Journal of Open Innovation: Technology, Market, and Complexity

Article

Academic Assets, Life-Cycle, and Entrepreneurship: A Longitudinal Study of Estonian Academic Workers

Maksim Mõttus and Oliver Lukason *

School of Economics and Business Administration, University of Tartu, 51009 Tartu, Estonia; maksim.mottus@ut.ee
* Correspondence: oliver.lukason@ut.ee

Abstract: This study aimed to find out how academic assets are interconnected with firm creation by academic staff at different academic life-cycle stages. The applied theoretical setting integrated resource-based and life-cycle explanations of academic entrepreneurship. A longitudinal whole population dataset of Estonian academic workers was applied, with a dependent variable reflecting firm creation, and independent variables representing different academic assets. The logistic regression results indicated the varying importance of different academic assets at different academic career stages, while divergence also exists with respect to academic discipline. The results enable postulating several theoretical propositions, accompanied by practical implications for technology transfer at universities.

Keywords: academic entrepreneurship; firm creation; academic assets; academic life-cycle; career stages; public universities; Estonia; open innovation

Citation: Mõttus, M.; Lukason, O. Academic Assets, Life-Cycle, and Entrepreneurship: A Longitudinal Study of Estonian Academic Workers. *J. Open Innov. Technol. Mark. Complex.* **2021**, *7*, 113. https://doi.org/10.3390/joitmc7020113

Received: 10 February 2021
Accepted: 14 April 2021
Published: 17 April 2021

1. Introduction

Knowledge created at universities plays an important role in driving innovation and contributes to the economy and society, while its importance has especially grown in recent decades [1–3]. Hence, it is also of major interest to decision makers in the public sector, who try to determine the most suitable ways of transferring knowledge from universities and achieving maximum return on public resources [4,5].

The methods of transferring knowledge created at universities into society are diverse and can be both official and unofficial [6,7]. This study focuses on company creation, as the most explicit and essential way of monetizing academic knowledge [5,7–10]. However, the extant literature indicates that although firm creation as a form of academic entrepreneurship is becoming a mature topic [11], it is still understudied [12,13], and less exploited than the potential alternatives [14].

As academic workers themselves are usually involved in technology transfer and business creation processes, their individual assets become topical [15,16]. In order to explain why some academic workers are more likely to create spin-off companies than others, Landry et al. [12] created a theoretical concept relying on the resource-based theory of the firm. According to this concept, academic workers as entrepreneurs have access to different resources, which in turn vary from one individual to another and affect the likelihood of firm creation.

The effects of academic assets on company creation might vary during a career. One explanation for the latter could be that scientific productivity is not constant, nor linear, during the careers of academic staff, and hence, life-cycle effects in research productivity exist [17–19]. Perkmann et al. [2] concluded that individual life-cycle effects in academic engagement need further investigation, as the evidence is still inconclusive. Moreover, a longitudinal analysis should be conducted, as the profiles of academic workers evolve over time [10,11]. Relying on the latter, the commercialization engagement of academics could be enhanced by accounting for the specific phase of their academic career and other individual characteristics. Therefore, the design of commercialization incentives and measures should also follow the life-cycle approach, for instance, early-stage academics exposed to publishing pressures should be rewarded for committing resources to commercialization [2].

Academic entrepreneurship can be considered a special case in innovation studies, as in the era of open science the provider (academic worker) and recipient (academic spinoff founder) of open innovation (OI) in the outside-in model (see further [20]) are the same. The latter is especially important as, despite the increasing diffusion of OI created at universities [21,22], its absorption by SMEs other than academic spinoffs has remained modest [23]. According to the theoretical concept of relational involvement, by Perkmann and Walsh [24], academic workers creating a firm and retaining their job in academia could be among the best examples for studying OI, mainly because the creation and commercialization of innovations can be seen as a lengthy interactive process [25], rather than two distant discrete events. Strong internal R&D competences, organically inherent to academic spinoffs, have been found to make firms benefit more from OI [26].

Relying on the aforementioned motivation, and by linking the resource-based and life-cycle theories, this study aims to find out which academic assets are linked with firm creation by academic staff at different academic career stages. By doing so, the study aims to be the first to outline the dynamic linkage between academic achievements and a specific type of commercialization. The reliability of the results is enhanced by the usage of a factual longitudinal whole population dataset of Estonian academic workers, while the existing research has in turn mostly relied on sample-based questionnaires. The results provide a population level track, which specific academic assets matter at varying career stages, therefore enabling extending the so far statically applied theoretical concept of academic assets as determinants of firm creation into the academic life-cycle context.

The rest of the paper encompasses the following sections. In the next part, the theoretical foundations of academic entrepreneurship, academic assets, and academic life-cycle are discussed and interlinked. The third part is devoted to explaining the data, variables, and method applied. Thereafter, the results are provided, based on which theoretical propositions are summarized. This is followed by a section discussing the results in the light of the extant empirical research and innovation literature. After providing practical implications, the last part concludes the paper, while also providing limitations and future research directions.

2. Literature Review

2.1. Firm Creation by Academic Workers: A Resource-Based Theory

The literature review of this paper relies on the conceptual framework created by Landry et al. [12], which, by implementing a resource-based theory, explains why university researchers create spin-offs. Academic workers have access to different tangible and intangible resources, which in turn generate diversity between them. The latter suggests that the likelihood of business creation by academic workers will differ due to the availability of specific resources, which are financial, intellectual property, knowledge, social capital, organizational, and personal assets, according to the concept proposed by Landry et al. [12]. A literature review on each of these factors and their role in firm creation is outlined in the following subsections. Out of the six asset types, social capital assets are not in the scope of this study, because it is very difficult to measure social capital objectively, and moreover, quantitatively.

2.1.1. Financial Assets

According to the resource-based theory, financial assets are related to the entrepreneurial activity of academic workers [12], but there has been a certain controversy in previous studies about the exact attributes of that relationship.

The receipt of more research grants by academic staff serves as a better foundation for cooperating with industry [27–29]. Several studies have found that a larger amount of grants increases the probability of founding a company [13], while increased knowledge creation could serve as a moderator for the latter [30]. The findings by Aldridge and Audretsch [31] confirmed that grants are conducive to academic entrepreneurship, i.e., academics who received grants and found them helpful have a higher propensity to start a new company.

On the contrary, many authors found no significant effect of grants on the likelihood of academic entrepreneurship [28,29,32]. While Aldridge and Audretsch [31] concluded that grants have a positive effect, they also found that the size of grant, as an independent variable, has no significant effect on the likelihood of founding a firm.

As a measure of financial assets, Landry et al. [12] used: (a) the assessment of academic workers, whether private funding was important; and (b) obtained public research grants as a quantitative measure. The latter quantitative measure has also been used by the majority of other authors in this research substream [13], and thus, it is also applied in this study.

