

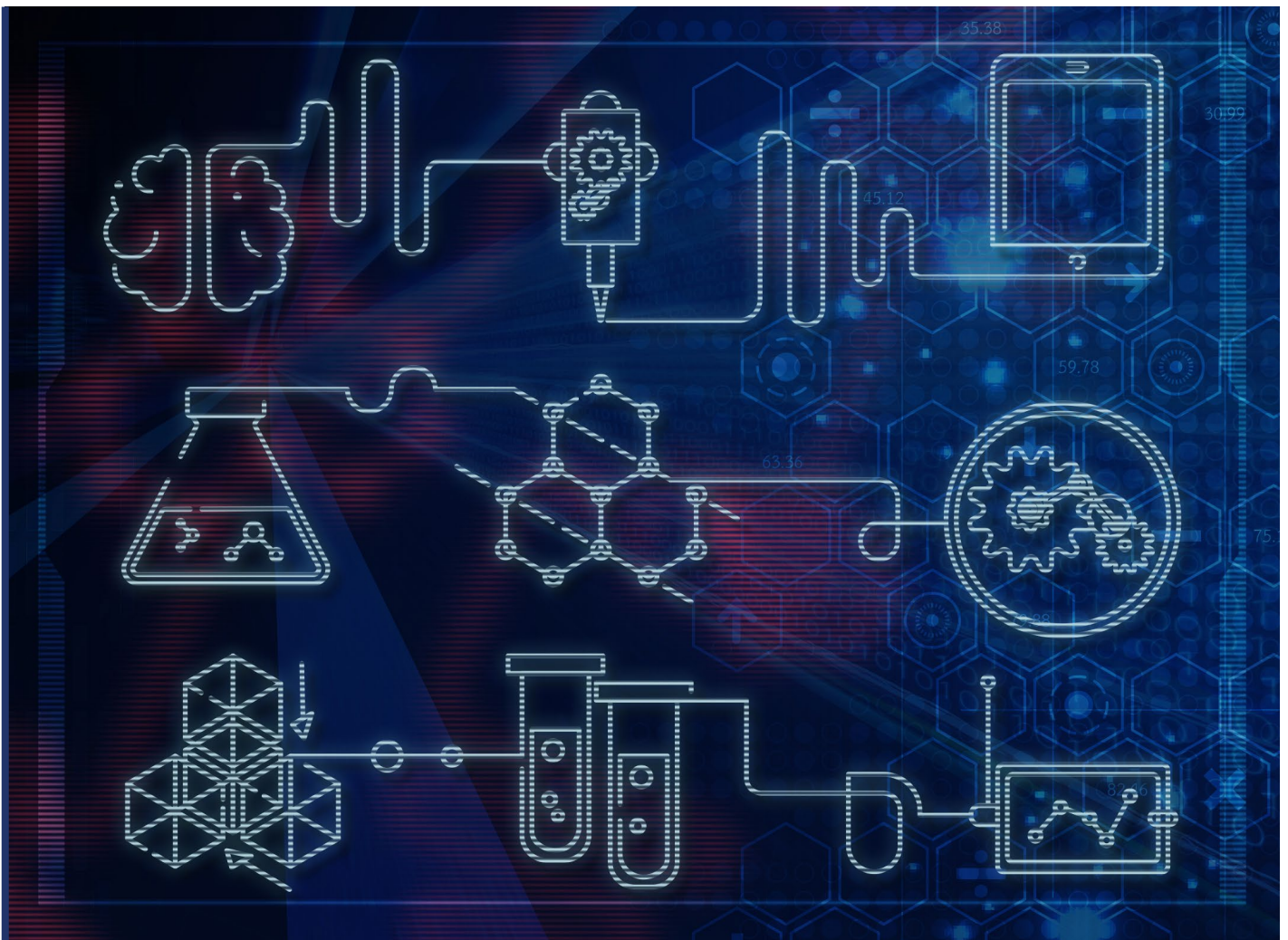



Intellectual
Property
Office

The changing profile of users of the UK patent system

Supporting the innovation ecosystem:

Building the evidence base on the drivers of IP





ISBN: 978-1-910790-92-2

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Published by The Intellectual Property Office
August 2021

1 2 3 4 5 6 7 8 9 10

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1. Executive summary

The trends in patent applications made to the Intellectual Property Office (IPO) over a twenty-year period (2000-2020) were analysed and compared to the trends at the European Patent Office (EPO). Although applications to the IPO have dropped over the period, the fall in the second half has been slower than the first half with a clear change in the pattern occurring around 2010; on closer inspection, it turns out much of the fall is from a particular group of customers who are UK-based and are individuals rather than companies. These customers tended not to pursue their applications to the publication or grant stages, whether through lack of interest or through lack of merit, and so the reduction in applications has made less impact on publication numbers and grant numbers. Underlying demand from other customer groups has remained, especially non-UK based applicants, large businesses, and users of the Patent Cooperation Treaty (PCT), and the number of applications reaching publication and grant from business customers is significant.

Factors affecting patent applicants were considered and the Great Recession of 2008 appears to have had the biggest influence on applicant behaviour; around this period there was a significant turnover of applicants. There are early indications that Brexit and COVID-19 have affected applicant behaviour, but no fundamental changes to the patent system have resulted from Brexit, not least because the European Patent Convention is independent of the EU and the UK's status is unaffected. IPO and EPO targets and priorities have a clear effect on the number of patents granted and in force as backlogs are processed, but do not appear to influence applicant behaviour.

UK-based applicants use the IPO more than the EPO, but the gap has closed. There is some evidence of a small number of applicants shifting to using the EPO instead of the IPO in certain circumstances. The different trends between the offices are driven by changes in the behaviour of two exclusive groups of customers, as would be expected given the differences in fees and coverage of these two offices. The majority of applications to the IPO are from UK applicants. UK-based applications to the IPO have dropped whilst applications from abroad have remained at a more constant level. The mix of applications from abroad has changed somewhat, with applications from China in particular having grown significantly.

The largest technical fields at the IPO are Civil Engineering, Computer Technology, and Transport. Telecommunications was previously among them but applications have fallen greatly during the time period studied. A number of large companies have stopped making telecommunications applications to the IPO, and in some cases to the EPO also.

The IPO is commonly used as an office of first filing, with more than 40% of IPO applications being used as a basis for a later priority claim.

The IPO's customer base is increasingly comprised of business customers and international customers.

This research forms part of the IPO's research programme on the Drivers of Intellectual Property, which aims to build the evidence base on what drives demand for IP rights and the strategic drivers of IP. This research contributes to building a more comprehensive picture of why and how applicants use IP.

2. Introduction

This paper presents a comparison of patenting trends at the Intellectual Property Office (IPO) and the European Patent Office (EPO) between the years 2000 and 2020¹. In the earlier part of this period there was a decline in total applications to the IPO, but more recently the trend has been less clear. Applications to the EPO have continued on a clearer, increasing trend.

There are many factors underlying these trends, which will be broken down in the following sections. A variety of potential causal factors will be discussed, and an attempt will be made to develop an understanding of how these factors continue at play today and into the future.

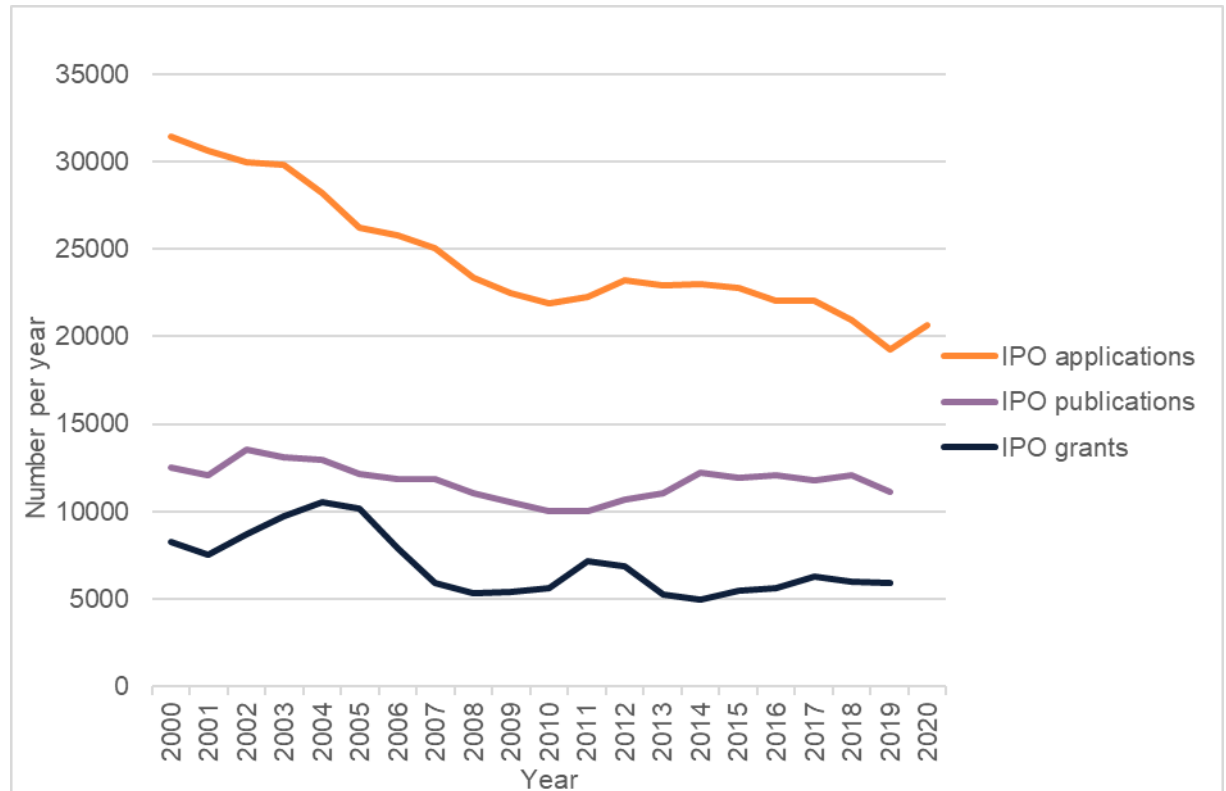
Data sources for this paper were the official UK patent register, which is a live source maintained internally by the IPO, and the EPO Worldwide Patent Statistical Database (PATSTAT) (2020 Autumn Edition), which is a worldwide patent database supplied by the EPO comprising a snapshot of the EPO master database.

¹ Data from the UK patent register is complete until 2020. Data from the EPO PATSTAT (2020 Autumn edition) database is complete until 2019 for some fields

3. IPO filing trends

This section will discuss overall use of the UK and European patent systems in terms of the number of applications, publications, and patents granted each year, as shown in Figure 1.

Figure 1: The trends in IPO applications (including direct national applications and PCT applications entering the national phase in the UK), publications, and patents granted from 2000 until 2020, counted by the year of application, publication, and grant respectively



Source: PATSTAT/UK patent register

Over the longer term applications to the IPO have declined significantly when using a simple count of applications received per year, particularly before 2010. There is a drop of 34% from 2000 to 2020 and 6% from 2010 to 2020. Thus, the trend may be divided into two different 'eras': the first, until 2010, where the decline was steeper and consistent; the second, since 2010, where applications rose initially, but then fell (albeit at a slower rate) until 2019, and with some sign of an upturn in 2020.

Note the curves for publications and grants are lower than that for applications. Once a patent application has been filed, it must successfully progress through several stages before being published (18 months after first filing) and ultimately granted². The entire process can take a few years, and many applications fail to meet the requirements at some stage so do not reach the publication stage, nor are ever granted. Examples of requirements not met are: the examiner finds the invention to be unpatentable; formalities are not fulfilled or deadlines are not met; the applicant makes initial applications at the IPO and the EPO before deciding

² For detailed guidance on interpretation of patent data, please see The Patent Guide: <https://www.gov.uk/government/publications/the-patent-guide>

which one to progress fully to grant; the applicant has simply changed their mind or their strategy.

Publications as a percentage of applications were 40% in 2000 and 58% in 2019³, because the number of publications remained much flatter whereas the number of applications fell more steeply. Therefore, much of the loss in applications is in applications that would not have been published, suggesting a large-scale change of attitude has occurred among applicants, or a change in the type of applicants using the UK patent system has occurred. The reasons for this become clearer with the breakdowns presented in the following sections.

Similarly, the curve for patents granted has remained flatter, with grants as a percentage of applications moving from 26% in 2000 to 31% in 2019. The bulge in the number of granted patents around 2003-2005 coincides with IPO targets for grants to be within 3 years of request, reducing to 2.5 years⁴, and the bulge around 2010-2012 with IPO targets to complete examinations within 49 months of request, reducing to 42 months. These bulges are therefore a result of shifts in the IPO's priorities rather a direct result of applicant behaviour, although the reducing input does appear to be a factor in the IPO having been able to offer faster processing. For these reasons the trends in granted patents are more volatile and are not a good measure of underlying applicant trends.

Overall, this demonstrates that a significant component of the drop in applications has resulted from applicants who would not have chosen to proceed to publication or to grant. This has resulted in less work for the IPO through the reduced numbers of applications but has not resulted in a commensurate reduction in patent protection achieved. The earlier, steeper drop is not evident in the granted patent data, suggesting that a consistent, underlying demand for patent protection has remained throughout and has been relatively unchanged.

A number of internal and external factors were investigated which may have had some impact on application trends over the period. These factors are introduced here but will be brought in throughout the paper where relevant.

1. Brexit and COVID-19

During the period 2016-2020 the UK negotiated the conditions of its exit from the European Union and the arrangements for future trading. The UK's withdrawal took effect from the end of January 2020, and although the transition period ended more recently, in December 2020, this may be regarded as ending a period of uncertainty, with applications rising by 7% between 2019 and 2020, despite the global COVID-19 pandemic. Analysis of data for applications filed each month in 2020⁵ does not show any obvious link with national lockdown periods associated with COVID-19.

³ These are in-year figures, so it cannot be concluded that 40% of applications filed in 2000 were published

⁴ IPO Corporate Plans 2003-2007

⁵ <https://www.gov.uk/government/statistics/monthly-statistics-patents-trade-marks-and-designs-december-2020>

2. 2008 Great Recession

Following the worldwide economic downturn in 2008 the size of the UK economy fell, and although it was recovering by 2010 it was not until 2013 that the economy recovered to its previous size⁶. The effects of this can be seen more clearly in the detailed breakdowns of patent data in the following sections than in Figure 1 above, because different customers were affected in different ways.

