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Who gets the patent? Academic origin and ownership transfer in Norwegian life-sciences patenting 2003-2024

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Abstract

One of the core Europe$scompetitive \neq ssdebateshasbeenaboutitsacademic \in stitution$s ability to turn research into technology. This study addresses commercialization of life-science research in Norway and investigates to what degree academia transfers ownership of its protected scientific inventions, counted as academic patents, to commercial owners. Studies of academic patenting often count filings or trace the citations they attract; few follow what happens to the patents themselves. We follow the patents across a 20 year period, starting with the ownership reform introduced in 2003 which removed the professor`s privilege. We identify 827 academic patent families with priority dates 2003–2024 and classify each by its owner at filing: university, university hospital, public research institute, technology transfer office (TTO), or individual academic inventor. Our findings show that 8.2 per cent had transferred to a firm, but rates differ sharply by origin. TTO-held patents transferred least, at 1.1 per cent, while individual academic inventors, the route the ownership reform was designed to replace, transferred most, at 28.6 per cent. The TTO portfolio shows the highest share of retained patents still in force, and the patents the offices maintain score high on quality indicators. We discuss limitations and future research needed to uncover the mechanisms behind commercialization motivation, and suggest implications for innovation policies beyond the ownership model.

1. Introduction

Public research institutions` role in innovation has been evolving during the past 20 years. From primarily supporting industry-led innovation through researcher involvement, they are becoming major patent applicants, with greater institutional responsibility in commercializing research outcomes. European academic patenting has been growing steadily and startups linked to public research attract a high share of investment, helping to advance capital-intensive technologies in fields such as healthtech, energy, or hardware (Arribas Martinez et al., 2025). Of all patents filed by universities, public research offices and research hospitals, more than 30% are connected to biotechnology, pharmaceuticals and medical technology and HealthTech is dominant among all sectors in EPOs DeepTech Finder (Rudyk et.al, 2026). However, despite the growing number of academic patenting and the professionalization of technology transfer offices, evidence suggests a gap in the economic impact of patents owned by European universities (Rudyk et al., 2026).

Norway is a star example of this paradox. The country funds life-sciences (LS) research generously, and ranks among the world’s most productive in scientific output per capita (World Intellectual Property Organization [WIPO], 2026). However, little of that research leads into commercial results (WIPO, 2026), and few domestic firms have grown out of it (Cappelen et al., 2025).

Patents are important in life-sciences in a way they are not in every field. In many industries firms protect inventions through secrecy, speed to market, or control of complementary assets, and the patent record, which registers who owns the patent, when it has been filed and whether renewal fees are still being paid, misses most of those strategies (Cohen et al., 2000). Life-science works differently. A patent is

often a precondition for investment and sale, especially in pharmaceutics (Wagner & Wakeman, 2016).Even if public funding at the research end is good, life-sciences and health-tech breakthroughs are notoriously capital-intensive to develop into industry, products and services. Moving a discovery through clinical trials and across the valley of death takes many years and large amounts of patient capital (DiMasi et.al, 2016; Seyhan, 2019). The products, the sales and the growth come in close collaboration with commercial actors and private firms.

For an industry with such long development cycles from basic research to final product, investors need to know the underlying invention is protected (Häussler et al., 2014). A patent can raise the financial return on an invention by an estimated 40 to 50 percent (Jensen et al.,2011). In life-sciences a patent is thus often a “ticket-to-play” because it offers protection for an invention whilst also satisfying the common interest of publishing the scientific discovery for the general public. Since most of the early inventive activity begins in public research (Nicol et al., 2014 ; Eisenberg & Nelson, 2002), LS can be considered a science-based sector in Pavitt`s (1984) taxonomy of technical change. This study therefore concentrates on *academic* life-science patents.

Research institutions have a growing responsibility on whether and how inventions are protected, and how these inventions are financed (Rudyk et al 2026). Yet filing or applying for a patent measures the propensity to protect an invention, not whether that invention reaches a market (Perkmann et al., 2013) The same filing starts a clock, because protection lasts maximum twenty years from filing, extended by up to five years for pharmaceuticals through supplementary protection certificates. Much of that window closes before any product reaches the market, leaving little time to earn a return on what can be an enormous investment. We therefore follow what happens to academic patents *after* filing and ask:

(i)How many Norwegian academic life-science patents leave the academic ownership?

(ii) Do transfer rates differ across universities, university hospitals, research institutes, technology transfer offices (TTOs), and individual academic inventors.

Ownership transfer has precedent as a commercialization proxy (Giuri, Munari & Pasquini, 2013; Dahlborg et al., 2017), and it carries a signal of value, because patents that change hands tend to be the ones that carry a higher commercial value. They draw more citations, cover more jurisdictions, and stay renewed for longer than patents that never move, since a firm buys a patent only when it judges the invention worth the price (Serrano, 2010; Sterzi, 2013; Ciaramella et al., 2017). Reading commercialization in this way misses licensing, which is more widely practiced in Norway as elsewhere (Lie et al., 2025; Bengtsson, 2017; Jensen & Thursby, 2001), but in an industry requiring so much investment, a transfer would indicate that the invention moves to an owner able to fund the decade of development that usually follows (Kulkov et al., 2020; Styhre, 2015; Dahlborg et al., 2017).

