How does Equity Allocation in University Spinouts affect Fundraising Success? Evidence from the UK

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Abstract

There is considerable controversy about the allocation of equity in university spinouts. Founder teams and outside investors frequently criticize universities for taking excessive ownership stakes, weakening entrepreneurial incentives, and making spinouts 'uninvestable.' Universities in turn defend their ownership rights in terms of the resources needed to generate the research in the first place. This paper uses detailed data from UK spinouts to assess the impact of university ownership on subsequent fundraising success. Perhaps surprisingly, the data suggests a positive correlation between university stakes and fundraising success, even after controlling for observable characteristics. However, this correlation appears to be partly driven by universities retaining larger stakes in their most promising spinouts. Using an instrumental variable based on the precedence set by prior spinouts within a university, we find some evidence that higher university stakes reduce the likelihood of fundraising success. A 10% larger university stake decreases the probability of raising venture capital on average by 3%. The negative effect is concentrated in less science-intensive spinouts (e.g., IT), and is statistically insignificant in the more science-intensive spinouts (e.g., engineering, or biomedical). Reductions in university stakes are also associated with increases in the spinout rate.

Keywords: university spinout, equity allocation, fundraising

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Executive Summary

University spinouts, which combine entrepreneurship and innovative technologies, significantly contribute to economic growth. Yet there is considerable debate about how universities should foster the commercialization of innovations. In March 2023, the UK announced an independent review of the UK spinout landscape. One of the main concerns is that universities take overly large equity stakes in their spinouts, to the point of making them unfundable by private investors. Others argue that universities need to take appropriate stakes in order to recover costs and support the internal spinout process. While these issues have been debated for a long time, there is a surprising lack of objective data to inform the discussion.

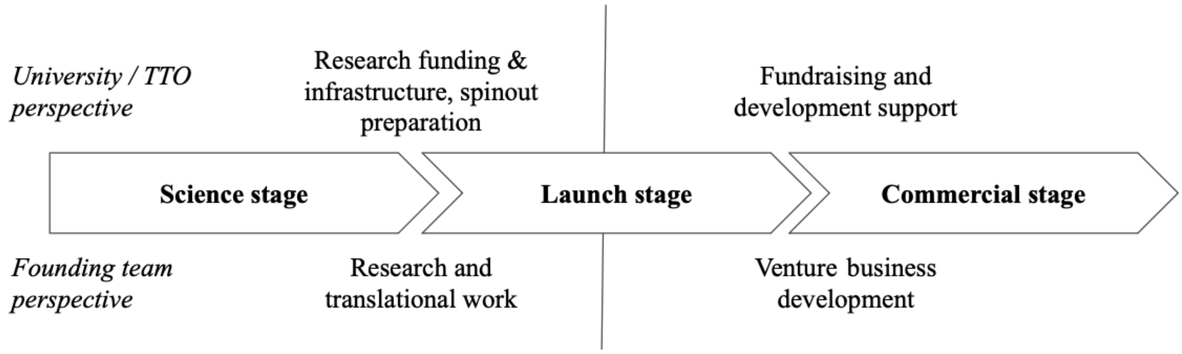
In this paper we gather systematic data on a sample of 650 UK spinouts over the period 2010-2021. Our definition of a university spinout requires that a UK university owns at least 1% of the company's founding equity. The average university stake in our sample is 31%, trending down from 33% in 2010 to 24% by 2020. 66% of spinouts in the sample raise equity from some investors, 30% from venture capitalists. Only 5% of spinouts raise over £25M in total.

Our statistical analysis focuses on the relationships between university stakes and spinout fundraising. Perhaps surprisingly, we find a positive (and sometimes statistically significant) correlation between university stakes and several fundraising metrics, including the probability of raising equity and VC, the amount of funding raised, and the post-money valuation. Correlation does not imply causation because of selection effects. Specifically, universities may selectively retain higher stakes in their most promising ventures. To identify causal relationships, we use so-called instrumental variable regressions. We find that their estimated coefficients are typically smaller, often negative, which is consistent with the selection effect conjectured above. In this causal analysis, we find a negative significant relationship between higher university stakes and the probability of raising venture capital. A 10% decrease in the university stake leads to an estimated 3% increase in the probability of raising venture capital. However, this effect only applies to raising venture capital, and we do not find any statistically significant effects on the broader probability of raising equity, nor on the amount of funding raised, nor on the post-money valuations obtained.

We further separate our data into two subsamples, one for more science-intensive sectors (involving industries based on engineering and biomedical sciences), and one for less science-intensive sectors (such as AI, IT, manufacturing, and others). We find that the negative causal effects of university stakes are stronger in the less science-intensive subsample, and statistically insignificant in the more science-intensive subsample. We also examine the relationship between university stakes and spinout formation. We examine data about the total number of spinouts per university and ask whether a recent history of lower university stakes increases the number of spinouts. We estimate that 10% reduction in the (three-year trailing) average of university stakes leads to ~8% increase in the number of spinouts.

Overall, the results shed new light on the ongoing discussions about the role of university stakes in the spinout process. The debate often occurs in a data vacuum, this paper hopes to address that gap. Our findings do not support the claim that higher university stakes make spinouts unfundable, the evidence is much more nuanced. Simple regressions suggest a positive correlation between university stakes and fundraising outcomes, but one should not infer causality. Using an instrumental variable approach, we find a negative causal relationship between university stakes and the probability of raising VC. However, we do not find any significant effects for the probability of raising equity, the amount of funding, or the post-money valuation. The negative university stake effects are mainly in less science-intensive sectors. Finally, the evidence suggests that lower university stakes encourage spinout formation.

Figure 1: The spinout process from the science to the commercial stage



1 Introduction

A key challenge in the commercialization of science is the allocation of equity in university spinouts. Broadly speaking, there are two opposing and often strongly held views. The "university-friendly" view is that through their technology transfer offices (TTOs henceforth) universities are entitled to a 'reasonable' equity stake that pays for the resources expended in the creation of the spinout. The "founder-friendly" view, by contrast, questions the university's entitlement to any ownership and frequently doubts the effectiveness of TTO services. Under this view, practically all the equity should go to the founding team.

This debate occurs in a highly fluid environment where most universities are still relatively new to commercialization. TTOs continuously adapt to changing pressures from a variety of sometimes discordant stakeholders, including university leaders, academic scientists, venture investors, not to mention concerned policy makers. Passions can fly high in these debates, for example, when private investors complain that high university stakes make spinouts 'uninvestable.'[2] Yet there is surprisingly little data to objectively assess the merits of these alternative views.

This paper examines the relationship between the allocation of equity in university spinouts and their subsequent fundraising. The main research question is to assess the validity of the claim that higher university stakes make university spinouts less investable. To assess any causal relationship naturally requires disentangling treatment and selection effects. We also consider to what extent these effects differ by the type of underlying inventions, focusing on how science-intensive spinouts are different.

Because of its confidential nature, obtaining ownership data on university spinouts remains difficult in many countries, including the US. In the UK, however, the government requires public disclosure of ownership data for all private companies. We gather detailed data from a variety of sources on a sample of UK spinouts for the period 2010-2021. To isolate the initial allocation of spinout equity, we separate out the ownership of all early investors. We believe our sample has the most comprehensive and detailed data on UK university spinouts to date.

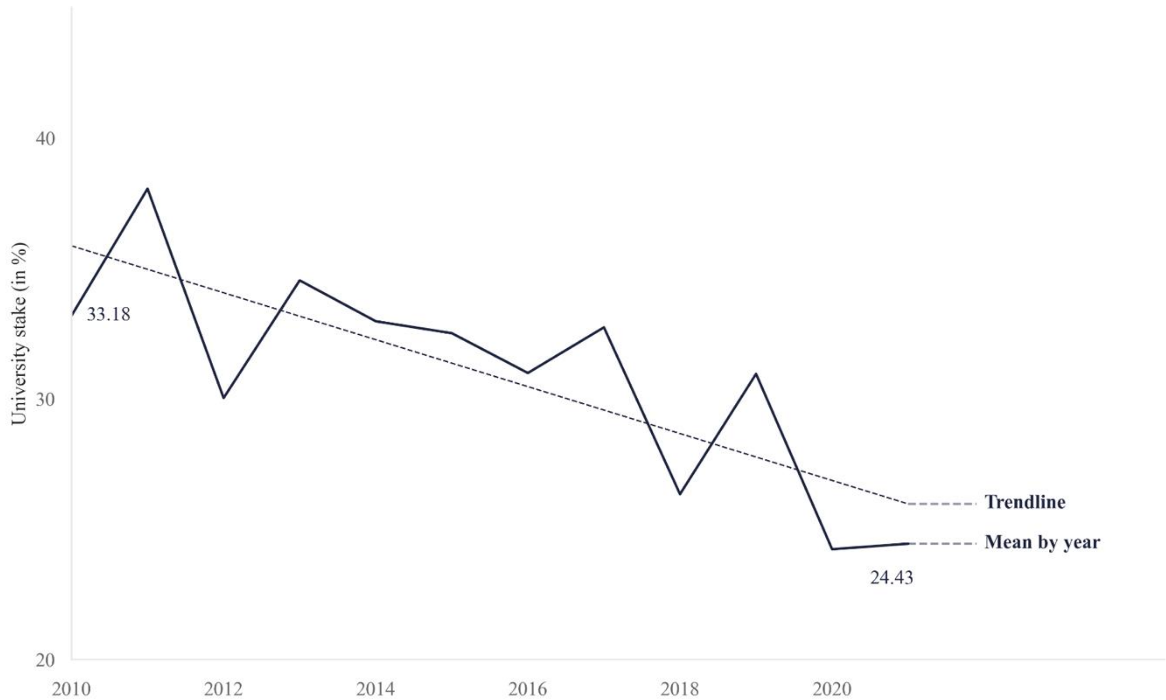
To motivate our analysis, consider Figure 1 which provides a simple framework for thinking about the spinout process.

Prior to the spinout event, both the scientist founders and the university TTO perform important tasks, developing the underlying science and technology and preparing for the spinout event. After it, the technology still needs further development. Moreover, the entire business needs to be developed. The

[2] Riam Kanso, founder of Conception X, is quoted by Heim (2022) saying "The potential for meaningful innovation brewing across Europe's research labs largely remains untapped due to varying — and at times stifling — IP ownership rules that can make spinout companies uninvestable and hard to scale."

TTOs decision on the allocation of ownership occurs at an interim point in time, and therefore needs to balance rewards and incentives for both past and future work. In terms of economic theory, this is a typical incomplete contract setting where important tasks are performed before contracts are written (see Aghion and Tirole, 1994). In practice, this means that TTOs have internal rules and guidelines that influence these allocation decisions, but they also have some discretion. In fact, deals are often negotiated based on *precedence*. Once one founder team received a better deal, it becomes harder for the TTO to refuse the next team a similarly attractive deal. We would thus expect there to be pressure on university stakes to fall over time. Indeed, Figure 2 shows that the average university stake fell from 33% in 2010 to 24% in 2020. However, there is a lot of variability around the mean. Different universities have different approaches, and within universities, different types of spinouts can receive vastly different deals. Hence the need for detailed data to not only measure ownership stakes, but also to control for numerous other factors about the spinouts, their founder teams, and the university structure.

