



# **Strategies For Sustaining Growth Of Income From Knowledge Exchange Across Higher Education Institutions (HEIs) In The UK**

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# Acknowledgements

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## Non-technical summary

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- Public incentives for knowledge exchange (KE) seek to develop academic engagement, remove obstacles to collaboration, and embed a culture of enterprise across the HE sector. KE activities are also a source of income for HEIs and reached £3.57bn in 2012-13.
- There are seven streams of recorded income from Knowledge Exchange (KE) between universities and business: consultancy, contract research, continuing professional development, facilities and equipment, intellectual property income, collaborative research with business, and regeneration income. The latter three are either highly volatile or subject to availability of public funds, so this report focusses on the first four over the six years from 2007 to 2013.
- This report offers new evidence on the patterns of and reasons for sustained growth of KE income across HEIs in the UK. More and better evidence of the benefits of academic activity outside academia is continuously needed by policy makers to justify the presence of dedicated incentives for KE activities, but evidence of progress may also be of use for the purpose of allocating these funds.

### Key findings include:

- Most HEIs actively manage their KE portfolio growing some elements and depleting others. However, the ability of HEI managers to pursue a particular strategy depends on them having enough resources available – endowment, capital, staff -- together with facing sustained demand to ensure continued growth.
- HEIs engaged in broader KE activities are better positioned to re-deploy and focus resources for optimal growth. However, a balance between diversification and specialisation tailored to the advantages of the HEI will achieve higher than average growth.
- Smaller HEIs with broader KE portfolios have been more likely to growth KE income than their larger scale counterparts over the last six years. However, specialist HEIs are unlikely to fully catch-up with the broader ones in terms of total KE income drawn.
- For all HEIs, sustained growth provides a chance for catching up on others who are just ahead of them. This means that the distribution is stable but not static.
- Features other than scale and size are at work in explaining KE income growth, and larger HEIs may find it difficult to grow as they are potentially at full capacity.
- Competition across HEIs for income from the more prevalent KE activities, such as consultancy and CPD is increasing. Specialising in these activities brings KE income in but does not bring as much growth above average as a strategy of not specialising.
- No single strategy stands out as best for all HEIs, but those that have resources and demand to hold a diverse portfolio of KE are more likely to grow income in the medium run as well as to above the average.

## Introduction

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This report analyses patterns of and reasons for sustained growth of Knowledge Exchange (KE) income across British HEIs in recent years. The exchange of knowledge between universities and the wider economy and society encompasses a wide variety of activities, some of which are easier to observe (and count) than others. Many before us have offered accounts of the partial coverage provided by commercial outputs such as spin-outs or patents, both because HEIs offer multiple other services that have benefits outside academia<sup>1</sup> but also because technology transfer activities are the remit of a small proportion of academics<sup>2</sup>, while most academics engage in KE activities that are people based but, as a result, difficult to count and monitor.

Acknowledging the partiality of any system for monitoring KE does not exempt managers and funders of these activities from assessing progress from these investments. Moreover, from a public funders' point of view it is difficult to argue for dedicated funds and resources to be allocated to KE without evidence, however partial, of the benefits that such investments bring about. In this report we add to the incipient but rapidly growing evidence underpinning a dedicated funding stream for KE activities with two new approaches. First, we focus on sustained KE income growth over six years, thereby following over the medium term the value of KE for those who have paid for it. Second, we use cumulative growth as the variable of interest, thus treating all HEIs equally and individually, regardless of scale or specialism throughout the whole UK HE sector.

In continued evaluation reports HEFCE has progressed our understanding of the governance of KE within institutions through case studies and surveys<sup>3</sup>. These studies contribute a fuller picture of how the levels of KE are distributed across HEIs and what difference these activities make HEIs. In their annual monitoring statements, HEIs identify key achievements of HEFCE KE funding across a wide range of activities, with a majority (53% of 99 returns) citing "student enterprise and entrepreneurship activity" as an achievement, followed by "strengthening internal capability" cited by 45% of returns. Despite their widespread incidence, neither of these activities have a direct proxy in KE funding. Interestingly, "products and research commercialisation" are cited as achievements as often as "continuing professional development and short courses", 38%<sup>4</sup>.

This diversity of perceived benefits illustrates the difficulties with monitoring the outcomes of KE funding on behalf of the funders. For example, while it is possible to count student start-ups, not all turn into successful companies; participation in courses gives an idea of volume or take-up but not of learning outcomes and productivity potential for employers. Networking and events are often mentioned as a vital part of developing relationships and such achievements are cited by 22% of returns above but – to date – no satisfactory indication of how to quantify these has been proposed.

The majority of quantitative evaluations to date have exploited the cross-sectional variation in the levels of KE income, seeking to associate these levels of income (some of which is direct public funding) with the presence of resources for KE activities in that HEI and to the presence of outcomes (which cannot be exclusively attributed to any single income stream)<sup>5</sup>. A common finding in these studies is that the larger scale or more research intensive HEIs are also more likely to display higher levels of KE income, and more likely to receive incentive funding based on income. These findings reflect commonalities in the skewness of the distributions of scale, research intensity and KE income rather than explain why they are skewed<sup>6</sup>.

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<sup>1</sup> OECD report "Commercialising Public Research: New Trends and Strategies" (2013). [www.oecd.org/sti/sci-tech/commercialising-public-research.htm](http://www.oecd.org/sti/sci-tech/commercialising-public-research.htm);

Ulrichsen (2014) "Knowledge exchange performance and the impact of HEIF in English higher education institutions" [www.hefce.ac.uk/pubs/rereports/year/2014/keheifimpact/](http://www.hefce.ac.uk/pubs/rereports/year/2014/keheifimpact/)

<sup>2</sup> Hughes and Kitson (2012) "Pathways to impact and the strategic role of universities", forthcoming Cambridge Journal of Economics.

<sup>3</sup> [www.hefce.ac.uk/whatwedo/kes/strat/keresearch/](http://www.hefce.ac.uk/whatwedo/kes/strat/keresearch/)

<sup>4</sup> For a full list see Figure 5.1 in Ulrichsen (2014) op cit.

<sup>5</sup> See Ulrichsen (2014) op cit and Rossi and Rosli (2013) <http://eprints.bbk.ac.uk/8476/>

<sup>6</sup> The large economies of the G8 likely draw a larger volume of foreign direct investment than the smaller ones overall but this may just mean they are large, not that they are more attractive to foreign investors.

The levels of KE income display a highly unequal distribution, with most KE income concentrated in a few larger scale HEIs. This observed concentration of KE income is further reinforced by the finding that the best determinant of KE income is its own past level, that is, it is highly persistent or sticky<sup>7</sup>. Concentration and persistence may give the false impression that there is limited variation in KE activity across HEIs and limited scope to induce mobility in the relative position or ranking of HEIs. Income mobility is however enabled through sustained growth, and growth patterns need not reflect scale or be skewed. This report explores patterns of sustained growth across HEIs in the UK to provide a view of KE activity that can be used alongside but counters the tendency of levels to lead to concentration and immobility. We demonstrate diverse growth patterns in KE income across HEIs and suggest a conceptual way of linking this diversity to institutional strategies for KE income accumulation.

This analysis based on income growth may prove a useful complement to those of levels when aligning policy actions to its objectives: the current allocation of public funding to HEIs for KE reinforces the current distribution of levels through concentration among those who are already doing well (albeit with a limit imposed by a funding cap for a certain proportion of HEIs). This strategy is perfectly legitimate for the objective of maximising KE income overall, as it rewards growth on larger bases more, but it tends to perpetuate the status-quo. From a systems point of view, there is also an argument for weighing the additional or marginal effects of incentivising those who are already doing well against those who could do better with more help.

Previous work on the direct associations between inputs and outputs of KE across HEIs give a sense of the immediate effects of KE funding (public and not) but qualitative studies also provide enough evidence of longer term strategies for KE management, which should reflect better in sustained growth than in levels of income or spot one-year changes. In addition, sustained growth purges away the bias in scale that is present in analyses of levels, and, as we show below, allows for a clearer illustration of the breadth of KE as a contributor to income growth across the sector.

Even though continued growth can lead to mobility up and down current positions, it is important to acknowledge at the outset that the specialist HEIs are unlikely to fully catch-up with the larger multi-disciplinary ones in terms of total KE income<sup>8</sup>. And yet for all HEIs, sustained growth provides a chance for catching up on others who are just ahead of them. Because of the longer timescales applicable to teaching and research outcomes, HEIs plan for the long-term more than other service organisations, so a strategy for KE is embedded in their mission<sup>9</sup>. The increased funding for KE activity and the move from competitive to formula-based funding to support longer term strategies carry a need to demonstrate the presence of a KE strategy within institutions, as well as a better understanding of the governance of knowledge exchange<sup>10</sup>.

Funding bodies do not seek to influence the internal governance of autonomous HEIs and limit their monitoring to following funding inputs, and some observable economic and social outputs, leaving the specific mechanisms by which these public resources are managed to the autonomy of institutions. However, public incentives for KE are not just a credit line for “buying outputs”, they seek to develop academic engagement, remove obstacles to collaboration and embed a culture of enterprise across the HE sector. These enabling structures are intangible and thus more difficult to capture in specific measureable outputs but are still being assessed through qualitative indicators of strength of incentives and obstacles as perceived by the HEI<sup>11</sup>.

With this paper we provide a view of internal strategies as reflected in the growth in income for specific areas of KE. This gives a longer term and sustained view of KE activity as captured by income growth, without having to specify the nuances of what activities are recorded or not under each KE income stream. In so far as income is what users have paid for the relevant KE services, it provides a reflection of the value attached to them by the customers, and where this value is growing sustainably for different types of services, it reflects a dynamic KE sector, responsive to external demand.