3. Patent Box tax relief

The Patent Box allows companies to apply a lower rate of Corporation Tax to profits earned from patented inventions. It was announced in the pre-budget report in 2009⁷, was incorporated into law in 2010⁸, and was phased in from April 2013. The eligible patents⁹ must be granted before the tax relief is claimed, so it is a real possibility that applicants started to make additional patent applications in response to the announcement of the Patent Box with a view to them having been granted by the time it came into force. There is some published evidence¹⁰ that patent box schemes can cause a transfer of ownership of patents, but not that it creates new activity. Tax returns are not public information, so there is no direct evidence of whether the increase in patent applications from 2010-2012 is linked to the announcement in this way. The available evidence shows that large companies have benefited most from the scheme, forming 32% of claimant companies by number but 95% by value of relief claimed¹¹. When comparing with patent statistics broken down by company size (see section 6.2), it can be seen that the increase in the period 2010-2012 is reflected in the number of patent applications from large companies, but not from small companies, so the figures are consistent with the hypothesis that the Patent Box scheme encouraged patent applications.

4. Internal IPO search targets

In the period 2004-2006, IPO Corporate Plans made a commitment that the target time for examiners to issue the search report search would be tapered from six months down to four months, and this target was maintained at four months until 2014¹². This factor does not appear to be correlated with the changing application pattern and so does not appear to be a driver of applicant behaviour.

5. Internal IPO examination targets

As noted in the earlier discussion around patents granted per year, the target time for examiners to issue an examination report clearly impacted upon the number of patents granted as the backlog of examinations at that time was cleared and converted to granted patents. In the case of the period 2010-2012,

⁶ <https://www.ons.gov.uk/economy/grossdomesticproductgdp/articles/the2008recession10yearson/2018-04-30>

⁷ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/238510/7747.pdf

⁸ Corporation Tax Act 2010

⁹ Eligible patents may be granted by the IPO, the EPO, and other countries in the EEA. Details at <https://www.gov.uk/guidance/corporation-tax-the-patent-box#what-makes-a-patent-eligible>

¹⁰ https://www.nber.org/system/files/working_papers/w24843/w24843.pdf

¹¹ "Patent Box September 2016" statistics release

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/552641/Sep2016_201314_PB_Official_Statistics.pdf

¹² IPO Corporate Plans 2004-2014: see

<https://webarchive.nationalarchives.gov.uk/20140603100317/http://www.ipo.gov.uk/about/whatwedo/ourpublications/ourpublications-plan.htm>

the increase in applications does coincide with a reduction in the target time, and the subsequent flattening coincides with the examination target being dropped as a Ministerial Target from the IPO's Corporate Plan for 2012 (although still mentioned as an aim) and dropped altogether from the Corporate Plan in 2013. Potentially, the improved target times may have influenced applicants to choose the IPO rather than the EPO.

6. Requirement for first filing in the UK

In 2005, a change to the Patents Act¹³ dispensed with the requirement for UK residents to first make an application in the UK via the IPO before making applications in any other country for the same invention. Potentially this change could have dissuaded certain applicants from making applications to the IPO, but it would be unusual for a UK-based applicant to require protection abroad without protection in the UK¹⁴. Indeed, no clear response to this change can be seen in the application trend.

7. Pendency

In the period 2010-2012, the percentage of patents granted by the IPO within two years changed from 20% to 15%¹⁵, and the percentage of patents granted within four years changed from 57% to 63%. Meanwhile, EPO pendency by these same measures has changed very little at all over the last ten years, having remained at 3% patents granted within two years and around 28% granted within four years throughout. These changes alone do not seem a compelling explanation for the changes in applications received over the period.

8. Fees

Patent fees are another potential factor in an applicant's decision to file patent applications. At the IPO, changes in fees are infrequent, with minor fee increases occurring in 1998 and 2010, and more significant changes in 2017. The latter introduced new fees for excess claims and excess pages¹⁶, but other fees were minimally altered, so total pre-grant fees at the IPO are just £310¹⁷, and are far less than fees at the EPO¹⁸. It seems unlikely any of these changes could be responsible for affecting trends, or for motivating a shift from national to European patenting. Note that fees reviews at the EPO occur on a regular basis.

¹³ Section 23 as amended by the Patents Act 2004, which entered into force in 2005

¹⁴ In the co-published paper entitled "Analysing the Global Patenting Activities of UK Applicants" in the series "Building the Evidence Base on the Drivers of IP Demand" it was found that a relatively small number of UK-based applicants do seek protection abroad without corresponding protection in the UK

¹⁵ EPO PATSTAT (2020 Autumn edition)

¹⁶ 25 claims and 35 pages of description are permitted before excess charges apply

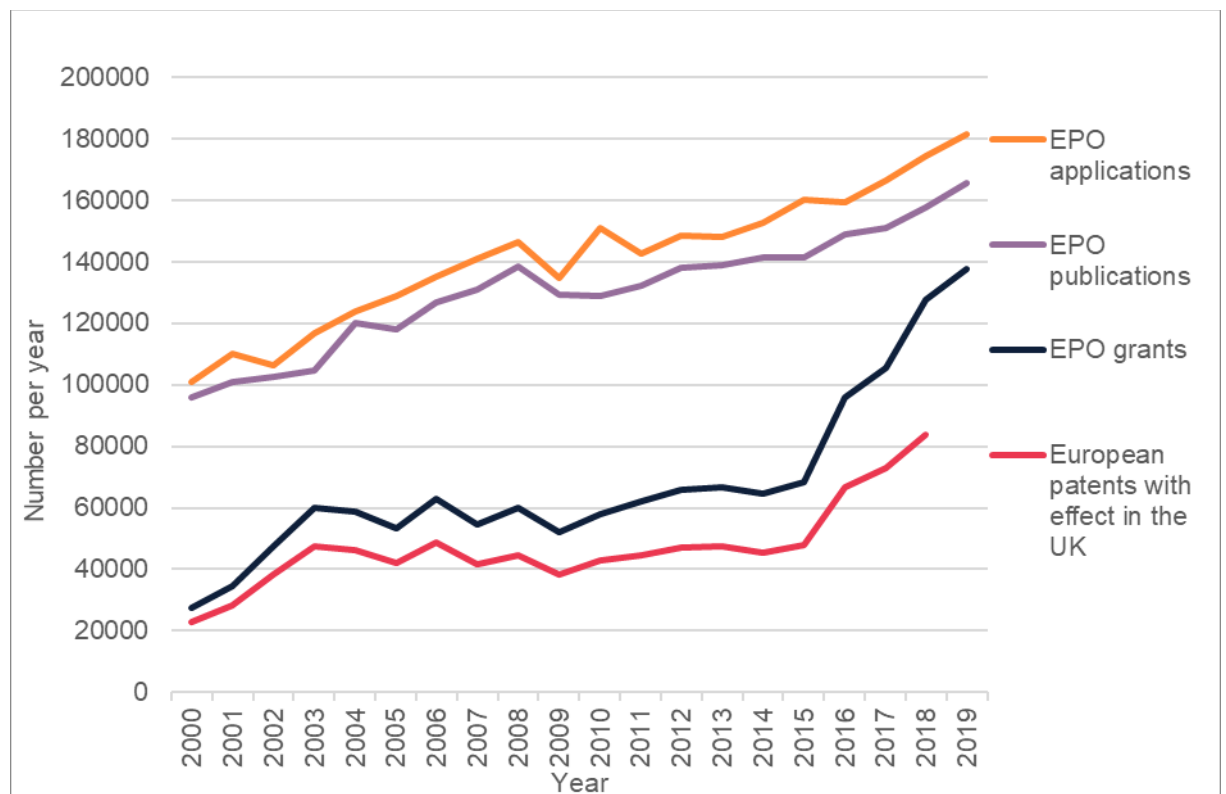
¹⁷ Cost using online forms 1, 9A, and 10 for application, search, and examination respectively <https://www.gov.uk/government/publications/patent-forms-and-fees/patent-forms-and-fees>

¹⁸ Cost for online filing, search, designation, examination, and grant totals €4750, from <https://www.epo.org/law-practice/legal-texts/official-journal/2020/etc/se3.html>

4. EPO filing trends

Applications for European patents are available in any of the 38 member countries of the European Patent Convention (EPC), including the UK. These applications are dealt with solely by the EPO and, once granted, a European patent has the same effect as a bundle of national patents in the designated states. After grant, the applicant may renew the patent in as few or as many member countries as they wish by payment of the appropriate fees. Note the EPC is independent of the EU and the UK's membership is unaffected by Brexit. Any litigation takes place in the respective national court and so a European patent gives the same rights in the UK as a patent granted by the IPO. Figure 2 shows trends for these applications.

Figure 2: The trends in EPO applications, publications, patents granted, and UK coverage from 2000 until 2020, counted by the year of application, publication, and grant respectively. In this paper, the payment of the first due UK renewal fee is used as an indication that the European patent is, or has been, in force in the UK, and *mutatis mutandis* for other EPC member states



Source: WIPO Statistics Data Centre/PATSTAT

Applications to the EPO have increased consistently over the period 2000 to 2019, and are currently almost ten times greater than at the IPO. Note that EPO publications have remained at more than 90% of applications, showing that in most cases applicants choose to proceed with their applications. The higher fees at the EPO form a higher barrier to entry and the practice of making an application simply to obtain a search, without any intention to proceed further, is less likely to occur at the EPO than at the IPO. The most striking feature of Figure 2, however, is that the number of patents granted doubled from 2015 to 2019. This coincides with the EPO's "Early Certainty from Search" (EPO Early Certainty) scheme, announced in 2014, which included a commitment to

expedite grants once a positive search opinion has been issued¹⁹. This period does coincide with a drop in applications at the IPO since 2017. Evidence collected from customer feedback²⁰ contains regular comments about the time pressure caused by the IPO compliance period²¹, and although these comments rarely explicitly state an intention to switch to using the EPO, this suggests applicants are conscious of pendency issues.

The highest rates of patents in force of all 38 EPC member states are in Germany, France, and the UK. Around 68% of European patents are in force in the UK²², down from 84% in 2000 and 73% in 2010. By comparison, 72% of European patents today are in force in France and 90% in Germany.

The total number of patents in the UK is therefore also growing at a significant rate, being composed mainly of European patents, which currently form 91% of all granted patents in force in the UK.

¹⁹ EPO news announcement <https://www.epo.org/news-events/news/2014/20140703.html>

²⁰ IPO internal Customer Insight database

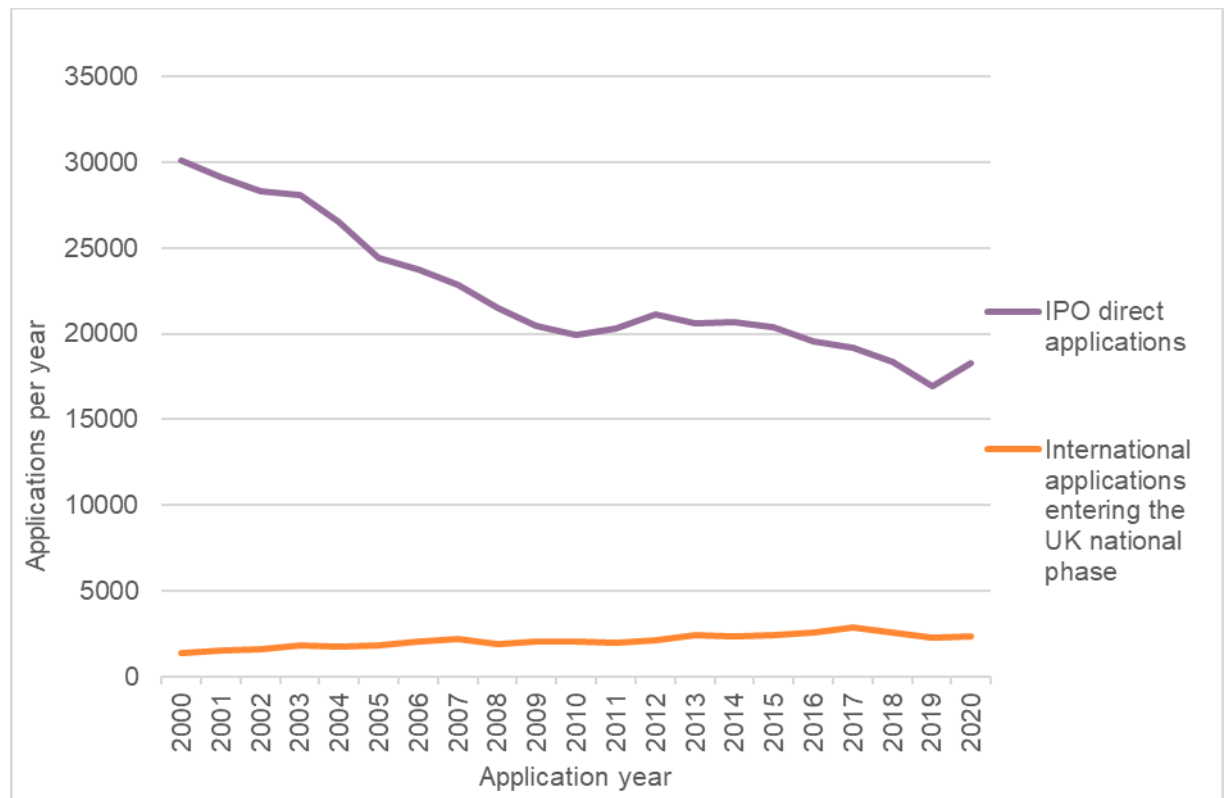
²¹ The deadline in UK law for the applicant to get the application complete and ready for grant. No equivalent exists for European applications, nor most other countries

²² Renewal figures for European patents granted in 2017

5. International Applications to the UK

Patent protection may be obtained in the UK by making an international application to the World Intellectual Property Organization (WIPO) which designates the UK²⁴. These applications are searched and published by WIPO in the international phase, before entering the national phase for further processing and grant by the IPO.

Figure 3: The trends in international applications received at the IPO from 2000 to 2020



Source: UK patent register

Figure 3 shows these have increased from 1,336 in 2000 to 2,329 in 2020, an increase from 4% of IPO applications to 11%. In terms of granted patents, the number of international applications granted has risen and fallen with the IPO's changing priorities as noted above, but currently form around 20% of all patents granted. International applications are a steady, gradually increasing source of input to the IPO, and these applications are more likely to achieve a grant. Fees for international applications are much higher than IPO fees²⁵, and these applications are only used when the applicant intends to obtain protection in many of the PCT Contracting States, so it would be expected that weaker or speculative applications are less likely. In relation to overall UK applications and grants, international applications form a significant component of the underlying demand which has changed little over the timespan considered.