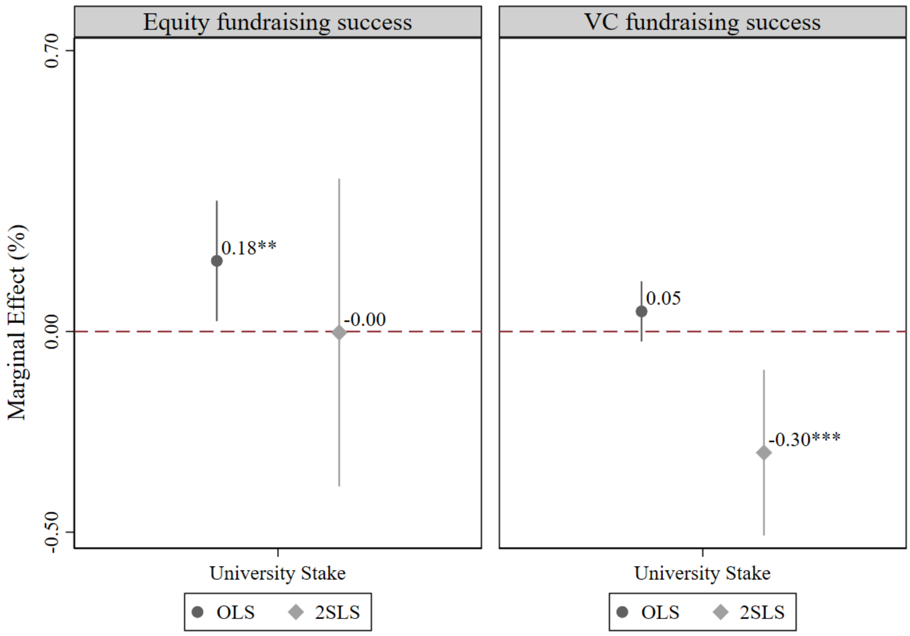
Figure 2: University stakes over time from 2010 to 2021, sample mean is 31%



Our set of dependent variables focuses on fundraising success. The ability to raise external funding is a first test of the commercial viability of the spinouts. It is also at the core of the public debates about whether high university stakes make spinouts uninvestable. One measure considers all types of equity providers, another focuses only on venture capital, which is typically considered harder to get (and thus a stronger signal of commercial potential). We examine the probability of obtaining funding, the amounts raised, and the post-money valuation obtained.

Our first result may be considered surprising. In a simple regression that controls for standard observable characteristics (industry, location, university type, founder team characteristics and calendar time), we consistently find positive correlations between university stakes and the probability of raising funding; and same for funding amounts and valuations. However, such correlation does not imply causation. We recognize the possibility that TTOs may insist on larger stakes in their most promising spinouts, while being easier with less promising ones. Some correlations with observable characteristics support that pattern. For example, university stakes are higher with more experienced founder teams, and when the spinout includes a professor or an MBA. The econometric concern is naturally about unobservable characteristics. Our instrumental variable builds on the above discussion about ‘precedence’ and leverages variation in the stakes of recent prior deals. We first establish the validity of the instrument. We then find that instrumentation typically lowers the coefficients of the university stake variable. Figure 3 shows a core finding about the estimated coefficient for university stakes on the probability of fundraising success. While the instrumented coefficients are negative, and sometimes statistically significant, their economic magnitudes do not appear overly large. For example, a 10% increase in the stake held by the university reduces the probability of raising venture capital by 3% on average.

Figure 3: Coefficient plot for the marginal effects of university stakes on fundraising success



We also examine the relationship between university stakes and fundraising amounts among those spinouts that raise funding. After instrumentation, university stakes are not significantly related to funding round amounts. We also find no significant relationship between the university stake and the probability of raising cumulative amounts above critical thresholds, such as £15M or £25M. We also do not find any significant relationship with the post-money valuations companies obtain when raising equity.

Next, we ask whether the effect of university stakes is heterogenous in nature. In our sample, 57% of spinouts fall into a UK industry classification labelled “Professional, Scientific, and Technical.” This category includes engineering and biomedical sciences.[3] Spinouts in this category typically make substantial uses of university resources, including lab spaces and expensive equipment. We ask whether the impact of university stakes on fundraising differs for more versus less science-intensive spinouts. We find that the negative fundraising effects of university stakes are stronger for less science-intensive spinouts.

[3] In future research we plan to gather additional data to measure this aspect more finely.

The paper closest to ours is Hvide and Jones (2018) who use a quasi-experimental setting leveraging the abolition of the "professor's privilege" (PP henceforth) in Norway. Before the abolition, academics owned their IP, but the abolition meant that two-thirds of the stake was transferred to their universities. The paper finds that the abolition of PP reduced the production of start-ups by university researchers by about 50%. Martínez and Sterzi (2021) summarize several more studies about similar PP abolitions in other European countries, showing that they tend to find similar results. A unique strength of these PP abolition studies is that they have a quasi-natural experiment with a strong discontinuity. However, their study design cannot speak to what most practitioners and policy makers want to know most, namely how marginal changes in university stakes affect spinout performance.

In related work, Asterbro et al., (2019) compare US and Swedish university spinouts. They note that the PP abolition studies focus on a relatively short window and ask whether over longer periods the PP model generates different quantities and qualities of spinouts. Comparing detailed data from the US and Sweden (before its PP abolition), they do not find large differences in relative spinout rates between academic and non-academic founders. Interestingly, they also find that academic founders have significantly lower earnings in both countries. They thus question the desirability of policies that simply increase the number of spinouts without also improving quality.[4]

Our paper builds on a prior theory literature about the optimal allocation of rights. Aghion and Tirole (1994) provide a general theory of innovation under incomplete contracts. Jensen and Thursby (2001) and Hellmann (2007) focuses more specifically on incentives in technology transfer. Hvide and Jones (2018) also develop a theory model where both academic founders and university TTOs add value. They show that stakes should be allocated towards the agents whose investments has a greater effect on overall surplus. Interestingly, they themselves point out that the PP with a zero university stake can be suboptimal, because it discourages commitment of university resources.

Incentives are at the core of all these theories. A large empirical literature examines how scientists and universities respond to different commercialization incentives. Lach and Schankerman (2008), for example, examine the incentives of academics for patenting. Azoulay et al., (2009) consider the relationship between publishing and patenting. Debackere and Veuglers (2005) provide a useful discussion of the incentives and governance in technology transfer. The work of Avnimelech and Feldman (2015) identifies universities' academic quality and R&D budgets as important characteristics associated with high spinout rates. Tartari and Stern (2021) further find that US federal research funding plays a unique role in stimulating academic entrepreneurship. However, some authors question to what extent university TTOs help or hinder the success of technology transfer (see Thursby and Kemp, 2002 and Litan et al., 2007).

Our analysis is based on UK spinout companies. Useful reports on the UK spinout landscape can be found in Wright and Fu (2015), Hewitt-Dundas (2015), Ulrichsen (2019), and Beauhurst (2021). Ulrichsen, Roupakia, and Kelleher (2022) provide a detailed discussion of the process by which university stakes are determined. Of note, they call for more data-driven analysis, arguing that "Much has been claimed on these topics, but many claims appear to be justified largely on anecdotes and experiences with specific universities."

[4] Åstebro et al. (2019) frame their comparison in terms of professor's privilege in Sweden (where universities have no stake) vs. versus Bayh-Dole act in the US (where universities get positive stakes). A separate and large literature compares the commercialization of innovation in the US before and after the Bayh-Dole act of 1980. This is a different policy change, because prior to the Bayh-Dole act, most of the university IP belonged neither to the university, nor to the professor, but to the federal government. The overwhelming conclusion from that literature is that the Bayh-Dole act played an important role in fostering university licensing and spinouts (see Mowery et al., 2001).

This is a preliminary draft, and we plan to expand our analysis further by augmenting several parts of data ad analysis. We rely on publicly and commercially available data, and therefore cannot comment on any of the license terms that accompany university spinouts. Moreover, we do not have any systematic outcomes data beyond fundraising, such as spinout's sales growth, employment growth, let alone investor returns. Finally note that we only focus on UK spinouts and do not attempt to make any international comparisons.

This paper is structured as follows. Section 2 provides an overview of the data sources and our methodology for computing university stake. Section 3 contains the main empirical results, and Section 4 concludes.

2 Data and Variables

This section introduces our hand-collected dataset of British spinouts founded between 2010 and 2021. The dataset is very rich and includes ownership tables, stakeholder classifications, stakeholder characteristics, and financial performance measures. Utilizing data from the UK university spinouts identified by the British startup data aggregator Beauhurst, we have compiled a robust and unique dataset of 650 spinouts, and we aim to fill an important gap in the debate about the optimal university stakes for spinouts.

2.1 Data Sources

This project involves an extensive data collection effort about British spinouts founded in the decade starting in 2010, including data on ownership tables, stakeholder classifications, stakeholder characteristics, and financial performance measures.

For our analysis, we rely on the UK university spinouts identified by the British startup data aggregator Beauhurst.[5] Their definition of a spinout aligns with Higher Education Statistics Agency's (HESA, 2023): A university spinout is any company that was created to use intellectual property developed by a recognized UK university. Their dataset uses administrative data from the British company registry called Companies House, making the data more accurate and comprehensive as compared to commercial databases such as Crunchbase or Pitchbook. Ulrichsen (2019) provides further discussion on the completeness of Beauhurst's sample of spinouts. Beauhurst identifies a total of 1,103 spinouts incorporated between 2010 and 2021 and provides rich data on spinout characteristics such as industry classification and fundraising data, including deal-level data on the funding amounts. We apply objective filtering criteria to this initial sample to obtain a final sample consisting of 650 spinouts.[6]

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[5] Beauhurst (2021) defines a university spinout company as one that adheres to the HESA definition and meets at least one of the following criteria: the university possesses intellectual property (IP) which it has licensed to the company; the university holds shares in the company; or the university has the option, through an options or warrants contract, to acquire shares in the company at a future date.

[6] Our filtering criteria are as follows. Firstly, because our goal is to identify how equity is allocated between academics and the university, we exclude 6 spinouts where there are filing mistakes in the capitalization table. In addition, we exclude 40 spinouts where we cannot identify any members of the founding team who were affiliated at an academic position with a university. Secondly, the university equity stake is ultimately a reflection of a policy choice that the university has at its disposal due to owning IP rights. To minimize pollution of our sample with companies where the university may not have the same choice, we exclude the following: 56 RCA spinouts since there is some uncertainty about whether they are student startups or true university spinouts, 6 other startups (e.g., formed out of university incubators) and 10 spinouts of spinouts or spinouts of non-universities. Finally, as we are interested in studying the implications of marginal increases in university stake, we exclude from current analysis any remaining spinouts with a university stake smaller than 1%. We intend to include analysis of the latter in future versions of our paper.

We use Companies House administrative records to extract the equity distribution between the university and the founding team. From Companies House, we collect all annual capitalization tables. There are two documents in Companies House that contain capitalization tables: The Certificate of Incorporation and Confirmation Statements. The Certificate of Incorporation is filed when the company is set up and contains the capitalization table at incorporation. Confirmation Statements are filed annually and contain the updated capitalization table with any additional shareholders (e.g., investors).