<sup>7</sup> Ulrichssen (2014) op cit.

<sup>8</sup> The larger HEIs are around ten times the scale of the smaller ones, most of which as specialist HEIs. Not only the growth rates needed to become 10 times larger are disproportionate but also 10 times would only be enough if target did not move, but the larger HEIs continue to grow as the others try catch-up.

<sup>9</sup> [www.hefce.ac.uk/media/hefce/content/whatwedo/knowledgeexchangeandskills/heif/HEIF11-15-FullReport.pdf](http://www.hefce.ac.uk/media/hefce/content/whatwedo/knowledgeexchangeandskills/heif/HEIF11-15-FullReport.pdf)

<sup>10</sup> Kitagawa and Lightowler (2012) “Knowledge exchange: a comparison of policies, strategies and funding incentives in English and Scottish higher education” Research Evaluation. OUP.

<sup>11</sup> See e.g. part A of the Higher Education Business and Community Interactions survey ([www.hefce.ac.uk/whatwedo/kes/measureke/hebci/](http://www.hefce.ac.uk/whatwedo/kes/measureke/hebci/))

We find that, once we control for the breadth of sources of income and for the availability of research staff, the overall scale of the HEI is not a significant driver of sustained KE income growth. Smaller HEIs with a broad KE activity base are as likely to grow as the larger scale counterparts. This is partially because those HEIs that start from low KE income levels have been growing faster, and thus catching up with their immediate competitors. This may be a reflection of capacity constraints among the larger HEIs but also of capacity restraint imposed by a funding cap present for some but not all in sample. This dynamic repositioning is found to match with competition across the system for the more popular research resource intensive activities. While growing any KE activity is good for absolute growth, growing the more popular and easier to manage elements, e.g. Consultancy, faces competition from everywhere, pushes up growth on that element in general but reduces the relative growth of any HEI with respect to the average.

While in absolute terms, broad growth of KE aids performance for all HEIs, in relative terms (relative to other HEIs) and over the medium run, they must and do strike a balance between diversification and specialisation that allows them to grow sustainably over time.

## The HE-BCI survey and KE income

Coinciding with the allocation of a dedicated funding line for incentivising knowledge exchange in the late 1990s, the Higher Education Business and Community Interactions (HE-BCI) survey was developed to set a baseline and monitor trends in KE. By 2003-04<sup>12</sup> the survey became a condition of grant, that is, a formal requirement for HEIs to complete so that it could be used to inform formulaic allocations by funders, which improved its completeness and robustness<sup>13</sup>. The survey records quantitative and qualitative elements of knowledge exchange but this report uses only KE income drawn from a selection of components<sup>14</sup>.

Of the seven streams of income collected in the survey we exclude three. Collaborative research and Regeneration income are regarded as less responsive to external demand and somewhat more to availability of public funds for partnerships. Income from Intellectual Property can be very volatile and less as a result of long term strategies and its cumulative growth can be misleading if income fluctuates unpredictably. Thus the analysis here includes strategies for growing KE income from Consultancy, Contract Research, Continuing Professional Development and Facilities and Equipment. Together these elements accounted for 66% of KE income in 2012/13.

In the cross-section of HEIs, there is significant variation in the levels and proportions of income from each of these four elements demonstrating that not all institutions concentrate in the same income sources. In **Figure 1** HEIs are sorted by the size of Contract Research income levels in cash terms<sup>15</sup>. It is apparent that HEIs which specialise in this element are less likely to have a large CPD component in the KE income; that is, the cross-sectional correlation between Contract Research income and CPD income in the UK is negative. This can be readily seen by observing that the blue section thins down as the green section thickens, with few exceptions. No such a clear pattern of negative correlation is observed for the other two components<sup>16</sup>.

Academic activities in HEIs are often (over) simplified as being either 'Teaching' or 'Research' related despite the fact that HEIs tend not to acknowledge such silos. Of the selected indicators, it may be reasonable to suggest that Contract Research is more linked to research intensity while CPD is akin to a teaching intensive activity. Consultancy is carried out across the academic spectrum and facilities may be linked to research (such as a particle accelerator) or teaching (such as physiotherapy teaching facilities also used by local hospitals) so they are both largely independent of specialism.

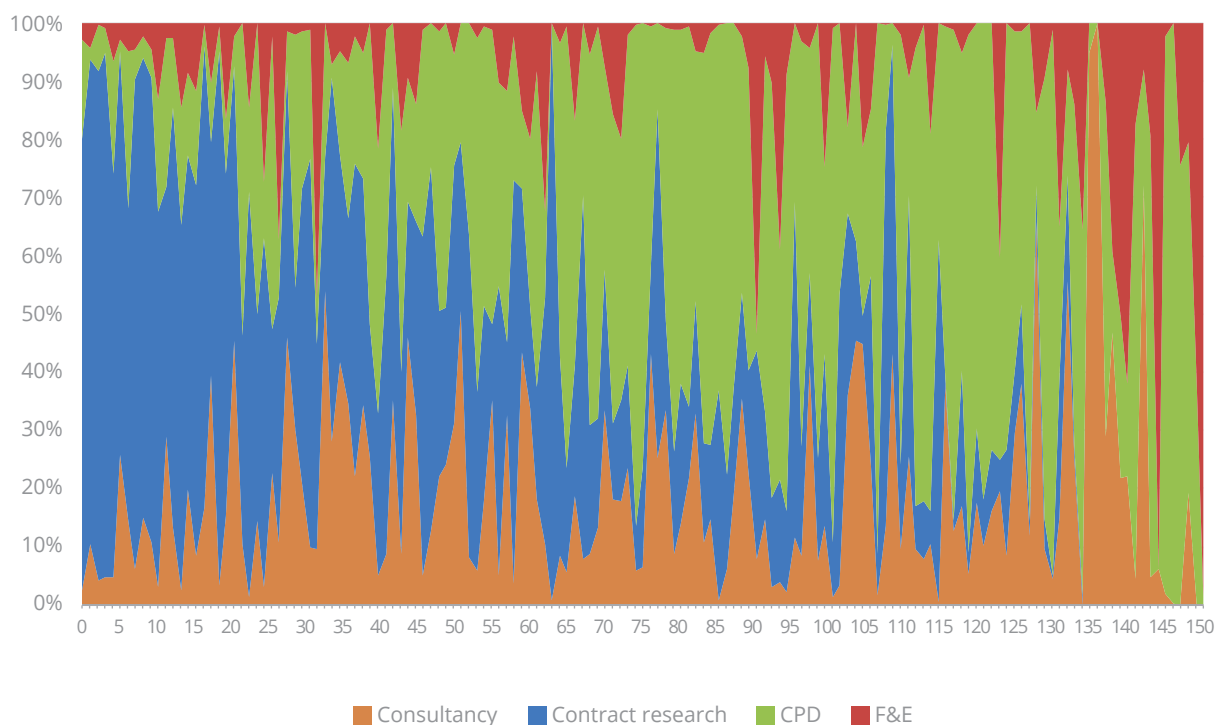
<sup>12</sup> Scotland did not require completion of HE-BCI until 2010-11

<sup>13</sup> A full evaluation of the developments in KE funding is available here [www.hefce.ac.uk/pubs/year/2009/200915/name,63809,en.html](http://www.hefce.ac.uk/pubs/year/2009/200915/name,63809,en.html)

<sup>14</sup> Current and past surveys area available online; link in footnote 9.

<sup>15</sup> Excluded due to a lack of data are Rose Burford College; Royal Conservatoire of Scotland; London Business School; The School of Pharmacy; SRUC; Heythrop College; The Liverpool Institute for Performing Arts and the Leeds College of Art

<sup>16</sup> The actual Pearson correlations between the proportions of Contract Research with Consultancy, CPD and Facilities and Equipment were -0.27, -0.74 and -0.13 in 2012/13. They are negative because when proportions in one increase, they have to decrease in others.



**Figure 1:** Relative weight of each KE income component in 2012/13 across 149 HEIs.

It is apparent that the observed relative specialisation in KE income streams ought to reflect the presence of resources and internal decisions as to the use of these resources, perhaps even strategies related to the wider institutional mission. It follows that the impact of teaching or research resources on total KE income ought to be confounded by which elements of KE are more prevalent; whether research or teaching resource intensive, or both. We exploit this dependency in the subsequent analysis: we first examine the pattern of total KE income growth and which elements have been contributing to that growth over the last six years; we then link the growth of KE total to the research and teaching related resources available to the HEI.

## Methodology

While experimental for KE, income decomposition is a common method used for describing system dynamics in economics. Cross-country studies seeking to clarify what makes some countries grow faster than others in the long run decompose the growth of GDP per capita into capital and labour inputs plus an unexplained factor often called total factor productivity<sup>17</sup>. Studies of the distribution of household income seek to understand what makes some households richer than others by separating what sources of income (wages, endowment, assets) are more prevalent in explaining total household wealth<sup>18</sup>.

We adapt the above techniques to separate the relative importance of KE income components in explaining growth in total income over the last six years. Longer time series could be considered but the last six years coincide with a change in the allocation of institutional funding, therefore enabling us to interpret changes in income as stemming from strategy as well as opportunity. We also test the validity of the analysis by splitting the six years into pre and post said change in 2009/10.