Our contribution is two-fold. Prior work on the Nordic ownership reforms asks whether abolishing the professor’s privilege changed *how much* academics patent (Hvide & Jones, 2018; Ejermo & Toivanen, 2018; Iversen et al, 2007) and count patents filed/applications sent. Yet effective patenting needs to be

connected to market demand, technical validation ,potential partners and an appropriate transfer route (Rudyk et. Al,2026). We **therefore** ask *what happened to the patents themselves*, across the twenty years the reform has now had to work, whether they reach commercial owners, whether they are maintained or let die. Second, we disaggregate the academic category into universities, university hospitals, research institutes, technology transfer offices, and individual academic inventors, because treating academia as one actor conceals the heterogeneity that produces the aggregate rate.

The paper proceeds as follows. Section 2 is the literature review. Section 3 describes the data and classification pipeline. Section 4 presents the methodology. Section 5 reports results. Section 6 discusses implications and limitations.

2. Literature review

2.1 Academic patents

Over the past two decades, innovation policies meant to incentivize commercialization have been reshaped by reforms meant to improve the utilization of publicly funded research. Following the United States Bayh-Dole Act of 1980, a wave of OECD countries transferred ownership of academic inventions from researchers to their institutions (Mowery et al., 2001; Grimaldi et al., 2011). These reforms mostly addressed ownership and control, while a second instrument was meant to professionalize the path from laboratory to market by the introduction of the TTOs (see Borlaug et.al, 2022 for a Norwegian analysis of TTOs).

Norway abolished the professor's privilege, transferring the invention ownership from the professors to the institutions, in 2003, Finland in 2007. The evidence since then is mixed. Hvide and Jones (2018) documented a halving of Norwegian academic patenting after 2003, and Ejermo and Toivanen (2018) report a similar decline in Finland. Two Norwegian studies read the drop differently. Iversen et al. (2007) saw it as temporary adjustment to new rules and note that researcher-held patents were rare in most sectors even under the professor`s privilege. Spilling et al. (2015) find a fall of only about one percentage point in the public-sector share of filings, and warn against blaming the reform for it, since much else changed in the Norwegian economy over those years. All four studies measure filings, and none follows the patents afterwards.Dahlborg et al. (2017) come closest to what we attempt. Their framework traces academic patents from inventor to original owner to current owner and show that two-thirds of Karolinska Institutet's academic patents leave the university within a few years. The setting differs from ours in the ownership model, because Sweden has maintained the professor's privilege, so ownership sits with the inventor, not the institution. Whether the same pattern occurs if the institution holds the ownership rights is an open question, and a single-university case cannot answer, nor can it show which academic actors drive the pattern.

Comparing university regimes across Europe could give answers, but Geuna and Rossi (2011) argue that European IPR systems remain structurally heterogeneous, and that reform effects are best examined

country by country. We therefore concentrate on one country only, Norway.

2.2 Institutional function of patents

Firms and academics patent for different reasons. Firms file to protect market positions, exclude competitors, and signal capability to investors (Cohen et al., 2000; Blind et al., 2006). Academics file for a partly overlapping set of purposes: to establish priority, to enable transactions with industry partners, to secure credit, and to create a licensing platform (Göktepe-Hultén & Mahagaonkar, 2010). These motives follow institutional incentives rather than the commercial readiness of the invention.

Academic filing is not uniform either and the TTOs managing academic intellectual property (IP) have different logics too. Brantnell and Baraldi (2022) studied medical inventions at Stanford and Uppsala and identified eleven TTO roles, which they group into two functions: sheltering and pushing. Sheltering means defensive patenting, holding IP to prevent appropriation, maintain rights, and keep future options open, a strategy that is more common with university ownership, like in the US. Pushing means active commercialization through licensing, spin-off support, and industry partnership, and it associates more strongly with inventor ownership found in Sweden.

If the intended effect of the ownership reform was professionalization of academic patenting, both pushing or sheltering should show higher patent value. Martínez and Sterzi (2021) investigated university-owned and company-owned patents across eleven European countries and found that after the abolition of the professor's privilege, university owned-patent actually declined in technological importance and were renewed less often, while company-owned academic patents improved. It seems like institutional ownership did not change in the direction the reform intended.

Whether this holds for Norway is less clear. The negative effect on patent value in the Martinez & Sterzi (2021) study is driven by Germany and excluding Germany reverses the sign for the remaining countries, but their Norwegian sample contains fewer than a dozen university patents. Carayol and Sterzi (2021) explain why university-held portfolios should look weaker. Where the TTO is one route among several, academics choose other routes for their most promising inventions and leave the TTO with what remains, so the institutional portfolio is weaker before any commercialization effort begins. The Martinez and Sterzi classification separates universities from companies but does not identify patents held by a TTO. Separating the two and treating the TTO as a distinct channel rather than folding it into the university category can give other insights.

2.3 Control rights and contractual configuration

If researchers choose between routes, something must govern that choice. Halilem et al. (2017) find that it is not ownership, what matters instead is control rights and income sharing. Their multilevel models cover 2,230 professors at 27 Canadian universities, and the researchers show that formal ownership of the invention shows no significant effect on patenting, spin-off creation, consulting, or commercial agreements. Mandatory disclosure actually reduces patent applications, and a longer institutional option

to commercialize reduces them even more. A higher university revenue share reduces formal commercialization and increases the use of informal channels.

Norway has both a compulsory disclosure of invention form and high university share for the invention. Halilem and colleagues (2017) suggest that the variable that separates one academic patent from another is not who owns it but which obligations attach to it.

Some obligations are set by the university, others are written into the contracts that fund the research or licence the patent. These contracts often settle the question of ownership before the patent exists. Lie et al. (2025) analysed 484 university-industry collaboration contracts funded by the Research Council of Norway. Most cluster into what they call controlled access agreements, where the university takes formal ownership of the IP while the industry partner holds exploitation rights and imposes restrictions on publication and confidentiality. Under this licensing arrangement the firm can already use the invention. Buying the patent would cost money and change nothing. The patent stays with the university, and no transfer is recorded, even though the invention is being exploited.