2.1.2. Intellectual Property Assets

Number of patents is the most frequently used indicator to portray the entrepreneurial activities of academic staff [12]. Previous studies have shown that the presence of patenting is positively related to business creation, i.e., academic workers engaged in the protection of intellectual property are more likely to establish a company [12,28,33–37].

Previous inventing experience increases the likelihood of exploring potential entrepreneurial opportunities [35]. Krabel and Mueller [36] concluded that academic entrepreneurship is the likely outcome of intellectual property possession. Moreover, Goel and Grimpe [33] argued that patents might make it easier for academic workers to raise financing for their start-ups, and therefore boost academic entrepreneurship.

Contrary to the findings arguing a positive relationship between patents and firm creation by academics, Marion et al. [38] found that the number of patents has no significant effect on the entrepreneurial activity of academic staff.

Landry et al. [12] used patenting as a quantitative representation of intellectual property assets, while the latter is a characteristic of most of the available studies [13]. Thus, this paper follows previous research to ensure comparability.

2.1.3. Knowledge Assets

Knowledge assets, expressed as the number of publications, might have a positive impact on academic entrepreneurship, because the more research knowledge has been produced by academic workers, the more likely that some of it could be commercialized [12]. Moreover, academic workers with a high number of publications could be more respected and have more resources available to them [39].

On the other hand, a negative impact of publications might be present, as academic staff are often free to distribute time between research and entrepreneurial activities, and the more time is spent on research and publishing, the less probable is the creation of spin-offs [12].

Previous empirical research has found contrary evidence. Some authors argued that the number of publications has no statistically significant effect on the entrepreneurial activity of academic workers, reasoning that active publishing inevitably creates commercializable results, or that scientists are just obliged to fulfil both tasks [12,16,27].

Some studies found opposite evidence, i.e., the number of publications increases the likelihood of starting a company by academic staff [28,33,37,40]. Karlsson and Wigren [39] found that the quality of publications plays an important role in predicting firm creation: popular science publications have a positive effect on firm creation by academic workers, scientific publications alone were not significant, and publications in non-peer reviewed journals even had a negative impact.

Landry et al. [12] used publication assets and research field as quantitative measures of knowledge assets, which is also a characteristic of many similar papers [13], and thus, this study follows this research track.

2.1.4. Organizational Assets

Landry et al. [12] proposed that universities can affect, via incentives and regulations, how academic workers distribute their time between teaching and other (including entrepreneurial) activities, which might affect the time-resources available for entrepreneurship.

Abreu and Grinevich [1] and Landry et al. [12] found that involvement in teaching activities is not a statistically significant predictor of company creation by academic staff, which suggests that different academic objectives can be concurrently achieved. Moreover, teaching, research, and entrepreneurship have synergies, and thus, they can and should be developed simultaneously [10].

University size and research unit size, as organizational assets according to Landry et al. [12], are out of the scope of this study because of the low number of Estonian non-specialized public universities (namely four). Thus, this study uses supervision experience as a quantitative proxy of teaching activity. Supervision experience has benefits and shortcomings when compared with the alternative proxy of teaching, namely classroom hours; but as it was impossible to obtain information about the latter for this study, a more detailed discussion about the differences is neglected herewith.

2.1.5. Personal Assets

According to the conceptual framework used in this study, personal assets are portrayed by experience and seniority. Landry et al. [12] found that the seniority of academic workers, as measured by academic rank, is not significant, and experience measured in years since completion of PhD is in turn a significant determinant of firm creation.

Many papers have also used academic status (usually whether a person is a professor) as a proxy for the experience and seniority of academic staff. Still, these studies failed to find evidence of being a professor having an effect on the likelihood of founding a company [1,27,30,33,34,38,39]. Interestingly, none of the studies found a negative link between academic status and company creation by academic staff. The possible explanation could be that workers with entrepreneurial orientation leave university positions, either because of preferring entrepreneurship or not having advanced quickly enough in their academic career [1,12,41].

Contrarily, Clarysse et al. [41] argued that professors are twice as likely to start a company compared to non-tenured academic workers, because the latter allocate more time for publishing and building their academic career. D'Este and Perkmann [32] also found a weak positive link between experience (expressed in professor status) and spin-off activity. Haeussler and Colyvas [40] concluded that career stage is a strong predictor of entrepreneurial activity and that professors are more active in firm creation.

For assessing academic experience, previous studies have mainly used age, years in tenure, and professorship [13]. Professorship might not be the best measure, as academic structures vary by country, and therefore, so might the motivation and abilities of academic workers to become a professor [42]. As the individual's age is not a direct expression of academic experience, and moreover, it is already used as a control variable in this study, the possession of a doctoral degree was applied as a quantitative measure of academic experience. This is also in line with previous literature, as a PhD degree is required for professorship.

2.2. Life-Cycle Context in Academia

Studies analyzing individual life-cycles in labor productivity and earnings are usually based on Becker's [43] human capital theory. Levin and Stephan [18] combined this theory with investigating research productivity and pioneered the research field known as the economics of science. They found that scientific productivity (usually measured as the quantity of publications) declines with a person's age, but the effect is nonlinear, reaching a peak at a specific age (39–59, depending on the model). Diamond [17] and Thursby et al. [19] also argued that life-cycle effects are present in research productivity.

Goodwin and Sauer [44] found that research productivity varies throughout an academic career, but instead of the commonly used quadratic form, the distribution of research productivity is hump-shaped. In addition, the shape of the distribution is significantly affected by the individual characteristics of researchers [44,45].

Life-cycle models have also been applied to investigate the technology transfer by academic staff. Roberts [9], by analyzing technology transfer activity in different age groups, found that two thirds of MIT spin-off entrepreneurs founded a new company at the age of 28–39, while only 7% of the entrepreneurs were younger than 28 and less than 10% were older than 48.

Shane [8] concluded, based on career-cycle models, that academic researchers tend to establish spinoffs at later stages of their careers, which is supported by Bercovitz and Feldman [46] with the argumentation that the amount of knowledge and the will to monetize it are greater at later career stages. Moreover, based on life-cycle models of academic careers, researchers at early stages of their careers are motivated to work on publications, while at later stages they have more time to be engaged in commercialization activities [47–49].

Haeussler and Colyvas [40] found that career stage is a strong predictor of academic entrepreneurship, based on the argumentation that older academics have a wider access to different types of capital. In addition, older academic workers could feel more confident to take commercialization risks, as potential failures will not have a crucial effect on their careers [37,40,46]. On the contrary, Karlsson and Wigren [39] argued that age is negatively correlated with starting firms, i.e., the firm creation probability of older academic workers is lower.