<sup>17</sup> See e.g. Corry et al 2011 "UK Economic Performance since 1997: Growth, Productivity and Jobs" CEP – LSE [http://cep.lse.ac.uk/conference\\_papers/15b\\_11\\_2011/CEP\\_Report\\_UK\\_Business\\_15112011.pdf](http://cep.lse.ac.uk/conference_papers/15b_11_2011/CEP_Report_UK_Business_15112011.pdf)

<sup>18</sup> Brewer and Wren-Lewis (2011) "Why did Britain's households get richer? Decomposing household income growth between 1968 and 2008-9. IFS. [www.ifs.org.uk/bns/bn125.pdf](http://www.ifs.org.uk/bns/bn125.pdf)



**Figure 2:** Correlation between HEI scale (KE Income in horizontal axis) and KE Income growth (vertical axis).

To illustrate what using growth instead of volume adds to the analysis, consider the relationship between of KE income growth and the level of KE income as depicted in **Figure 2**. A slight upward sloping linear trend could be fitted, but the coefficient would be 0.00000002, so the correlation between scale of KE income and growth in it is essentially nil<sup>19</sup>. That is, we cannot say that larger HEIs are more likely to experience sustained growth in KE income than the smaller scale HEIs. Admittedly, larger scale HEIs may find it more difficult to grow as they are potentially closer to full capacity, but equally, and judging from the data below, smaller scale HEIs are also not at an advantage for experiencing sustained growth, either. This opens the possibility that features other than scale are at work in explaining KE income growth.

In so far as drawing income from one or another type of KE activity (e.g. consultancy) is as a result of an opportunity (the presence of sufficient demand for that service outside the HEI), a closer look at which components of KE income matter more its growth, or even if any element is being depleted, gives information about a strategy within the HEI. We proceed with detail on how the total growth splits into (or stems from) each of the four demand-led components of KE income selected between 2007/8 and 2012/13.

In the same way as total income is the sum of its components, the growth in income is also a sum of the growth of components, but weighted by the importance of that component in the initial year (see Appendix 1). To illustrate this the Figure in Appendix 2 plots actual cumulative growth for Consultancy, Contract Research, Continuing Professional Development and Facilities & Equipment. Some add up to more than 100% because these are un-weighted, but it is clear that not all HEIs have been growing all elements of KE, and whether one or more elements is being grown or depleted continuously over six years it implies a purpose or a need (led by demand) to change the composition of KE in the HEI.

<sup>19</sup> This result is not new, the absence of a correlation between initial size and growth has been reinforced in multiple tests of Gibrat's law for incomes, firms and cities.

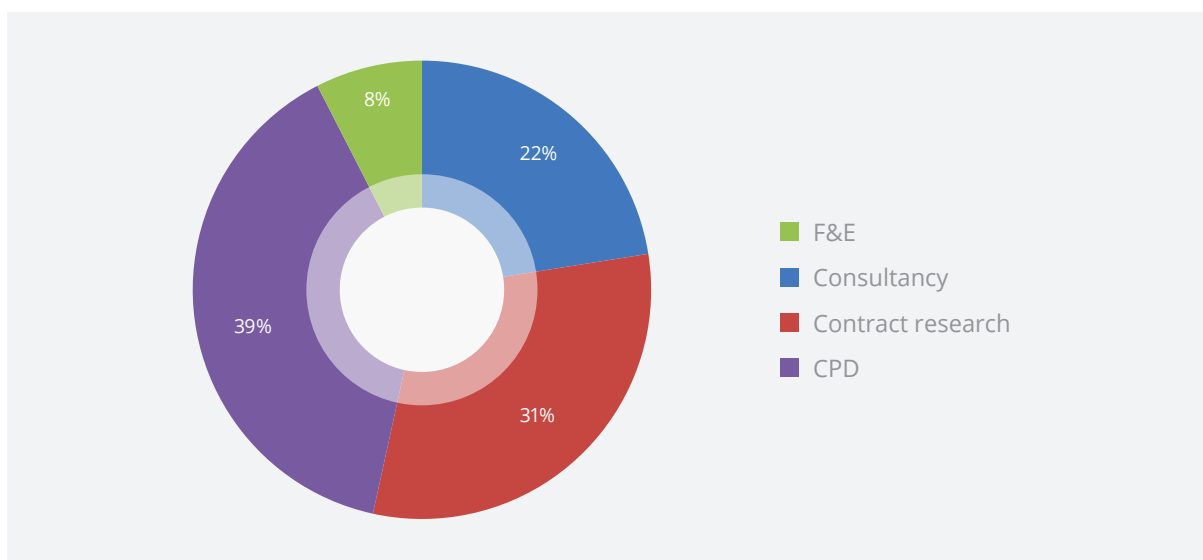


What makes some HEIs continuously grow some components and deplete others? We suggest that whatever we observe KE income doing is the result of some internal decision making, and where these choices result in cumulative change over 6 years, they reflect longer term strategy better than spot (one-year only) choices. The reasoning underlying this interpretation is as follows: when an opportunity arises for a HEI to increase one of the four KE services considered, managers have to decide whether to take the opportunity up – with implications on resources – or not. In doing so, we imagine, they take into account availability of resource in the HEI to dedicate to this service and sustainability of demand for this service. We do not observe internal decision-making but we do observe the result of that decision which balances opportunity and strategy in KE income accumulation for each HEI. We next use this argument to cluster HEIs according to a special view of “strategy”.

## Strategies for optimising KE income accumulation

To establish whether any HEI could be growing KE income faster than they actually are, we assess the “goodness” of their implicit strategy in comparison with a created counterfactual. When KE management faces a new opportunity, they are bound by their current situation in KE components. When the opportunity arises the decision is only whether or not to change the composition of KE income, i.e. grow some elements and possibly deplete others.

Appendix 1 shows that total KE growth is a weighted average of the growth of each component. KE managers can decide on the growth of each component (within demand restrictions) but cannot change the relative weights of components at the starting point. We therefore create a counterfactual for each HEI that shows their strategic choices of growth rates for KE components, but fitting this strategy to the ‘average HEI’. The average is calculated by attaching to each component in each HEI the average weight in the initial year and the growth rate of that HEI for each component. The average weights do not vary, they are always 22% for Consultancy, 31% for Contract Research, 39% for CPD and 8% for F&E; but the counterfactual average is a variable that reflects each HEI’s unique strategy of growing or depleting KE components over the next six years. The counterfactual average tells us how well this strategy would have worked for a HEI with the weights equal to the average. If the choice of growth strategy is better suited for the real HEI, the total growth of KE achieved over six years will be higher than what ‘average HEI’ would have achieved. The reverse is also true: if the strategy was not well suited to this HEI then it will achieve lower total growth than the average.



**Figure 3:** Average weights in 2007/8

A HEI may have started with higher or lower weights than the average but what is true for all is that the weights add up to 100%. This is important because by using this comparison we ensure that all HEIs will have at least one component that is higher than the average and this indicates a certain comparative advantage that could be exploited to design optimal KE growth strategy<sup>20</sup>.

In Appendix 1 we show that HEIs that grow faster than the average are those that develop elements of KE on which they are above average to start with. That is, an efficient strategy for growing KE income is to specialise more in those elements that are stronger than the average, or alternatively, to deplete elements that are below the average.

- HEIs with an initial weight of one component, say contract research, higher than the average - 31%, have a comparative advantage in that service. If these HEIs continue to grow this element they comply with the two conditions shown in the appendix to aid above average growth, namely, an advantage on weight and positive growth of that element. Conversely, growing elements where the HEI has a weight disadvantage puts a drag on growth above the average.
- The reciprocal arguments hold for the case in which HEIs choose to deplete KE elements. Depleting those on which they had a weight advantage has the effect of slowing KE growth in relation to the average. Conversely, drawing resources away from KE elements that are not as prevalent as the average improves KE growth, compared to the average.