Since the legal entity in Companies House is not always set-up at the time when the spinout deal between the university and the founding team is finalized, the Certificate of Incorporation does not necessarily reflect the equity split resulting from this deal. In fact, there are often cases when the capitalization table at incorporation contains only the university or only the founders, with subsequent capitalization tables containing both.

Because the date of the spinout event is unknown, we assume that the ownership stake which goes to the university is reflected in the capitalization table of the next immediate Confirmation Statement/Annual Return to be filed. We define such a capitalization table as the 'relevant capitalization table.' Thus, the 'relevant capitalization table' is the earliest one which contains all publicly identified founders and the university.

2.2 Inferring the Spinout Date

Our analysis of the performance of the company after the spinout event requires information on the date the company spun out. Unfortunately, this date is not publicly available. A simple proxy would be the date of the relevant capitalization table. By our previous assumption, this would be the latest possible date on which the real spinout date could fall. We improve on this simple proxy by exploiting the publication date of several more frequently filed documents: SH forms and Articles of Association.

Whenever the university enters the capitalization table, it is often the case that the overall number of shares changes. To track the various changes in the share capital, UK companies are legally required to file SH forms typically within one month since the change occurred (Companies House, 2021). A second useful document is the Articles of Association (AoA). Universities usually encourage spinouts to file AoA at the spinout event, so that the rights and responsibilities of shareholders are clearly spelled-out (e.g., see OUI, 2021). The detailed methodology of inferring the spinout date is given in the Appendix 1.

Our methodology for dating the spinout event is prone to error when there are multiple SH forms filed. In order to minimize the noise, we also use information on the type of investors involved in each round, assuming that private investors would not invest in the spinout before the equity distribution deal between the spinout and the university is finalized due to concerns about how university stake may potentially affect founders' incentives. The government, university, or charities, on the other hand, may well do so to support the creation of the spinout. Hence, the spinout date is taken to be the minimum between our inferred spinout date and the date of the earliest round where any investor other than the government, university or non-for-profit organizations participated.

2.3 Institutional Complexity

The structure of TTOs is complex due to some UK universities outsourcing commercialization services to external organizations. Notable examples include Imperial College London fully outsourcing its services to Touchstone Innovations, and multiple other universities partially outsourcing commercialization to investment vehicles (RSM, 2018; HEBCI, 2022). Due to the help provided by these outside organizations, the university either fully or partially transfers a part of its equity stake to them. We define these vehicles as university-affiliated funds. Appendix 2 lists the summary of the deals between universities and university-affiliated funds over our sample period.

Moreover, scientists could sometimes be jointly affiliated with the university as well as outside research agencies. A notable example is medical scientists being affiliated at NHS trusts. In this case, both the university and external research agencies can claim IP rights to the invention. We define these agencies as trusts.

Since both university-affiliated funds as well as trusts take some of the IP rights away from the founding team, we deem their equity stake detrimental to the founding team incentives. As such, our analysis treats the IP rights of funds and trusts the same as those of universities and adds the equity stake held by them to the equity stake held by the university.

2.4 Shareholder Categorization

Being equipped with the capitalization table reflecting the equity allocation deal at the spinouts event, the spinout date, and our understating of the commercialization process, we next turn to identify involved parties who are allocated an equity stake.

Using the information on several sources such as Articles of Association, spinout website, LinkedIn, departmental websites as well as other publicly available information, we classify each person and entity in the relevant capitalization table into one of the following categories: university, university-affiliated fund, trust, scientist, manager, and investor. Any shareholder for which we could not find any information is categorized as an unknown.

A scientist is defined as any shareholder who was involved in developing the technology which the spinout is based on. A manager is defined as any shareholder who held an executive position within the spinout at the inferred spinout date. Note that these categories are not mutually exclusive, such that a founder could fall into any of the following categories:

1. Scientists who develop the technology but who do not get involved in the running of the spinout after the spinout event (Remaining Scientists)
2. Scientists who give up their academic position and transition into running the firm (Transitioning Scientists)
3. Managers who are brought in to run the venture, but who have not contributed to the technology (New Managers)[7]

For our analysis, the spinout founding team is comprised of remaining scientists, transitioning scientists and New Managers. Appendix 3 provides a description of how the judgement calls on shareholder classifications were made. Several variables are collected for members of the founding team, including gender, highest education level completed, field of study, prior entrepreneurial experience, affiliation with the academic institution, and position held within the spinout.[8]

2.5 Computation of University Stake

[7] We also include here any advisors who join at the spinout event.

[8] Currently, we have only gathered the variables on founder backgrounds only for a subset of the founding team. Our data collection process is still ongoing, and we plan to gather variables for all members of the founding team.

2.5.1 Excluding Investment Stakes

Our research question focuses on the equity allocation between the founding team and the university at the spinout event, which in turn reflects the allocation of IP rights between the two sides. As such, when calculating the university stake, we exclude any investment made by external investors, the university, or university-affiliated funds.

External investors could represent deals made before or after the actual spinout event. They are excluded from the university stake calculation because their inclusion would create a mechanical dilution of the university stake. Assuming the investment was made after the spinout event, spinouts where an external investor is part of the 'relevant capitalization table' would otherwise have a lower university stake and better fundraising outcomes. Appendix 4 includes an example that illustrates this issue.

Apart from external investors being part of the 'relevant capitalization table,' the university and university-affiliated funds could themselves have invested. Observing that a spinout has not raised any investment post-spinout event could be due to the spinout not needing funding during that time horizon, or the spinout needing funding but being unable to raise any due to poor performance. Since a spinout that has already raised some funding from the university/affiliated fund may have fulfilled its fundraising objective, including university investment in the definition of university stake may result in a spurious negative correlation between university stake and our measures of spinout performance. As such, we only measure the equity stake granted to universities, university-affiliated funds, and trusts in exchange for them licensing/transferring IP to the spinout. We define this as the University IP Stake.

2.5.2 Computing the University IP Stake

We utilize SH01 forms, which are filed whenever new shares are allotted, to identify the price of issued shares.[9] Although SH01 forms provide the price per share issued, they do not provide the identity of the shareholders holding them. In many cases, it is possible to infer the identity of the shareholder by using the class of shares held by him/her in the capitalization table, or by matching his/her holdings in the capitalization table to the block structure in which shares are issued in SH01 forms.

However, there can also be more complicated cases when SH01 forms do not have enough information needed to infer the price per share for different shareholders. Interviews with practitioners suggest that the founding team is very unlikely to invest, compared to the university. We hence assume that the founding team has priority in receiving the lowest priced shares followed by the university, university-affiliated funds and lastly investors.

We define free shares as shares with a price per share equal to the lowest priced shares held by the founding team. We use the lowest founder share price as opposed to the university lowest share price because it could be that university has received no IP stake and has solely made an investment into the spinout.

Letting University IP Shares denote the free shares held jointly by the university, university-affiliated funds and trusts, the formula for the university IP stake is thus given by:

[9] Companies in UK are legally required to file SH01 forms within one month following the allotment of new shares (Companies House, 2021).

$$\text{University IP Stake} = \frac{\text{University IP Shares}}{(\text{University IP Shares} + \text{Free Founding Team Shares})} \cdot 100$$

Appendix 5 has a detailed explanation of our methodology. From this point forward, we use the term University stake and University IP stake interchangeably.

Given that we are only considering the equity deal reflected in the relevant capitalization table, the present analysis cannot speak about how the university and founder stake is diluted with subsequent investments. In particular, we abstract from considerations of anti-dilution provisions. This assumption could be relaxed in future work if we consider the dynamic evolution of university stakes in filings after the one containing the 'relevant capitalization table.'

2.6 Variable Definitions

2.6.1 Measuring Spinout Performance

The measure of spinout performance we consider is whether the spinout raised equity investment as well as the amount raised, conditional on fundraising success. We consider two different measures of equity investment, depending on the type of investor. The first one is a general measure which includes all equity investment received, coming from various investors including government agencies, university, university-affiliated funds, angel investors, venture capital. We also consider another measure of performance, namely fundraising from venture capitalists. This measure could be more useful in measuring spinout performance since it signals the level of confidence outside investors have in the future success of the companies (Hellmann and Wasserman, 2017). Table 1 provides the definitions of the dependent variables we use in our main analysis, alongside the control variables.

Insert Table 1 about here

2.6.2 Controls

The key independent variable of interest is the University IP Stake, computed according to the methodology outlined in Section 2.5. Next, we construct several controls describing characteristics of the founding team.

Building on the literature which explores how founders' prior work experience shapes early business strategies (see Beckman et al. 2007), we control for managers' prior entrepreneurial experience and prior work experience. We summarize the former into a dummy variable about whether any of the manager founders has prior entrepreneurial experience; for the later, we use founders' average number of years of work experience. To gauge the business background of the manager founders, we specify a dummy about whether any of them holds an MBA. We also control for founding team size, as prior studies show it is correlated with fundraising outcomes (e.g., Hellmann and Wasserman, 2017).

Apart from founding team characteristics that could determine the commercialization success of the spinouts, the strength/innovative nature of the technology upon which it is based on is equally important. A way to infer this is to summarize the research quality of the scientist founders - we proxy research quality by the nature of the academic affiliation of the scientist founders. The dummy variable we define captures whether any of the scientist founders held a professorship[10] during the year preceding the spinout event.

The next group of controls is spinout characteristics. Given the limited number of observations, we group the industry and region into broader categories defined in Table 1. The universities are grouped into three categories: Oxbridge, Russell Group and Non-Russell Group. We also include spinout year dummies, to account for potential UK- wide policies affecting the particular spinouts and universities as well as the general entrepreneurial climate in those years. Finally, we include dummies for the age of the spinout (in years) at the period in which we study its fundraising outcomes.

2.7 Summary Statistics

Table 2 provides summary statistics at the cross-section. Table 3 reports pair-wise correlations. Our initial sample consists of 650 spinouts, but 22 spinouts have missing values for the average work experience of founders and are thus excluded from the regression analysis. There is considerable variation in the university stake in our sample, ranging from 1.3% to 76.4%, with an average stake of 31%. This reflects the variation in the institutional design of IP policy across universities, but also over time. Our data reveals that 66% of the spinouts raised funding. The proportion drops to 30% when considering venture capital.

Insert Table 2 about here

The majority of spinouts have a Transitioning Scientist in the capitalization table, while only about one third have a New Manager. Table 2 reveals that Remaining and Transitioning Scientists are on average allocated 33.9% and 27.8% of equity each, in contrast to New Managers who are allocated only 7.4%.

Insert Table 3 about here

In order to better understand the correlation between equity allocation and spinout characteristics, Table 4 reports results from an OLS regression at the cross-section. A higher founding team size is correlated with lower university stake. This suggests that bigger teams may be better able to negotiate in their favour. Indeed, the coefficient of team size is positive for the equity stake held by remaining scientists and new managers, but negative for transitioning scientists. This indicates that the later may hold less bargaining power within the team, which is consistent with the fact that it is usually more junior researchers who transition from academia to commercialization.