2.3. Conceptual Framework of the Study

This study aims to find out which academic assets are linked with firm creation by academic staff at different academic career stages. Therefore, we postulate a concept provided in Figure 1 to guide the research. We rely on Landry et al.'s [12] theoretical setting to explain company creation by academic workers with resource-based theory. Namely, under the resources, different types of academic assets are considered in Figure 1 (FA—financial assets, IA—intellectual property assets, KA—knowledge assets, OA—organizational assets, and PA—personal assets). The dependent variable represents a certain type of academic entrepreneurship, i.e., firm creation by academic workers; referred to as "founders" in the next sections. Unlike in previous research, we merge the resource-based theory of academic entrepreneurship with academic life-cycle theory, considering different career stages to control for the relationship between the independent and dependent variables depicted on Figure 1.

Variables			Variable context	Theoretical background
Academic career stage 1	…	Academic career stage N	Control	Academic life-cycle theory
↓	↓	↓		
Academic assets' set 1 (FA_1, IA_1, KA_1, OA_1, PA_1)	…	Academic assets' set N (FA_N, IA_N, KA_N, OA_N, PA_N)	Independent	Resource-based theory in entrepreneurship setting
↓	↓	↓		
Firm creation at stage 1	…	Firm creation at stage N	Dependent	

Figure 1. Conceptual framework of the study.

3. Study Design

The data for this study include the whole population, i.e., all academic workers from all four non-specialized public universities of Estonia (i.e., Tartu University, Tallinn University, Estonian University of Life Sciences, and Tallinn Technical University) from the year 2017. Two very small, specialized public universities (i.e., Estonian Academy of Music and Theatre, and Estonian Academy of Arts) focused on arts, music, and theatre studies were excluded from the analysis. The positions of the included universities, according to different QS rankings (e.g., EECA or subject rankings) [50], are relatively high, thus the study focuses on advanced institutions.

The academic workers included had to be employed at the university with at least a 0.5 position. The latter guarantees that the individuals included are not occasional, part-time workers, as lecturing by practitioners at universities is common in Estonia [51]. All academic positions, starting from the most junior and ending with professorships were included. The database of academic workers was merged with data from the Estonian Business Register (EBR), which enabled understanding when exactly each of the individuals founded a firm. In total, the database includes 1929 unique academic workers, out of whom 306 have become entrepreneurs at some stage of their career. The latter is defined as an individual becoming a company founder irrespective of ownership share, and is coded as FOUNDER. The latter results in a proportion of 15.9%, which is around twice as low when compared with the 33.2% value of the ratio of all firms and people in Estonia in the same age group as in this study in the year 2020 (calculated based on [52,53]). Thus, the entrepreneurial orientation in the academia portrayed through this specific commercialization type is much lower than in the general population. Still, the latter is not caused by difficulties in starting and running a business, as Estonia ranks among the top countries with respect to the ease of doing business (see the country rankings in [54]), while the country also has an advanced innovation system [55] and public universities are favoring spin-off entrepreneurship by creating the respective infrastructure (see e.g., [56]). Other forms of commercialization tend to dominate spin-off entrepreneurship among Estonian academic workers (see e.g., [57]), probably because running a firm is more time consuming. Nevertheless, since 2011 business creation has been made very easy in Estonia, as firms can be started without paid in capital and fully digitally [58]. Partly due to this, 41% of firms originated between 2011 and 2015 in the dataset. All the respective firms are private SMEs, while the dominating size group is micro-firms. In addition, in the year 2017, the majority of the owners were still board members as well, thus being actively engaged in the daily management of their respective firms. The firm size and corporate governance setup in this study corresponded well to the overall Estonian population of firms (see e.g., [59]).

Information about the academic performance of individuals was collected from the Estonian Research Information System (ERIS), where the CVs of academic workers are available based on certain universal fields. For each of the academic workers, five independent variables were coded (see Table 1). Supervision experience (SUPEXP) is accounted as the number of supervisions of master's theses and doctoral dissertations. As these require different amounts of effort, for summing up, doctoral dissertation supervision was weighted with four, i.e., their supervision was considered four times more laborious. In addition, as in the Estonian higher education system the Bologna approach (3 years bachelor and 2 years master's studies, instead of the former 4 + 2 years) was introduced in 2002, the former master's theses were weighted with two. Bachelor theses were not counted in the supervision experience, as information about them was not available in ERIS; moreover, in various curriculums there is no bachelor thesis.

Previous involvement in scientific and applied scientific projects (PROJECT) was accounted as the number of projects the academic worker has been involved in as a project head or one of the main executors. We summed these two project types because ERIS does not provide a full distinction between them and organically many projects include both domains as well. In addition, it was not possible to account for project budgets, as it would demand knowledge of how many people were factually involved in them, but in case of many projects the latter is not documented in ERIS.

Authorship of intellectual property (IP) was accounted as whether the academic worker has authorship of intellectual property objects (almost exclusively patents in the dataset). We did not account for the number of intellectual property objects, as only on rare occasions was the number more than one.

Table 1. Variables used in the analysis.

Variable (Coding)	Content
Firm foundation (FOUNDER)	1 if a person founded a firm, 0 otherwise
Supervision experience (SUPEXP)	Number of supervisions of master's and doctoral theses [1]
Involvement in (applied) scientific projects (PROJECT)	Number of projects where the person is/was either the project's head or one of the main executors
Intellectual property authorship (IP)	1 if there is at least one intellectual property object [2] the person has authored
Publications (PUBLIC)	Number of high-quality [3] publications the person has authored
Doctoral degree (PHD)	1 if a person has a doctoral degree, 0 otherwise

[1] Based on the formula 4 × (number of doctoral dissertations) + 2 × (number of 4 + 2 system master's theses) + 1 × (number of 3 + 2 system master's theses); [2] In the database, these are almost exclusively patents; [3] Articles in peer-reviewed international journals, chapters in monographs of known publishers, Web of Science indexed conference proceedings.

The number of high-quality publications (PUBLIC) was accounted as the number of articles in international peer-reviewed journals, chapters in monographs by international publishers, and Web of Science indexed conference proceedings (categories 1.1, 1.2, and 3.1 in ERIS). Solely written monographs were not counted, as this information has not been listed homogenously throughout the history of ERIS, and thus was not applicable. The last variable indicates the presence of a doctoral degree (PHD) for a specific academic worker.

As the aim of this paper is to study how academic assets are linked to firm creation at different career stages, four career stage groups were created. As these individuals have been constantly involved in academia, we applied biological age as a proxy of career length. The first considers academic workers up to 30 years old (STAGE_1), the second 31–40 years old (STAGE_2), the third 41–50 years old (STAGE_3), and the last all academic workers whose age is at least 51 years (STAGE_4). Roberts [9] applied five-year steps in creating age categories, but in this study, it would lead to a too low frequency of entrepreneurs in each age group. Moreover, it is reasonable to apply wider categories, as in the academic scene a few years is a too short period for fundamental changes in academic assets to occur. However, we acknowledge that different grouping logics could be applied, and thus, a robustness test was provided with only two groups (≤40 years and >40 years, respectively). We controlled for career stage effects by creating separate groups, not by including relevant control variables in the equation, for the following reasons. First, the association of independent and dependent variables can be too sophisticated to be handled by control variables in the models. Second, when for each career stage a separate model is composed, the coefficients and significances of independent variables can be directly compared.