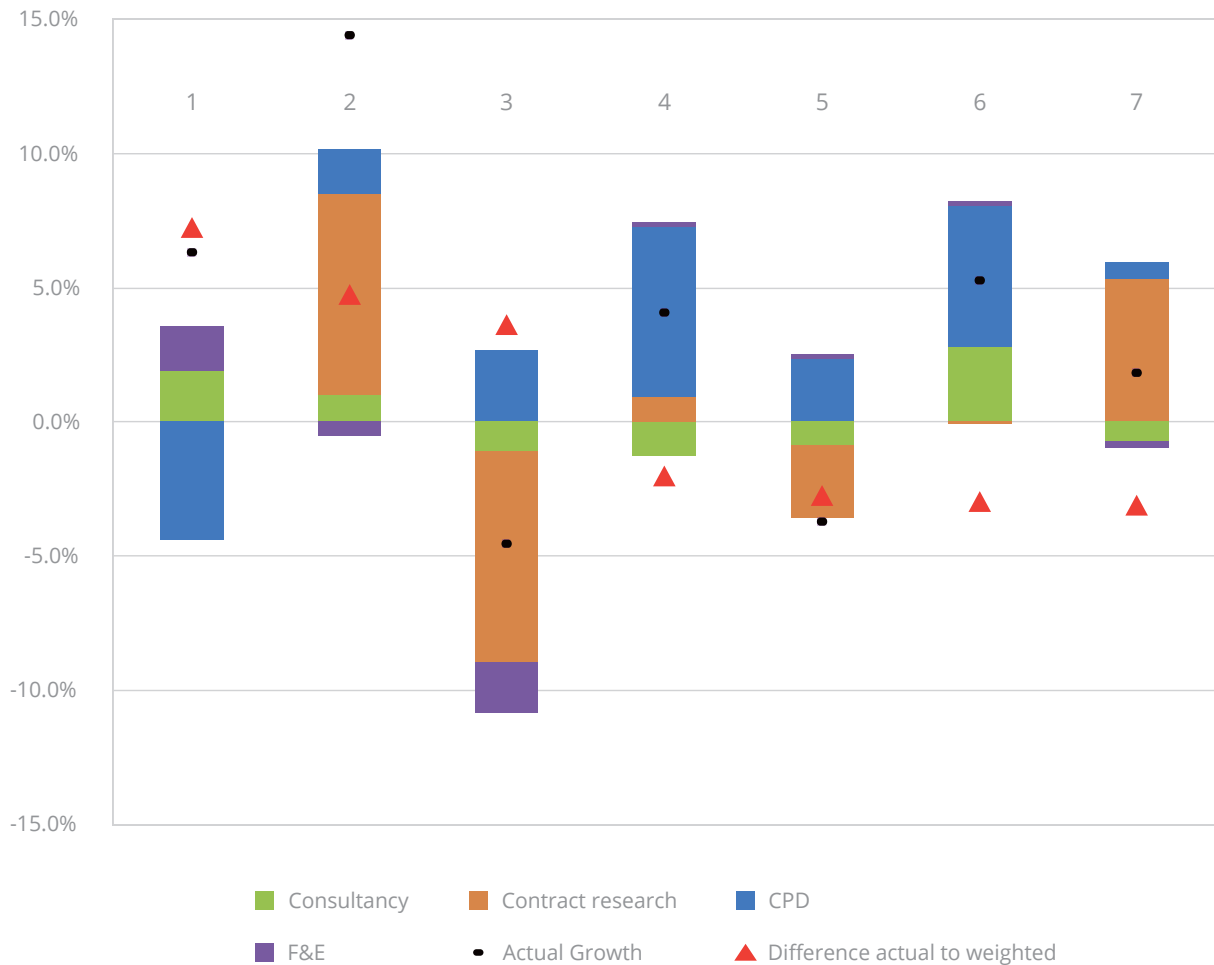
As is clear from Appendix 2, most HEIs develop some types of KE and deplete others. Using the tools developed in Appendix 1 we can cluster HEIs according to how many and which elements are contributing to KE income growth and thus assess the fit of the underlying KE management strategies. For each HEI we count how many KE elements have a weight higher than the average and how many of these have grown in the following six years. Because the weights of KE components add to one, HEIs cannot have a weight (comparative) advantage in more than 3 of them. For the same reason, all HEIs will have at least one component on which they have a weight advantage. Thus HEIs will either have 3, 2 or 1 KE element above the average and these are the three groups we proceed with for illustrating optimal KE growth strategies and how they link to institutional observable characteristics, such as scale. However, acknowledging the experimental nature of this study, the identity of HEIs is omitted throughout and a number is attached to each of them.

For each HEI in each group we compare the actual growth rate of KE income, designated by a dash in charts below, with what the average would have achieved using this HEI's growth strategy, shown as stacked bars. Each bar indicates whether that HEI is growing or depleting a KE element but this chosen growth rate is weighted at the average weight. Adding up the magnitudes of each stacked bar gives average growth (which is not shown). Instead of average growth we display the difference of actual to average growth, as this is our indicator of how well the HEI's strategy is working.

The difference of actual to average growth is displayed as a triangle in the charts. Where the triangle is above the horizontal axis, that HEI – due to its strategy - grew faster than the average. Conversely, where the triangle is below the axis, the KE income growth strategy is less effective for this HEI as others (e.g. the average) would have grown faster with it. HEIs with lower than average KE growth are concentrating efforts in elements of KE service where they do not have a weight advantage (see equation B in Appendix 1). It is worth noting that some HEIs may be strategically changing the composition of KE services overall, and in this framework these HEIs that are undergoing major restructuring may appear as performing below average. Nevertheless demand constraints that last for 6 years of cumulative annualised growth or depletion rates should be rare.

Consider the cluster of HEIs that counted 3 out of 4 KE elements or services above the average (the smallest of the three groups).

<sup>20</sup> Other counterfactuals are possible but we feel less suited, we could evaluate HEIs against the weights of the largest, or the smallest. We have no basis for establishing which HEI is the model to follow in the case of KE growth so the average in a distribution that is skewed to the top seems a good compromise.



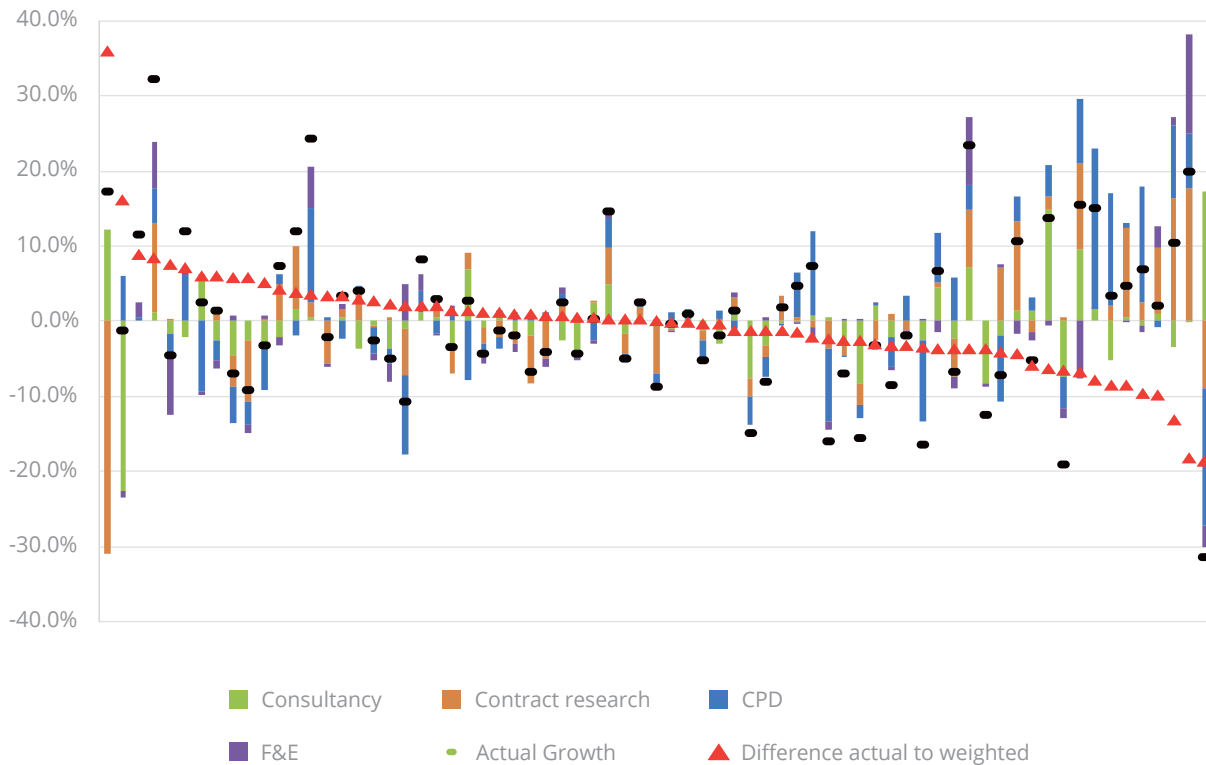
**Figure 4:** HEIs with three out of four KE elements with higher weight than the average in 2007/8

Three of the seven HEIs in Figure 4 are growing faster than the average (positive triangle), so their strategies are effective. The HEI closest to the axis is growing two elements (Consultancy and F&E) among the three they could and depleting CPD; the next HEI is growing three and depleting one slightly; both HEIs are managing KE income growth above the average. The third HEI is an interesting case of depleting three elements and experiencing negative growth (dash is negative) but still with a positive triangle, this indicates that given this HEI's strategy, the 'average HEI' would have shrunk much more, therefore this HEI still does better (shrinks less) than the average. In fact this HEI experiences growth of -5% and at the average it would have shrunk by -8.2% with its strategy.

The remaining four HEIs in this cluster could have grown faster with a different strategy as the negative triangle indicates. The HEI ranking 6 has a strategy of growing everything, thereby imposing a drag on KE growth by increasing the one element where it does not have a weight advantage. The other three HEIs are growing some KE elements and depleting others but not specialising in the ones where they have a weight advantage; or else the triangle would be positive.

**Figure 5** depicts the same variables as above but for HEIs with a weight advantage in two out of four components of KE: HEIs are sorted by difference to average, starting with those who have performed better. Recall that the stacked bars show growth (or depletion) strategies for the HEI but evaluated at the average weight, the sum of stacked bars is comparable with the actual KE growth (dash). The difference of actual to average is shown in triangles (i.e. how well KE growth strategy fits the HEI).

A fair number of triangles are in the negative, indicating that a few HEIs could have grown faster with a different strategy. And this goes for HEIs that were experiencing positive KE income growth (dash above zero) as well as for HEIs that are experiencing negative KE income growth.



**Figure 5:** HEIs with two out of four KE elements with higher weight than the average in 2007/8

The picture is now more complex but the interpretation is the same as the first group: strategies that grow the two elements in which the HEI has an advantage and/or deplete the other two bring faster growth than the average (positive triangle). Alternatively, if only one element is grown then it would need to be grown intensively to compensate for the others. The first two HEIs in this cluster are good examples of these extreme strategies, the first one is growing Consultancy and depleting Contract Research heavily, coming up with substantial growth, and this strategy grants this HEI growth of KE that is much higher than the average. The second HEI on the other hand is growing CPD and depleting Consultancy, coming up with negative growth itself (-1%), however such a strategy would have brought the 'average HEI' a heavy loss of -17% income growth, therefore this HEI is tailoring its strategy to its KE advantage, even if KE income has reduced overall<sup>21</sup>.