²⁴ International applications administered by WIPO via the Patent Cooperation Treaty (PCT). These are counted in the year of entry to the UK national phase

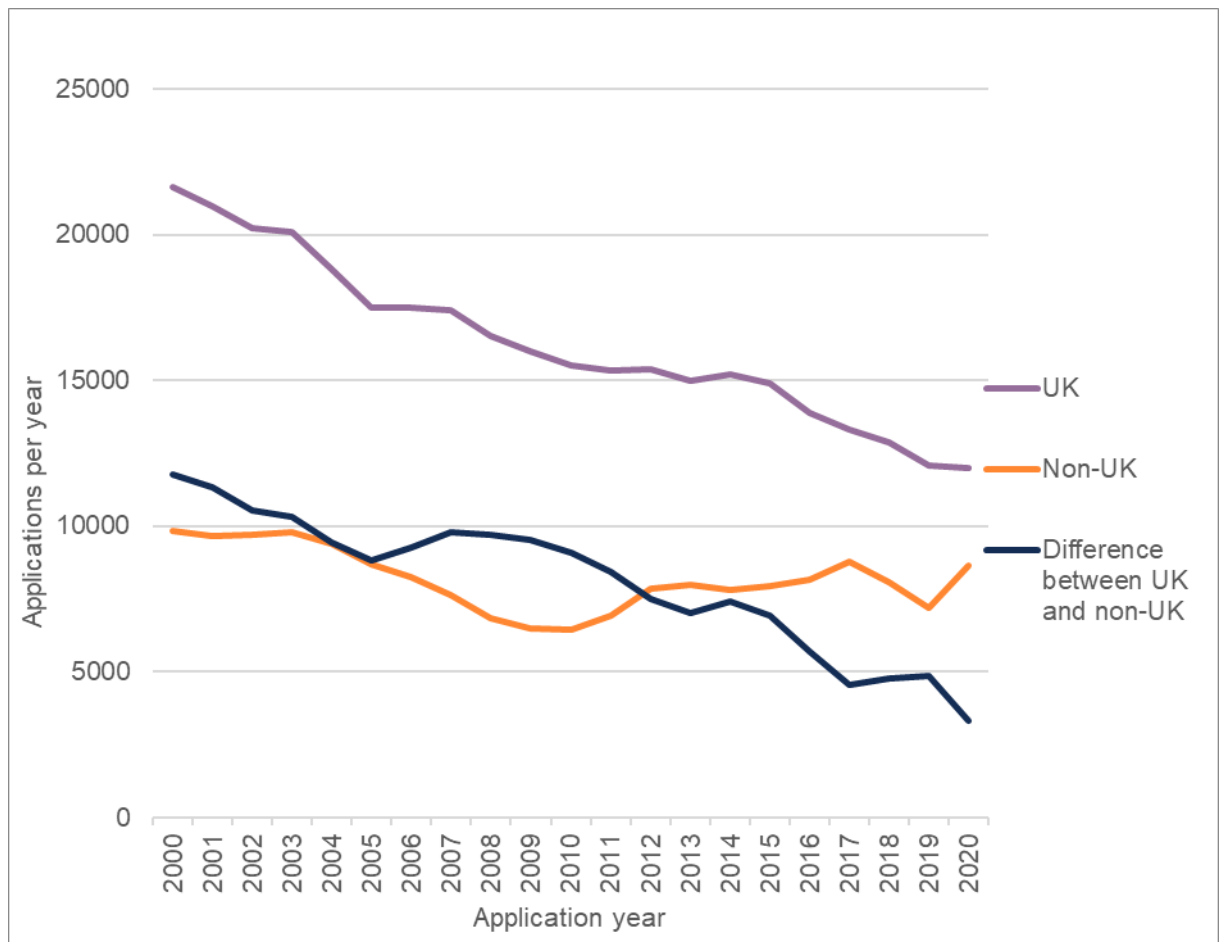
²⁵ Cost for transmittal fee, international filing fee, and international search (using the EPO) totals £2713, with IPO fees also applying separately. From <https://www.wipo.int/export/sites/www/pct/en/fees.pdf>

6. Origin of IPO applications

6.1. Country of origin

The country of origin of an application is determined by the stated address of the applicant, and the trends are shown in Figure 4.

Figure 4: Breakdown of applications to the IPO by applicant country. In the case where there is more than one applicant, only the country of the first applicant is used



Source: UK patent register

Most applications to the IPO are from UK applicants²⁶, but these have fallen in number and in proportion, from 21,614 (69% of all applications) in 2000 to 11,991 (58%) in 2020. This is almost a halving of numbers, and this change in behaviour has had the greatest impact on total applications at the IPO. Applications from non-UK applicants have changed much less and have increased as a proportion of total IPO applications from 31% in 2000 to 42% in 2020. Although UK applicants have been the most important factor in past trends, the gap has narrowed so that applications from abroad are now of much more importance.

From Figure 4 it becomes apparent that there are some differences in the trends between UK applicants and non-UK applicants, with the increase around 2010-2012, the steep drop to 2019, and the apparent recovery in 2020 originating from

²⁶ Country is determined by the given address of the first applicant in the IPO's official register

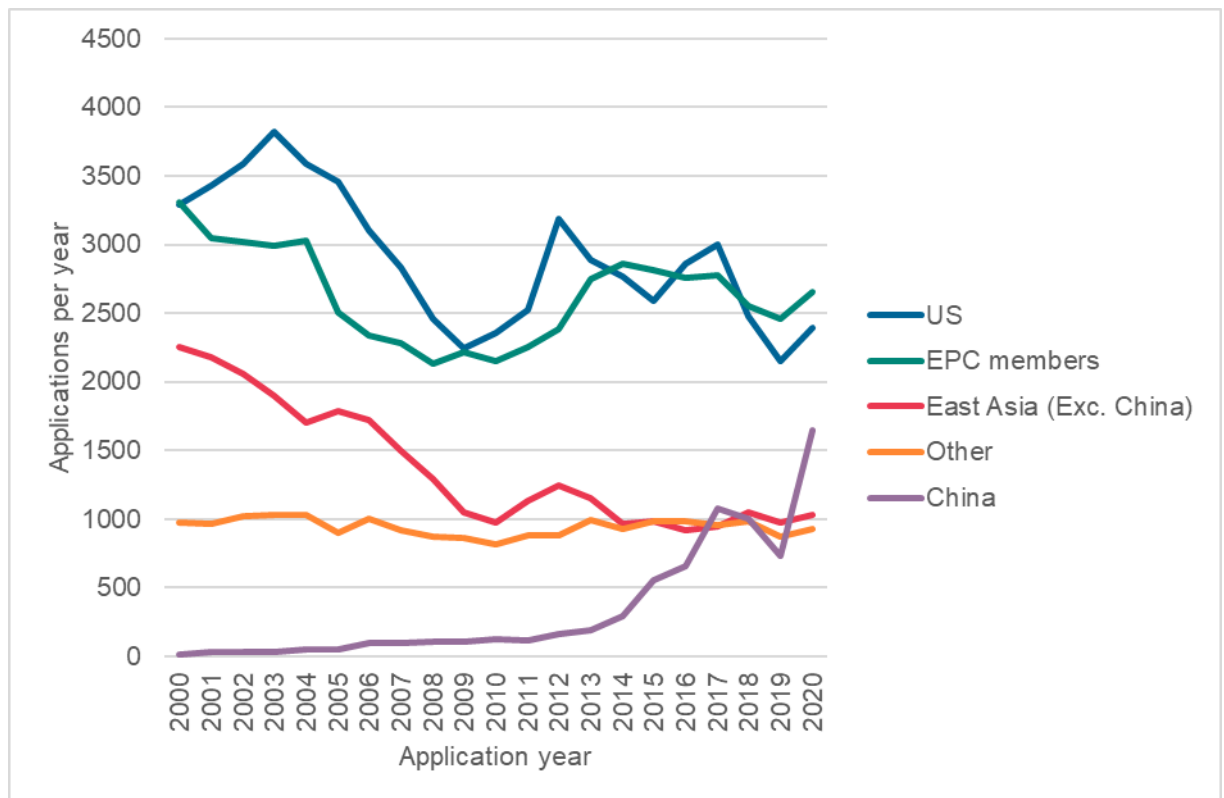
non-UK applicants, with little sign of these features from the UK applicants, although the decline in these appears to have paused in 2020. Events around 2010-2012, during which time applications from non-UK applicants increased, include improved examination pendency and the prospect of the Patent Box tax reduction, but it is unclear why either of these would affect non-UK applicants exclusively, especially since the Patent Box applies only to companies which pay corporation tax in the UK²⁷. Brexit is likely to have had more impact on the filing behaviour of non-UK applicants than UK applicants in the period 2017-2019 because of the uncertainty around the UK's future relationship with the EU. Applicants from the EU would need to await the outcome of negotiations before understanding the potential issues of trading across a new border. In contrast, UK applicants could continue to trade within the UK unaffected and thus would be more likely to continue the previous trend in applications. By January 2020 the UK had withdrawn from the EU, potentially creating more certainty for non-UK applicants, and an increase in applications. If the period 2017-2019 is regarded as an anomaly which has now passed, then it is possible to interpret the trend as applications from outside the UK remaining broadly steady from 2010 onwards.

The change introduced in 2005 to remove the UK first filing requirement affected only UK applicants, and it could be expected this would drive down applications from UK applicants and would be more evident from a comparison of UK and non-UK applicants. Given the existing declining trend, and the other differences between the two curves in Figure 4, it is not clear whether this had much real effect.

The more detailed breakdown of applications from non-UK applicants in Figure 5 shows the drop in applications from 2017 is common to US, EPC countries, and China.

²⁷ Note that no attempt is made to establish the tax position of any applicant, so it is possible that entities treated here as non-UK applicants are in fact benefitting from the Patent Box

Figure 5: Detailed breakdown of IPO applications by applicant country. "East Asia (Exc. China)" includes Japan, Korea, Taiwan, Hong Kong, and Singapore

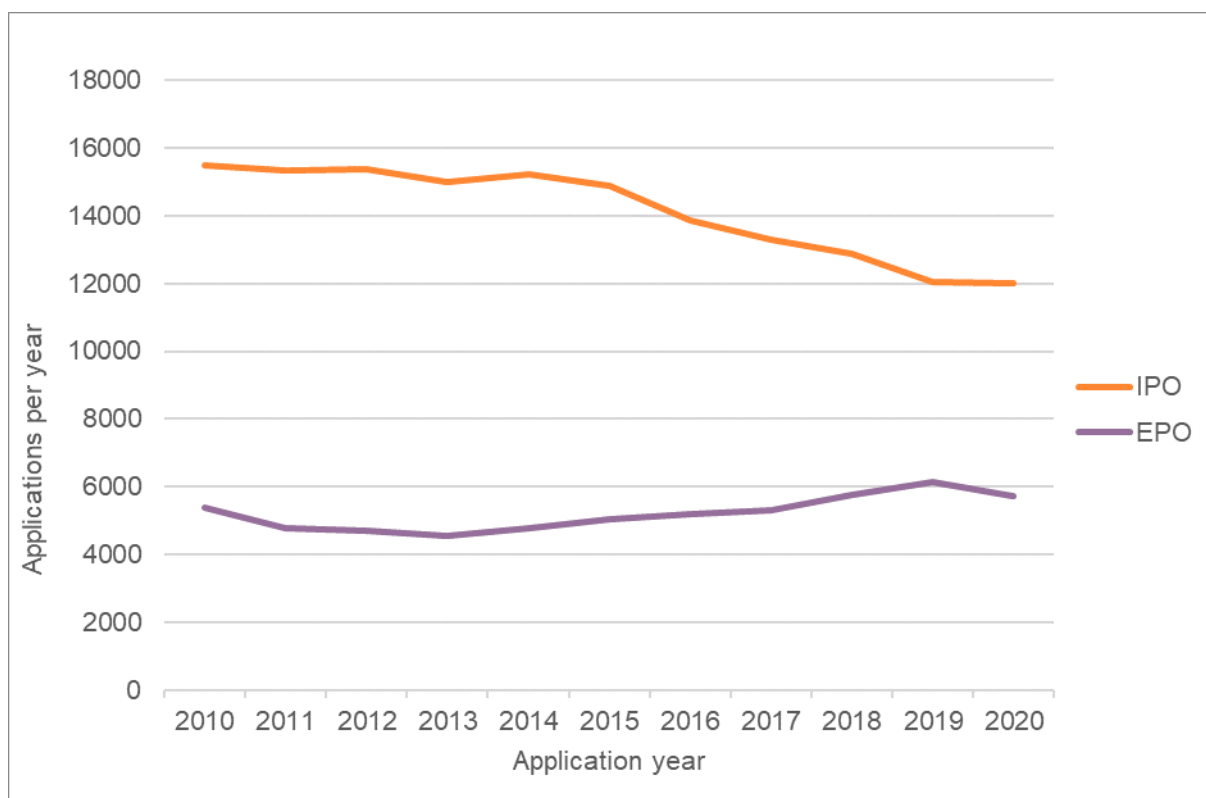


Source: UK patent register

In contrast to UK applicants there is an increase in 2020 from the US, EPC countries, and China, with applications from China in 2020 more than double those in 2019, continuing with the strong growth in applications from China seen in the period 2012-2017. Applications from other east Asian countries had levelled off by 2014 and appear to have been unaffected by more recent events. Similarly, applications from the rest of the world have remained steady.

Looking at the contribution of UK applicants to European applications at the EPO, UK applicants still make more applications to the IPO than the EPO, although the gap has closed, as shown in Figure 6.

Figure 6: Applications made to the IPO and the EPO by UK applicants



Source: UK patent register/EPO Patent Index 2010-2020

This is around 3% of EPO input. The trends of the period 2013-2019 appear to have been disrupted in 2020, but it is not yet clear if this is an anomaly caused by the COVID-19 pandemic or the start of a new trend.

6.2. Applicant types

Patents contain information about the name and address of the applicants, but do not contain information about their nature or status, such as whether the applicant is a person or an entity, and, if it is an entity, the size and type of the entity. Furthermore, unique identifiers are not assigned to applicants so analysis must be done using the name text itself. PATSTAT contains applicant name information which has been harmonised²⁸ to provide cleaner and more reliable name data, and also contains categories of applicants, including Individual and Company.

