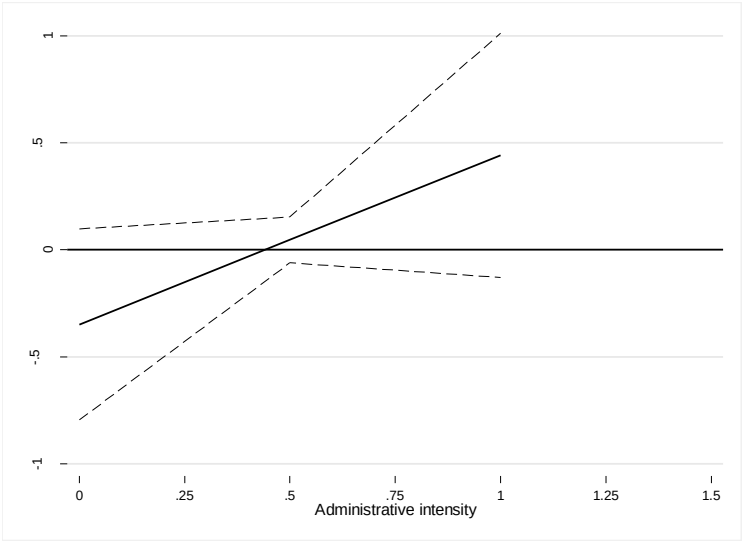


Figure 10 Marginal impact of departments on NSS contingent on administrative intensity

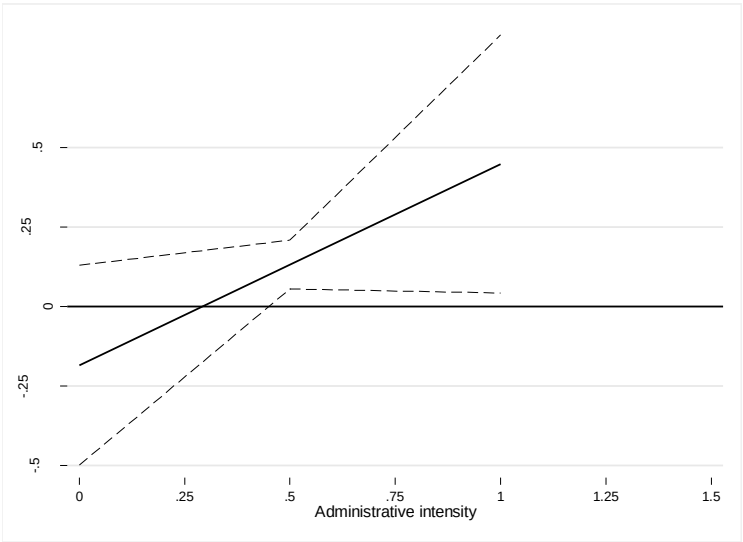


Figure 11 Marginal impact of departments on employment rate contingent on administrative intensity

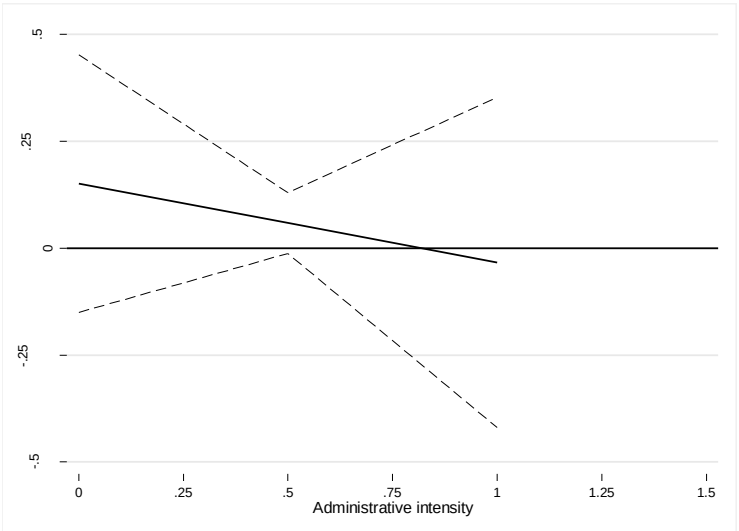
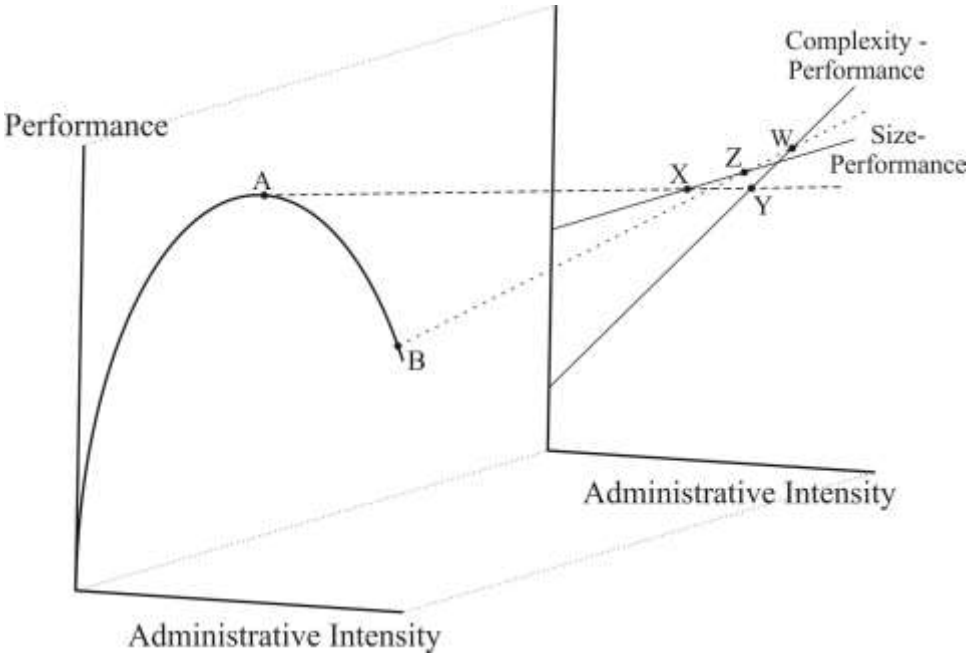