Other work points the same way. Corsino and Torrisi (2023) report that formal university-industry collaboration is negatively associated with university patent ownership, which Audretsch and Belitski (2022) attribute to a protectiveness that deters the partnerships commercialization requires. Taxt (2023) and the National Export Council (Nasjonalt eksportråd,2025) document fragmented Norwegian university IPR policies and the cost of maintaining portfolios that generate no income. Although we know that a patent still sitting with a university may be commercially active even if the patent register does not show it, we do not know which academic actors transfer most.

2.4 The Norwegian case - what we expect to find

There is no Norwegian evidence on how often academic patents transfer to a commercial owner. We therefore attempt to form expectations based on international literature and describe the Norwegian context, disaggregating the academic sector.

The first expectation regards the TTOs. Brantnell and Baraldi (2022) describe a mechanism under which academic patents should not transfer. Tech transfer offices either shelter IP, meaning they hold it, protect it or license it out, or they push it, meaning they market it and broker it out. Where the university owns the invention, like in the US, sheltering dominates, and that implies not giving up the title. Under Norway´s university-ownership model we would therefore expect a low transfer rate.

Carayol and Sterzi (2021) point to the same low transfer rate through a different mechanism. Where the TTO is one route among several, academics route their most promising inventions through direct contact with the industry, leaving the office with already filtered inventions. They observe this in a system where, like in Norway, the university holds title to the invention. The filtering is therefore not a consequence of who owns, so we can expect the same to be valid for Norway. On this reading the TTO transfer rate should be no better than the rate for patents held by universities, hospitals or research institutes.

Another mechanism is related to incentives in the system, and here we have some Norwegian evidence. FORNY, the Norwegian Research Council's commercialization program, paid the TTOs an annual performance bonus for results, and counting patents rewarded volume. The count-based criteria paid the office for the filing itself, so a patent could be worth applying for even when no firm wanted the invention. If nobody is waiting to buy it, and nobody is earning from it, the office had little reason to pay the renewal fees that keep it in force. Early filings from TTOs should neither transfer nor survive.

That incentive system changed and Borlaug et al. (2009) show that the criteria shifted over the years, from counting outputs such as patents and the number of start-ups to also include more qualitative measures. By 2008 the bonus ran on a points system, and a license earned points on a graded scale set by the license income and by whether the licensee covered the patenting and development costs (Borlaug et al., 2009). A license lets a firm use the invention while the office keeps the ownership. This same mechanism is described by Lie et.al (2025). The scheme paid for start-ups and for licenses, not for selling a patent. Later filings should therefore not transfer either.

All three accounts predict a low transfer rate, even if the mechanisms for that rate cannot be distinguished from each other, since the patent register records only who owns a patent and whether it is still in force (alive or lapsed).

E1: a. TTO patents transfer to commercial owners at rates no higher than patents from other academic institutions.

Since the TTOs funding has been tied to counting patents to begin with, we expect also that

b. retained TTO patents lapse more often than retained patents held elsewhere in the academic sector,

and we return in Sections 5 and 6 to whether the age composition of the portfolios can separate the earliest rules from the later ones.

The second expectation concerns researchers who filed under their own name after 2003. Their patents should transfer more often, based on the same mechanism described by Carayol & Sterzi (2021): academics with a commercial plan or industrial network keep their best inventions outside the institutional route, whether in agreement with the TTO or around it. Formal ownership does little to change this commercialization behaviour, and Halilem et. al (2017) find that in their study. The important factors are disclosure obligations, the length of the institution’s option to commercialize, and revenue sharing, and an individual filing would have fewer of these, leaning towards a bigger number for solo transfer.

The patent register does not distinguish which route an invention travelled, only where the title ends up, so the group is defined by its endpoint.

E2. Patents held by individual academic inventors transfer at a higher rate than patents held by academic institutions.

SINTEF, NORCE and Nofima are among Norway's largest research institutes, and sit between universities and firms, with much of their income coming from research commissioned by industry and government. That proximity to industry would suggest a higher transfer rate than universities achieve. But commissioned work often has client co-owning the rights, so the patent owner has no reason to change ownership. We therefore do not form any specific expectation for the research institute sector.

3. Data

3.1. Data source and extraction

The data was extracted from international databases using PatSeer, on 18 December 2025, with priority dates 01.01.2003 to 31.12.2024. PatSeer is a commercial patent database that consolidates filings across national and regional offices into families, and carries legal status, ownership history and a set of indicators scores for each record. The resulting database is a snapshot of patent ownership at the time of extraction. Patent applications publish about 18 months after priority, so a December 2025 extraction sees the 2024 priority cohort only partially, and filings from roughly the second half of 2024 were mostly still unpublished at extraction. "Norwegian patents" are defined as filings where at least one assignee or inventor is registered with the country code NO. The dataset does not restrict the priority country to Norway, thus also capturing Norwegian actors who file first abroad.

The raw extraction contains 30479 filings. To compute the ownership transfer we have looked at the original assignee (who has filed the patent) at the time of filing t1, and the current assignee (who owns the patent now) at t2 = time of extraction, 18.12.2025. Any additional changes between t1 and t2 are not reflected in the data, so we see the endpoints of the ownership, not the path. The database reports also the legal status of each record, alive or dead, which tells us whether renewal fees were being paid at the snapshot.