Table 2 documents the number of observations by career stage group and also by academic field. The latter categorization was added as, since science workers have a higher likelihood of being an academic entrepreneur, the created codified knowledge can be more easily commercialized, and scholars in that area have more links with firms [13]. Similarly to Mõttus et al. [13] the non-science field includes social sciences and arts and humanities. The number of observations (2314 individuals) was larger than the unique number of individuals (1929). This is because some individuals in the dataset passed through multiple age groups throughout their career. The earliest firm creations originated in the year 1995, and thus, we started to consider the academic characteristics from 1994. Therefore, the early career stages of older academic workers, falling into the Soviet era, are not the focus of this study.

For founders, the values of academic assets were collected from the year previous to founding the firm. In the case of academic workers having not founded a firm, the latter should be handled differently, as in their case there is no specific time available in order to position academic performance. As four career stages are used in the analysis, the most logical way is to account for each non-founder's median value for each of the independent variables at the specific career stages. As the age of the academic worker at firm creation is random at each of the career stages, the median time of firm creation is always exactly in the middle of each of the career stages. This also lends support to the suitability of using the median value in case of non-founders.

Table 2. Population used in the analysis.

Population	STAGE_1	STAGE_2	STAGE_3	STAGE_4	Total
All workers					
Non-founder	713	641	474	180	2008
Founder	93	116	70	27	306
Total	806	757	544	207	2314
Only science workers					
Non-founder	491	369	277	120	1257
Founder	60	73	54	20	207
Total	551	442	331	140	1464
Only non-science workers					
Non-founder	222	272	197	60	751
Founder	33	43	16	7	99
Total	255	315	213	67	850

For each of the four career stages, a separate logistic regression model was composed, with dependent and independent variables from Table 1. After this the population of academic workers was divided into those working in the science field or not (i.e., social sciences and arts and humanities), and separate four logit models were composed for both of those populations. In addition, statistical tests were conducted to supplement the descriptive analysis available in the results section.

4. Empirical Analysis

4.1. Descriptive Statistics and Logistic Regression Models

Based on Table 2 it can be concluded that the highest proportion of founders came from STAGE_2. At that stage, probably their position in academia has been secured, PhD defended, and first substantial results from research obtained. This finding is consistent with the results of Roberts [9] that two thirds of academic entrepreneurs founded a new company at the age of 28–39, and in addition with Karlsson and Wigren [39], who concluded that age is negatively correlated to starting firms. In the non-science field, firm creations occur to a certain extent earlier than in science. Namely, the share of companies created at STAGE_1 and STAGE_2 of total foundations were respectively 76.8% in the non-science, and 64.3% in the science, fields. In addition, the share of founders from all academic workers at STAGE_1 were 12.9% for non-science and 10.9% for science, while the latter had a higher overall proportion of firm founders (i.e., 14.1% vs. 11.6% in non-science).

Based on the results in Table 3, academic founders at all career stages generally possess more academic assets (with the only exception being PhD degree possession at STAGE_2 and STAGE_4). Despite larger academic asset values for entrepreneurs, the statistical tests documented in Table 3 indicate only a few statistically significant differences in academic asset values between founders and non-founders. Thus, a similar result was expected from the multivariate analysis. The same information as provided in Table 3, but for the science and non-science fields separately, can be found in Appendix A, Tables A1 and A2.

Table 4 documents logistic regression models composed for the four career stages in the whole population, while science and non-science workers were viewed individually as well. By applying the significance threshold $p < 0.05$, the significant variables by career stage are as follows ("+" indicating a rise in variable value increasing the likelihood of being a founder and "−" otherwise): at STAGE_1 SUPEXP "+" and PUBLIC "+", at STAGE_2 SUPEXP "+" and IP "+", at STAGE_3 SUPEXP "+", at STAGE_4 IP "+" and PHD "−".

Table 3. Means of independent variables with statistical tests.

Status	SUPEXP	PROJECT	IP	PUBLIC	PHD
STAGE_1					
Non-founder	0.01	0.82	0.02	0.69	0.00
Founder	0.18	1.53	0.03	2.14	0.06
Total	0.03 *	0.90 *	0.02	0.86 **	0.01 ***
STAGE_2					
Non-founder	1.51	2.60	0.04	7.02	0.50
Founder	2.97	3.30	0.09	7.97	0.47
Total	1.74	2.71	0.04 *	7.17	0.49 *
STAGE_3					
Non-founder	4.01	2.63	0.07	10.33	0.52
Founder	7.19	3.11	0.13	13.09	0.57
Total	4.42 *	2.69	0.07	10.69	0.53
STAGE_4					
Non-founder	8.22	3.77	0.09	15.00	0.71
Founder	9.63	5.44	0.33	17.33	0.63
Total	8.40	3.99	0.13 ***	15.30	0.70

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. For SUPEXP, PROJECT, and PUBLIC, the Brown–Forsythe ANOVA test was used, as they are continuous variables. For IP and PHD, the Pearson Chi-Square test was used, as they are binary variables.

Table 4. Logistic regression models (dependent FOUNDER).

Variable	STAGE_1 B	STAGE_1 *p*-value	STAGE_2 B	STAGE_2 *p*-value	STAGE_3 B	STAGE_3 *p*-value	STAGE_4 B	STAGE_4 *p*-value
All Workers [1]								
SUPEXP	1.064	0.014	0.048	0.011	0.031	0.031	−0.005	0.813
PROJECT	0.032	0.642	0.030	0.226	−0.009	0.750	0.050	0.199
IP	−0.174	0.810	0.881	0.043	0.690	0.123	1.909	0.001
PUBLIC	0.159	0.005	−0.009	0.418	−0.004	0.681	0.010	0.407
PHD	1.158	0.191	−0.276	0.253	0.037	0.905	−1.427	0.022
Constant	−2.333	0.000	−1.748	0.000	−2.081	0.000	−1.679	0.000
Only Science Workers								
SUPEXP	1.457	0.015	0.059	0.068	0.030	0.128	0.014	0.615
PROJECT	0.017	0.829	0.011	0.699	−0.011	0.733	0.040	0.334
IP	0.008	0.991	0.834	0.059	0.342	0.459	1.508	0.017
PUBLIC	0.162	0.009	−0.005	0.693	0.001	0.919	0.006	0.606
PHD	0.859	0.430	−0.416	0.169	−0.275	0.460	−1.379	0.070
Constant	−2.468	0.000	−1.577	0.000	−1.649	0.000	−1.598	0.001
Only Non-Science Workers								
SUPEXP	0.550	0.305	0.052	0.026	0.077	0.010	−0.164	0.240
PROJECT	0.275	0.166	0.099	0.102	0.018	0.799	0.827	0.045
IP	−19.015	0.999	N/A [2]	N/A [2]	7.146	0.430	38.894	0.999
PUBLIC	0.279	0.128	−0.107	0.070	−0.131	0.071	−0.303	0.264
PHD	0.857	0.636	0.216	0.639	0.495	0.446	−1.892	0.364
Constant	−2.188	0.000	−1.850	0.000	−2.725	0.000	−1.928	0.001

[1] For none of the regression models the variance inflation factor exceeded 2.00, thus the models can be considered free from multicollinearity. [2] IP was not included in case of non-science workers' STAGE_2, as this variable has only one value (i.e., IP = 0) in the case of both groups, i.e., entrepreneurs and non-entrepreneurs.