Figure 12 Marginal impact of departments on continuation rate contingent on administrative intensity

Figure 13 Model of the high-performing organization



Appendix A Academic cost centres in UK universities (incl. HESA coding)

01 Clinical medicine
02 Clinical dentistry
03 Veterinary science
04 Anatomy & physiology
05 Nursing & paramedical studies
06 Health & community studies
07 Psychology & behavioural sciences
08 Pharmacy & pharmacology
10 Biosciences
11 Chemistry
12 Physics
13 Agriculture & forestry
14 Earth, marine & environmental sciences
16 General engineering
17 Chemical engineering
18 Mineral, metallurgy & materials engineering
19 Civil engineering
20 Electrical, electronic & computer engineering
21 Mechanical, aero & production engineering
23 Architecture, built environment & planning
24 Mathematics
25 Information technology & systems sciences & computer software engineering
26 Catering & hospitality management
27 Business & management studies
28 Geography
29 Social studies
30 Media studies
31 Humanities & language based studies
33 Design & creative arts
34 Education
35 Modern languages
37 Archaeology
38 Sports science & leisure studies
41 Continuing education

Appendix B Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. QR																	
2. Grants	.93**																
3. Phds	.84**	.72**															
4. NSS	.63**	.58**	.54**														
5. Student employment rate	.36**	.33**	.26**	.35**													
6. Continuation rate	-.31**	-.39**	-.27**	-.16**	-.12**												
7. Administrative intensity	-.04	-.00	-.09*	-.24**	-.06	-.04											
8. Total staff	.71**	.80**	.53**	.39**	.25**	-.59**	.04										
9. Departments	.22**	.31**	.14**	.11**	.14**	-.58**	-.16**	.58**									
10. Total expenditure	.36**	.46**	.26**	.09*	-.20**	-.37**	.16**	.36**	.21**								
11. Budget surplus	.26**	.28**	.20**	.21**	-.00	-.23**	.01	.38**	.18**	.20**							
12. Disadvantaged students	-.63**	-.56**	-.55**	-.35**	-.33**	.25**	-.19**	-.46**	-.11**	-.24**	-.15**						
13. % teaching only staff	-.18**	-.27**	-.08+	-.10*	-.03	.34**	.27**	-.27**	-.33**	-.50**	-.10*	.09*					
14. % research only staff	.91**	.94**	.70**	.57**	.34**	-.43**	-.08+	.80**	.37**	.45**	.29**	-.59**	-.33**				
15. % technical support staff	.50**	.58**	.32**	.31**	.22**	-.31**	-.21**	.57**	.45**	.30**	.15**	-.28**	-.44**	.62**			
16. Degree courses	.35**	.40**	.33**	.20**	.15**	-.62**	-.11**	.72**	.76**	.17**	.23**	-.23**	-.28**	.47**	.48**		
17. UG/PG ratio	-.47**	-.41**	-.44**	-.42**	-.21**	.34**	.06	-.38**	-.03	-.17**	-.20**	.40**	.10*	-.42**	-.19**	-.22**	
18. Old/New Universities	.86**	.73**	.81**	.63**	.32**	-.27**	-.13**	.51**	.16**	.25**	.20**	-.55**	-.08*	.74**	.33**	.31**	-.44**

Note: significance levels: +p ≤ 0.10; *p ≤ 0.05; **p ≤ 0.01 (two-tailed test).