3.2. Defining the sample

We operate with *academic* patents and define these by their origin. A patent is academic when its first owner is a Norwegian academic body, be it a university, a university hospital, a public research institute, or a TTO. In addition to these institutional filings, we also track Norwegian academics (individuals) who patented LS inventions in their own name whilst holding an academic post and distinguish them from other individuals who did not. This separation matters because our window opens in 2003, the reform year when Norway moved ownership of academic inventions from the researcher to the institution, abolishing the so called "professors's privilege". Every patent we study was filed under the regime that reform created.

Life-science and health technology has no clean boundary in the international patent classification (IPC), so we built the sample in two stages.

The first stage was automated. We built a fully reproducible multi-stage regex pipeline matching assignee and owner names against curated dictionaries of universities, hospitals, TTOs, RTOs, corporate titans, and foreign entities (see Master R script - Appendix 1). The IPC codes used were A61B through A61Q, C12M, C12N, C12P, C12Q, G01N, G01R, G06F19, and G16H, and omitted petroleum-specific codes E21B (well drilling), C09K8 (drilling fluids) or C10L (fuels), producing a sample that includes human medicine, medical devices, diagnostics and animal and fish health. The unit of analysis is the patent family rather than the individual filings meaning that all national and regional filings of the same invention share a PatSeer simple family ID and are represented by a single record. Where available, the Norwegian-priority filing was used. The regex pipeline was iteratively refined through over 100 diagnostic passes identifying institutional entities misclassified as individual inventors — including abbreviated university names (e.g. “UNIV OSLO” and “UNI I TROMSO”), hospital name typos (e.g. “UNIVERSITETSSUKEHUS”), and foreign names of academic Norwegian institutions.

The second stage was manual. We hand-screened all individual-inventor families for life-science relevance, dropping 64 families that the IPC flag had caught wrongly. Institutional filings outside the boundary were not hand-screened, so the screening is tighter on individual filings than on institutional ones. The academic status of individual inventors was also verified by hand against NVA, the Norwegian research information system. Where affiliation could not be established, the inventor was classified to Individual (Other).

The unit of analysis is the invention, not the filing. One invention protected in Norway, at the European Patent Office and in the United States appears three times in raw data, which would inflate the numbers. We therefore used simple patent families, with the Norwegian filing as the representative record where one exists and coded the family as transferred if any of its filings transferred. The sample contains 2901 families. Of these, 2074 are Norwegian SME filings, and 827 are academic patent families.

Table 1
Composition of the analytic sample, by origin group and filing era

Origin group	2003–2004	2005–2009	2010–2014	2015–	Total	Mean 360 score
TTO	0	12	21	59	92	18.5
University	11	64	108	203	386	20.6
Hospital	7	12	12	9	40	22.0
Research Institute	2	17	14	12	45	18.0
Individual (Academic)	18	25	11	9	63	22.7
Individual (Other)	25	74	44	58	201	11.8
Analytic sample	**63**	**204**	**210**	**350**	**827**	**18.9**
Industry SME (benchmark, not modelled)	118	539	511	906	2,074	24.9

*Notes: patent families, counted by priority year. The analytic sample excludes Norwegian industry filings, which are reported as a benchmark only. The final column gives the mean PatSeer 360 composite score, used descriptively (*Section 4.2*) .*

We classified each patent by who held it at filing, not by who invented it. This choice means that a patent invented by a university researcher but filed by a company is a company patent in our coding. A patent filed by a TTO is a TTO patent. All coding decisions are summarized in Appendix 2.

4. Methods

4.1. The transfer variable

The dependent variable is binary, coded 1 if a transfer event happened. Transfer is strictly defined as a Norwegian academic body holding the patent at filing and a commercial entity holding it at the snapshot, on December 18th 2025. Everything else is coded 0, including patents that are still held by academia, lapsed /dead patents, and patents whose ownership moved between academic institutions.

4.2 Life status

Because the transfer variable is blind to licensing, we report a second description. Using PatSeer's legal status field we record whether the non-transferred patents are alive or dead at the snapshot. We restrict this analysis to patents at least three years old at the snapshot, so that every patent in it has faced at least one renewal decision. Patents filed in 2023–2024 are excluded as too young to have faced a renewal decision. This removes 31 of the 827 families and leaves 796.

Renewal fees must be paid to keep a patent in force, so a patent still alive has had someone paying for it. That someone may be a licensee, who has every reason to keep the patent alive, or it can be a university that decides that the patent is valuable enough. A patent that is alive will therefore only imply how much licensing could go on, yet a dead patent almost certainly had nobody licensing it.

Within the non-transferred stock we also compare PatSeer's composite quality score across maintained and lapsed patents. The score embeds citation and market components that rise once a patent is sold. That rules it out as a control in the transfer models, because it partly measures the outcome (reaching the market), but is valid here since we compare two groups of patents that stay in academic hands.

4.3 Estimation

The main analysis is descriptive and uses exact methods. We report each transfer rate with a Clopper-Pearson exact binomial confidence interval, and test differences across origin groups with Fisher's exact test, using Monte Carlo simulation. Small samples like ours (one transfer among 92 TTO patents and three among 40 hospital patents) would produce unreliable asymptotic intervals and a non-valid chi-square test.

We also fit a multivariable model, as a robustness check rather than the main result. Ordinary logistic regression would not work here, because the TTO reference group carries only one transfer, which produces quasi-separation, and the 68 events across ten parameters give 6.8 events per variable, below the conventional floor of ten (Peduzzi et al., 1996). We therefore use Firth's penalized likelihood, which corrects the small-sample bias and handles separation without dropping any cases (Firth, 1993; Heinze & Schemper, 2002).