Insert Table 4 about here

Surprisingly, the presence of a founder who holds a Professorship or an MBA is positively correlated with the university stake. This may seem counter-intuitive, as we would expect such founding teams to hold higher bargaining power. One potential explanation is that the TTO may view these characteristics

[10] Here we include Assistant, Associate as well as Full Professors.

as a signal of good future performance, and hence may extract higher equity stakes in what it expects to be more promising ventures.

Finally, Russell Group universities extract higher university stakes compared to both Oxbridge and Non-Russell Group.

3 Empirical regression analysis

This section shows the results of our investigation of the empirical relationship between university stakes and the fundraising success of spinouts. Using instrumental variables, the section aims to estimate the causal effect of university stakes at the time of spinout on subsequent fundraising success. Moreover, we put these estimates into the context of the effect of equity allocation on transitioning scientists, remaining scientists, and new managers.

3.1 Correlation of university stakes and fundraising probabilities

We are interested in examining how the university stake affects the fundraising success of university spinouts. We consider two main fundraising metrics. The first includes all types of equity irrespective of investor type. The second focuses on venture capital which is typically considered both more valuable and harder to get. For each of them, we first analyse the probability of raising such funding, and later we add an analysis of funding amounts.

In order to assess the determinants of the probability of fundraising, we begin by estimating a pooled OLS regression which does not address endogeneity concerns. We use linear regression models throughout because they can address both uninstrumented and instrumented regressions consistently. For each one-year period after the spinout event, we specify a dummy for fundraising success equal to 1 if the spinout raised funding for the first time in that year and has been operating for the entire period (i.e., exclude recent spinouts which do not cover all the period specified). Once a spinout raises funding in a given one-year period, it is excluded from the sample for the subsequent years since we are interested in the probability of the first fundraising success. Standard errors are clustered at the spinout level to allow for the correlation of yearly observations within a spinout. We use several controls, including industry and university groups, spinout cohort, and age fixed effects. Please refer to Table 1 for more details on our independent variables. The results are shown in the first and third columns of Table 5.

Insert Table 5 about here

The coefficient for the university stake is positive, even significant at 5% for equity fundraising. This may be considered slightly surprising, given the widely held belief that higher stakes hinder fundraising. This regression coefficient, however, is consistent with the univariate tests shown in Table 2, which shows that, among spinouts with above-median university stakes, 71% raised equity and 32% raised VC, compared to 62% and 28% for spinouts with below-median university stakes. All the coefficients in columns (i) and (iii) measure is the (conditional) correlation between university stakes and the probability of raising funds, they do not imply a causal relationship. For that reason, we now develop our instrumental variable approach.

3.2 Instrumental variable estimation

In the above specification, the university stake could be endogenous. Of particular concern is the possibility that the university negotiates different stakes depending on its expectation of how well the spinout will perform in the future. A priori, the direction of the bias is not entirely clear. It could be that more promising ventures are given easier terms, to incentive their growth, resulting in a downward bias of the OLS coefficients. Alternatively, the university could simply insist on higher stake in those ventures they consider most promising, but go easier on those with lower return potential, resulting in upward bias of the OLS coefficients. For the regressions we are mainly concerned about the bias resulting from unobservable return expectations. As a preliminary step, we consider correlations with observable founder and venture characteristics. Tables 3 and 4 suggest that higher university stakes are associated with having a professor scientist or an MBA in the founder team.[11] This pattern favours the latter conjecture that universities negotiate harder with their most promising spinouts.

We do not have the benefit of a discontinuous policy shock, such as the abolition of the PP. Also, our analysis does not focus on the presence or absence of university stakes but focuses instead on the level of university stakes, the issue that has preoccupied most of the practical debates. We propose an instrumental variable that reflects exogenous changes in the university's bargaining position. Specifically, we measure the 'precedent stakes' that the university and founder team can invoke as part of their negotiations. Recall that TTOs negotiate university stakes within a set of rules and guidelines that leave some discretion. In reaching an agreement, both universities and founders can invoke examples of what happened before to justify their bargaining positions. Put differently, we would expect the university to offer similar deals to comparable prior spinoffs. This justifies the relevance condition for a first-stage regression. For the second-stage regression, the exclusion restriction holds because precedent deals concern other spinoffs and therefore do not affect the performance of the focal firm.[12]

Concretely, our instrument, called "Precedent University Stake," is a 3-year moving average of the university stakes from spinouts in the same university[13] that preceded the focal spinout. With this, we estimate a 2SLS regression using Precedent Uni Stake as an instrument in the first stage regression. Columns (ii) and (iv) of Table 5 report the results. To begin with, we note that the instrument itself is highly significant at the 1% level, with a large F-statistic. Turning to the second-stage regression we find that the coefficient in column (ii) is smaller than in column (i), thus turning a positive significant coefficient insignificant; and the coefficient in column (iv) is smaller than in column (ii), thus turning an insignificant coefficient into a negative significant one.

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[11] We also find a positive correlation with founders having more prior work experience. Interestingly, the opposite is true for founders with prior entrepreneurial experience, presumably because they know better how negotiate for themselves.

[12] Our instrument is based on peer effects where the ownership of the focal spinout is affected by the deals received by peers, most specially spinouts in the same university that came before the focal on. Research on peer effects dates back to Sacerdote (2001). Ahern et al. (2011) use peer effects to study risk versions, and Lerner and Malmedier (2013) examine peer effects among entrepreneurial MBA students. Our identification logic is thus related to instruments that leverage local peer effects. Along similar lines, Berger et al. (2005) use variation in local banking markets to control for endogenous matching of firms with banks. In the venture capital literature. Bottazzi et al. (2008) and Chemmanur et al. (2011) also use similar instruments based on the local funding availability. Throughout this literature the relevance condition comes from local peers influencing the transaction of the focal actors. The exclusion restriction requires that the only way peers influence the focal actor is through the transaction, but they do not influence the focal spinout's performance directly. In our context, the precent university stakes influence the stake in the focal spinout, but they do not directly affect the performance of the focal spinout.

[13] If a company spun out from two universities, we assign it to the university holding the highest equity stake for the purpose of constructing the instrument. When the universities hold equal stake, we assign the spinout to the university which has had the highest spinout activity in our sample, as measured by the number of spinouts it has produced. The rationale for doing so is that the university with the highest stake or activity would presumably have the highest bargaining power and hence it is the precedence from this university which would be most predictive of the equity stake taken in the focal spinout. For spinouts formed before 2013, the window of constructing the precedent stake is smaller than three years since our sample begins in 2010.

To give an idea of the economic magnitudes, let us focus on column 4. Evaluated at the mean, a 1% increase in Uni Stake decreases the probability of raising VC by 0.3%. The probability of raising VC in the overall sample is 30%, so a 10% increase in the university stake would take that down to 27%.

3.3 Investment amounts

So far, our analysis focuses on the probability of raising funding. We also obtain data on the amounts raised. We estimate pooled OLS and 2SLS regressions where the dependent variables are the natural logarithm of the annual amount raised each year after the spinout event, conditional on the amount being positive.[14]

Table 6 shows the results using the same structure as Table 5. All the estimated coefficients are positive and turn insignificant after controlling for endogeneity.

Insert Table 6 about here

An alternative signal of performance is the ability of the spin-out to scale. In terms of fundraising, this is reflected in reaching rounds B or C. Unfortunately, the type of rounds reached is not available in our data. Instead, we proxy this by asking whether the spinout has managed to pass the £15M or £25M thresholds of the investment amounts raised over its lifetime. We estimate a cross-sectional regression, where the dependent variables are dummies for whether the spinout reached the specified fundraising goals. Table 7 reports the results.

Insert Table 7 about here

The first and third column report results from OLS. Uni Stake is positively correlated with the probability of raising large amounts and is consistent with the universities taking higher stakes from more promising ventures. Once we use the precedent university stake as an instrument in columns two and four, the effect disappears.

3.4 Valuations

A final metrics of performance we consider is post-money valuation. We estimate cross-sectional OLS and 2SLS regressions where the dependent variable is the natural logarithm of the earliest available post-money valuation[15].

Table 8 reports the results. The coefficient of Uni Stake is insignificant for both OLS and 2SLS specifications. In the 2SLS specification, the size of the coefficient suggests that a 1% increase in Uni Stake reduces the earliest post-money valuation by 0.6%[16].

[14] Spinout-year observations are dropped if spinout age does not cover the entire period specified so that we do not underestimate the actual amount raised. For the same purpose, we also drop spinout-year observations, where amount was undisclosed for any of the deals falling in a particular year. This problem is only limited to about 3.6% of the deals in our sample. Future work intends to impute the missing values utilizing SH01 forms filed in Companies House.

[15] If a round has missing valuation, the next available valuation is used. Using latest, as apposed to earliest valuation give similar results qualitatively, so we only report regressions on the determinants of earliest post-money valuation.

[16] Since the dependent variable is the natural logarithm of the earliest post-money valuation and Uni Stake is measured in units from 1-100, the marginal effect is calculated as (Exponential (Uni Stake coefficient)-1)*100%.

Insert Table 8 about here

3.5 Sectoral differences

In this section, we investigate whether the effects of Table 5 apply across different sectors. We already established the distinction between more and less science-intensive, noting that universities spend considerably more resources on science-intensive spinouts. One may thus ask whether this affects the role of the university in fundraising. We therefore rerun the analysis in the two subsamples of more and less science-intensive spinouts. Table 9 reports the results. Looking first at the un-instrumented regressions, the coefficients are positive and significant for the more science-intensive spinouts but remain insignificant for the less science-intensive ones. In the instrumented 2SLS regressions, we notice smaller coefficients. They are insignificant for the more science-intensive spinouts, but for less science-intensive spinouts we find a negative significant coefficient on the probability of raising VC. On average, a 10% increase in the university stake decreases the probability of raising VC by 4.5.%.

Insert Table 9 about here

Overall, these results suggest that university stakes can have different effects on different spinouts. The problem of high university stakes making companies less fundable seems to be more salient in less science-intensive sectors, such as IT. In the more science-intensive sectors, such as engineering or biomedical, however, there is no statistically significant effect.

3.6 Extensive margin: number of spinouts formed

So far, we have focused on how Uni Stake affects the fundraising performance of spinouts which have already been formed. We next ask whether Uni Stake may have an effect on the extensive margin through influencing the decision of the scientists to create a spinout to begin with. Since the decision of individual scientists is unobservable, we rely on the number of spinouts formed across UK universities over time to describe effects on the extensive margin.

We construct a panel where the dependent variable is the natural logarithm of 1 + the number of spinouts with positive university ownership[17], formed in each university at each academic year in our sample. The main independent variable of interest is the average equity stake that the university has taken from its spinouts over the previous three academic years, excluding the year under consideration. We also control for various time-varying characteristics provided by the annual HEBCI survey. Each year, universities across the UK are legally required to report answers to the survey, which cover a broad range of services the university offers, as well as performance indicators for the startups and spinouts it produces (HEBCI, 2022).

The first group of controls we employee captures the inflow of innovation into university's TTO: the number of scientific disclosures and number of patent applications.