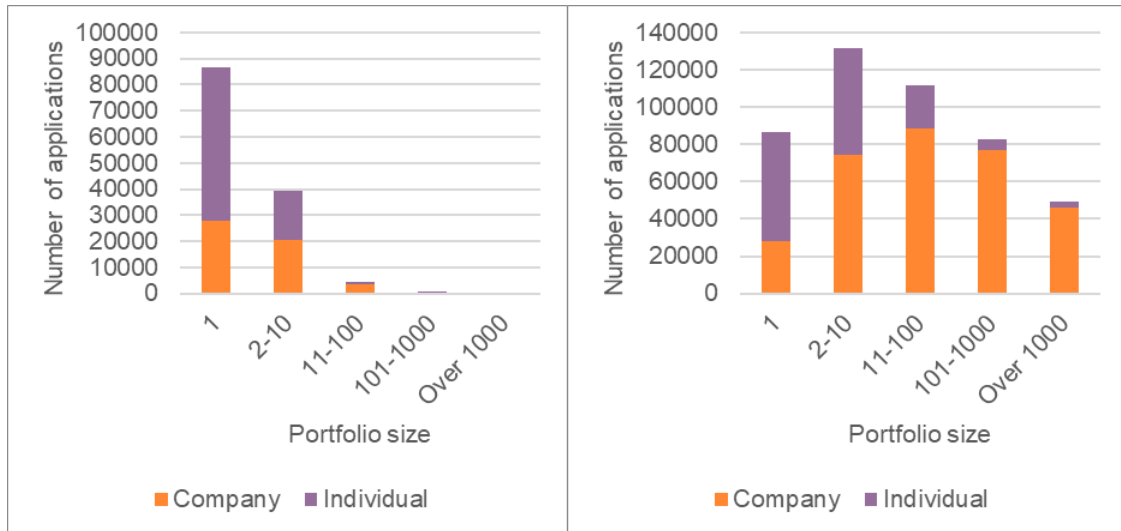
In addition to the above, it can be noted that some applicants are bigger users of the patent system than others, and this degree of usage may be captured by using the portfolio size. Portfolio size is the number of patent applications to the IPO within the period 2000-2019 associated with a particular applicant²⁹. Portfolio size is highly skewed, with a small number of large portfolios and a large number of small portfolios (Figure 7), with the majority of large portfolios being held by companies rather than individuals. The behaviour of these two

²⁸ PATSTAT Standardised Name field, which is generated using a mixture of automated and human cleaning processes

²⁹ The PATSTAT Standardised Name field was used for this analysis

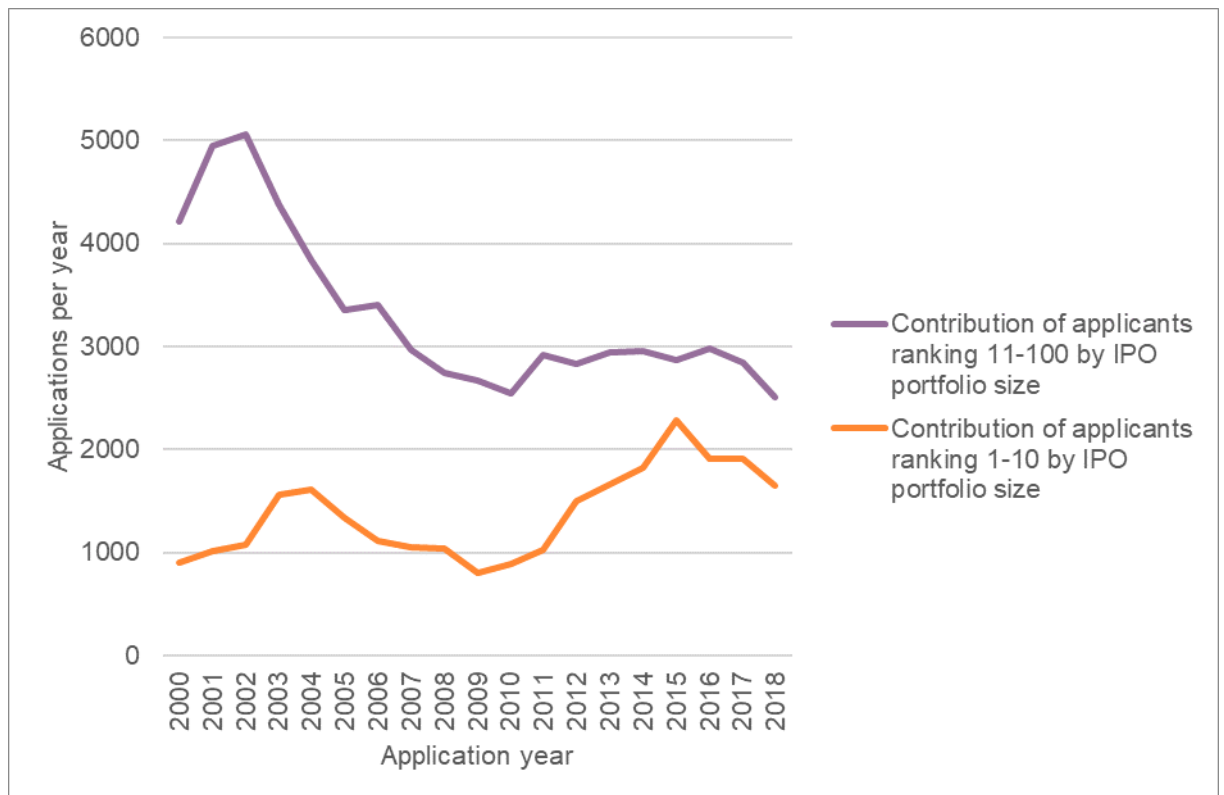
groups differs and, since each accounts for a significant proportion of total applications, is worthy of attention.

Figure 7: Portfolio sizes of companies and individuals. Left: number of portfolios (or number of applicants) by portfolio size; showing that the distribution of portfolio size is highly skewed. Right: number of applications by portfolio size of the portfolio within which the application sits; showing that a small number of applicants, who hold large portfolios, account for a significant fraction of applications



Source: PATSTAT

Figure 8: Composition of IPO applications from applicants with the largest total portfolios over the period 2000-2018



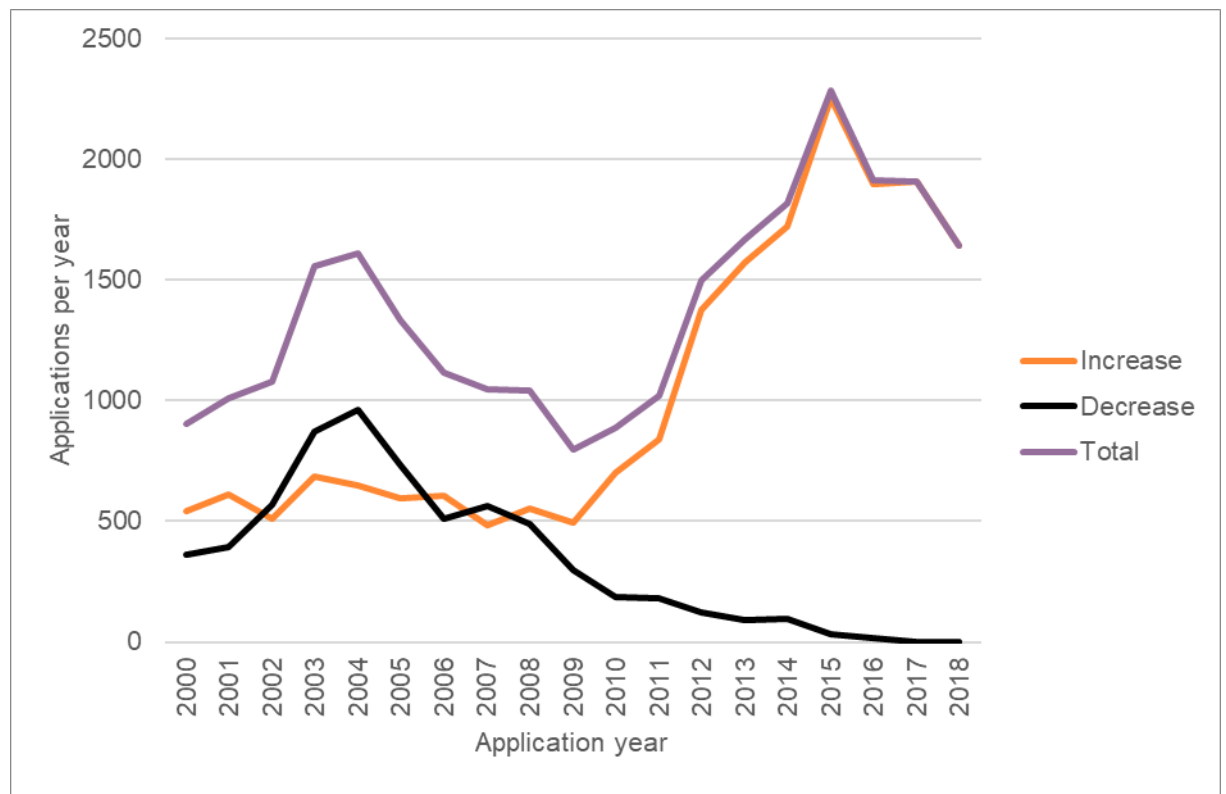
Source: PATSTAT

From a comparison of Figure 7 with Figure 1, it can be seen the top ten largest portfolios at the IPO, having portfolio sizes ranging from 4,679 to 1,896, demonstrate a pattern that is very different to that of total IPO applications. Applications from this group increased from 3% of total input in 2009 to 10% in 2015, although they have since fallen to 8% in 2018. The long-term trend in this

group is an increase, unlike any other group. Looking beyond this group to the remainder of the top hundred, having portfolios sizes ranging from 1,817 to 367, the curve has some similarities but more closely reflects the overall declining trend seen in Figure 1, and the peak around 2015 is not evident at all.

By breaking down the dataset further into individual applicant portfolios, the behaviour of applicants at an individual level can be seen. The individual applicants from the top ten list can be split into those with a decreasing trend (which peak before 2010 – three applicants) and those with an increasing trend (which peak after 2010 – seven applicants) and reaggregated into these two groups. Figure 9 shows the trends within two groups.

Figure 9: Composition of IPO applications from largest applicants divided into those with an increasing trend and those with a decreasing trend



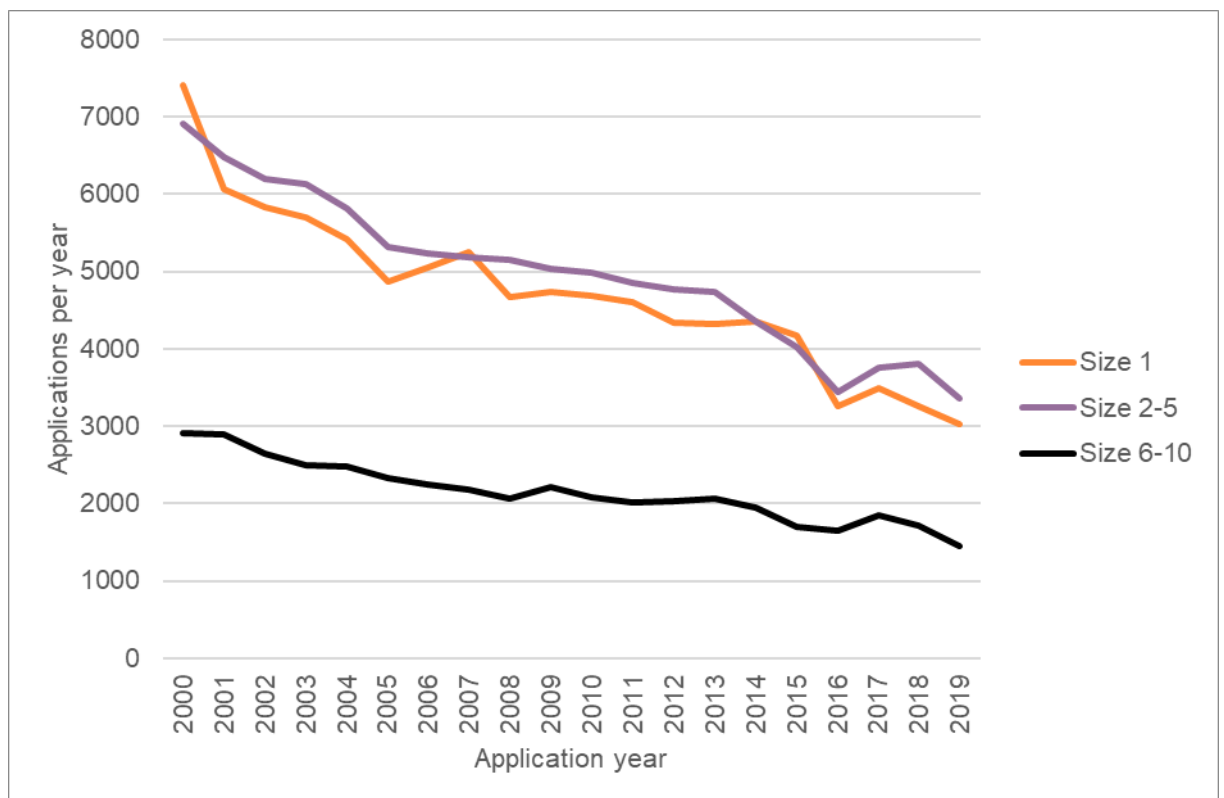
Source: PATSTAT

Viewed in this way, it becomes clear that the applicants responsible for the later peak are different to those responsible for the earlier peak, and there has been a turnover of applicants, rather than all applicants following a similar trend to each other. Whilst some turnover of applicants would be expected across any time period, the turnover appears to have been particularly large and rapid in the years around 2010. Thus, the dip in 2010 was caused not so much by a widespread and homogeneous reaction by many applicants to the events around that time, in which they reduced applications for a period but then increased them again. Instead, events affected different applicants in different ways and precipitating a divergence in behaviour after this point. This introduces a new possibility for the effects of the Great Recession; that some applicants were affected in a permanent way leading to lower filings, whereas others found opportunity in the recovery afterwards and have innovated their way to success.

By taking a dataset of applications to the EPO which have been made by these same IPO top ten applicants and treating it in a similar way the trend was that both groups had a reasonably flat profile. Thus, EPO application numbers appear to be independent of the IPO application numbers and so there appears to have been no switch between the IPO and the EPO in these groups.

As portfolio sizes get smaller, a different trend emerges. Applicants with a portfolio size of one, meaning they appear only once in the dataset, make a significant contributor to total numbers (ranging between 15-20%), and demonstrate a quite consistent decline, as shown in Figure 10.