We have three specifications. M1 contains origin group alone. M2 adds filing era in four bands, to control for the fact that a patent filed in 2019 has had less time to move than one filed in 2004. M3 adds the number of distinct IPC subclasses, as a measure of technological breadth, and an indicator for more than one assignee at filing.

The odds ratios use TTOs as a reference group with one event, which gives a baseline with wide uncertainty. We therefore also report adjusted predicted probabilities, computed by G-computation across the covariate distribution. These probabilities do not need a reference group and instead estimate how likely it is that a patent transfers.

5. RESULTS

5.1. Transfer rates by origin

So where do patents go? As expected, we find sharp differences in transfer rates across origin groups.

We expected (E1) that TTO-held patents transfer at a different rate from those held by universities, hospitals and research institutes. The results (Table 2) show that they do and one transfer in 92 patents

puts TTOs at 1.1 per cent, below all other academic institutions in the sample. Section 5.2 takes up what happened to the 91 patents that stayed.

With E2, we expected individual academic inventors to transfer more often than institutions. They transferred 28.6 per cent of their patents, six times the university rate and twenty-five times the TTO rate. The confidence intervals do not overlap, so the observed difference in patent transfer rates is statistically significant.

Table 2
Ownership transfer by origin group

Origin group	n	Transfers	Rate (%)	Exact 95% CI
TTO	92	1	1.1	[0.0, 5.9]
University	386	18	4.7	[2.8, 7.3]
Hospital	40	3	7.5	[1.6, 20.4]
Research Institute	45	5	11.1	[3.7, 24.1]
Individual (Other)	201	23	11.4	[7.4, 16.7]
Individual (Academic)	63	18	28.6	[17.9, 41.3]
All	**827**	**68**	**8.2**	—

Notes: Clopper-Pearson exact binomial confidence intervals. Fisher's exact test of independence between origin group and transfer, $p < 0.001$ (Monte Carlo, $B = 100{,}000$).

5.2. Most academic patents lapse

We examined what happened to the patents that stayed in academic hands. Among those old enough to have faced a renewal decision, 8.4 per cent transferred, 20.9 per cent were still in force at the snapshot, and 70.7 per cent had lapsed. Counting only the patents that did not transfer, more than three in four are dead. Table 3 gives the breakdown by origin group, and figure ones shows how many patents are dead/alive, distributed by their origin.

Table 3
Life status at the December 2025 snapshot, by origin group (percentage).

Origin group	n	Transferred	Retained alive	Lapsed
TTO	88	1.1	35.2	63.6
University	367	4.6	21	74.4
Hospital	40	7.5	17.5	75
Research Institute	44	11.4	15.9	72.7
Individual (Other)	194	11.9	20.1	68
Individual (Academic)	63	28.6	7.9	63.5
All groups	**796**	**8.4**	**20.9**	**70.7**

This is the opposite of what E1b predicted. We expected retained TTO patents to lapse more often than retained patents elsewhere, and they lapse less. 35.2 per cent of the renewal-eligible TTO portfolio is still in force, against 21 per cent at universities. An office that pays renewals on a patent it has not sold is doing something with it, and licensing is the obvious candidate. The maintained patents meet the expected profile: among renewal-eligible TTO patents, those still in force score on average 22.2 on PatSeer's composite quality score against 17.1 for the lapsed, and 26.5 against 17.8 on its market sub-score.

Part of this can be explained by age. Of 92 TTO patents, 59 were filed in 2015 or later, against 203 of 386 at universities, and a younger patent has had less time to lapse. We asked whether the age composition could separate the earlier funding rules from the later ones, and it cannot on its own: the young TTO portfolio was filed under the later, licence-rewarding criteria, so the high maintained share is consistent with those rules, but equally consistent with a portfolio too young to have lapsed.

The differences shrink once we count more than sales. If a patent counts as commercially engaged when it is *either* transferred *or* retained and alive, the academic origin groups are no longer statistically distinguishable (Fisher's exact, $p = 0.24$).

Individual academic inventors look different again. Only 7.9 per cent of their patents sit maintained without a transfer, against 21 per cent at the universities.

5.3. Adjusting for era and breadth changes little

The infrastructure for academic commercialization has been evolving since 2003, so we wanted to analyze if there is any change in the transfer rate across several time periods (era). We fitted the Firth model to adjust for filing era (Table 4) and find that filing era is not significant in any specification, and neither is technological (IPC) breadth of patenting, meaning how many distinct IPC classes a patent has. Figure 2 shows the adjusted predicted probabilities of ownership transfer as a function of different

variables, estimated from a Firth penalized logistic regression model. The TTO reference group carries one transfer, so the upper bounds are wide and should not be read as estimates.

Table 4
Firth penalized logistic regression of ownership transfer (M3).