We conducted a robustness test by considering only two career stages, namely ≤40 years old (i.e., STAGE_A) and >40 years old (i.e., STAGE_B). At STAGE_A, the only significant ($p < 0.05$) variable was SUPEXP, in the earlier analysis being significant at STAGE_1 and STAGE_2, which summed as STAGE_A. At STAGE_B, the only significant ($p < 0.05$) variable was IP, while it was significant at STAGE_4, but at STAGE_3 its significance (0.123) slightly exceeded the largest reasonable p-value threshold of 0.1. The latter more consolidated results provide additional proof that pooling various career stages together can, to a certain extent, distort the stage-specific findings.

4.2. Theoretical Conceptualization

This paper extends the extant literature by providing an empirically validated integrative concept of resource-based and life-cycle theories in an academic entrepreneurship setting. Specifically, based on the empirical evidence we formulated the following five theoretical propositions of how academic assets and career stages are interlinked:

Time varying property (#1): The relationship between academic assets and firm creation by academic workers is non-linear, i.e., assets that are significant determinants at one career stage often might not be so in another. Thus, a career stage specific role of academic assets in firm creation is apparent.

Uniqueness property (#2): Only a few academic assets at specific career stages have a significant association with firm creation. Thus, at each career stage, only certain academic asset types portray the individual characteristics needed for starting a company.

Field-specific property (#3): The relationship explained in points 1 and 2 is academic field specific, i.e., substantial differences occur between science and non-science fields. In science field, a larger variety of academic assets tend to determine firm creation.

Scale property (#4): Academic assets are usually associated with firm creation by following a “more is better” logic, i.e., the larger the portfolio of a specific asset, the higher is the likelihood of firm creation.

Sophistication property (#5): At later career stages, somewhat more sophisticated assets are associated with launching a firm. Specifically, publishing and supervision, which are easier to achieve, do not play a role at later stages, where, for instance, the much more difficult patenting activity obtains a major role.

5. Discussion of Findings

5.1. Comparison with Previous Empirical Research

Multiple important conclusions can be made from the empirical results. SUPEXP is a significant determinant of FOUNDER at all career stages, except for STAGE_4, although with constantly reducing magnitude of effect (when comparing coefficients). Supervision experience (SUPEXP) as an academic asset could portray different entrepreneurial characteristics, among them the ability to manage human resources being probably the most important one. In science field, the variable is significant only at STAGE_1, while in non-science field at STAGE_2 and STAGE_3. Probably in non-science field the accumulation of knowledge takes longer to enable the successful supervision of students, and therefore, the career stage effect is shifted.

The results are partially in line with previous studies [1,12], which concluded that teaching does not affect the likelihood of firm creation by academic workers. In our case, this was true mostly at later career stages. Thus, we can conclude that the life-cycle effects of academic entrepreneurship determinants exist, as teaching experience is an important predictor of company creation, mostly at the earlier career stages.

Intellectual property (IP) is a very important determinant at STAGE_4, while being near borderline (in) significant at STAGE_2 (p-value 0.043) and STAGE_3 (p-value 0.123). Older academics are generally more likely to have invented something worth commercializing, or they are just more focused on the commercialization of intellectual property at the later stages of their career. It is also likely that patenting is not dealt with “just for fun”, but with the clear aim of monetizing it. The significance of intellectual property clearly originates from the science field, which generally is known for codified knowledge, while in non-science field tacit knowledge often dominates.

The results could explain why previous research has found evidence for both a significant relationship between patents and entrepreneurship [33,36,37] and for the contrary [38]. Life-cycle effects of academic entrepreneurship determinants exist, as the relationship between intellectual property assets and firm creation is stronger at the later stages of the academic career.

Publications (PUBLIC) play a role only at the earliest career stage, with a probable explanation that individuals with a high number of publications at the beginning of their career are generally more productive and knowledgeable than the opposite group, and therefore, can undertake and handle different activities. In time, the differences are levelled off by non-entrepreneurial workers being focused mainly on academic output. The differences originate solely from the science field, while applying a $p < 0.1$ threshold, in non-science field the opposite effects can be seen at STAGE_2 and STAGE_3. The latter is a clear indication that in the non-science field, academically productive workers in the middle of their career might not show any interest in commercialization.

While previous studies have found evidence for both publications having a significant effect on firm creation [28,33,37,40] and the opposite [12,16,27], this study explains, based on life-cycle theory, how both approaches can be supported. Specifically, publications are a significant determinant of academic entrepreneurship only at the early stages of an academic career.

The possession of a PhD degree (PHD) is the only variable having a negative effect, specifically at the last career stage. Such a phenomenon can be explained with the fact that older academic workers without a PhD degree are usually in lower academic positions, and thus, need to compensate for the lack of financial resources, and are not too involved with academia (e.g., involved only part-time and/or conducting simple tasks) or are eager to prove themselves in areas other than scientific research. This is in line with previous studies establishing that older academic workers could take higher commercialization risks because potential failures will not affect their academic careers remarkably [37,46]. In addition, as older academic workers without a PhD degree are likely to be non-tenured, then the finding in this study to a certain extent opposes previous papers claiming that tenure has no effect on commercialization.

Being engaged in scientific and applied projects (PROJECT) is the only variable not significant at any of the career stages. The latter could point to different aspects:, e.g., being too involved with project activities to start a firm; some of the commercialization already occurring through projects, which in turn creates enough income for the academic workers; or there are (legal) restrictions to commercializing the results (i.e., one entrepreneurship type rules out the other). When considering the academic fields, then STAGE_4 for non-science is the only one where this variable is significant and leads to a positive effect.

While a few previous studies have found that grants are a significant predictor of firm creation by academic staff [12,30,31], this study was mostly in line with research showing no relationship between them [28,29,32].

In summary, as the relationship between academic assets and firm creation is clearly dependent of the academic life-cycle stage, the findings could explain the remarkable controversy in the available empirical literature about the effects of specific academic assets (for a literature review, see e.g., [13]). Thus, accounting for career stage should serve as an important requirement in future studies.