Figure 10: Composition of IPO applications from applicants with the smallest portfolios

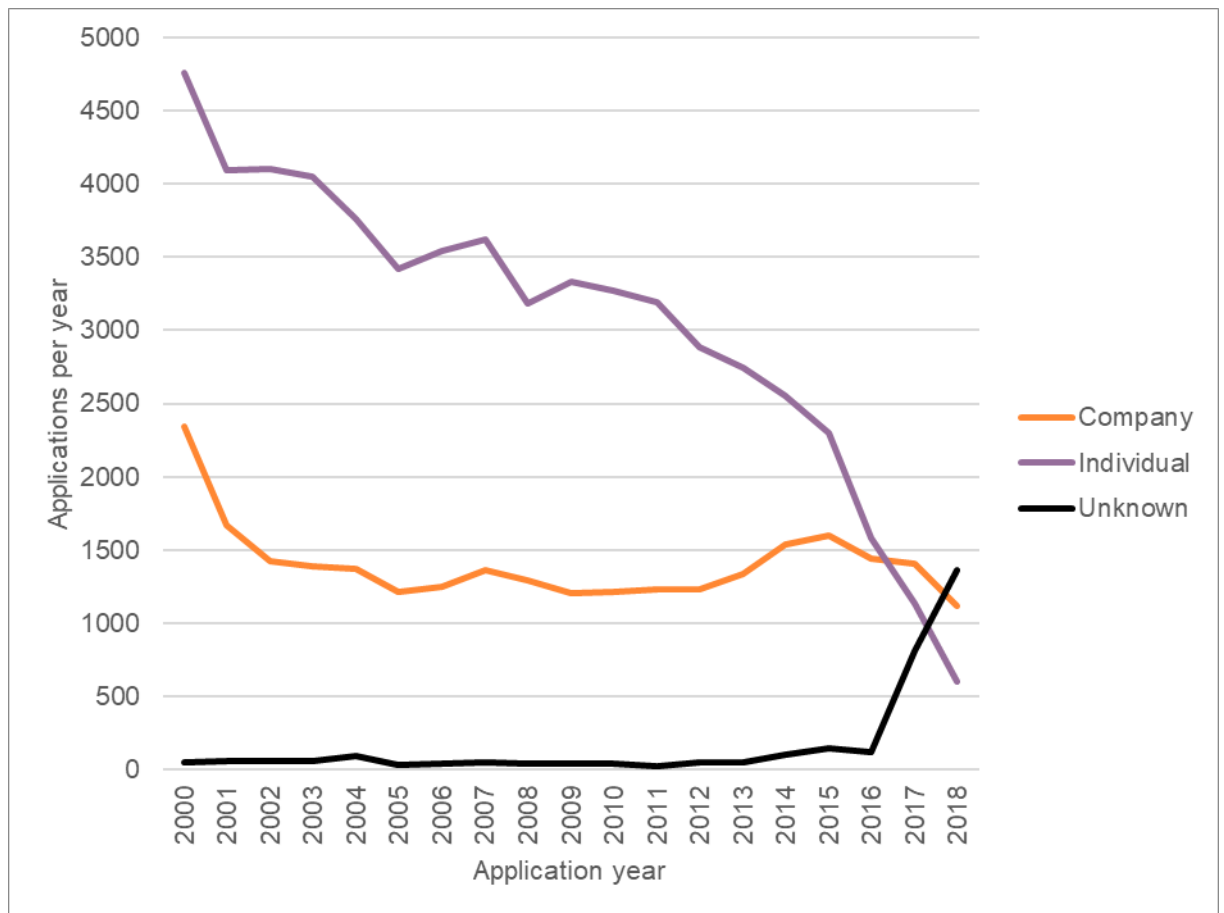


Source: PATSTAT

Applications in a portfolio of size 1, size 2-5, and size 6-10 have all halved since 2000, and have done so at a consistent rate, unlike the remainder of the top 100 group discussed above. Therefore, a significant component of the overall decline in applications to the IPO appears to be the loss of these groups of applicants.

Using the breakdown of applicant type for applicants with the smallest portfolios (with a size of one), in Figure 11 it can be seen the majority of applicants in this group are individuals, and they have driven the decline most strongly, with companies in this group maintaining a more steady input. Therefore, it seems individual inventors who have one-off ideas are becoming much less likely to file applications, and this does not seem connected with any of the particular factors identified earlier in section 3.

Figure 11: Composition of IPO applications from portfolios with size 1 by applicant type. "Unknown" type is used where detailed data is not yet available

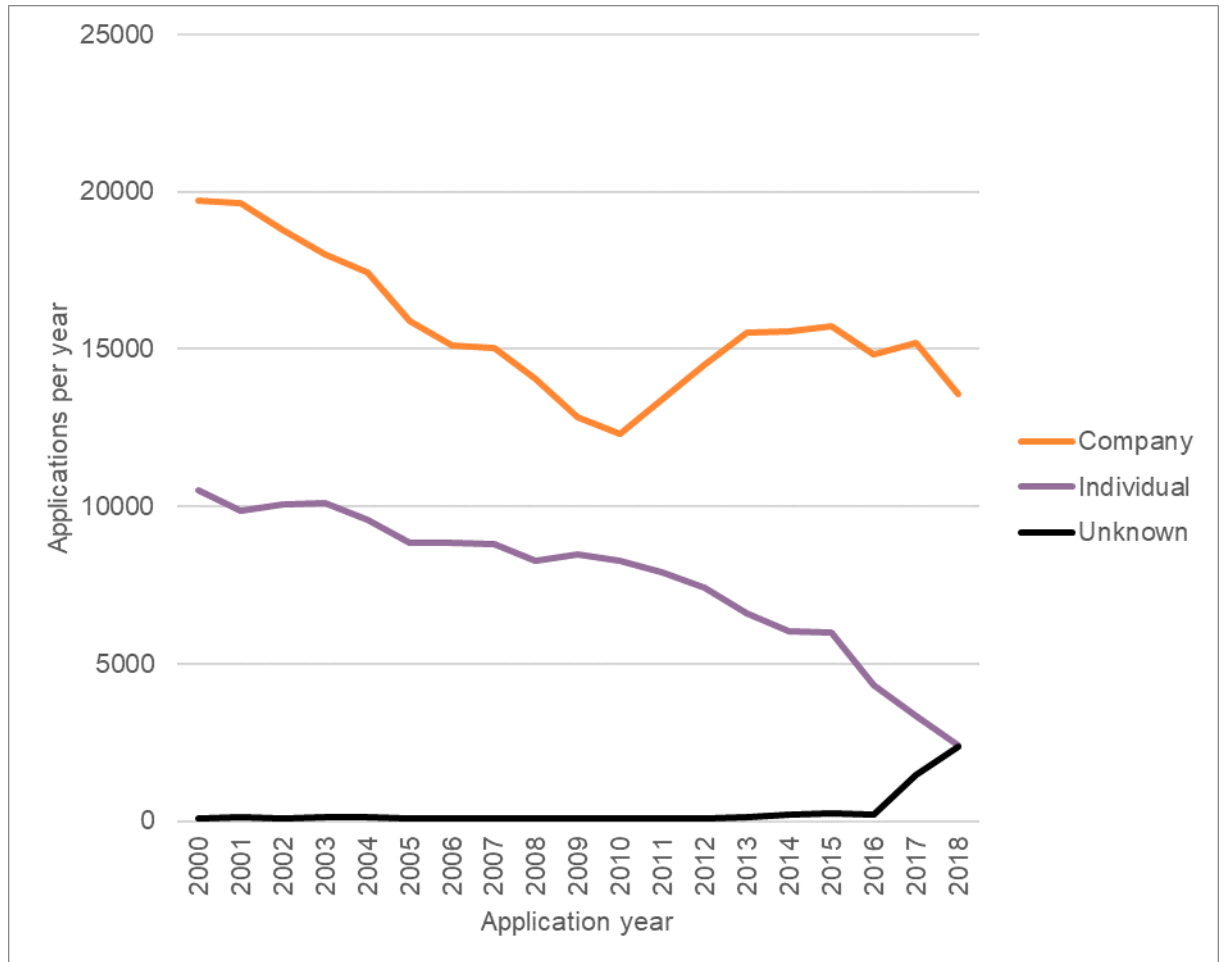


Source: PATSTAT

The usage pattern of the UK patent system is therefore skewing towards larger customers, who are more consistent, and away from infrequent users of the system.

Turning to the full breakdown of applicant types for all applicants to the IPO in Figure 12, it is clear that the majority of applications have a Company applicant, with Individual applicants making up most of the rest.

Figure 12: Composition of IPO applications by main applicant type. Small contributions by other applicant types have been removed

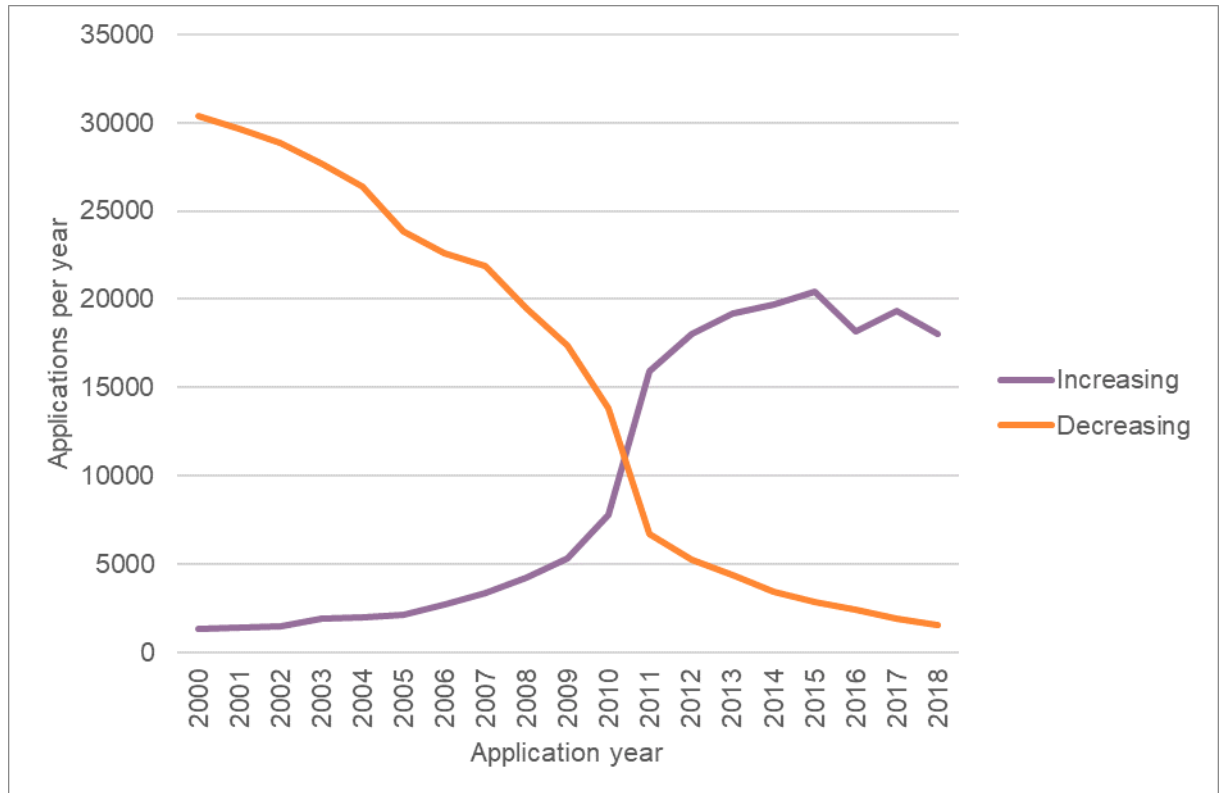


Source: PATSTAT

An overall decline in applications to the IPO is common to both the Company and Individual categories in the pre-2010 era, but in the second era the behaviour has diverged. Applications from individuals have continued to fall in a steepening trajectory, from a peak of 38% of all applications in 2010 to 12% in 2018, whilst applications from companies account for 69% of all applications in 2018. There have clearly been factors which have influenced companies since 2010 which do not appear to have had an effect upon individuals. Economic factors, particularly the Great Recession, could be expected to have a bigger impact upon companies than individuals, who may be characterised as hobbyists and as having different motivations for making patent applications than companies. Alternatively, there may have been changes in regulatory factors which have provided an incentive for individuals to register as businesses.

The earlier insight into differences in behaviour within the top ten applicants could be applied to the entire dataset to see whether a similar pattern applies broadly to company applicants. Clearly this cannot be done by inspection, so an analytical process was used to assign applicants to an increasing or decreasing trend, and applicants were re-aggregated into these two groups, shown in Figure 13.

Figure 13: Composition of IPO applications from all applicants divided into those with an increasing trend and those with a decreasing trend



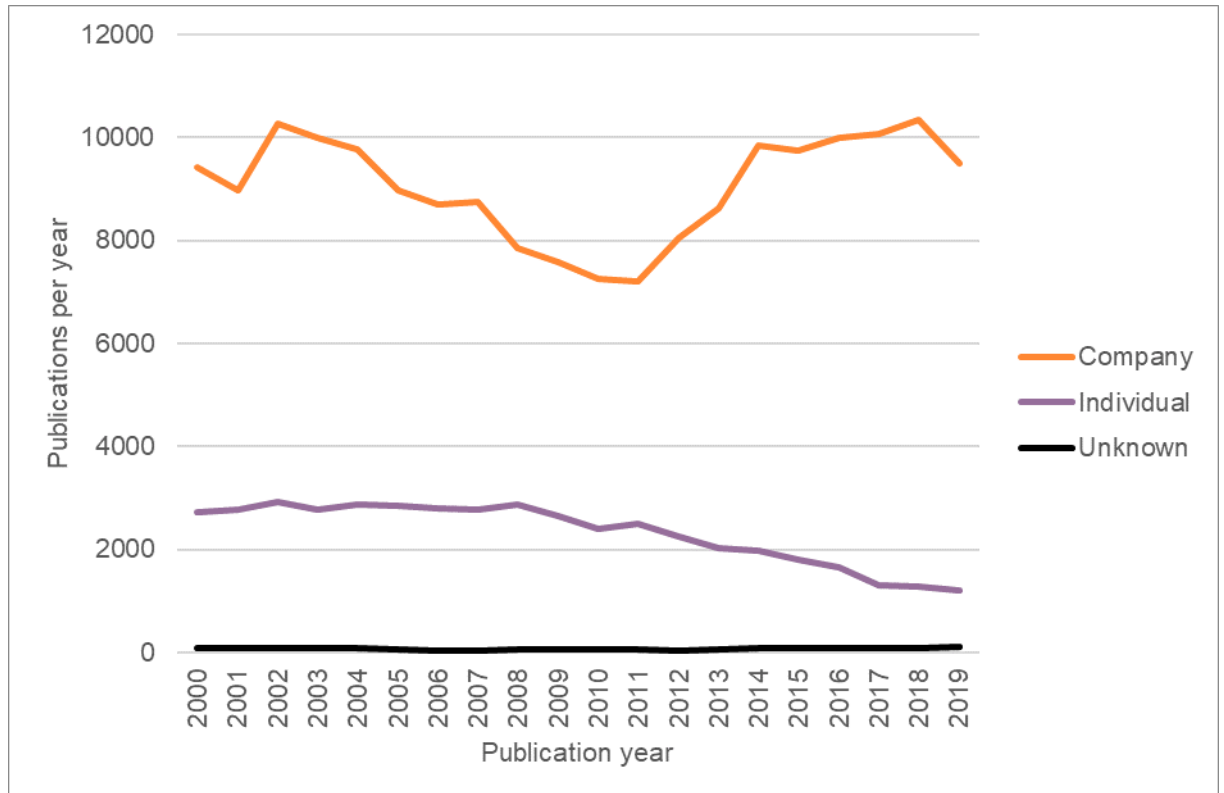
Source: PATSTAT

This makes it clear that a turnover of applicants has occurred over the time period, and although some turnover would always be expected, the turnover was accelerated during the period of economic disruption after 2008, before settling again afterwards.

Similar analysis for EPO applications by the same sets of applicants, as before, shows the set of applicants with a decreasing trend at the IPO have not increased filings to the EPO, suggesting this decline is not a result of switching to the EPO.