Term	OR	95% CI	p	Adj. P(transfer), %
Origin group (reference: TTO)				
TTO	—	—	—	1.9
University	2.55	[0.63, 23.33]	0.218	4.7
Hospital	4.94	[0.77, 52.90]	0.093	8.7
Research Institute	7.17	[1.35, 72.25]	0.020	12.1
Individual (Other)	7.69	[1.91, 70.25]	0.002	12.8
Individual (Academic)	19.30	[4.40, 182.59]	< 0.001	26.4
Filing era (reference: 2003–2004)				
2005–2009	1.69	[0.67, 4.81]	0.273	
2010–2014	2.20	[0.85, 6.45]	0.108	
2015–	1.28	[0.47, 3.82]	0.641	
Patent characteristics				
IPC breadth	0.96	[0.73, 1.23]	0.764	
Co-assignee at filing	2.01	[1.18, 3.44]	0.011	

*Notes: n = 827 families, 68 transfer events. Firth penalized likelihood (*Firth, 1993*), profile-penalized 95 per cent CIs. Adjusted probabilities by G-computation; unlike the odds ratios, they do not depend on the reference group. The TTO reference carries one transfer, so upper bounds are wide by construction. Co-assignee is a control, not an effect: the association weakens to OR 1.62 (p = 0.095) once the force-coded joint co-filings are dropped.*

6. DISCUSSION

With the rising importance of the academic institutions when it comes to the transfer of technology and valorization of research, our main goal in this study has been to see what happened to the life-science patents across the twenty years the IP-ownership reform has been in place in Norway. We investigatedwhether they reach commercial owners, whether they are maintained, and what trace does the TTO infrastructure leave in the register.

We expected (E1a) TTO patents to transfer no more often than patents held elsewhere in academia, and in fact they transfer least of all: one family out of 92, 1.1 per cent. Of the 827 academic and individual

life-science patent families in our sample, 68 had changed owners by December 2025, 8.2 per cent. Counting only the institutional holders, the universities, hospitals, research institutes and TTOs, the rate is 4.8 per cent.

All three mechanisms described (sheltering, cherry-picking and early patenting invcentives) predicted a low rate, so this result does not tell us which of them is operating. It does seem to rule out that Norwegian offices` main strategy is pushing inventions out through sales.

We also expected retained TTO patents to lapse more often than retained patents held elsewhere, because an office that has found no licensee has to pay the renewal fees alone. We found the opposite. Among the patents old enough to have faced a renewal decision, 35.2 per cent of the TTO portfolio was still in force at the snapshot, against 21 per cent of the university portfolio. The patents the offices keep alive are also the stronger ones. They average 22.2 on PatSeer's composite score against 17.1 for the lapsed, and 26.5 against 17.8 on its market sub-score.A retained patent can mean two opposite things. The invention may be in commercial use under a contract we cannot see, or it may be a patent kept alive by an office that still hopes for a licensee. The register looks the same in both cases. When a firm funds university research, the contract usually settles who may use the results before any patent exists. Lie et al. (2025) find that Norwegian agreements typically leave the university as owner and give the industry partner the right to exploit the invention. The firm can already use it, so it has no reason to buy it. The title stays with the university, and the patent register shows no change.

Lapsing is not a single event with a single cause, and it carries less information than a transfer does. Because renewal costs money, a patent that continues to be renewed is generally one whose holder still expects something from it, and renewal data has been used as indicators of patent value since Lanjouw et al.(1998). Later studies have looked at the same two outcomes we do, namely transfer and renewal. Bessen (2008) finds that patent value varies systematically with who owns the patent, Harhoff et al. (2003) that patents renewed to full term are more heavily cited than those dropped earlier, and Serrano (2010) posits that patents which change hands are renewed longer than those that do not, which ties our two outcomes together.

The reverse does not follow, and a lapsed patent is not necessarily one that failed. A patent may lapse because no licensee or buyer was found. It may lapse because the technology has been overtaken. It may also lapse because a sale was never the point, or for reasons internal to the holder, such as a portfolio review or the end of the funding that paid the fees. Our data cannot separate these, and we do not read the lapsed share as a count of failed commercialization.

The observed pattern can be partly explained by the incentive system. From the mid 2000s the FORNY bonus rewarded licenses and gave more credit when the licensee covered patenting costs, which is an incentive to hold the patent while a firm uses it. The controlled-access contracts that Lie et al. (2025) document work in the same direction: the university keeps its name on the patent, the industry partner holds the right to exploit the invention, and the register records no change of owner. The offices are doing what their funding criteria and their contracts ask of them. Whether that is good

commercialization is a question the ownership register cannot answer. The 2003 ownership reform in Norway coincided with the continuous development of the infrastructure, from the establishments of TTOs between 2003 and 2005, and to infrastructure investment through 2010–2014 (Borlaug et.al 2021). Separating the effect of the ownership rule from the effect of the infrastructure build up is not possible to distinguish in patent data, since every patent we observe has been filed under all these reforms, so the effect we observe is the joint one.

How much of this is age is hard to say. The TTO portfolio is young: 59 of its 92 families were filed in 2015 or later, against 203 of 386 at the universities, and a young patent has faced fewer renewal decisions at which it could have been dropped. Tables 3 and 4 show that the portfolios that are youngest are also the ones with most patents still in force. Part of the maintained share therefore reflects the age of the portfolio rather than a decision to keep those particular patents alive, and we cannot say how large that part is.

Other studies show that academic patents are maintained less frequently than the average patents for European applicants (Rudyk et.al, 2026), a difference that is more pronounced than in other parts of the wolrd, like the US.

As expected (E2), researchers who filed under their own name transferred 28.6 per cent of their patents, six times the institutional rate. The gap is not an artefact of when the patents were filed or how broad they are, and we check that in the Firth model with controls(M3). We also made sure these researchers were inside the system and verified each against the national research information system (NVA). The pattern seems to fit the one Goel and Göktepe-Hultén (2018) report for the physical and life sciences, where personal filing concentrates among researchers with industrial contacts and senior standing rather than among those at odds with their institutions.