[17] As reported by HEBCI.

The second group of controls are two income measures at the level of TTO: IP Revenues and IP Expenditure. These variables aim to capture resources available to the TTO as well as resources invested towards exploitation of IP, respectively.

The third group of controls captures the facilities and networks the university has made available each year for its spinouts:

- The provision of campus or local incubators is one of the ways in which the university can directly support spinout development, as well as facilitate networking between spinouts and different kind of investors (Patton and Marlow, 2011).
- The provision of other facilities such as science park accommodation.
- The number of staff startups (not spinouts) is a signal of overall entrepreneurial climate in the university in a particular academic year

All controls are specified as the average university characteristics over the previous three academic years, excluding the year under consideration. For dummy variables describing facilities offered, the value is equal to 1 if the dummy took the value of 1 in the proceeding three-year period. In addition, regressions control for university and academic year fixed effects. Table 10 reports regression results.

Insert Table 10 about here

The coefficient of past average Uni Stake is negative and significant across all specifications. We find that a 1% increase in Uni Stake decreases the number of university-owned spinouts with 0.78%[18]. This suggests that high Uni Stakes are detrimental on the extensive margin.

3.8 Robustness

As a first robustness check, we explore whether our results are sensitive to the definition of sectors. The current definition only consists of four categories, where we have grouped multiple SIC groups in the last category. We consider an alternative sectoral definition, similar to Hvide and Jones (2018)[19], using fixed effects for each SIC group. Table 11 reports the results for the probability of fundraising success. Both the size as well as the statistical significance of the Uni Stake coefficient remains intact.

Insert Table 11 about here

As a further robustness check, we move away from linear probability model and estimate Probit and IV-Probit regressions for the probability of fundraising success, using the same Instrumental Variable as before. Table 12 reports results. Qualitatively, the effect on Uni Stake remains the same: Uni Stake is detrimental for VC fundraising success, with effect focalized in Less Science Intensive spinouts. In terms of the size of the effect, the IV Probit predicts a 0.22% decrease[20] in the probability of VC funding for the overall sample (as opposed to 0.3% with linear model) and a 0.44% decrease in probability of

[18] Since the dependent variable is a log transformation and the independent variable is measured in units from 1-100, the marginal effect of Uni Stake is calculated as (exponential(UniStake Coefficient)-1)*100.
[19] Hvide and Jones (2018) determine sectors using the 1-digit NACE code in their main analysis (see Table 2 for e.g.). Similar to us, they make this choice as opposed to using more granular industry controls because they are constrained by the number of observations.
[20] This is the average marginal effect of Uni Stake on probability of VC funding.

VC funding for the less Science Intensive sample (compared to 0.45% in linear models) for a 1% increase in University Stakes. Hence the results remain similar both qualitatively and quantitatively.

Insert Table 12 about here

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4 Conclusion

In this paper, we examine how the allocation of ownership in university spinouts affects their ability to raise subsequent funding from outside investors. Simple correlations suggest a positive relationship between university stakes and fundraising metrics. This may be partly driven by selection effects where universities retain larger stakes in their most promising ventures. Using an instrument based on precedent stakes, we find some evidence of a negative causal relationship between the university stake and the probability of raising venture capital. However, the estimated magnitudes remain relatively small. We also find that the negative impact is concentrated in less science-intensive spinout sectors.

The analysis provides new insights into the role of equity allocation on spinout performance and raises further questions for future research. A typical spinout involves a complex contract that specifies not only the allocation of equity, but also several other terms, most notably licensing terms. This data is not publicly available and would thus require access to confidential data. This would allow an examination of the relationships between licensing terms and spinout performance, and how this might interact with the ownership channel discussed here. Beyond looking at fundraising success, it would be valuable to consider additional performance metrics, such as sales growth, employment creation, and eventually exit values and investment returns.

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Table 1: Variable definitions

Dependent Variables	
(1) Raised Eq	Dummy variable for spinouts that raised equity investment each year after spinout event.
(2) Amount of Eq Investment	Annual amount raised in million GBPs over each one-year period after the spinout event, conditional on the spinout having raised equity funding.
(3) Raised VC	Dummy variable for spinouts that raised VC investment each year after spinout event.
(4) Amount of VC Investment	Annual amount raised in million GBPs from rounds where VC participated over each one-year period after the spinout event, conditional on the spinout having raised equity funding.
(5) Earliest Post-money Valuation	Earliest available post-money valuation in million GBPs for a spinout.
(6) Raised >= GBP 15M	Dummy variable for spinouts that raised more than GBP 15 million over its lifetime.
(7) Raised >= GBP 25M	Dummy variable for spinouts that raised more than GBP 25 million over its lifetime.
Independent Variables	
(8) University Stake	University equity stake in % at time of spinout.
(9) Transitioning Scientist Stake	Transitioning scientist (TS) equity stake in % at time of spinout.
(10) Remaining Scientist Stake	Remaining scientist (RS) equity stake in % at time of spinout.
(11) New Manager Stake	New manager (NM) equity stake in % at time of spinout.
(12) Precedent Uni Stake	Average university stake of companies spun out from the same university in the three-year period prior to the spinout event of the focal company.
(13) Nr of Founders	The number of transitioning & remaining scientists, and new managers.
(14) MBA	Dummy variable equals to 1 if any of the spinout managers has an MBA.
(15) Entre Exp	Dummy variable equals 1 if any of the managers has prior entrepreneurial experience.
(16) Avg. Work Exp	Average work experience (in years) of founders.
(17) Prof Scientist	Dummy variable equals 1 if any scientist founder was a professor before the spinout event.
Fixed effect Variables	
Industries	Dummy variables for Manufacturing, IT, Scientific, and Other industries.
Regions	Dummy variables for London, Northern Ireland, the Rest of England, Scotland, and Wales.
Spinout Age	Dummy variables for the age of the spinout in years.
Spinout Cohort	Dummy variables for the year in which the company spun out of the university.
University Groups	Dummy variables for the membership of the focal university belonging to Oxbridge, Russell Group Universities, and the Non-Russell Group Universities.

Table 2: Summary Statistics

Table shows summary statistics for overall sample, High Uni Stake and Low Uni Stake subsamples. Subsamples: relative to median university stake. Variables (1) and (3): dummy for whether spinout raised funding type over lifetime; (2) and (4): average raised amount over lifetime in Million GBPs, conditional on success. Variable (5) is defined as the earliest available post-money valuation (if a round has a missing valuation, the next available valuation is used). Two-sided Welch test conducted for mean equality across subsamples. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

	Full Sample			High Uni Stake	Low Uni Stake
	Obs.	Mean	St.dev.	Mean	
(1) Raised Eq	650	0.6646	0.4725	0.7064**	0.6223
(2) Amount of Eq Investment	403	2.1762	5.1971	2.4500	1.8471
(3) Raised VC	650	0.3015	0.4593	0.3211	0.2817
(4) Amount of VC Investment	184	2.6926	5.6781	3.2635	2.0130
(5) Earliest Post-money Valuation	399	3.4110	7.6991	3.1088	3.8381
(6) Raised >= GBP 15M	650	0.0862	0.2808	0.1101**	0.0619
(7) Raised >= GBP 25M	650	0.0477	0.2133	0.0581	0.0372
(8) University Stake	650	30.9827	16.8667	45.3727***	16.4144
(9) Transitioning Scientist Stake	650	27.7824	27.5737	20.0799***	35.5803
(10) Remaining Scientist Stake	650	33.8689	24.5895	30.1916***	37.5917
(11) New Manager Stake	650	7.3661	14.6038	4.3559***	10.4136
(12) Precedent Uni Stake	564	31.6372	12.0441	36.4252***	27.0161
(13) Nr of Founders	650	3.6308	2.2085	3.3486***	3.9164
(14) MBA	650	0.3231	0.4680	0.3700***	0.2755
(15) Entre Exp	650	0.4631	0.4990	0.4679	0.4582
(16) Avg. Work Exp	628	15.6499	8.9852	17.0840***	14.1975
(17) Prof Scientist	650	0.7400	0.4390	0.7798**	0.6997
(18) Oxbridge	650	0.2292	0.4207	0.2202	0.2384
(19) Russell Group	650	0.5092	0.5003	0.5841***	0.4334
(20) Non-Russell Group	650	0.2615	0.4398	0.1957***	0.3282
(21) Manufacturing	650	0.1631	0.3697	0.1468	0.1796
(22) IT	650	0.1800	0.3845	0.1437**	0.2167
(23) Scientific	650	0.5692	0.4956	0.6239***	0.5139
(24) Other Industries	650	0.0877	0.2831	0.0856	0.0898
(25) London	650	0.1477	0.3551	0.1223*	0.1734
(26) Rest of England	650	0.6323	0.4825	0.7187***	0.5449
(27) Scotland	650	0.1262	0.3323	0.1009*	0.1517
(28) Wales	650	0.0585	0.2348	0.0214***	0.0960
(29) Northern Ireland	650	0.0354	0.1849	0.0367	0.0341

Table 3: Pair-Wise Correlations

Table shows pair-wise correlations. Variable numbers in Table 2, definitions in Table 1. Variables (2) and (4) are zero if spinout did not raise funding. Because earliest post-money valuation is only available for spinouts that raised funding, the correlation between variable (5) and (1) is not applicable. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(2)	0.23***															
(3)	0.47***	0.30***														
(4)	0.17***	0.85***	0.36***													
(5)	NA	0.47***	0.09*	0.31***												
(6)	0.22***	0.68***	0.29***	0.51***	0.40***											
(7)	0.16***	0.77***	0.25***	0.63***	0.46***	0.73***										
(8)	0.09**	0.12***	0.04	0.11***	0.00	0.10**	0.08**									
(9)	-0.06	-0.08**	-0.07*	-0.09**	-0.08	-0.09**	-0.10**	-0.36***								
(10)	-0.06	0.03	0.03	0.05	0.08*	0.05	0.07*	-0.14***	-0.73***							
(11)	0.10***	-0.04	0.04	-0.05	0.02	-0.02	-0.03	-0.24***	-0.24***	-0.15***						
(12)	0.10**	0.00	-0.04	-0.01	-0.05	0.00	0.00	0.42***	-0.16***	-0.07*	-0.06					
(13)	0.17***	0.13***	0.15***	0.13***	0.04	0.10***	0.10**	-0.12***	-0.15***	0.13***	0.21***	0.03				
(14)	0.03	0.05	0.03	0.06	0.00	0.05	0.03	0.14***	-0.56***	0.53***	-0.01	0.04	-0.01			
(15)	0.09**	0.06	0.06	0.05	0.00	0.06	0.05	0.05	-0.50***	0.40***	0.20***	0.04	0.13***	0.63***		
(16)	0.04	0.08**	-0.05	0.09**	0.08	0.05	0.06	0.20***	-0.26***	0.04	0.18***	0.00	0.06	0.15***	0.26***	
(17)	0.05	0.12***	0.05	0.10**	0.11**	0.13***	0.12***	0.15***	-0.29***	0.22***	0.00	0.05	0.18***	0.12***	0.16***	0.33***

Table 4: OLS Regression of Determinants of University and Founding Team Equity Stake