In the breakdown of applicant type for published applications, in Figure 14, it is clear that individuals account for a smaller proportion of publications than overall applications, and this proportion is decreasing, from over 20% originally to just over 10% currently. The number of publications by companies has recovered following the dip around 2010 and is around the levels seen in the early 2000s. This appears to show that the 'need' for businesses to obtain patents in the UK via the IPO is not in decline, but that applications being filed now are more likely to be published and granted.

Figure 14: Composition of IPO publications by applicant type



Source: PATSTAT

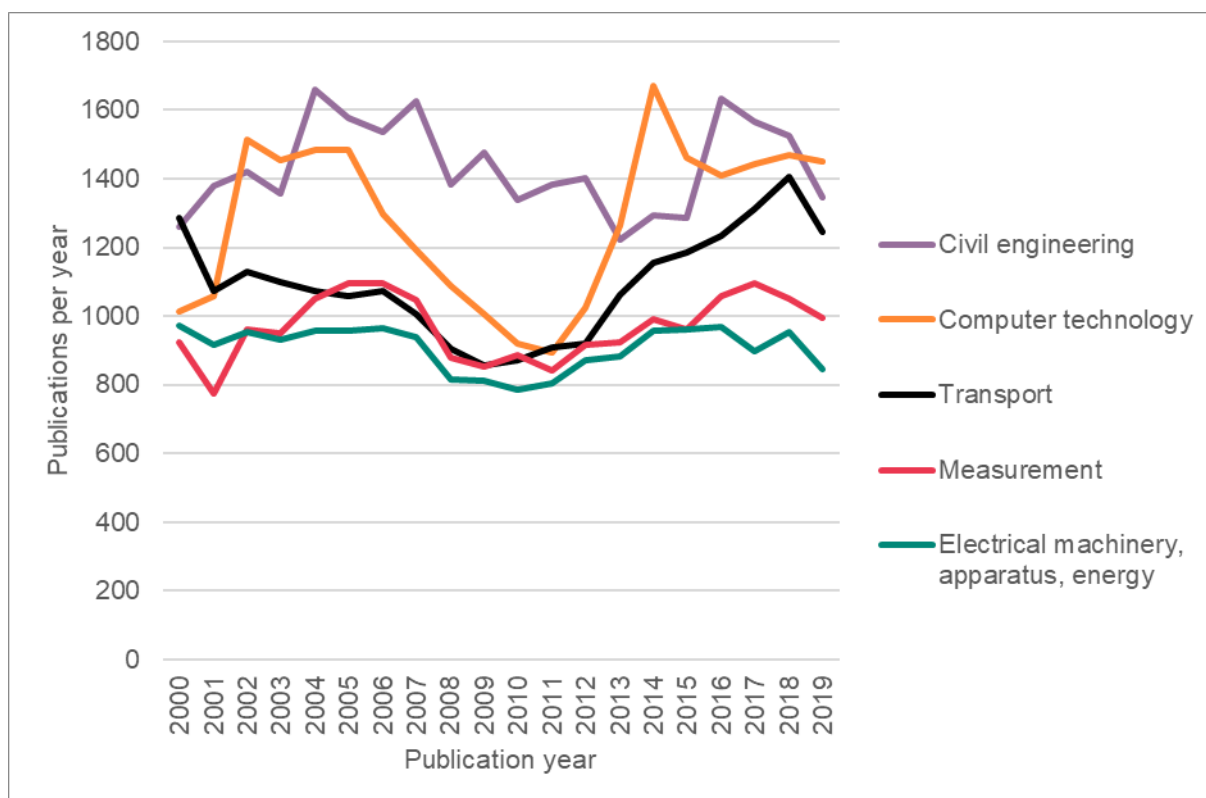
Since individuals tend to hold smaller portfolios (Figure 6), the trend for individuals mirrors that for small portfolios, and as this group of applicant types diminishes in significance, the overall trend converges upon the trend for companies. This suggests there is a limit to how far IPO applications and publications can fall as a result of changes to the behaviour of individual applicants, since even in the worst case scenario in which individual applicants disappear altogether, this would give a drop of 2,000-3,000 applications per year, from Figure 11 (since this is the total number of applications per year currently from this group), and around 1,000 publications per year, from Figure 13.

6.3. Technology

Published patent applications are comprehensively categorised using patent classification schemes, which detail the purpose and technical workings of the invention in each patent. In the International Patent Classification (IPC) system there are 70,000 subdivisions at the most detailed level. These categories may be aggregated into broader technical fields using WIPO concordance³⁰. This information is available only on published patent applications, so it cannot cast any light on the total applications to the IPO, but only on that fraction which is published. Nevertheless, it is useful to track changes in the composition of applications to the IPO and any shifts in filing strategy from IPO to EPO.

³⁰ WIPO Concordance table for IPC: https://www.wipo.int/export/sites/www/ipstats/en/statistics/patents/xls/ipc_technology.xls

Figure 15: IPO publications by WIPO technical field, largest fields only, as summed over the period 2000-2019



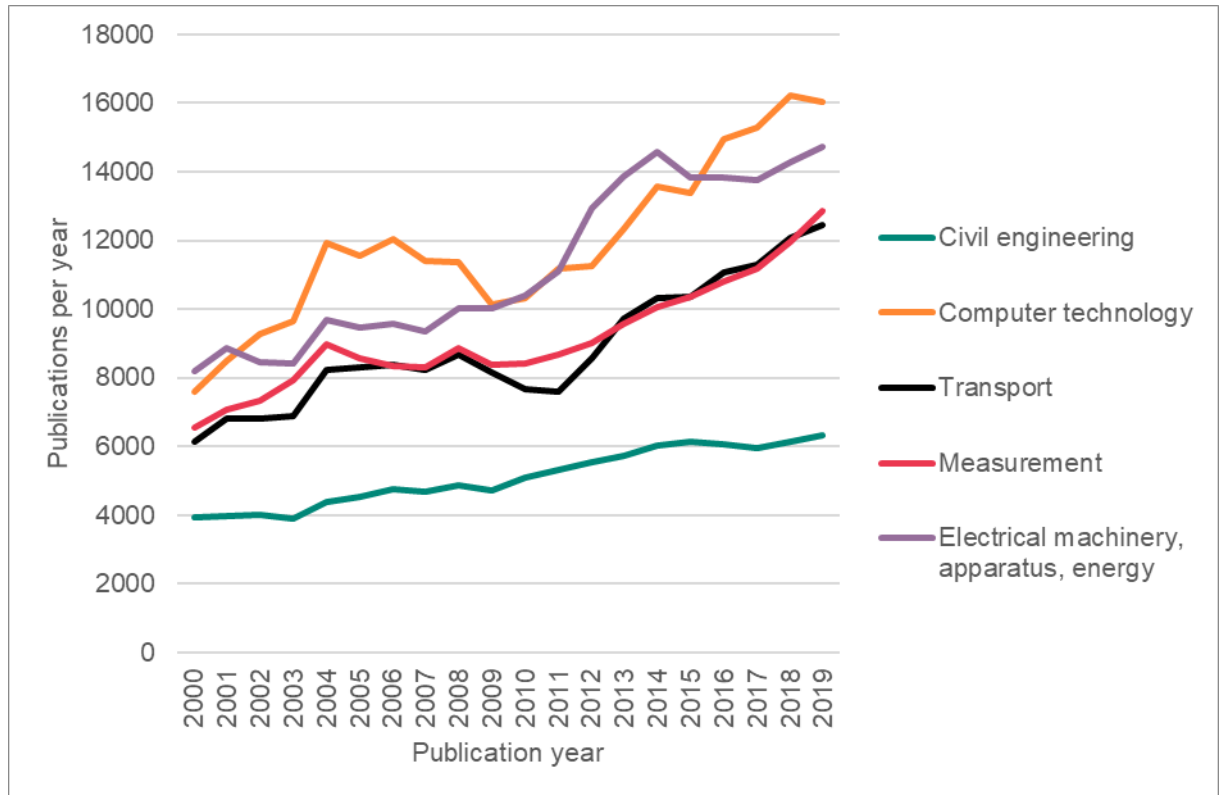
Source: PATSTAT

Figure 15 shows the largest technical fields for IPO publications. Most of these fields have fluctuated in line with overall applications, especially Computer Technology. In IPO customer feedback, a common area of comparison between the EPO and the IPO is the approach to dealing with inventions relating to computer programs, with frequent comments that applicants prefer the EPO's approach³¹. When compared to EPO publications in Computer Technology (Figure 16), it is not clear that an overall shift is occurring, but it is possible that at some points changes in UK practice has contributed to the exaggerated fluctuations in this technology.

All these technical fields have generally increased at the EPO over the same period (Figure 16). Civil Engineering is notable in that the magnitude of publications at the IPO is around 30% of that at the EPO, whilst for the other technical fields (and for overall levels of applications at the EPO – see section above) the magnitude is around 10%. A large component of this field is in earth drilling and obtaining oil and gas from wells, which is a specialised technology with limited markets, of which the UK is one in Europe.

³¹ European and UK patent law both specify that computer programs per se cannot be patented, but under IPO practice examiners commonly refuse to conduct a search in these types of applications, in contrast to EPO practice

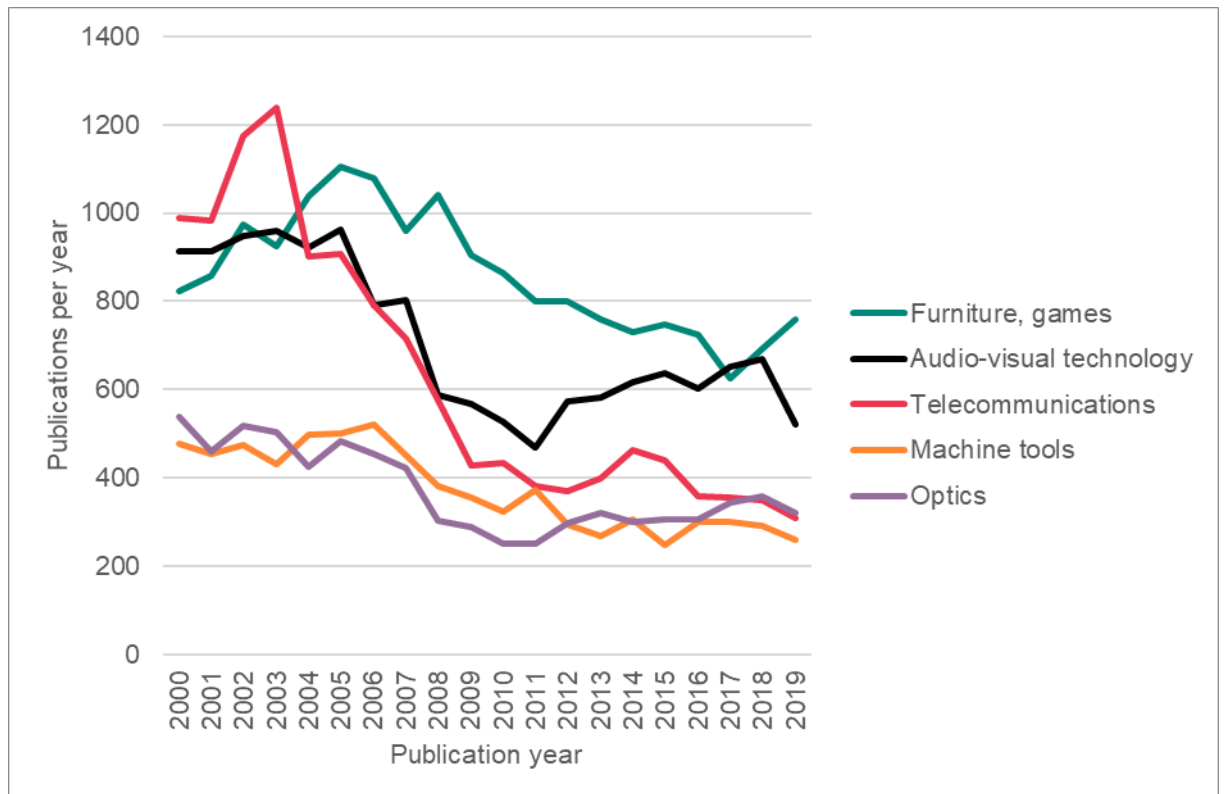
Figure 16: EPO publications in the same selection of technical fields as Figure 14



Source: PATSTAT

In some technical fields a clear decline at the IPO has been seen over the period (Figure 17).

Figure 17: IPO publications in selected technical fields with a decreasing trend



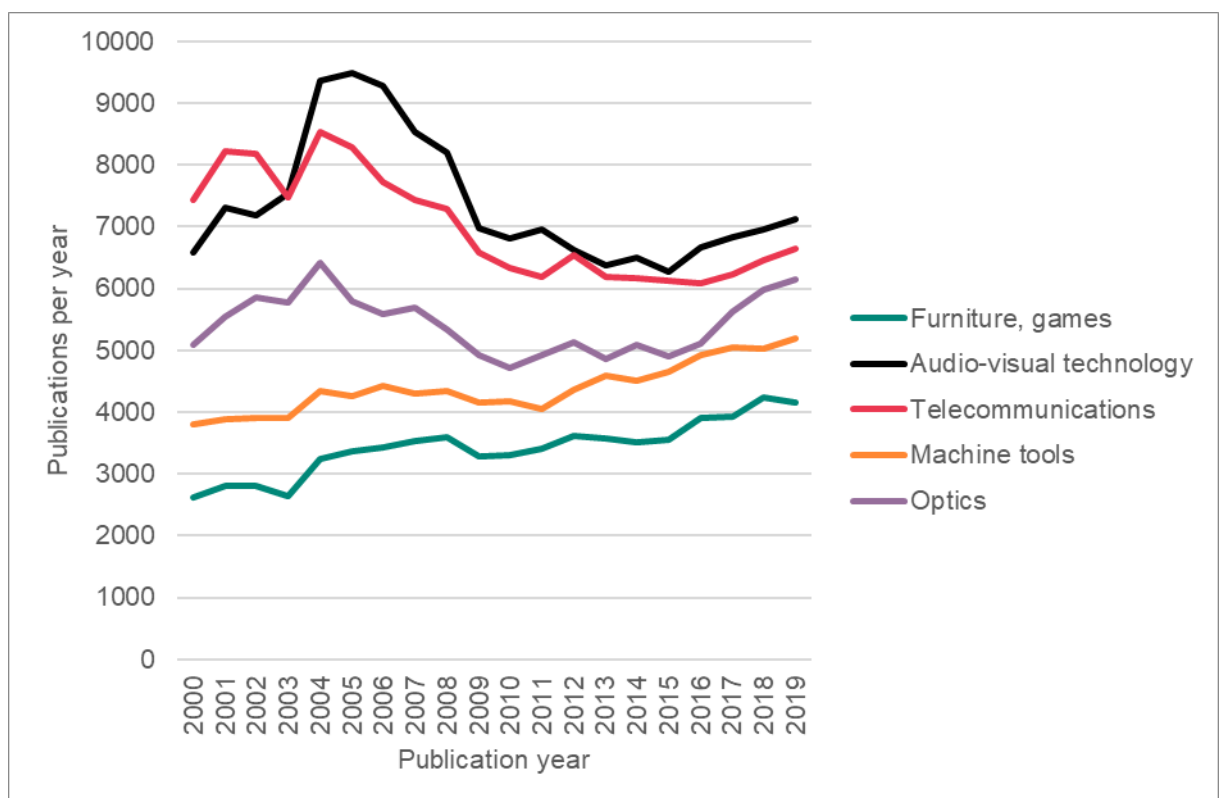
Source: PATSTAT

The biggest decline in absolute terms is in Telecommunications, which fell significantly until 2009 but with much smaller falls since. Furniture, Games and Audio-Visual Technology are the other largest areas of decline.