The third HEI counting from the axis in this cluster is a special case worth noting, as they offer CPD and F&E but not the other KE services, and the income between these two is split in such a way that both these elements weight more than the average, so this HEI can continue to specialise in both of these and grow faster than the average. However, if this HEI were to start offering one of the other two elements, they would impose a drag on growth because they would be increasing an element over which they have lower than average weight (currently their weigh is 0 for Contract Research and Consultancy). To understand how our framework works, for this HEI to maintain a strategy of continued KE growth they could start new services without reducing the ones they currently have, providing they had sufficient resources and a healthy demand.

At the other end of the cluster we observe HEIs with strategies of growing elements of KE on which they do not have a weight advantage, experiencing positive KE growth (dash is positive) but could have grown faster overall with a different strategy. We also find at this end HEIs with strategies of depleting elements over which they do have a weight advantage, displaying negative growth (dash is negative) but this negative growth could have been even lower (triangle is above dash). The last HEI in this cluster for example, growing Consultancy heavily and depleting the other three would have experienced lower loss in KE income by growing whichever other component over which they had a weight advantage – hence the triangle is

<sup>21</sup> HEIs that display cumulative growth rates of over 10% for 6 years started from small bases and have been increasing income from all KE elements, e.g. depleting none, but not all of them with these high growth rates are doing better than the average, as illustrated by the right hand end of the chart.

above the dash. For this HEI specifically, actual growth was -31% but this strategy would have achieved the average HEI a lower loss in KE income of -19%. It is also evident from the figure that such an extreme case is uncommon and may be caused by demand restrictions.

It is worth stressing that many of these HEIs are experiencing positive KE income growth, as indicated by a positive dash, they are simply not optimising the composition of KE activity internally and this may be for many reasons. KE income growth is a result of strategy and opportunity and we are only able to observe the outcome. It is possible or likely that the HEIs that are not optimising their strategies may be constrained by other factors – internal and/or external. We elaborate on this matter after considering the third cluster of HEIs.

Illustrating whether a strategy is fit for a HEI becomes easier when considering the cluster of HEIs that have an advantage over one element of KE only. Given our counterfactual, HEIs in this cluster should grow just that element. Should HEIs in this cluster wish to grow other elements as well, they will experience a drag on growth caused by pursuing growth where it does not have an advantage. HEIs can compensate for that drag by depleting other elements substantially.

The first HEI in **Figure 6** is a special case similar to the third HEI in **Figure 5**. The fact that the triangle is positive while the dash showing actual growth is negative means that the strategy of this HEI would have brought a higher loss to the average, the actual loss of KE in period was equivalent to -21% year on year but if this strategy would have been applied to the average HEI, it would have lost -50% year on year. According to our interpretation this HEI is optimising its KE strategy, doing better than the average counterfactual. The magnitude of growth is however striking: this HEI reports very little income from any of the three components of KE they actually report on, and the three are not even present in every year. As a result KE income fluctuates disproportionately and the detail shows that this HEI does not have a strategy of continued engagement.

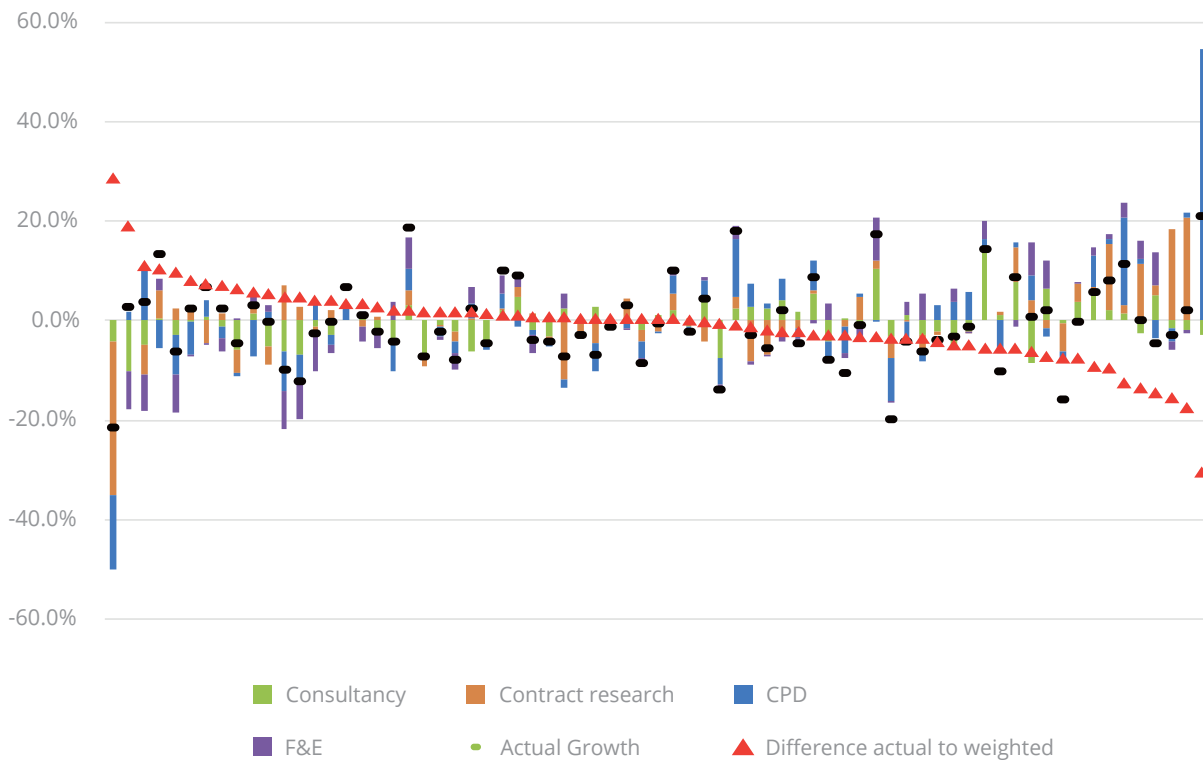
Many other HEIs in this cluster have a strategy of either growing the element on which they have an advantage or depleting the others, showing positive dash and triangle. Alternatively, if HEIs are growing more elements than one, then they experience actual growth in KE income (positive dash) but this growth could have been higher with a more tailored strategy (negative triangle).

A typical example of this is the last HEI in the cluster, they are growing CPD heavily which was not initially a large part of their KE strategy (had very low weight in 2007/8), this brings them to positive growth in KE but this strategy was better suited for a HEI with a comparative advantage on CPD.

Still, this last HEI appears to have undergone radical change; while CPD had a low weight in 2007/8, by 2012/13 it is now the element with the highest weight and therefore this HEI has a comparative advantage in it. They can continue growing this and experience not only actual growth but above average growth for the following six years. This last example illustrates that HEIs may be consciously pursuing a policy of re-balancing their KE income composition or broader institutional change such as a merger, and this may well have been a drag on growth. Therefore, they appear here as underperforming with respect to others which are perhaps in a more stable state but in doing so they may be improving their position over time.

All in all strategies for optimising KE income growth in a HEI entail a careful balancing of resources between KE elements. HEIs that concentrate in those activities where they are already above average have an advantage over the average, but dependence on one element also bears the risk of demand shifts, which may curtail growth. The last cluster where HEIs have an advantage in a single element demonstrates this dependence: positive growth (dash) is prevalent among HEIs that are developing one element much more than others, but if demand falls substantially for that single element where they have high concentration of resources, the HEI moves to the right end of **Figure 6**, with negative KE income growth and an sub-optimal strategy.

With so many different effects coming into play when assessing KE income growth strategies it is difficult to determine pair-wise influences on actual KE income growth and the fit of the underlying KE strategy. For example, whether growing CPD has an independent positive effect on KE income growth is conditional on what the HEI is doing elsewhere, as well as on what the HEI can do given HEI resources and demand conditions for CPD and other KE activities. We complete this report with further analysis that allows for multiple factors to be having an impact on KE income growth and KE strategy optimisation at the same time.



**Figure 6:** HEIs with two out of four KE elements with higher weight than the average in 2007/8

## Determinants of KE growth and KE growth strategies

This section explores what features of an HEI help or hinder strategies for optimising KE income growth as defined above. Because of multiple influences at work, we hypothesize and test jointly the relative important of the following factors:

1. **Scale:** larger HEIs engaged in broader KE activities are better positioned to re-deploy and focus resources for optimal growth. However, as noted in **Figure 2**, the correlation between KE income and growth is nil. Moreover, the descriptive analysis of the previous section indicates that a strategy of growing all elements will obviously bring growth but not as much as for HEIs with strategies of relative specialisation. A balance between diversification and specialisation tailored to the advantages of the HEI will achieve higher than average growth. Therefore the relationship between scale and growth may be mediated by breadth: while breadth contributes to higher growth in principle, higher than average growth could be achieved under some relative specialisation.
2. **Resources:** the ability of managers to pursue a particular strategy depends on having enough resources available within the HEI to do this, together with a sustained demand for continued growth over time. For example, income from Facilities & Equipment can be grown if these facilities are available and useful for external customers. Similarly for Consultancy, the relevant resource and an ability to match expertise to demand-side problems may determine the success of HEIs specialising in this activity. Strategic choice ought to be linked to the presence of other resources in the HEI: endowment, capital, staff etc. and this determines possibility (and rate) of KE growth.
3. **Initial position:** the volume of KE in the initial decision year (2007/8 in this case) is a result of past strategy and/or capacity constraints. HEIs that start with the highest levels of KE income may be closer to full capacity and may find it more difficult to continue pursuing an ever expanding strategy, compared to HEIs that have scope for manoeuvring<sup>22</sup>. Testing a convergence hypothesis in KE income can help discern whether the smaller HEIs are catching up with the larger ones. A convergence effect of initial KE income on its own growth can also be evidence of a successfully working funding cap: by spreading the incentive income more evenly funders aid the smaller HEIs to grow faster<sup>23</sup> than the larger ones.