5.2. Contribution to Innovation Literature

As the bulk of academic entrepreneurship is based on the commercialization of innovative knowledge, the theoretical propositions offered here have a several-fold contribution to innovation literature as well (for an overview, see e.g., [3]). Namely, the sophistication property logically hints that a higher level of innovation could be expected from later career stage commercialization. For instance, the last career stage indicates a high propensity to patent before commercialization. The field-specific property provides clues that innovation in non-science field could be more open when compared with science. Namely, academic entrepreneurs in the non-science field are not likely to use patenting. The latter might, in turn, raise a separate research question, whether the academic entrepreneurs in non-science field are actually less innovative or not. Lastly, the uniqueness property proposes that scientific innovations are channeled into entrepreneurship by the moderation of specific well-developed types of academic assets, rather than by an abundant portfolio of different academic assets. For instance, highly skilled and successful project applicants might specifically target such innovations in their area, which are supported by a rich selection of available entrepreneurial grants.

6. Practical Implications

The practical implications directly originate from the earlier theoretical conceptualization and empirical findings. Technology transfer offices at universities should ensure that incentives and mechanisms for academic entrepreneurship follow a life-cycle approach, i.e., the design of incentives should account for the specifics of different life-cycle stages (including academic assets and academic field). The latter is in line with Perkmann et al. [2] and Hossinger et al. [11], who concluded that policies and incentives should be tailored to support academic workers' entrepreneurial activities.

Generally, at earlier stages academic workers who are more productive in simple academic tasks (e.g., supervision or publishing) seem to be more likely candidates for firm creation, while at later stages, more specific assets such as the presence of intellectual property are the cornerstones for starting a company. Potentially overlooked are the older academic workers without a PhD, who might have enough accumulated knowledge for commercialization.

Statistically speaking (see also Table 2), the field of science seems to offer more commercialization opportunities, except for in the earliest career stage. However, the latter postulate is based on actual longitudinal information about firm creations, and thus, might not disclose unexploited potential. Namely, the population of academic workers with similar characteristics to firm founders, but having not achieved this, is remarkable. The second career stage, which is characterized by workers having obtained a PhD and moved above basic academic positions, seems to be the best springboard for firm creation. Such individuals have not reached a breakpoint in their career, where too many academic activities might start hindering entrepreneurial opportunities.

7. Conclusions

The paper aimed to find out which academic assets associate with firm creation at different academic career stages; while the extant literature has mostly remained silent about the potential dynamics of entrepreneurship determinants. A study design integrating different theoretical perspectives was implemented, while the dataset included the longitudinal whole population of Estonian academic workers. Logistic regression was implemented to test which academic assets were associated with business creation by academic staff at four career stages, determined by an individual's age. Additional models were composed for the two main academic disciplines.

We conceptualized the empirical findings into theoretical propositions reflecting the time varying, uniqueness, field-specific, scale, and sophistication properties of the interconnection of academic assets and academic entrepreneurship (specifically, firm creation). The results indicated that at different academic career stages, the academic assets associated with firm creation differ, leading to the time variation context. However, at each stage, the frequency of significant determinants was low, and moreover, they tended to be unique. Namely, while at earlier stages more general assets (e.g., supervision experience, number of publications) associate with company creation, at later stages they become more sophisticated (e.g., possession of intellectual property). The associations between the two phenomena are generally positive, meaning that a larger scale of assets leads to a higher likelihood of becoming an entrepreneur. The results varied between two academic disciplines, i.e., science and non-science fields, thus providing a field-specific context. In addition, the findings include some statistically significant relationships between academic entrepreneurship and academic assets that static studies have not found before. For instance, grants (only for non-science field) and PhD status decrease the likelihood of firm creation at the last stage of academic careers.

As a major avenue of further research, the concept provided in the paper could be further developed and tested. The few limitations, also giving rise to ideas for future studies, are discussed as follows. First, follow-up research could resolve the limitation of this study that only one proxy for each academic asset type is used. The latter limitation originates from using factual population level information from a database, i.e., such sources are not as rich as interviews or questionnaires. Second, the context of the founded firms could be elaborated further, as there could be a high level of diversity among them [60–62]: e.g., by evaluating for their financial performance, exact technology transfer mechanism from academia, and corporate governance (i.e., roles, background and relationship between managers and owners). Third, the population applied in this study could be even futher enlarged by counting those academic workers who have permanently left academia to be entrepreneurs. Last, as the paper is directed to studying only the association between academic assets and firm creation, future studies could focus more on causality questions: namely, if and how these assets exactly contribute to knowledge commercialization through firm creation.

Author Contributions: Both authors contributed to all parts. Both authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the European Union Horizon 2020 Research and Innovation action under grant agreement No. 822781 GROWINPRO and Estonian Research Council's grant PRG791 "Innovation Complementarities and Productivity Growth".

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data sharing restricted by a third party.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Science workers' means with statistical tests.

	Status	SUPEXP	PROJECT	IP	PUBLIC	PHD
STAGE_1	Non-founder	0.01	1.07	0.03	0.92	0.00
	Founder	0.17	1.90	0.05	2.73	0.07
	Total	0.03 *	1.16 *	0.03	1.12 **	0.01 ***
	Status	SUPEXP	PROJECT	IP	PUBLIC	PHD
STAGE_2	Non-founder	1.67	3.63	0.06	9.55	0.61
	Founder	2.88	4.22	0.14	11.19	0.56
	Total	1.87 *	3.73	0.07 *	9.82	0.60
	Status	SUPEXP	PROJECT	IP	PUBLIC	PHD
STAGE_3	Non-founder	4.28	3.31	0.11	13.95	0.62
	Founder	6.48	3.59	0.15	16.11	0.61
	Total	4.64	3.35	0.11	14.30	0.62
	Status	SUPEXP	PROJECT	IP	PUBLIC	PHD
STAGE_4	Non-founder	7.38	4.78	0.14	18.08	0.80
	Founder	11.20	6.65	0.40	21.05	0.75
	Total	7.92	5.04	0.18 **	18.51	0.79

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. For SUPEXP, PROJECT and PUBLIC, the Brown–Forsythe ANOVA test was used, as they are continuous variables. For IP and PHD, the Pearson Chi-Square test was used, as they are binary variables.

Table A2. Non-science workers' means with statistical tests.

	Status	SUPEXP	PROJECT	IP	PUBLIC	PHD
STAGE_1	Non-founder	0.01	0.26	0.01	0.18	0.00
	Founder	0.21	0.85	0.00	1.06	0.06
	Total	0.04	0.33	0.01	0.29	0.01 **
	Status	SUPEXP	PROJECT	IP	PUBLIC	PHD
STAGE_2	Non-founder	1.29	1.20	0.00	3.58	0.34
	Founder	3.14	1.74	0.00	2.51	0.33
	Total	1.55	1.28	0.00	3.43	0.33
	Status	SUPEXP	PROJECT	IP	PUBLIC	PHD
STAGE_3	Non-founder	3.62	1.67	0.01	5.25	0.38
	Founder	9.56	1.50	0.06	2.88	0.44
	Total	4.07	1.65	0.01 *	5.07	0.38
	Status	SUPEXP	PROJECT	IP	PUBLIC	PHD
STAGE_4	Non-founder	9.90	1.77	0.00	8.83	0.53
	Founder	5.14	2.00	0.14	6.71	0.29
	Total	9.40	1.79	0.01 **	8.61	0.51

** $p < 0.01$, * $p < 0.05$. For SUPEXP, PROJECT and PUBLIC, the Brown–Forsythe ANOVA test was used, as they are continuous variables. For IP and PHD, the Pearson Chi-Square test was used, as they are binary variables.