Table presents OLS regressions for equity stakes determinants for universities, transitioning scientists, remaining scientists, and new managers. Unit: spinout level (cross-sectional analysis). 22 spinouts dropped due to missing founder work experience. Intercept included. Coefficients reported, robust standard errors in parentheses. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

	DV: Uni Stake	DV: TS Stake	DV: RS Stake	DV: NM Stake
Nr of Founders	-1.2325***	-1.2709***	1.2830***	1.2205***
	(0.3263)	(0.3668)	(0.3831)	(0.2659)
MBA	6.0127***	-24.4646***	24.7955***	-6.3436***
	(1.7063)	(2.7195)	(2.3705)	(1.8832)
Avg Work Exp	0.2767***	-0.2171**	-0.3445***	0.2850***
	(0.0775)	(0.1061)	(0.1024)	(0.0680)
Entre Exp	-4.0120**	-8.7572***	4.5282**	8.2410***
	(1.6811)	(2.7351)	(2.2339)	(1.8663)
Prof Scientist	3.8396**	-9.8947***	9.7858***	-3.7308***
	(1.5967)	(2.2615)	(2.0391)	(1.4335)
Rest of England	6.3766***	-9.5886***	4.3956*	-1.1836
	(1.9351)	(2.7212)	(2.4577)	(1.9613)
Scotland	1.1475	-6.1086*	6.1501*	-1.1891
	(2.2960)	(3.3293)	(3.2032)	(2.3926)
Wales	-3.3146	-2.5041	11.5042***	-5.6855**
	(3.2290)	(4.6376)	(4.3863)	(2.7512)
Northern Ireland	3.5455	-8.1672*	7.5208	-2.8991
	(3.4523)	(4.5079)	(4.8010)	(2.6416)
Manufacturing	-2.6485	0.7722	1.6063	0.2699
	(2.7118)	(3.6052)	(3.9532)	(2.3730)
IT	-3.4424	1.8924	-0.7908	2.3408
	(2.5010)	(3.5116)	(3.7900)	(2.6218)
Scientific	2.1839	-3.5362	2.1266	-0.7742
	(2.3240)	(3.0719)	(3.5789)	(2.2601)
Oxbridge	-1.6675	5.0366*	-2.5455	-0.8236
	(2.0170)	(2.8073)	(2.6134)	(1.7925)
Russell Group	4.7465***	-1.1735	-1.2908	-2.2822
	(1.6394)	(2.1891)	(2.0445)	(1.4310)
Cohort fixed effects	Yes	Yes	Yes	Yes
Observations	628	628	628	628
R^2	0.2014	0.4355	0.3561	0.1659

Table 5: Determinants of Probability of Fundraising Success

Table shows OLS/2SLS panel regressions for fundraising success determinants. Dependent variables: binary indicators for equity/VC yearly post-spinout. Intercept included. OLS/2SLS coefficients reported, standard errors in parentheses (clustered at spinout level). 2SLS: university equity stake instrumented by average stake of same-university spinouts in prior 3-year period. Only instrumental variable coefficient/standard error shown in first stage. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

	DV: Raised Eq		DV: Raised VC	
	OLS	2SLS	OLS	2SLS
University Stake	0.0018**	0.0000	0.0005	-0.0030***
	(0.001)	(0.002)	(0.000)	(0.001)
Nr of Founders	0.0227***	0.0232***	0.0077**	0.0021
	(0.006)	(0.007)	(0.004)	(0.004)
MBA	-0.0206	-0.0222	-0.0102	0.0152
	(0.036)	(0.044)	(0.020)	(0.024)
Avg Work Exp	0.0000	-0.0005	-0.0011*	-0.0008
	(0.001)	(0.001)	(0.001)	(0.001)
Entre Exp	0.0395	0.0668	0.0116	0.0023
	(0.034)	(0.042)	(0.019)	(0.023)
Prof Scientist	-0.0018	0.0189	0.0095	0.0378*
	(0.026)	(0.033)	(0.013)	(0.020)
Rest of England	0.0069	0.0168	-0.0028	0.0049
	(0.031)	(0.032)	(0.016)	(0.020)
Scotland	0.0409	0.0421	0.0183	0.0161
	(0.040)	(0.043)	(0.020)	(0.025)
Wales	-0.0610*	-0.0608	-0.0430***	-0.0516**
	(0.037)	(0.042)	(0.017)	(0.021)
Northern Ireland	-0.0287	-0.0025	-0.0031	-0.0127
	(0.062)	(0.086)	(0.027)	(0.038)
Manufacturing	0.0615	0.0898*	0.0309	0.0448*
	(0.040)	(0.049)	(0.019)	(0.024)
IT	0.0393	0.0602	0.0344*	0.0462*
	(0.039)	(0.050)	(0.020)	(0.027)
Scientific	0.0669*	0.0969**	0.0268	0.0480**
	(0.036)	(0.044)	(0.017)	(0.022)
Oxbridge	0.2197***	0.2391***	0.1256***	0.1437***
	(0.044)	(0.050)	(0.023)	(0.027)
Russell Group	0.018	0.0423	0.0141	0.0438***
	(0.025)	(0.035)	(0.011)	(0.017)
Cohort fixed effects	Yes	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes	Yes
Observations	1484	1226	2353	1887
R^2	0.287	0.2969	0.1115	0.0835
First Stage for 2SLS regressions				
		DV: Uni Stake		DV: Uni Stake
Precedent Uni Stake		0.6106***		0.5560***
		(0.069)		(0.076)
F-Statistics		78.6745		53.1803

Table 6: Determinants of Amount of Funding Raised, conditional on Fundraising Success

Table shows OLS/2SLS panel regressions for investment amount determinants, conditional on fundraising success. Observations: positive yearly post-spinout amounts. Dependent variable: natural logarithm of funding from any source/VC firms. Excludes Wales spinouts for VC funding since they did not raise VC. Intercept included. OLS/2SLS coefficients reported, standard errors in parentheses (clustered at spinout level). 2SLS: university equity stake instrumented by average stake of same-university spinouts in prior 3-year period. Only instrumental variable coefficient/standard error shown in first stage. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

	DV: Log amount of Eq Investment		DV: Log amount of VC Invesmtent	
	OLS	2SLS	OLS	2SLS
University Stake	0.0104**	0.0012	0.0122*	0.0170
	(0.0048)	(0.0152)	(0.0063)	(0.0193)
Nr of Founders	0.0497	0.0414	0.0542	0.0812*
	(0.0392)	(0.0462)	(0.0467)	(0.0443)
MBA	-0.2920*	-0.1562	-0.4067*	-0.4228
	(0.1648)	(0.1971)	(0.2352)	(0.2994)
Avg Work Exp	0.004	0.0083	0.0092	0.0134
	(0.0088)	(0.0105)	(0.0135)	(0.0166)
Entre Exp	0.1493	0.0771	0.2026	0.2707
	(0.1656)	(0.2011)	(0.2428)	(0.2849)
Prof Scientist	0.3189*	0.4770**	0.4985**	0.5102**
	(0.1731)	(0.1973)	(0.2494)	(0.2527)
Rest of England	-0.2842	-0.3188	-0.6249*	-0.8379**
	(0.2239)	(0.2733)	(0.3435)	(0.3707)
Scotland	-0.1547	-0.2741	-0.6101	-0.6922*
	(0.2833)	(0.3324)	(0.3771)	(0.3688)
Wales	-1.4972***	-1.5095***		
	(0.3797)	(0.3989)		
Norther Ireland	-0.3321	-0.3795	-1.0164**	-1.1795***
	(0.3610)	(0.3794)	(0.4221)	(0.4539)
Manufacturing	0.2162	0.3531	-0.0303	0.5806
	(0.3270)	(0.3472)	(0.4122)	(0.4893)
IT	0.176	0.3905	-0.0142	0.509
	(0.3079)	(0.3396)	(0.3493)	(0.4212)
Scientific	0.4579	0.6342**	0.3176	0.7854*
	(0.2953)	(0.3191)	(0.3240)	(0.4013)
Oxbridge	1.5309***	1.4816***	1.2460***	1.3076***
	(0.1963)	(0.2392)	(0.2597)	(0.3140)
Russell Group	0.5393***	0.4422**	0.4652*	0.3096
	(0.1669)	(0.2210)	(0.2575)	(0.3361)
Cohort fixed effects	Yes	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes	Yes
Observations	905	771	307	267
R^2	0.2905	0.2813	0.3763	0.3816
First Stage for 2SLS regressions				
		DV: Uni Stake		DV: Uni Stake
Precedent Uni Stake		0.4485***		0.4179***
		(0.0787)		(0.1213)
F-Statistics		32.4689		11.8729

Table 7: Determinants of Probability of Large Cumulative Fundraising

Table shows OLS/2SLS panel regressions for probability of raising large cumulative life-time funding. Unit: spinout level (cross-sectional). Dependent variables: Dummy equals to 1 if spinout raised cumulative life-time funding over GBP 15M and 25M. Intercept included. OLS/2SLS coefficients reported, standard errors in parentheses (robust). 2SLS: university equity stake instrumented by average stake of same-university spinouts in prior 3-year period. Only instrumental variable coefficient/standard error shown in first stage. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

	DV: Cumulative Amount >= £15M		DV: Cumulative Amount >= £25M	
	OLS	2SLS	OLS	2SLS
University Stake	0.0016**	-0.001	0.0009*	-0.0001
	(0.001)	(0.002)	(0.001)	(0.002)
Nr of Founders	0.0119*	0.0119	0.0076	0.0084
	(0.007)	(0.008)	(0.005)	(0.006)
MBA	-0.0025	0.0209	-0.0151	-0.0089
	(0.031)	(0.033)	(0.023)	(0.027)
Avg Work Exp	-0.0011	-0.0011	-0.0004	0.0000
	(0.001)	(0.001)	(0.001)	(0.001)
Entre Exp	0.0029	-0.0046	0.0128	0.0159
	(0.029)	(0.032)	(0.021)	(0.025)
Prof Scientist	0.0468**	0.0684***	0.0255*	0.0290*
	(0.021)	(0.024)	(0.014)	(0.017)
Rest of England	-0.0027	0.0198	-0.0302	-0.0233
	(0.030)	(0.036)	(0.025)	(0.029)
Scotland	0.0234	0.0196	-0.0017	0.0027
	(0.038)	(0.044)	(0.031)	(0.037)
Wales	-0.0275	-0.0261	-0.0289	-0.0323
	(0.033)	(0.035)	(0.025)	(0.028)
Northern Ireland	0.0109	0.0353	0.0022	0.0118
	(0.029)	(0.036)	(0.024)	(0.028)
Manufacturing	0.0641**	0.0650*	0.0222	0.0323*
	(0.032)	(0.037)	(0.016)	(0.019)
IT	0.0336	0.0443	0.0033	0.0142
	(0.030)	(0.036)	(0.014)	(0.018)
Scientific	0.0697***	0.0908***	0.0625***	0.0799***
	(0.027)	(0.034)	(0.016)	(0.019)
Oxbridge	0.2184***	0.2096***	0.1279***	0.1216***
	(0.036)	(0.037)	(0.028)	(0.028)
Russell Group	0.0178	0.0291	0.0068	0.0071
	(0.017)	(0.023)	(0.011)	(0.018)
Cohort fixed effects	Yes	Yes	Yes	Yes
Observations	628	546	628	546
R^2	0.1704	0.1658	0.1395	0.1414
First Stage for 2SLS regressions				
		DV: Uni Stake		DV: Uni Stake
Precedent Uni Stake		0.5627***		0.5627***
		(0.0571)		(0.0571)
F-Statistics		97.095		97.095