These same fields at the EPO have, in some cases, declined also (Figure 18). The drop in these fields is less dramatic at the EPO but even a small decline or a flat trend has to be seen in the context of the general increase in applications to the EPO, as shown in Figure 2 earlier. Therefore, the decline in these fields is seen more broadly than just at the IPO, but it has had a bigger impact at the IPO.

The trends in Telecommunications was investigated further by looking at individual portfolios for applicants filing at the IPO in this technical field. The decline is seen to be driven by most of the largest applicants apparently dropping out of the IPO altogether in this field, namely: NEC, Motorola, HP, and Nokia. Looking at the EPO filing patterns for these same companies shows big drops also for Nokia and Motorola, with NEC and HP remaining steadier. None show a clear pattern of decreasing IPO use and increasing EPO use, which would indicate a shift in strategy.

Figure 18: EPO publications in the same selection of technical fields as Figure 17



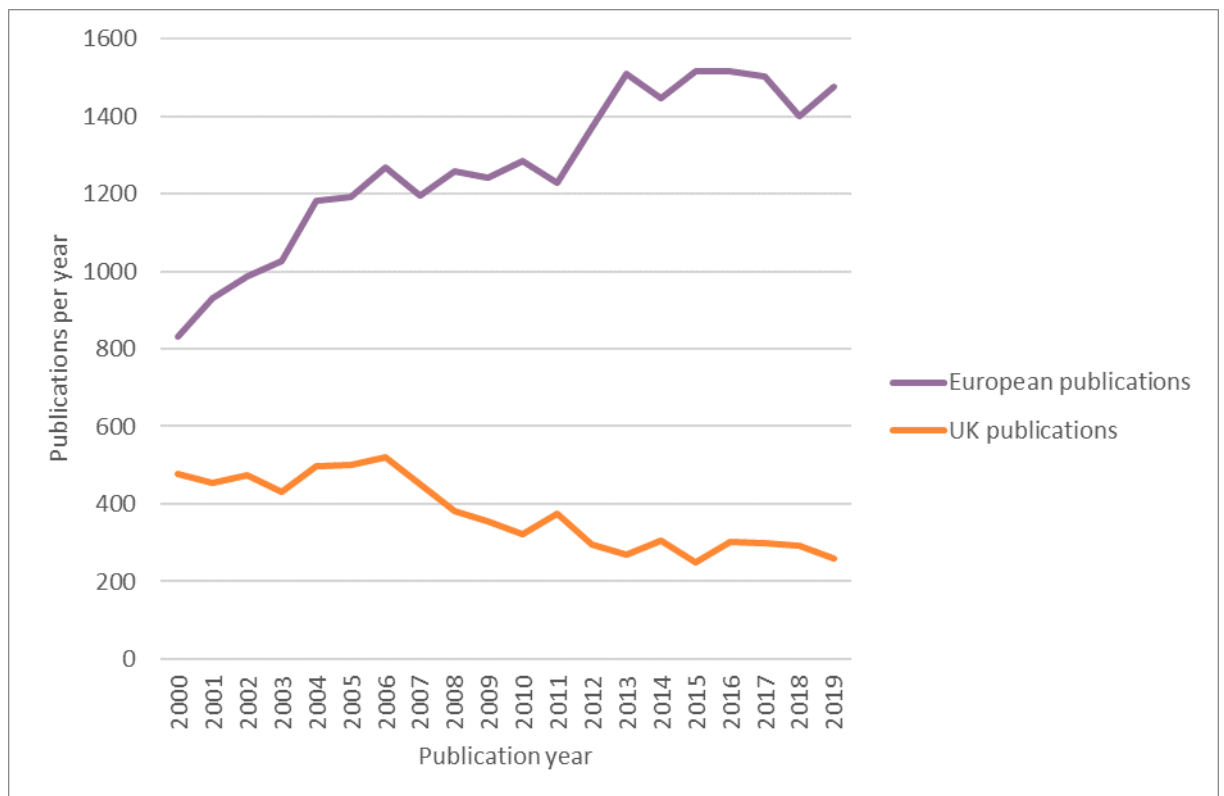
Source: PATSTAT

IPO applicants and EPO applicants may form different sets with little overlap, so it would not make sense to infer that applicants have decided to switch. Instead, a process of analysis was developed in which the list of all applicants who have made an application to the IPO was extracted and then the EPO applications only of these applicants was obtained, to form a common portfolio set. This was done separately for each technical field. This allows a like-for-like comparison of the aggregated IPO portfolios and EPO portfolios of a common group of

applicants. This goes beyond merely identifying correlation and a causal link can be more strongly inferred.

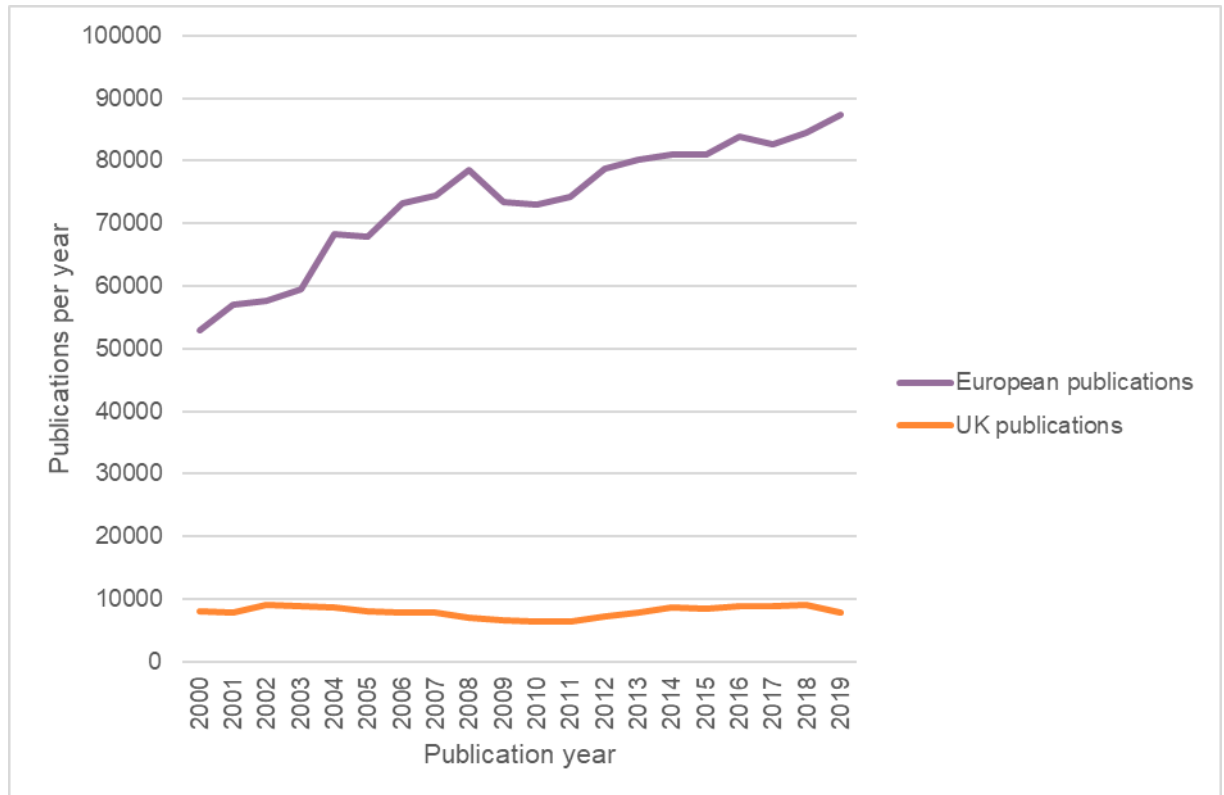
The aggregation process described above was applied to these fields and it was found that declining applications was common to the IPO and the EPO for Telecommunications, consistent with the findings for the largest applicants, but coincided with increasing applications to the EPO for Machine Tools and Furniture, Games (Figure 19). Since the same set of applicants were used for the comparison, this suggests a causal relationship, and that applicants in these specific fields have shown some shift to the EPO. Note, however, that the absolute size of the shift is of the order of 200 applications per year for Machine Tools, even if the entire UK decline is attributed to a shift, so it is not a big source of loss.

Figure 19: Common portfolio analysis of UK and European publications for the Machine Tools WIPO technical field, using all IPO applicants having applications in this field



Source: PATSTAT

Figure 20: Common portfolio analysis of UK and European publications for all IPO applicants

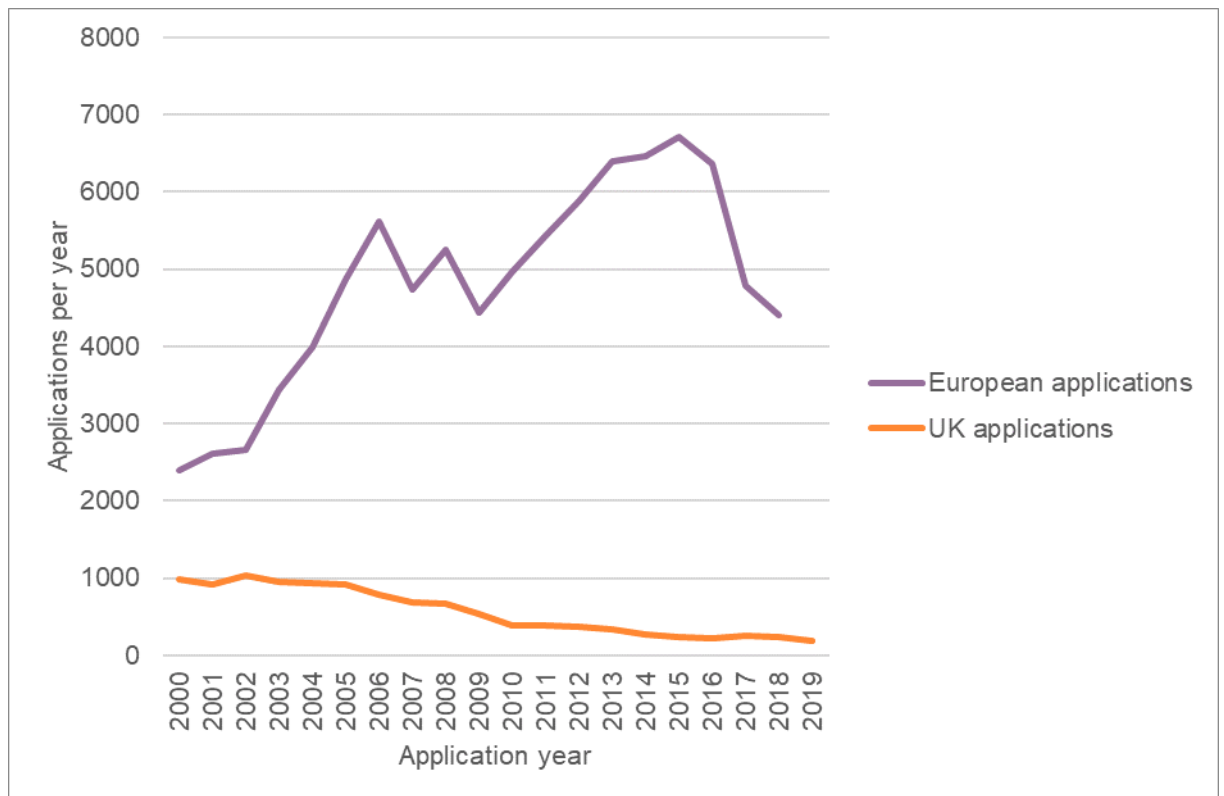


Source: PATSTAT

Figure 20 shows that overall, applications from this group of applicants to the IPO are fairly constant over time, whereas those to the EPO have increased. Therefore, there is no overall shift

This technique was generalised further by calculating a measure of gain or loss. Here, the list of all applicants who have made an application to the IPO was extracted and then the EPO applications only of these applicants was obtained to form the common portfolios set, as above, but this time without splitting into technical fields. The applicants were then assigned to groups according to whether their UK portfolio demonstrated a positive correlation with time (gain) or a negative correlation with time (loss), and similarly whether their European portfolio demonstrated a gain or a loss. Only applicants have a portfolio size greater than 50 were included to ensure meaningful correlations could be calculated. Figure 21 shows the results of this analysis for the group of applicants having UK loss and European gain.

Figure 21: Common portfolio analysis for IPO applicants having a declining trend in their UK portfolio but an increasing trend in their European portfolio

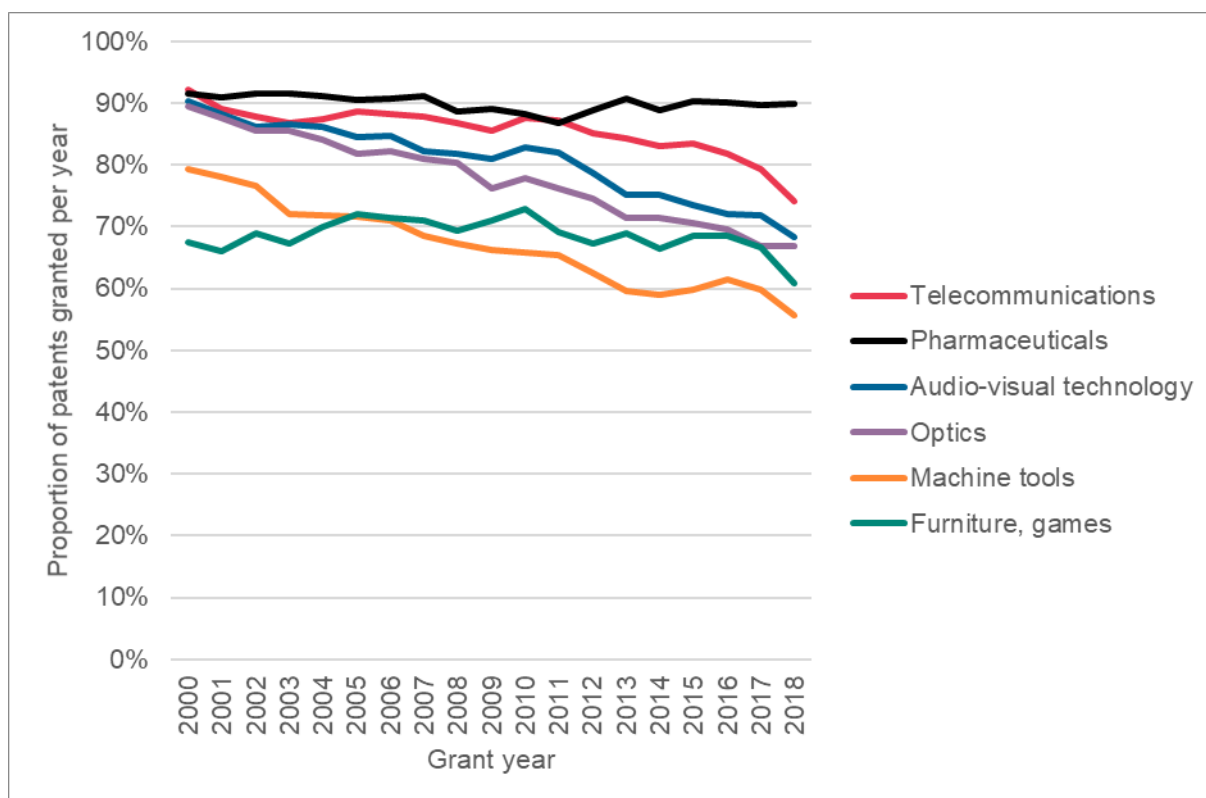


Source: PATSTAT

This shows the number of UK applications belonging to a portfolio with UK loss and European gain is of the order of a few hundred applications per year. This method provides an objective measure of the potential direct loss of applications from the IPO to the EPO, and the contribution of this appears to be small in size. Of much more importance (by an order of magnitude) is the contribution by applicants in the group having a UK loss and an European loss, thus demonstrating overall loss and excluding a switch to the EPO.