This group is also the closest our data comes to a counterfactual. Twenty years after the reform, the filing route the reform was designed to replace still produces the highest transfer rate in Norwegian academic life sciences. Researchers who patented privately under an institutional-ownership regime are a rough analogue of the pre-2003 situation, and their transfer rate raises the possibility that the reform redirected commercial behaviour rather than generated it. The size of the post-2003 decline in academic filing is disputed, and Iversen et al. (2007) read the early drop as temporary adjustment, while Spilling et al. (2015) caution against attributing it to the legislative change at all, given how much else changed in the Norwegian economy over the same years.

Limitations and future research

Our figures on the maintenance/ life-status are not adjusted for the age of patents unlike the transfer models. The comparison between the young TTO portfolio and the older university portfolio are biased since Norway bundled its policy changes over the years. The ownership reform, the establishment of the TTOs and the growth of FORNY funding arrived within a decade of each other, so what we observe is their combined effect, which is why Geuna and Rossi (2011) argue that these reforms are best examined

one country at a time. We also lean on Canadian evidence for what academics might prefer in terms of disclosure, option periods and revenues. Norwegian qualitative studies that investigate researcher motivations would advance the research frontier.

The question about mechanism remains open, and the register cannot answer it. Our study:shows where a patent ended up, not why. This study gives a sampling frame and classifies every academic patent family in Norway over two decades by origin and outcome, so further, qualitative research should interview TTOs and researchers to find out what happened to the patents. Borlaug et al. (2022) show the Norwegian TTOs are few enough to cover in full.

A qualitative study could also investigate whether the maintained patents have licensees behind them, and whether the office is holding them defensively or waiting for a buyer who has not appeared. Other directions are whether individual academics filed personally because a buyer was already in view or because the obligations were lighter, and how the disclosure duty, the option period and the revenue split entered that decision: this last point is where Halilem et al. (2017) can be tested under Norwegian conditions. Asking the holders directly would show why the lapsed families lapsed, and which of the causes set out above applied in each case. Talking also to TTOs managers could shed light on which criteria shaped what they filed and what they dropped, a choice our design cannot show because the portfolios differ in age.

Conclusion

European competitiveness relies more and more on the ability of turning research into companies and on embedding valorization in institutional strategy, incentives and measurement. The academic institutions are expected to take a more strategic role in this technical sovereignty, yet generating the knowledge is only part of the challenge (Rudyk et.al, 2026).

Countries diversify by converting knowledge into industries they can sell abroad (Hidalgo & Hausmann, 2009; Cai et al., 2018), and WIPO (2026) places Norway among the economies that generate research abundantly and convert little of it, arguing that remedies have to fit a country's existing capabilities rather than follow a standard template. Our data locates one part of that problem in the years after filing, when most protected academic inventions expire without reaching a firm.

Patents are filed for many reasons and lapse for many more, so not every expiry is a loss, but in the development of products in life-science the bottleneck is *after* the patenting phase. Creating scale around specialist capabilities and technology maturation may require a different set of incentives.Existing verification funding from the Norwegian Research council targets research institution level, but developing a life-science industry may require more specific policies targeted at the long life-cycle of product development.

Use of AI tools: We used generative AI in preparing this paper. Claude Opus 4.8, Opus 5 and Fable assisted with iterative development of the R analysis pipeline (entity classification regex,logistic

regression, robustness checks and diagnostic output). All analytical decisions, theoretical framing, data interpretation and substantive conclusions are the author`s own.