Table 8: Determinants of Earliest Post-Money Valuation

Table shows OLS/2SLS panel regressions for determinants of earliest available post-money valuation. Unit: spinout level (cross-sectional). Dependent variables: natural logarithm of earliest available valuation (i.e., if a round has missing valuation the next available valuation is used). Intercept included. OLS/2SLS coefficients reported, standard errors in parentheses (robust). 2SLS: university equity stake instrumented by average stake of same-university spinouts in prior 3-year period. Only instrumental variable coefficient/standard error shown in first stage. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

	DV: Log of Earliest Valuation	
	OLS	2SLS
University Stake	0.0043	-0.0059
	(0.004)	(0.012)
Nr of Founders	0.0365	0.0129
	(0.031)	(0.037)
MBA	-0.2256	-0.0619
	(0.147)	(0.175)
Avg Work Exp	0.0000	0.0083
	(0.008)	(0.010)
Entre Exp	0.0403	-0.0777
	(0.137)	(0.153)
Prof Scientist	0.2613*	0.3042**
	(0.141)	(0.154)
Rest of England	-0.6381***	-0.5133**
	(0.199)	(0.238)
Scotland	-0.4536*	-0.3777
	(0.258)	(0.280)
Wales	-0.512	-0.3953
	(0.342)	(0.383)
Northern Ireland	-0.5413	-0.6457**
	(0.349)	(0.319)
Manufacturing	0.4188	0.3122
	(0.285)	(0.333)
IT	0.2415	0.3461
	(0.265)	(0.306)
Scientific	0.4925**	0.4838
	(0.248)	(0.297)
Oxbridge	0.9522***	0.8092***
	(0.178)	(0.218)
Russell Group	0.0728	-0.0331
	(0.171)	(0.206)
Cohort fixed effects	Yes	Yes
Observations	388	339
R^2	0.2309	0.2108
First Stage for 2SLS regressions		
		DV: Uni Stake
Precedent Uni Stake		0.4754***
		(0.0768)
F-Statistics		38.332

Table 9: Determinants of Probability of Fundraising Success by Sector

Table presents OLS/2SLS panel regressions for fundraising success determinants in science-intensive and less science-intensive subsamples. Dependent variables: binary indicators for equity/VC yearly post-spinout. Controls: independent variables and fixed effects from Table 5. OLS/2SLS coefficients reported, standard errors in parentheses (clustered at spinout level). 2SLS: university equity stake instrumented by average stake of same-university spinouts in prior 3-year period. Only instrumental variable coefficient/standard error shown in first stage. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

	Science-intensive spinouts				Less science-intensive spinouts			
	DV: Raised Equity		DV: Raised VC		DV: Raised Equity		DV: Raised VC	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
University Stake	0.0037***	0.0014	0.0014**	-0.0022	-0.0006	0.0005	-0.0007	-0.0045**
	(0.0011)	(0.0029)	(0.0006)	(0.0014)	(0.0012)	(0.0027)	(0.0006)	(0.0018)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	781	677	1,324	1,091	703	549	1,029	796
R^2	0.3132	0.3302	0.1140	0.0882	0.2857	0.2951	0.14	0.117
First Stage of 2SLS regressions								
		DV: Uni Stake		DV: Uni Stake		DV: Uni Stake		DV: Uni Stake
Precedent Uni Stake		0.5827***		0.5985***		0.6240***		0.4896***
		(0.0930)		(0.0832)		(0.0917)		(0.1126)
F-Statistics		39.2848		51.6973		46.3461		18.9222

Table 10: Determinants of the Number of newly formed university-owned Spinouts

Table presents OLS/2SLS panel regressions for determinants of the number of new university-owned spinouts formed. Dependent variables: the natural logarithm of 1 + the number of newly formed university-owned spinouts in a given academic year as reported by HEBCI. Independent variables are specified as the average university characteristics over the previous three academic years, excluding the year under consideration. The moving average for IP Revenues and IP Expenditure is log-transformed. For dummy variables, the value is equal to 1 if the dummy took the value of 1 in the three-year period. Coefficients from fixed effects estimation are reported, with the associated cluster-robust standard errors in parenthesis. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

Variables	DV: Log of number of newly-formed university-owned spinouts									
Precedent Uni Stake	-0.0075**	-0.0075**	-0.0078**	-0.0076**	-0.0078**	-0.0076**	-0.0075**	-0.0069*	-0.0075**	-0.0078**
	(0.0036)	(0.0036)	(0.0037)	(0.0035)	(0.0035)	(0.0036)	(0.0036)	(0.0035)	(0.0036)	(0.0038)
MA(3) Nr of Disclosures		0.0003								-0.0001
		(0.0018)								(0.0020)
MA(3) Patent Apps			0.0081*							0.0078
			(0.0045)							(0.0047)
MA(3) IP Revenues				0.0279						0.0150
				(0.0557)						(0.0561)
MA(3) IP Expenditure					0.0744***					0.0563**
					(0.0246)					(0.0253)
MA(3) Campus Inc						-0.1155				-0.1816
						(0.2013)				(0.2025)
MA(3) Local Inc							0.0345			0.0191
							(0.1558)			(0.1573)
MA(3) Sc Park								0.1303		0.1158
								(0.1277)		(0.1136)
MA(3) Startup Nr									0.0001	0.0007
									(0.0035)	(0.0031)
Academic year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
University fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	434	434	434	434	434	434	434	434	434	434
R^2	0.0277	0.0278	0.0613	0.0290	0.0408	0.0286	0.0279	0.0309	0.0277	0.0750

Table 11: Robustness check – Alternative sector definitions

Table presents OLS/2SLS panel regressions for fundraising success determinants with an alternative sector definition, using fixed effects for each SIC Group. Dependent variables: binary indicators for equity/VC yearly post-spinout. Controls: independent variables and fixed effects from Table 5 except that Table 11 uses SIC groups as sector fixed effects. OLS/2SLS coefficients reported, standard errors in parentheses (clustered at spinout level). 2SLS: university equity stake instrumented by average stake of same-university spinouts in prior 3-year period. Only instrumental variable coefficient/standard error shown in first stage. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

	All spinouts				Science-intensive spinouts				Less Science-intensive spinouts			
	DV: Raised Equity		DV: Raised VC		DV: Raised Equity		DV: Raised VC		DV: Raised Equity		DV: Raised VC	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
University Stake	0.0022***	0.0018	0.0006	-0.0029***	0.0037***	0.0020	0.0014**	-0.0022	0.0001	0.0029	-0.0007	-0.0048***
	(0.0008)	(0.0019)	(0.0004)	(0.0011)	(0.0011)	(0.0028)	(0.0006)	(0.0014)	(0.0012)	(0.0027)	(0.0006)	(0.0019)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,484	1,226	2,353	1,887	781	677	1,324	1,091	703	549	1,029	796
R^2	0.295	0.3046	0.1142	0.0899	0.3132	0.3308	0.1140	0.0882	0.3002	0.2956	0.1459	0.1225
First Stage of 2SLS regressions												
		DV: Uni Stake		DV: Uni Stake		DV: Uni Stake		DV: Uni Stake		DV: Uni Stake		DV: Uni Stake
Precedent Uni Stake		0.6120***		0.5742***		0.5731***		0.5985***		0.6167***		0.5108***
		(0.0646)		(0.0794)		(0.0829)		(0.0832)		(0.0869)		(0.1143)
F-Statistics		89.8473		52.3037		47.8252		51.6973		50.3116		19.9686

Table 12: Robustness check – Probit and IV-Probit Regressions

Table presents OLS/2SLS panel regressions for fundraising success determinants using Probit and IV-Probit models. Dependent variables: binary indicators for equity/VC yearly post-spinout. Controls: independent variables and fixed effects from Table 5. Probit/IV-Probit coefficients reported, standard errors in parentheses (clustered at spinout level). IV-Probit: university equity stake instrumented by average stake of same-university spinouts in prior 3-year period. Only instrumental variable coefficient/standard error shown in first stage. Significance: ***, **, * for 99%, 95%, 90% confidence levels.

	All spinouts				Science-Intensive spinouts				Less Science-Intensive spinouts			
	DV: Raised Equity		DV: Raised VC		DV: Raised Equity		DV: Raised VC		DV: Raised Equity		DV: Raised VC	
	Probit	IV-Probit	Probit	IV-Probit	Probit	IV-Probit	Probit	IV-Probit	Probit	IV-Probit	Probit	IV-Probit
University Stake	0.0096***	0.0088	0.0047*	-0.0149**	0.0140***	0.0093	0.0099***	-0.0090	0.0042	0.0118	-0.0037	-0.0288***
	(0.0028)	(0.0068)	(0.0028)	(0.0070)	(0.0037)	(0.0104)	(0.0038)	(0.0099)	(0.0044)	(0.0100)	(0.0047)	(0.0103)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,375	1,155	2,131	1,755	706	618	1,240	1,046	603	486	846	631
First Stage of 2SLS regressions												
		DV: Uni Stake		DV: Uni Stake		DV: Uni Stake		DV: Uni Stake		DV: Uni Stake		DV: Uni Stake
Precedent Uni Stake		0.6149***		0.5821***		0.5729***		0.5682***		0.6208***		0.6980***
		(0.0639)		(0.0717)		(0.0827)		(0.0766)		(0.0855)		(0.0804)

Appendix 1: Method of inferring the spinout date

Since universities do not disclose the official spinout date using a consistent methodology, we developed our own method to infer it from administrative filings. We define the spinout date as the first date when the relevant capitalization table contains the founders and the university. As we observe capitalization tables in the incorporation and confirmation statements only at an annual frequency, we use SH forms to increase the accuracy of our spinout date to a specific date. Firms have to file SH forms whenever the ownership of a company in the United Kingdom changes. We use the following SH forms: SH01 forms (filed when new shares are allotted), SH02 forms (filed when shares are subdivided), SH06 forms (filed when shares are cancelled) (Companies House, 2021). When there is ambiguity in dating the spinout date using SH forms, for example, when multiple SH forms were filed in the year before the relevant capitalization table, then we use the Articles of Association (AoA) to date the spinout date. The AoA is a legal document that sets out the rules and regulations governing the internal management and operation of a company.

Case 0: The relevant capitalization table is contained in the Certificate of Incorporation.

> In this case the inferred spinout date is equal to the incorporation date as specified in Companies House.

Case 1: There is only a single SH form filed between the relevant capitalization table and the capitalization table immediately preceding it

> In this case, the inferred spinout date is equal to the date of SH form.

Case 2: There are multiple or no SH forms, but there is exactly one AoA filed between the relevant capitalization table and the capitalization table immediately preceding it.

> The Inferred spinout date is equal to the date of AoA.