<sup>22</sup> Such a capacity effect is also present in analyses of GDP growth where a convergence hypothesis is tested by checking if the initial level of GDP has a negative effect on long term growth.

<sup>23</sup> See booklet on Higher Education Innovation Funding allocations [www.hefce.ac.uk/pubs/year/2011/201116/#d.en.63908](http://www.hefce.ac.uk/pubs/year/2011/201116/#d.en.63908)

To separate some of these effects from one another we undertook regression analysis of the determinants of actual growth of KE income across HEIs (the dash in charts) and of the difference of actual to average growth (triangles). We consider growth and growth above average separately but include the same possible influencing (explanatory) variables for both. This is to allow influencing variables to have different effects on each, for example, scale may allow for more breadth and hence have a positive impact on actual growth. However, specialisation rather than breadth may be a better strategy, so scale may have asymmetric effects, positive on growth and negative on strategy.

Analyses that include multiple influences at the same time allow for some of the hidden effects mentioned earlier, such as high dependence on one particular KE element, or the presence/absence of resources to pursue a strategy, to have an effect independently from one another. For example, say contract research is a KE income stream that depends heavily on having researchers to contract out, and say researchers are more prevalent in the larger HEIs. If we omit researchers we would probably find a positive association of scale with KE income growth, however if we include both researcher counts and scale, we may find that scale becomes insignificant and what matters is researcher counts. Including both is needed to ascertain the independent effect of scale.

Results of multiple regression models are displayed in **Table 1**. For each actual growth and difference to average growth (strategy), we consider first the whole period of six years from 2007/8 to 2012/13 and then separate this into two periods of three years each, 2007/8 to 2009/10 and 2010/11 to 2012/13. Where each independent variable was included in the regression a “y” is displayed, conversely, “n” is displayed if this influence was excluded. HEI characteristics that have a significant effect are coloured: significantly positive effects are shown in blue, significantly negative effects are shown in yellow. The lower the R squared, the larger the residual variation that is not explained by these models. We omit and avoid using magnitudes in this report but the actual tables are presented in Appendix 3 for completeness.

| VARIABLES                          | Determinants of Actual Growth |       |       |       |       |       | Determinants of Difference to Average |       |       |       |       |       |
|------------------------------------|-------------------------------|-------|-------|-------|-------|-------|---------------------------------------|-------|-------|-------|-------|-------|
|                                    | 07/12                         | 07/12 | 07/09 | 07/09 | 10/12 | 10/12 | 07/12                                 | 07/12 | 07/09 | 07/09 | 10/12 | 10/12 |
| <b>Growing Element</b>             |                               |       |       |       |       |       |                                       |       |       |       |       |       |
| Consultancy                        | y                             | y     | y     | y     | y     | y     | y                                     | y     | y     | y     | y     | y     |
| Contract Research                  | y                             | y     | y     | y     | y     | y     | y                                     | y     | y     | y     | y     | y     |
| CPD                                | y                             | y     | y     | y     | y     | y     | y                                     | y     | y     | y     | y     | y     |
| Facilities & Equipment             | y                             | y     | y     | y     | y     | y     | y                                     | y     | y     | y     | y     | y     |
| Cluster 2                          | y                             | y     | y     | y     | y     | y     | y                                     | y     | y     | y     | y     | y     |
| Cluster 3                          | y                             | y     | y     | y     | y     | y     | y                                     | y     | y     | y     | y     | y     |
| Positive Growth KE income          | n                             | n     | n     | n     | n     | n     | y                                     | y     | y     | y     | y     | y     |
| LN Initial KE total                | y                             | y     | y     | y     | y     | y     | y                                     | y     | y     | y     | y     | y     |
| Initial research to teaching grant | n                             | y     | n     | y     | n     | y     | n                                     | y     | n     | y     | n     | y     |
| FTE research only in total         | n                             | y     | n     | y     | n     | y     | n                                     | y     | n     | y     | n     | y     |
| LN Initial Endowment               | n                             | y     | n     | y     | n     | y     | n                                     | y     | n     | y     | n     | y     |
| LN Initial Total Income            | y                             | n     | y     | n     | y     | n     | y                                     | n     | y     | n     | y     | n     |
| Russell Group                      | n                             | y     | n     | y     | n     | y     | n                                     | y     | n     | y     | n     | y     |
| 1994 Group                         | n                             | y     | n     | y     | n     | y     | n                                     | y     | n     | y     | n     | y     |
| Million +                          | n                             | y     | n     | y     | n     | y     | n                                     | y     | n     | y     | n     | y     |
| University Alliance                | n                             | y     | n     | y     | n     | y     | n                                     | y     | n     | y     | n     | y     |
| Constant                           | y                             | y     | y     | y     | y     | y     | y                                     | y     | y     | y     | y     | y     |
| Observations                       | 149                           | 142   | 149   | 142   | 149   | 142   | 149                                   | 142   | 143   | 136   | 143   | 137   |
| R-squared                          | 0.535                         | 0.547 | 0.408 | 0.379 | 0.486 | 0.482 | 0.421                                 | 0.480 | 0.149 | 0.142 | 0.250 | 0.289 |

**Table 1:** Results of multiple regression models

Start with the left side of **Table 1**, six columns showing determinants of actual KE growth in the three periods. Descriptive statistics for all variables are in Appendix 2. All models include the growth strategy as indicated by whether they are growing each of the four elements of KE used in this report. All models include the cluster to which the HEI belongs, Cluster 2 includes HEIs with 2 out of 4 elements above the average in 2007/8; Cluster 3 includes HEIs with 3 out of 4 elements above average Cluster 1 is one of the reference categories captured in the constant to avoid perfect multi-collinearity. All models include the catch-up effect of KE income in 2007/8 (£m) or 2010/11 (£m)<sup>24</sup>.

For each period of time we show two columns: in the first column per period we include the scale of the HEI as in grand total income in the starting year (in addition to all of the above); in the second column we exclude scale and include resources in the HEI as indicated by the endowment income, the ratio of recurrent research to teaching funding grants and the percentage of research only full time equivalent academic staff to total academic staff. The second column also shows the sequential (not simultaneous) inclusion of a dummy representing mission groups, where these were included none of the other results changed and thus they are omitted (available upon request).

Unsurprisingly (see equation A in Appendix 1) growing any of the elements of KE included in this analysis improves growth of KE income overall. Over 6 years, the HEIs in the cluster with two out of four elements above the average are less likely to grow than those with comparative advantage in one element only (Cluster 1 is the reference category). A tentative explanation of this is that HEIs in this cluster may find it attractive to go for a “broad” KE strategy, growing elements without a comparative advantage and thus imposing a drag on growth. However, pursuing broader KE strategies pays off if implemented successfully, as HEIs in Cluster 3 (with 3 out of 4 elements above the average) are more likely to experience growth in the last three years.

We can definitely establish that over 6 years there has been a tendency for the smaller HEIs (in terms of KE) to catch-up with the larger ones, as the coefficient of KE total is negative and significant. Despite this catch-up, the larger-scale HEIs remained more likely to experience KE income growth during the first half of the period. However in the latter half of the period, grand scale ceases to be an advantage for growing KE income and the catch-up effect is reversed when we exclude the grand total. This combination of findings suggests that by 2010-12 the larger scale HEIs are also those with higher KE income to start with in 2010, and these are the ones more likely to grow, possibly through a broader KE strategy, as larger scale HEIs are in a better position to pursue broad KE.

Whether this reversal of a catch-up by smaller HEIs in KE income is sustained in the future is left to be seen but what is definite is that smaller HEIs with broad KE strategies have been more likely to grow KE income than their larger scale counterparts over the six years to 2012/13, and this despite the independent advantage of scale for the larger ones.

The results also suggests that during the first half of the study period, the scale advantage is through availability of resources, as indicated by a positive significant independent effect of research staff that does not change any of the other findings. Such resource channel is robust to including a dummy identifying HEIs belonging to the Russell Group, which are growing faster than others in the first half of the period, but not subsequently, and not overall. Therefore, broader KE strategies enabled by resource availability were driving KE income growth earlier on but while breadth remains a driver, resource availability and scale are less important in recent years and over the long run.

Consider now the right-hand side of **Table 1** with the six columns repeating the analysis for determinants of the difference of actual to average growth. Only one addition to the above modelling framework which is a variable distinguishing HEIs with a positive dash (positive growth) to test for the plausible assumption that growing is a better strategy than not growing altogether. The rest of the modelling framework is as above. Three sets of two columns, one set per period. Each column including first scale of the HEI and then dropping this and including endowment income and research resources to ascertain if the impact of scale is through any of these. The mission groups included sequentially with no change in other results.

<sup>24</sup> In light of figure 1 suggesting Gibrat's law holds for KE income, with the implication that KE income is log normal, all income variables have been included in a natural logarithm functional form; this applies to KE, grand total and endowment income. Using levels instead does not change the results significantly, only the magnitude of the coefficients in Appendix 3.



Regardless of the period of analysis, growing Contract Research or CPD reduces the magnitude of growth above the average. Growing Consultancy income had a more noticeable effect in earlier years but while still significant, this is fading over time, which explains why over the six years it is found to be insignificant. This negative dependency reflects the fact that the averages are growing over time, particularly for these two elements, and a balance has to be sought between the opportunity of growing each of these and the fact that other HEIs may also grow them, making the average more difficult to surpass (see equation B in Appendix 1).