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Figures

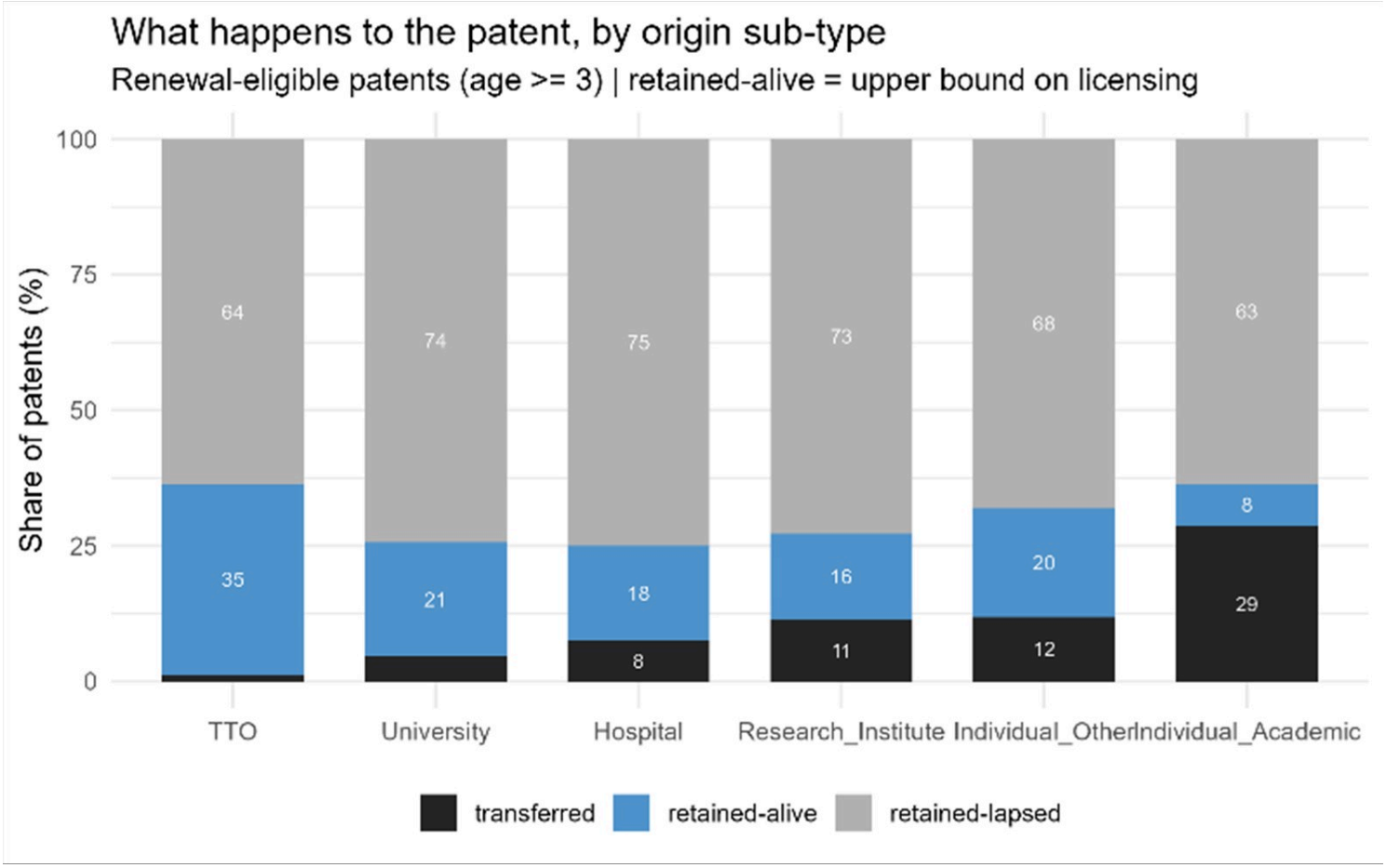


Figure 1

Life status by origin

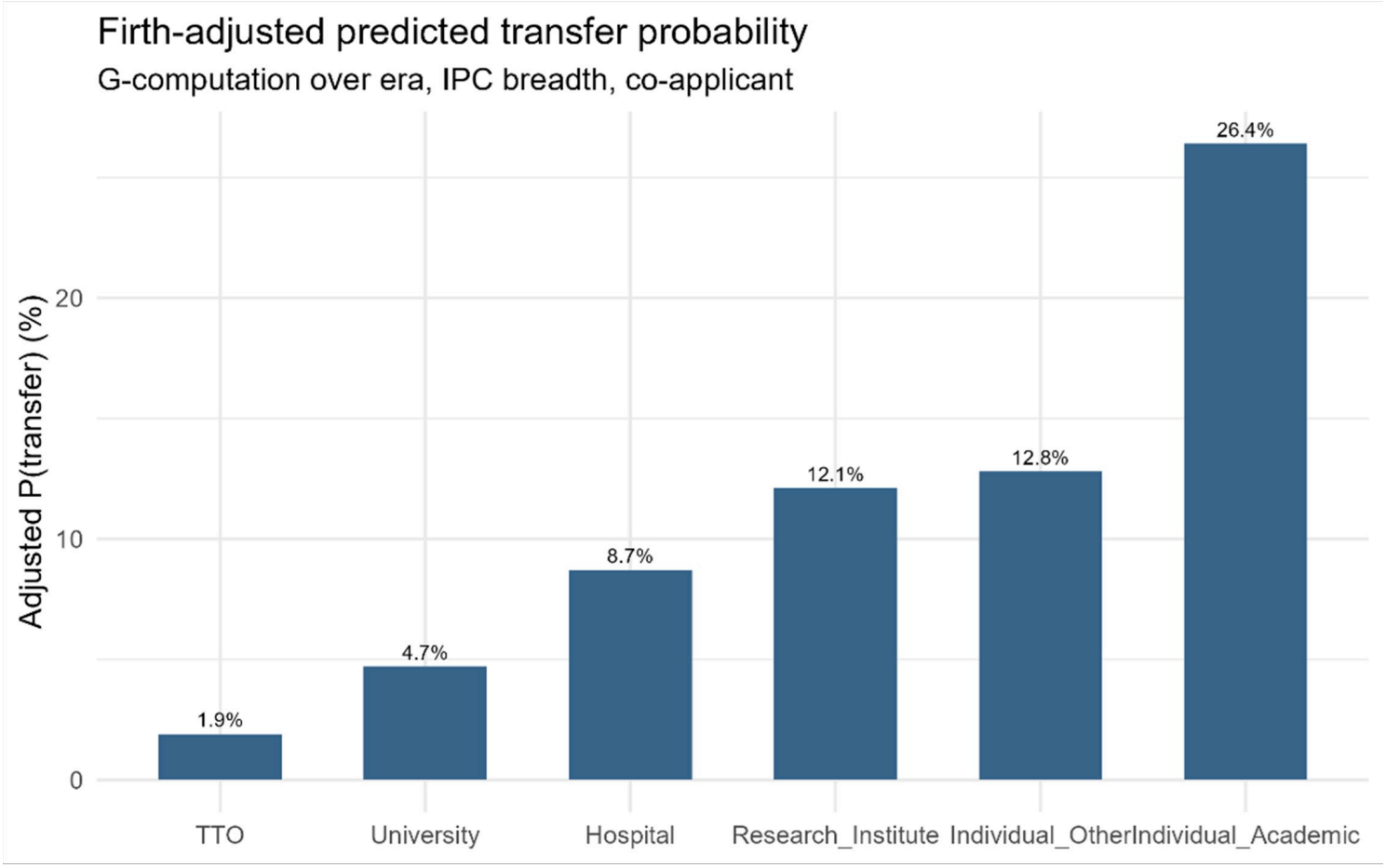


Figure 2

Adjusted predicted probabilities