Case 3: There are multiple or no SH forms, but there is more than one AoA filed between the relevant capitalization table and the capitalization table immediately preceding it.

> The spinout date is equal to the mid-point of the dates of the earliest and latest AoAs filed between the capitalization tables.

Case 4: There is no AoA filed between the relevant capitalization table and the capitalization table immediately preceding it. However, multiple SH forms have been filed between the capitalization tables.

> In this case, the inferred spinout date is equal to the mid-point of the date of the earliest and latest SH form filed between the capitalization tables.

Case 5: There is neither an SH form nor an AoA filed between the relevant capitalization table and the capitalization table immediately preceding it.

> In this case, the inferred spinout date is equal to the mid-point of the date of the complete capitalization table and the capitalization table immediately preceding it.

Our methodology for dating the spinout event is prone to error when there are multiple SH forms filed. In order to minimize the noise, we also use information on the type of investors involved in each round, assuming that private investors would not invest in the spinout before the equity distribution deal between the spinout and the university is finalized due to concerns about how university stake may potentially affect founders' incentives. The government, university, or charities, on the other hand, may well do so to support the creation of the spinout. Hence, the spinout date is taken to be the minimum between our inferred spinout date and the date of the earliest round where any investor other than the government, university or non-for-profit organizations participated.

Appendix 2: Summary of the Deal between the University and University-affiliated Funds

According to publicly available information, we identify the following deals made, where the university either partially or fully outsources its commercialization services to a university-affiliate fund. In exchange, the fund gets full or part of the university IP shares.

- Imperial College London fully outsourced its commercialization services to Touchstone Innovations (RSM, 2018)
- IP2IPO Ltd had (partial) commercialization deals with the following universities: Bath University, Glasgow University, Southampton University, Leeds University, Bristol University, King's College London, Oxford University (see for e.g., Investgate (2005), IPGroup 2021)
- Oxford University had additional (partial) commercialization deals with Oxford Sciences Enterprises Ltd and Technikos LLP (see for e.g., University of Oxford (2023), The Engineer (2005))

Appendix 3: Shareholder classification

A **scientist** is defined as any shareholder who was involved in developing the technology which the spinout is based on. The judgment call to determine involvement with technology relies on the following description:

In some cases, the company website mentions explicitly that the shareholder was involved with the technology. In this case, we classify him as involved. In the case when we do not find such evidence, we base our classification on the shareholders' field of study and affiliation with a university before spinout event. If the shareholder was not affiliated with any university and did not study in a field related to spinouts activity, we classify as him/her as non-scientist. If the shareholder was affiliated with the university and studied/did research/taught in an area similar to the spinouts area, we classify him as a scientist. If the shareholder was not affiliated with a university but did research in the same area where the spinout is operating and has publication records (as well as potential links to the other scientist founders such as they co-authored papers or worked in the same lab in the past), we classify him/her as a scientist.

A **manager** is defined as any shareholder who held an executive position within the spinout at the inferred spinout date (see section 2.3 for the method of inferring the spinout date). The judgment call to determine whether a shareholder had an executive position relies on the following description:

If the job title/role within the spinout is an executive/full-time position (e.g., CEO), we classify the founder as a manager. If the job title is not clear in distinguishing executive from non-executive (e.g., CTO, CSO etc) and the shareholder was an academic before the spinout event but did not maintain his academic position (or maintained it only part-time) afterward, we classify the shareholder as a manager; if he maintained his academic position, we classify shareholder as non-manager.

An **investor** is any shareholder who falls in either of the following categories:

1. Explicit evidence he/she/entity is an investor;
2. Wealthy individual with no clear employment link to spinout;
3. Representatives of investment funds;
4. Person holds (now or in the past) multiple positions as director/board member in different companies (classified as investor even if he is listed as advisor/non-executive members in the spinout website);
5. Family members of known founders-based on surname;
6. Family members of known investors-based on surname;
7. Pair of shareholders appearing in multiple spinouts not in overlapping field – co-investment networks;
8. If no information on Y but he has same stake as X who was classified as investor, Y classified as investor;
9. Nominees for which there is no information on underlying structure.

Appendix 4: Rescaling of University Stakes

Suppose we observe the following 'relevant capitalization table':

Founder 1: 30%; Founder 2: 30%; Investor 1: 5%; Investor 2: 10%; and University: 25%.

Because our goal is to uncover how equity stake is initially split between the founders and the university, we need to remove the investors from the capitalization table. To do so, we subtract investor share from 100% and rescale founders and university shares: 100%-(5%+10%)=85%. The rescaled capitalization table thus becomes:

Founder 1: 30/85=35.3%; Founder 2: 30/85=35.3%; University: 25/85=29.4%.

Notice the danger of using the 'unscaled' university stake in the analysis. Ventures that would have investors in the 'relevant capitalization table' would have a lower unscaled university stake than ventures with no investors in the cap, even if the deal between the founders and the university at the spinout event would be the same across the ventures. If these investments were made after the spinout date, there would be a negative correlation between the university stake and investment raised post spinout event simply due to the dilution in university stake when investors join.

Appendix 5: Method of Calculating the University IP Stake

We define the three main entities which could hold shares in exchange for transferring/licensing IP rights to the founding team:

Definition A1 (university): University shareholding is defined as holdings by any of the following entities appearing in capitalization table:

1. An entity identified by the university name (e.g., City University)
2. An entity not identified by the university name, but for which we find evidence that it holds IP shares on behalf of the university through publicly available information or from our private interviews. These entities are either fully owned by the university (e.g., Cambridge Enterprise Ltd) or owned by an entity which itself has been fully owned by the university, at a point in our sample period. (e.g., Ulive Enterprises Limited)

Definition A2 (trusts): We include here shareholdings of any other entities which appear alongside the university and which the company spun out from jointly (e.g., RBG Kew, Cambridge University Hospitals NHS foundation trust). These entities are not necessarily owned by the university, but according to our interviews can claim IP due to spinout founders being affiliated with them or receiving grant funding from them.

Definition A3 (university-affiliated fund): Funds which may or may not be owned by the university, but for which we found public or private evidence of having an agreement to provide some (or all) of the commercialization services to newly formed spinouts. In exchange, the university transfers a part (or all) of the IP shares to them. Examples include Oxford Science Enterprise Limited, Touchstone Business Ltd, IP2IPO etc.

We next describe our methodology in detail. The end goal is to calculate the IP stake held jointly by the university, university-affiliated funds, and trusts. There are two Companies House filings we utilize for this purpose:

1. Confirmation Statements which are filed annually and contain annual capitalization tables.
2. SH01 forms, which companies are legally required to file within a 30-day period of allotting new shares. The SH01 forms contain the number of shares issued, the class of shares, price, and notes on non-cash considerations for the issued shares. However, it does not contain which shareholder holds the issued shares.

Even though SH01 forms do not provide the identity of the shareholder the shares go to, the price per share paid by shareholders and/or university IP shares can still be easily identified or inferred in the following cases:

1. The complete capitalization table is contained in the Certificate of Incorporation, which lists price per shares held by each shareholder.
2. The complete capitalization table is filed in CS subsequent to the Certificate of Incorporation, but any of the following applies:
    a. All shares are priced at a unique price (equal to the nominal value which is usually negligible e.g., 0.001 GBP/share).
    b. Different classes of shares are issued, with unique price per each class. Because the Confirmation Statement notes down the class of shares held by shareholders, it is easy to identify the price per share paid by the university and founders on the different classes of shares they hold.
    c. The SH01 form explicitly mentions under non-share considerations that a given number of shares were allocated for licensing/transferring of Intellectual Property rights. We consider this as sufficient evidence to identify university IP shares.
    d. The number of shares held by different shareholders is issued as separate blocks in the SH01 forms. In this case we utilize information on blocks to infer price per share for shareholder holding the particular block.

Example A4 (different classes of shares): According to the Confirmation statement, founding team holds 2000 ordinary shares and 100 Series A shares, university holds 1200 ordinary shares, and 100 Series A shares and investors hold 2450 series A shares. SH01 forms issue 3200 ordinary shares at 0.01 GBP/share and 2650 series A shares priced at 100GBP/shares. As a result, founding team holds 2000 shares priced at 0.01 and 100 shares priced at 100, university holder 1200 shares priced at 0.01 and 100 shares priced at 100, and investors hold 2450 shares priced at 100.

Example A5 (block information): According to the Confirmation statement, founding team holds 5400 shares, university holds 1200 shares and investors hold 2450 shares. SH01 forms issue 5400 shares at 0.01 GBP/share, 1200 shares at 0.01 GBP/share and 2450 shares at 50 GBP/share. We consider this as sufficient evidence to infer that founder and university shares are priced at 0.01 and investor shares are priced at 50.

However, there can also be more complicated cases when SH01 forms do not have the information needed to infer the price per share for different shareholders in the CS. From our private interviews and second-look sample of data we received from particular universities, founders seem to be less likely to invest compared to the university. Indeed, whenever there are unique prices per share class as in Example 1, we observe founders holding the priced class of shares rarely. Whenever we cannot allocate issued shares to shareholders according to any of the evidence listed in Cases 1-2, we make the following assumption.

Assumption A6 *(pecking-order):* Issued shares, ordered from the lowest priced to the highest, are allocated to shareholders in the following priority:

1. Founding team
2. University as well as any other entity which the company spun out from (e.g., NHS hospitals, RBG Kew gardens etc)
3. University-Affiliated funds. To get to the list of university-affiliated funds, we use both publicly available information as well as information from our private interviews.
4. Investors/Unknowns

Example A7 *(pure pecking order)***:** In CS founders hold 2000 shares whereas university holds 4000 shares. According to SH01 forms, 10,000 ordinary shares are issued in total. 5000 are priced at 0.01 GBP/share and 1000 are priced at 20 GBP/share. Assumption A6 then suggests that founders hold 4000 shares at 0.01 GBP/share, university holds 1000 shares at 0.01 GBP/shares and 1000 shares at 20 GBP/share

Example A8 *(block information and pecking order)***:** According to the Confirmation statement, founders hold 5400 shares, university holds 1200 shares and investors hold 2450 shares. SH01 forms issue the following block of shares: 5300 shares at 0.01 GBP/share, 1200 shares at 0.01 GBP/share and 2550 shares at 50 GBP/share. Because the block of university shares is issued separately at 0.01 GBP/share, university is allocated 1200 shares at 0.01. By our pecking order assumption, founders have priority of receiving free shares over the investors. Hence founders hold 5300 shares priced at 0.01 GBP/share and 100 shares at 50 GBP/share. Investors thus hold 2450 shares at 50 GBP/share.

Free shares are defined as the lowest priced shares held by the founding team. We use the lowest founder share price instead of the university's lowest share price because it could be that the university has received no IP stake and has solely made an investment into the spinout.

Definition A9 *(free shares)***:** Free shares are defined as shares with a price per share equal to the lowest priced shares held by founders/employees

Definition A10 *(IP shares)***:** University IP shares are the number of free shares held jointly by the university, university-affiliated funds, and trusts

Definition A11 *(IP stake)***:** University IP stake = University IP shares*100/ (University IP shares + Free founding team shares)