References

1. Abreu, M.; Grinevich, V. The nature of academic entrepreneurship in the UK: Widening the focus on entrepreneurial activities. *Res. Policy* **2013**, *42*, 408–422. [CrossRef]
2. Perkmann, M.; Salandra, R.; Tartari, V.; McKelvey, M.; Hughes, A. Academic engagement: A review of the literature 2011. *Res. Policy* **2021**, *50*, 104114. [CrossRef]
3. Heras-Rosas, C.D.L.; Herrera, J. Research Trends in Open Innovation and the Role of the University. *J. Open Innov. Technol. Mark. Complex.* **2021**, *7*, 29. [CrossRef]
4. Mowery, D.C.; Nelson, R.R.; Sampat, B.N.; A Ziedonis, A. The growth of patenting and licensing by U.S. universities: An assessment of the effects of the Bayh–Dole act of 1980. *Res. Policy* **2001**, *30*, 99–119. [CrossRef]
5. Fini, R.; Fu, K.; Mathisen, M.T.; Rasmussen, E.; Wright, M. Institutional determinants of university spin-off quantity and quality: A longitudinal, multilevel, cross-country study. *Small Bus. Econ.* **2017**, *48*, 361–391. [CrossRef]
6. Bicknell, A.; Francis-Smythe, J.; Arthur, J. Knowledge transfer: Deconstructing the entrepreneurial academic. *Int. J. Entrep. Behav. Res.* **2010**, *16*, 485–501. [CrossRef]
7. O'Shea, R.P.; Allen, T.J.; Chevalier, A.; Roche, F. Entrepreneurial orientation, technology transfer and spinoff performance of U.S. universities. *Res. Policy* **2005**, *34*, 994–1009. [CrossRef]
8. Shane, S.A. *Academic Entrepreneurship: University Spinoffs and Wealth Creation*; Edward Elgar Publishing: Cheltenham, UK, 2004.
9. Roberts, E. *Entrepreneurs in High Technology: Lessons from MIT and Beyond*; Oxford University Press: Oxford, UK, 1991.
10. Miranda, F.J.; Chamorro-Mera, A.; Rubio, S. Academic entrepreneurship in Spanish universities: An analysis of the determinants of entrepreneurial intention. *Eur. Res. Manag. Bus. Econ.* **2017**, *23*, 113–122. [CrossRef]
11. Hossinger, S.M.; Chen, X.; Werner, A. Drivers, barriers and success factors of academic spin-offs: A systematic literature review. *Manag. Rev. Q.* **2020**, *70*, 97–134. [CrossRef]
12. Landry, R.; Amara, N.; Rherrad, I. Why are some university researchers more likely to create spin-offs than others? Evidence from Canadian universities. *Res. Policy* **2006**, *35*, 1599–1615. [CrossRef]
13. Mõttus, M.; Lukason, O.; Varblane, U. Which Individual Characteristics are Associated with Academic Entrepreneurship? Evidence from Estonia. *Int. J. Innov. Technol. Manag.* **2019**, *16*, 1950018. [CrossRef]
14. Iorio, R.; Labory, S.; Rentocchini, F. The importance of pro-social behaviour for the breadth and depth of knowledge transfer activities: An analysis of Italian academic scientists. *Res. Policy* **2017**, *46*, 497–509. [CrossRef]
15. Jones-Evans, D. A typology of technology-based entrepreneurs. *Int. J. Entrep. Behav. Res.* **1995**, *1*, 26–47. [CrossRef]
16. Renault, C.S. Academic Capitalism and University Incentives for Faculty Entrepreneurship. *J. Technol. Transf.* **2006**, *31*, 227–239. [CrossRef]
17. Diamond, A.M. An economic model of the life-cycle research productivity of scientists. *Science* **1984**, *6*, 189–196. [CrossRef]
18. Levin, S.G.; Stephan, P.E. Research productivity over the life cycle: Evidence for academic scientists. *Am. Econ. Rev.* **1991**, *81*, 114–132. Available online: https://www.jstor.org/stable/2006790 (accessed on 10 February 2021).
19. Thursby, M.; Thursby, J.; Gupta-Mukherjee, S. Are there real effects of licensing on academic research? A life cycle view. *J. Econ. Behav. Organ.* **2007**, *63*, 577–598. [CrossRef]
20. Bogers, M.; Chesbrough, H.; Moedas, C. Open Innovation: Research, Practices, and Policies. *Calif. Manag. Rev.* **2018**, *60*, 5–16. [CrossRef]