Still, in so far as growing any element will result in KE income growth for the HEI, this will improve the chances of growing above average as HEIs which experience positive growth also experience significantly higher growth than the average, particularly so in the second half of the 6-year period. This finding illustrates the balance that needs to be upheld, growing some KE will result in more income but growing “the right” KE elements will result in higher than average KE income growth.

Two other findings are worth noting, the first is the same effects of scale in KE and in grand total income as found explaining actual average growth. Throughout the period, there has been a catch-up effect among the HEIs with lower starting KE income, who are also growing faster than the average. Equally, the larger scale HEIs (as per grand total income) are also more likely to grow above the average. The grand total income scale effect is however channelled through the presence of research staff resources, which are a significant factor when scale is omitted. As before, both of these effects are seemingly fading over time and do not figure significantly in explaining shorter term growth. Over longer periods of time, however, smaller HEIs with more research staff have been better at optimising KE strategies than competitors.

This fading interaction of scale and KE income growth for both actual growth and strategy may be indicative of successful capacity building across the whole sector – where the smaller units can achieve the same KE income growth as the larger ones and better than the average if they pursue a strategy that builds on their KE strengths<sup>25</sup>.

## Conclusions

This report provides new evidence on the patterns of and reasons for sustained growth in KE income across HEIs in the UK. We add to and complement evaluations of KE activities based on case studies, which are difficult to compare, and evaluations based on the distribution of KE income, which is scale-skewed and persistent, and as a result conclude that the distribution is largely immobile and support policies that tend to perpetuate inequality and stickiness.

We focus on sustained income growth (thereby purging away the scale-bias) and decompose the relative contribution of Consultancy, Contract Research, CPD and Facilities and Equipment to long term KE income growth. This decomposition shows KE income growth as a weighted average of the growth of its components, with the weights being the importance of each component in the total. The actual growth of KE income for each HEI reflects the internal strategy to grow or deplete KE components sustainably over the last six years. This is a choice for the HEI in response to demand and/or resource availability and can be evaluated systematically using data.

We evaluate the growth strategy of each HEI using an absolute and a relative measure. The absolute measure is actual KE income growth, regardless of what others are doing, but to account for increasing competition in the system we also evaluate KE strategies using a relative measure – growth above the average. We compare each HEI’s strategy with what the average HEI would have achieved had it implemented this strategy. If the average grows faster, then this growth strategy is better suited for the average and worse for the HEI in question.

While absolute growth can be achieved by growing every element, HEIs that are constrained or face close competition in some elements have to strike a complex balance between breadth (for growth) and specialisation (for growth above average).

<sup>25</sup> We carried out sensitivity tests of these results, separating HEIs that grow from those that do not grow and separating KE income by source (private against public and charity) with no changes in the findings worth noting. These results are available upon request

In contrast with analyses of the distribution of KE income levels, we find that once the breadth of KE income sources is taken into account, the scale of the HEI does not matter. That is, smaller HEIs with broad KE bases grow as fast as the larger scale ones; and, at least earlier on in time, the advantage of the larger scale HEIs rested on the presence of research resources to pursue a strategy of growth. Once HEIs are made equal on breadth and resources, the larger scale ones are not growing faster.

Such finding is reinforced by the presence of a catch-up effect in KE which is more predominant in the first half of the period. HEIs who started from lower KE income levels have been significantly more likely to grow faster. This may indicate some degree of capacity constraints for those HEIs that start from high KE income, but also, it may be a reflection of the presence of a maximum cap in funding for KE among some of the HEIs in sample, which is favouring growth of KE income for the smaller HEIs. However, if present, this effect appears to have faded in the last three years.

The analysis of growth above the average (strategy) exposes the complexities involved in these decisions which need also to consider what others are doing. While all other findings remain unchanged, growing certain elements of KE income (Consultancy and CPD) has a negative impact on growth above the average. Specialising in the more popular elements of KE may not help with a strategy of growing faster than the average because everyone is concentrating in the common or accessible KE and this makes the average grow and thus more difficult to surpass.

The system as is displays evidence of dynamic changes and balancing diversification and specialisation to match increasing competition within the academic sector but also navigating shifting demands in the wider economy. Without further analysis of the pairwise interactions between growing and depleting elements – which determine growth – policy changes other than sustaining the current broad KE base may generate unforeseen perverse effects.

## Appendix I: Decomposing KE income growth into its components

For reasons explained in the introduction, we use the four components of KE income that fit best with activities paid for by external partners (clients rather than funders) and are more stable over time: Consultancy (CON), Contract Research (CRS), Continuing Professional Development (CPD) and income from using facilities and equipment (FAE). In any one year  $t$ , for each HEI therefore:

$$KE_t = CON_t + CRS_t + CPD + FAE_t$$

And the growth rate

$$\frac{KE_t - KE_{t-1}}{KE_{t-1}} = \frac{(CON_t - CON_{t-1}) + (CRS_t - CRS_{t-1}) + (CPD_t - CPD_{t-1}) + (FAE_t - FAE_{t-1})}{CON_{t-1} + CRS_{t-1} + CPD_{t-1} + FAE_{t-1}}$$

Defining  $g_X = \frac{X_t - X_{t-1}}{X_{t-1}}$  for any possible X equal to each component we can rewrite the above as

$$g_{KE} = \frac{(CON_t - CON_{t-1}) \frac{CON_{t-1}}{CON_{t-1}} + (CRS_t - CRS_{t-1}) \frac{CRS_{t-1}}{CRS_{t-1}} + (CPD_t - CPD_{t-1}) \frac{CPD_{t-1}}{CPD_{t-1}} + (FAE_t - FAE_{t-1}) \frac{FAE_{t-1}}{FAE_{t-1}}}{KE_{t-1}}$$

And thus

$$g_{KE} = g_{CON} \frac{CON_{t-1}}{KE_{t-1}} + g_{CRS} \frac{CRS_{t-1}}{KE_{t-1}} + g_{CPD} \frac{CPD_{t-1}}{KE_{t-1}} + g_{FAE} \frac{FAE_{t-1}}{KE_{t-1}}$$

Therefore, the growth of KE income is a convex combination of the components of income with the weights in the convex combination given by the relative importance of each component in the total (denoted as  $W$  for each below)

$$g_{KE} = g_{CON} W_{CON,t-1} + g_{CRS} W_{CRS,t-1} + g_{CPD} W_{CPD,t-1} + g_{FAE} W_{FAE,t-1} \quad (\text{A})$$

As shown in **Appendix 2**, the actual growth rates of each component are different across HEIs, and so are the relative weights of each component in the total, giving unique growth paths for each HEI. To compare and contrast growth dynamics we cluster HEIs according to how they fare in relation to the average, where the average is a hypothetical university that would start from the average composition of KE income and follow the paths indicated by the growth rate of each HEI in the sample.

Define  $\overline{W}_{CON}$  as the average weight of Consultancy income across all HEIs in 2007/8, and similarly for CRS, CPD and FAE. Then the average for each HEI is its own growth but departing from the average composition

$$\overline{g}_{KE} = g_{CON} \overline{W}_{CON,t-1} + g_{CRS} \overline{W}_{CRS,t-1} + g_{CPD} \overline{W}_{CPD,t-1} + g_{FAE} \overline{W}_{FAE,t-1}$$

And therefore the difference between the actual growth and the average for each HEI is the relative difference in weights – removed reference to initial year ( $t-1$ ).

$$g_{KE} - \overline{g}_{KE} = g_{CON} (W_{CON} - \overline{W}_{CON}) + g_{CRS} (W_{CRS} - \overline{W}_{CRS}) + g_{CPD} (W_{CPD} - \overline{W}_{CPD}) + g_{FAE} (W_{FAE} - \overline{W}_{FAE}) \quad (\text{B})$$

**Figure X** in the text shows that this difference – called management efficiency – is the result of two conditions; an initial condition of relative magnitude of each component with respect to the average, and a trajectory condition in the growth rate of that component.

If the weight of one component is higher than the average (and thus the magnitude in parenthesis is positive) then a trajectory condition of positive growth will contribute to higher growth than average in total KE.

$$g_x(W_x - \overline{W_x}) > 0$$

Conversely, if the initial condition is that the weight of one component is lower than the average then a trajectory condition of depleting that component contributes to higher growth than average in total KE, as above.