21. Perkmann, M.; West, J.; Link, A.N.; Siegel, D.S.; Wright, M. Chapter Open Science and Open Innovation. In *The Chicago Handbook of University Technology Transfer and Academic Entrepreneurship*; University of Chicago Press: Chicago, IL, USA, 2015; pp. 41–74.
22. Spender, J.-C.; Corvello, V.; Grimaldi, M.; Rippa, P. Startups and open innovation: A review of the literature. *Eur. J. Innov. Manag.* **2017**, *20*, 4–30. [CrossRef]
23. Avalos-Quispe, G.A.; Hernández-Simón, L.M. Open Innovation in SMEs: Potential and Realized Absorptive Capacity for Interorganizational Learning in Dyad Collaborations with Academia. *J. Open Innov. Technol. Mark. Complex.* **2019**, *5*, 72. [CrossRef]
24. Perkmann, M.; Walsh, K. University–industry relationships and open innovation: Towards a research agenda. *Int. J. Manag. Rev.* **2007**, *9*, 259–280. [CrossRef]
25. Enkel, E.; Gassmann, O.; Chesbrough, H. Open R&D and open innovation: Exploring the phenomenon. *R&D Manag.* **2009**, *39*, 311–316. [CrossRef]
26. Wynarczyk, P. Open innovation in SMEs. *J. Small Bus. Enterp. Dev.* **2013**, *20*, 258–278. [CrossRef]
27. Gulbrandsen, M.; Smeby, J.-C. Industry funding and university professors' research performance. *Res. Policy* **2005**, *34*, 932–950. [CrossRef]
28. Louis, K.S.; Blumenthal, D.; Gluck, M.E.; Stoto, M.A. Entrepreneurs in Academe: An Exploration of Behaviors among Life Scientists. *Adm. Sci. Q.* **1989**, *34*, 110. [CrossRef]
29. Perkmann, M.; Tartari, V.; McKelvey, M.; Autio, E.; Broström, A.; D'Este, P.; Fini, R.; Geuna, A.; Grimaldi, R.; Hughes, A.; et al. Academic engagement and commercialisation: A review of the literature on university–industry relations. *Res. Policy* **2013**, *42*, 423–442. [CrossRef]
30. Aldridge, T.T.; Audretsch, D.; Desai, S.; Nadella, V. Scientist entrepreneurship across scientific fields. *J. Technol. Transf.* **2014**, *39*, 819–835. [CrossRef]
31. Aldridge, T.T.; Audretsch, D. The Bayh-Dole Act and scientist entrepreneurship. *Res. Policy* **2011**, *40*, 1058–1067. [CrossRef]
32. D'Este, P.; Perkmann, M. Why do academics engage with industry? The entrepreneurial university and individual motivations. *J. Technol. Transf.* **2011**, *36*, 316–339. [CrossRef]
33. Goel, R.K.; Grimpe, C. Are all academic entrepreneurs created alike? Evidence from Germany. *Econ. Innov. New Technol.* **2012**, *21*, 247–266. [CrossRef]
34. D'Este, P.; Mahdi, S.; Neely, A. Academic Entrepreneurship: What Are the Factors Shaping the Capacity of Academic Researchers to Identify and Exploit Entrepreneurial Opportunities? DRUID Working Paper No. 10–05. Available online: https://wp.druid.dk/wp/20100005.pdf (accessed on 10 February 2021).
35. D'Este, P.; Mahdi, S.; Neely, A.; Rentocchini, F. Inventors and entrepreneurs in academia: What types of skills and experience matter? *Technovation* **2012**, *32*, 293–303. [CrossRef]
36. Krabel, S.; Mueller, P. What drives scientists to start their own company? *Res. Policy* **2009**, *38*, 947–956. [CrossRef]
37. Stuart, T.E.; Ding, W.W. When Do Scientists Become Entrepreneurs? The Social Structural Antecedents of Commercial Activity in the Academic Life Sciences. *Am. J. Sociol.* **2006**, *112*, 97–144. [CrossRef]
38. Marion, T.J.; Dunlap, D.R.; Friar, J.H. The university entrepreneur: A census and survey of attributes and outcomes. *R&D Manag.* **2012**, *42*, 401–419. [CrossRef]
39. Karlsson, T.; Wigren, C. Start-ups among university employees: The influence of legitimacy, human capital and social capital. *J. Technol. Transf.* **2010**, *37*, 297–312. [CrossRef]
40. Haeussler, C.; Colyvas, J.A. Breaking the Ivory Tower: Academic Entrepreneurship in the Life Sciences in UK and Germany. *Res. Policy* **2011**, *40*, 41–54. [CrossRef]
41. Clarysse, B.; Tartari, V.; Salter, A. The impact of entrepreneurial capacity, experience and organizational support on academic entrepreneurship. *Res. Policy* **2011**, *40*, 1084–1093. [CrossRef]
42. Blake, D. Motivations and Paths to Becoming Faculty at Minority Serving Institutions. *Educ. Sci.* **2018**, *8*, 30. [CrossRef]
43. Becker, G.S. Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education. National Bureau of Economic Research: New York, NY, USA, 1965; 187p, distributed by Columbia University Press.
44. Goodwin, T.H.; Sauer, R.D. Life Cycle Productivity in Academic Research: Evidence from Cumulative Publication Histories of Academic Economists. *South. Econ. J.* **1995**, *61*, 728. [CrossRef]
45. Rauber, M.; Ursprung, H.W. Evaluation of Researchers: A Life Cycle Analysis of German Academic Economists. *Conf. New Politi-Econ.* **2008**, *25*, 101–122. [CrossRef]
46. Bercovitz, J.; Feldman, M. Academic Entrepreneurs: Organizational Change at the Individual Level. *Organ. Sci.* **2008**, *19*, 69–89. [CrossRef]
47. Carayol, N. Academic Incentives, Research Organization and Patenting at a Large French University. *Econ. Innov. New Technol.* **2007**, *16*, 119–138. [CrossRef]
48. Link, A.N.; Siegel, D.S.; Bozeman, B. An empirical analysis of the propensity of academics to engage in informal university technology transfer. *Ind. Corp. Chang.* **2007**, *16*, 641–655. [CrossRef]
49. Stephan, P.E.; Gurmu, S.; Sumell, A.J.; Black, G. Who's Patenting in the University? Evidence from the Survey of Doctorate Recipients. *Econ. Innov. New Technol.* **2007**, *16*, 71–99. [CrossRef]
50. QS Top Universities. Rankings. Available online: https://www.topuniversities.com (accessed on 8 March 2021).
51. Kindsiko, E.; Baruch, Y. Careers of PhD graduates: The role of chance events and how to manage them. *J. Vocat. Behav.* **2019**, *112*, 122–140. [CrossRef]

52. Statistics Estonia. Statistical Database. Available online: https://andmed.stat.ee/en/stat (accessed on 8 March 2021).
53. Estonian Business Register. Statistics. Available online: https://www.rik.ee/et/e-ariregister/statistika (accessed on 8 March 2021).
54. The World Bank. Ease of Doing Business in Estonia. Available online: https://www.doingbusiness.org/en/data/exploreeconomies/estonia (accessed on 8 March 2021).
55. Mohnen, P.; Rõigas, K.; Varblane, U. Which firms use universities as cooperation partners?—A comparative view in Europe. *Int. J. Technol. Manag.* **2018**, *76*, 32. [CrossRef]
56. University of Tartu. UT Spin-Off Programme. Available online: https://en.eik.ut.ee (accessed on 8 March 2021).
57. BiGGAR Economics. Economic Contribution of the Estonian Universities. A Report to Non-Profit Association Universities Estonia. Available online: http://ern.ee/files/Biggar/economicimpact.pdf (accessed on 8 March 2021).
58. Commercial Code. 2021. Available online: https://www.riigiteataja.ee/en/eli/ee/Riigikogu/act/511012021004/consolide (accessed on 8 March 2021).
59. Lukason, O.; Camacho-Miñano, M.-D.-M. Corporate Governance Characteristics of Private SMEs' Annual Report Submission Violations. *J. Risk Financ. Manag.* **2020**, *13*, 230. [CrossRef]
60. Yun, J.J.; Won, D.; Jeong, E.; Park, K.; Lee, D.; Yigitcanlar, T. Dismantling of the Inverted U-Curve of Open Innovation. *Sustainability* **2017**, *9*, 1423. [CrossRef]
61. Zhu, X.; Xiao, Z.; Dong, M.C.; Gu, J. The fit between firms' open innovation and business model for new product development speed: A contingent perspective. *Technovation* **2019**, *86–87*, 75–85. [CrossRef]
62. Yun, J.J.; Zhao, X.; Jung, K.; Yigitcanlar, T. The Culture for Open Innovation Dynamics. *Sustainability* **2020**, *12*, 5076. [CrossRef]