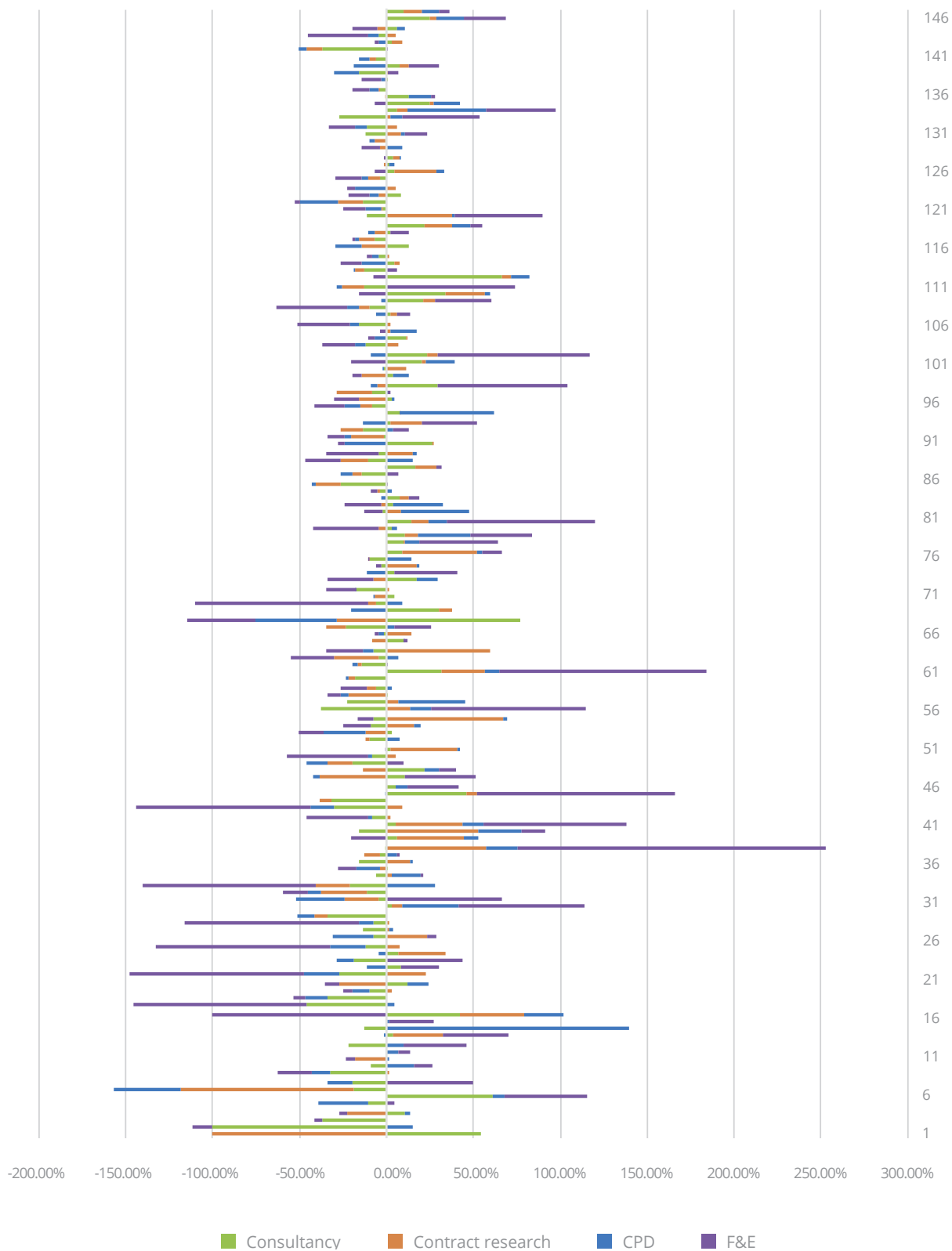
Where these two conditions are out of synch, e.g. depleting components that start from higher than average weight, or, growing components that start at lower than average weight, these components contribute to lower the difference.

$$g_x(W_x - \overline{W_x}) < 0$$

These components can some times erode the difference to the point of making it negative, indicating that KE growth could have been faster if a different management choice for which components to grow had been made.

## Appendix 2

Gross annualised growth between 2007/8 and 2012/13 of each component of KE income across 149 HEIs sorted by size from smallest - unweighted



## Appendix 3

|  | Obsrvatns | Mean  | Std Dev. | Min.  | Max.  |
|--|-----------|-------|----------|-------|-------|
| Annualised growth of KE                            | 149       | 0.01  | 0.10     | -0.34 | 0.36  |
| Difference actual to average growth                | 149       | 0.02  | 0.12     | -0.31 | 0.91  |
| Cluster 3  | 149       | 0.05  | 0.21     | 0     | 1     |
| Cluster 2  | 149       | 0.46  | 0.50     | 0     | 1     |
| Cluster 1  | 149       | 0.49  | 0.50     | 0     | 1     |
| Consultancy growing                                | 149       | 0.43  | 0.50     | 0     | 1     |
| Contract research growing                          | 149       | 0.49  | 0.50     | 0     | 1     |
| CPD growing  | 149       | 0.48  | 0.50     | 0     | 1     |
| Facilities and Equipment growing                   | 149       | 0.39  | 0.49     | 0     | 1     |
| Recurrent research to teaching grant ratio 2007/8  | 149       | 0.54  | 2.17     | 0     | 18.73 |
| Recurrent research to teaching grant ratio 2010/11 | 149       | 0.61  | 2.50     | 0     | 21.51 |
| FTE academic research over total 2007/8            | 142       | 0.16  | 0.16     | 0     | 0.64  |
| Ln grand Total Income 2007/8 (£m)                  | 149       | 11.47 | 1.04     | 9.19  | 13.89 |
| Ln grand Total Income 2010/11 (£m)                 | 149       | 11.64 | 1.03     | 9.42  | 14.04 |
| Ln KE income 2007/8 (£m)                           | 149       | 8.59  | 1.64     | 1.95  | 11.53 |
| Ln KE Income 2010/11 (£m)                          | 149       | 8.71  | 1.56     | 4.45  | 11.90 |
| Ln Endowment 2007/8 (£m)                           | 149       | 6.50  | 3.63     | 0     | 13.66 |
| Positive Growth                                    | 149       | 0.48  | 0.50     | 0     | 1     |
| 1994 Group   | 149       | 0.10  | 0.30     | 0     | 1     |
| Million + 149                                      | 149       | 0.17  | 0.38     | 0     | 1     |
| Russell Group                                      | 149       | 0.16  | 0.37     | 0     | 1     |
| University Alliance                                | 149       | 0.15  | 0.36     | 0     | 1     |

## Appendix 4




| VARIABLES                          | Determinants of Actual Growth |           |           |           |           |           | Determinants of Difference to Average |           |           |           |           |           |
|------------------------------------|-------------------------------|-----------|-----------|-----------|-----------|-----------|---------------------------------------|-----------|-----------|-----------|-----------|-----------|
|                                    | 07/12                         | 07/12     | 07/09     | 07/09     | 10/12     | 10/12     | 07/12                                 | 07/12     | 07/09     | 07/09     | 10/12     | 10/12     |
| <b>Growing Element</b>             |                               |           |           |           |           |           |                                       |           |           |           |           |           |
| Consultancy                        | 0.047***                      | 0.049***  | 0.097***  | 0.102***  | 0.048***  | 0.049***  | -0.017                                | -0.016    | -0.066**  | -0.063**  | -0.037**  | -0.034*   |
| Contract Research                  | 0.073***                      | 0.071***  | 0.091***  | 0.092***  | 0.074***  | 0.072***  | -0.090***                             | -0.08***  | -0.091*** | -0.087*** | -0.112*** | -0.113*** |
| CPD                                | 0.087***                      | 0.084***  | 0.093***  | 0.114***  | 0.102***  | 0.098***  | -0.067***                             | -0.069*** | -0.085*** | -0.082*** | -0.062*** | -0.068*** |
| Facilities & Equipment             | 0.033***                      | 0.036***  | 0.046**   | 0.042*    | 0.034**   | 0.037**   | -0.018                                | -0.018    | -0.012    | -0.018    | -0.019    | -0.01     |
| Cluster 2                          | -0.026**                      | 0.031**   | -0.027    | -0.032    | 0.022     | 0.016     | -0.013                                | -0.026    | -0.008    | -0.004    | 0.024     | 0.019     |
| Cluster 3                          | -0.017                        | -0.021    | -0.028    | -0.047    | 0.06*     | 0.055     | -0.005                                | -0.012    | 0.039     | 0.038     | 0.053     | 0.042     |
| Positive Growth KE income          |                               |           |           |           |           |           | 0.078***                              | 0.061***  | 0.077**   | 0.069**   | 0.118***  | 0.11***   |
| LN Initial KE total                | -0.026***                     | -0.019*** | -0.063*** | -0.034*** | 0.013     | 0.012*    | -0.057***                             | -0.052*** | -0.015    | -0.004    | 0.004     | -0.005    |
| Initial research to teaching grant |                               | -0.002    |           | -0.047    |           | -0.005    |                                       | 0.004     |           | -0.017    |           | 0.028     |
| FTE research only in total         |                               | 0.075     |           | 0.222*    |           | 0.034     |                                       | 0.230***  |           | 0.054     |           | -0.068    |
| LN Initial Endowment               |                               | 0.004     |           | -0.001    |           | 0.002     |                                       | 0.004     |           | 0.003     |           | 0.004     |
| LN Initial Total Income            | 0.030***                      |           | 0.065***  |           | 0.005     |           | 0.042***                              |           | 0.026     |           | -0.004    |           |
| Russell Group                      |                               | 0.011     |           | 0.114***  |           | -0.023    |                                       | 0.053*    |           | 0.037     |           | 0.018     |
| 1994 Group                         |                               | 0.012     |           | 0.014     |           | 0.003     |                                       | 0.005     |           | 0.036     |           | 0.012     |
| Million +                          |                               | 0.007     |           | 0.017     |           | 0.001     |                                       | 0.024     |           | 0.074*    |           | 0.014     |
| University Alliance                |                               | 0.013     |           | 0.01      |           | -0.015    |                                       | -0.025    |           | -0.03     |           | -0.022    |
| Constant                           | 0.205**                       | 0.042     | -0.334**  | 0.136*    | -0.318*** | -0.259*** | 0.081                                 | 0.473***  | -0.089    | 0.089     | 0.024     | 0.04      |
| Observations                       | 149                           | 142       | 149       | 142       | 149       | 142       | 149                                   | 142       | 143       | 136       | 143       | 137       |
| R-squared                          | 0.54                          | 0.55      | 0.41      | 0.38      | 0.49      | 0.48      | 0.42                                  | 0.48      | 0.15      | 0.14      | 0.25      | 0.29      |







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