The pattern in the proportion of European patents in force in the UK for the same group of technical fields discussed above was also analysed (Figure 22). Pharmaceuticals has maintained a high consistent level around 90%, and Furniture, Games has remained consistently around 70%, but the other fields have declined. This combination of reduced applications to the IPO and reduced proportion of European patents kept in force in the UK shows a reduced interest in protection in the UK for these fields.

Figure 22: Proportion of European patents that are, or have been, in force in the UK for selected technical fields from Figure 17 and Figure 18



Source: PATSTAT

7. Double filing at IPO and EPO

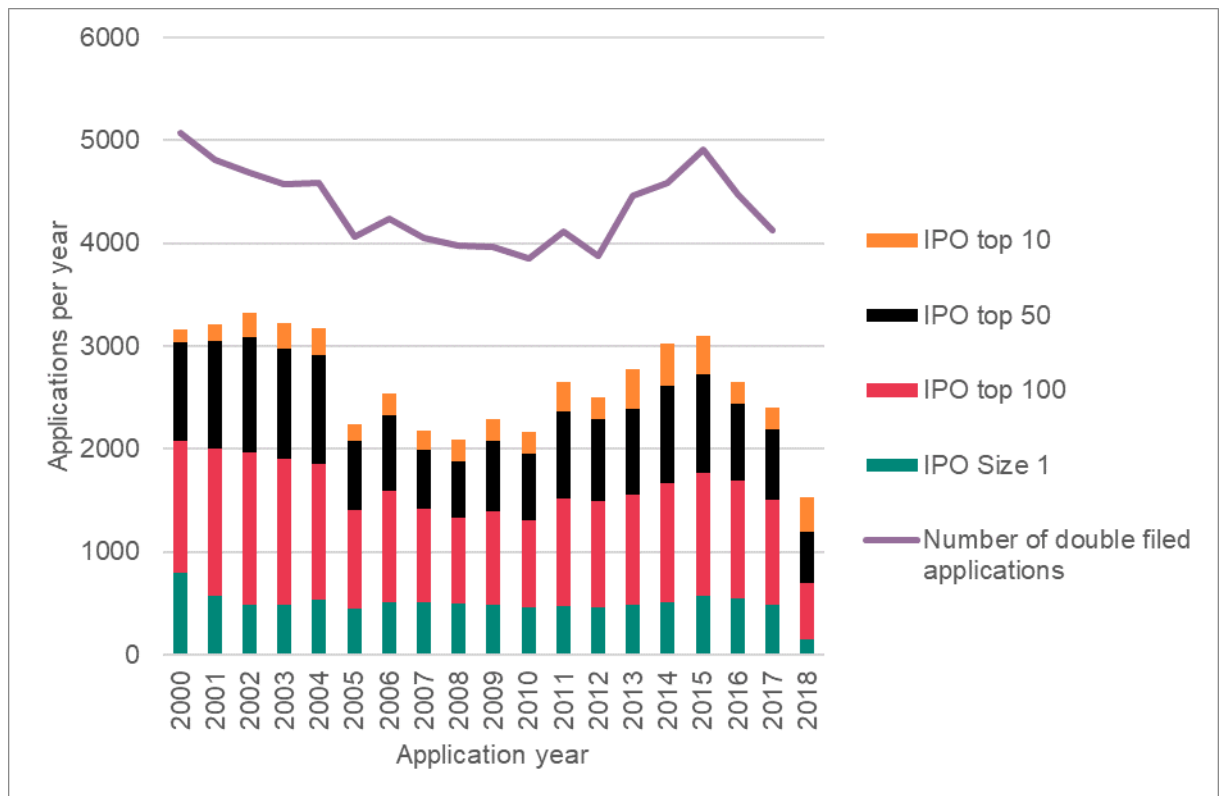
Applications for the same invention may be made to the IPO and the EPO, although the grant of a patent by the EPO will preclude grant of a patent for the same invention by the IPO. Nevertheless, this strategy allows a choice which may be beneficial to the applicant if one office has a more favourable opinion than the other. In this section the outcomes of these double-filed applications are examined³².

Double-filed applications are identified by using the EPO simple patent family identifier in PATSTAT (DOCDB family ID). Any patent family having both a UK application and a European application is incorporated in the dataset, and it is assumed that each patent family relates to a single invention.

Double-filed applications fell between 2000 and 2010 in step with overall IPO applications, and generally have risen since 2010. This latter rise follows closely the trend seen in larger portfolios and company portfolios (see section 6.2), where there is a boost in application numbers after 2010 which is not seen in applications overall. Nevertheless, the breakdown of applications by portfolio size actually shows a similar pattern to that for overall applications at the IPO, with the top ten applicants accounting for around 10% of input, and the top 100 applicants accounting for around 20-25% of input.

³² If identical double-filed applications are granted, the IPO will revoke the UK patent since a patentee must not have two patents in force in the UK for the same invention. The applicant must therefore choose which patent to keep

Figure 23: IPO applications which also have a related EPO application, by applicant portfolio size. The application year of the earlier application is used



Source: PATSTAT

Applicants with portfolio size 1 do not follow the steady decline seen in section 6.2, although there has been a decline over the period. Applicants who double file are more likely to be trading businesses than individuals, since a European patent is an indication of intention to export and trade abroad, so they follow the pattern of businesses even in the case they have small portfolios.

The rate of publication for these double-filed applications is similar to that for IPO applications as a whole. The trend for grants in the UK is similar to that for overall grants but with an increasing trend superimposed over the general peaks and troughs³³ (Figure 24).

More double-filed applications are granted at the EPO than the IPO, with numbers generally following the application trend³⁴, and showing the large increase since 2015 that is seen overall in European patents.

Applications made using the double-filing strategy therefore have a similar make up to overall applications to the IPO, with similar applicant breakdown and grant rate, yet they follow the patterns associated with companies and large portfolios, and have no signs of decline. It is more common for these applications to end up granted at the EPO than the IPO. This is consistent with the well-known strategy of using the IPO to gain a relatively fast, low cost search³⁵ (and examination, if

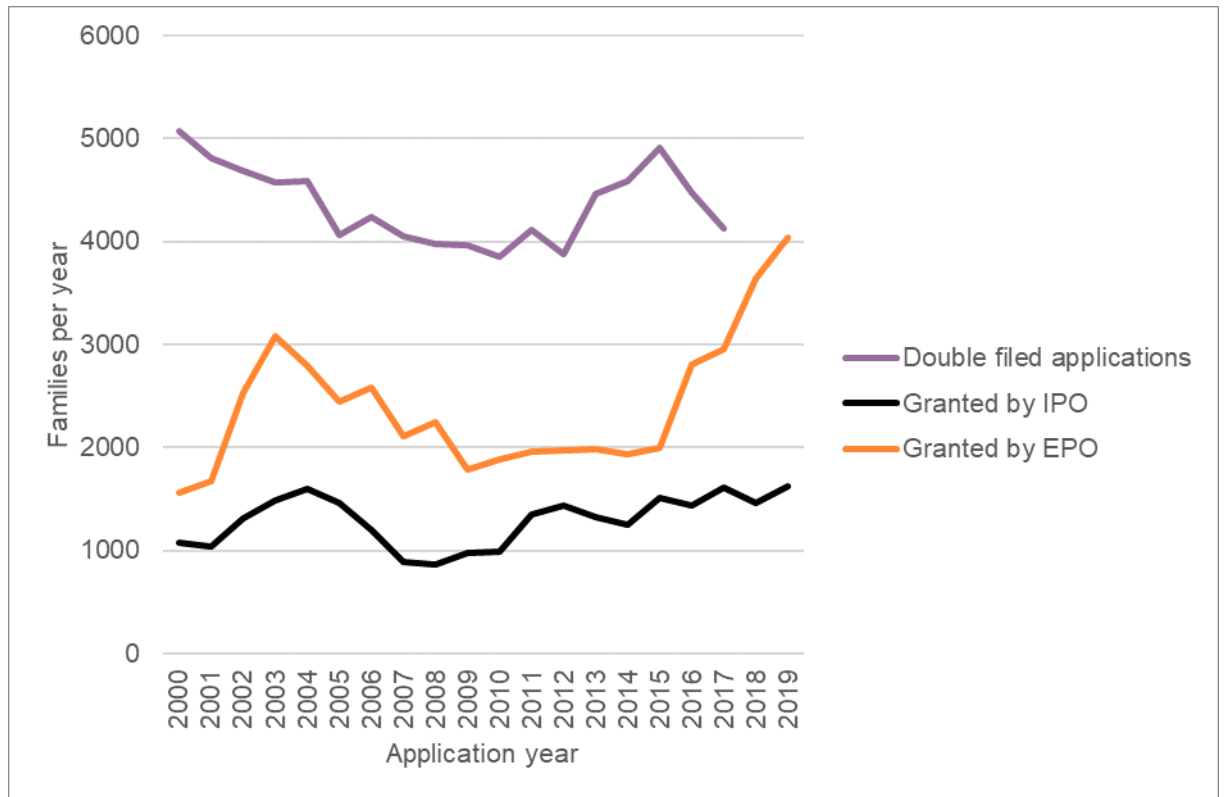
³³ As discussed in section 2

³⁴ Note that no information on pre-published European applications is available and so all families in this dataset must include a *published* European application

³⁵ Throughout the whole time period of this analysis, the IPO has had targets to deliver search results within 6 months, and at times 4 months, which is well within the 12-month priority period of the Paris Convention. Applicants may also request an examination at the same time

required), in order to make informed decisions in relation to future applications elsewhere.

Figure 24: Breakdown of double-filed applications by publication and grant rate. Note all applications in the chart include an EPO publication



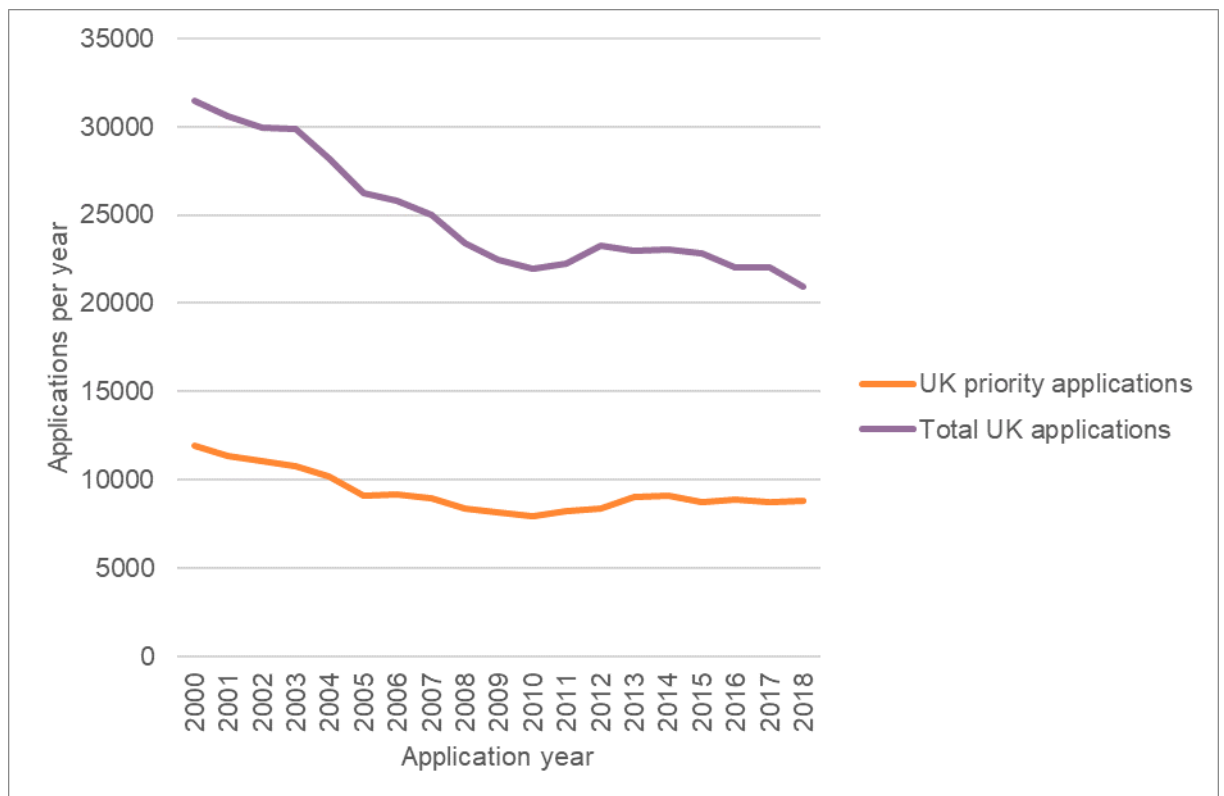
Source: PATSTAT

8. Use of UK as a priority country

It is common for patent applications to be linked to earlier applications by making a priority claim within 12 months³⁶. This option may be used to protect developments of the original invention, but also allows an invention to be protected in multiple jurisdictions without having to make applications in each jurisdiction at the same time. In this section IPO applications used as a basis for a priority claim are analysed.

Figure 25 shows applications at the IPO which had at least one subsequent application made claiming priority from the UK application.

Figure 25: IPO applications which are used as a basis for making a claim to priority in a subsequent application, compared to total IPO applications

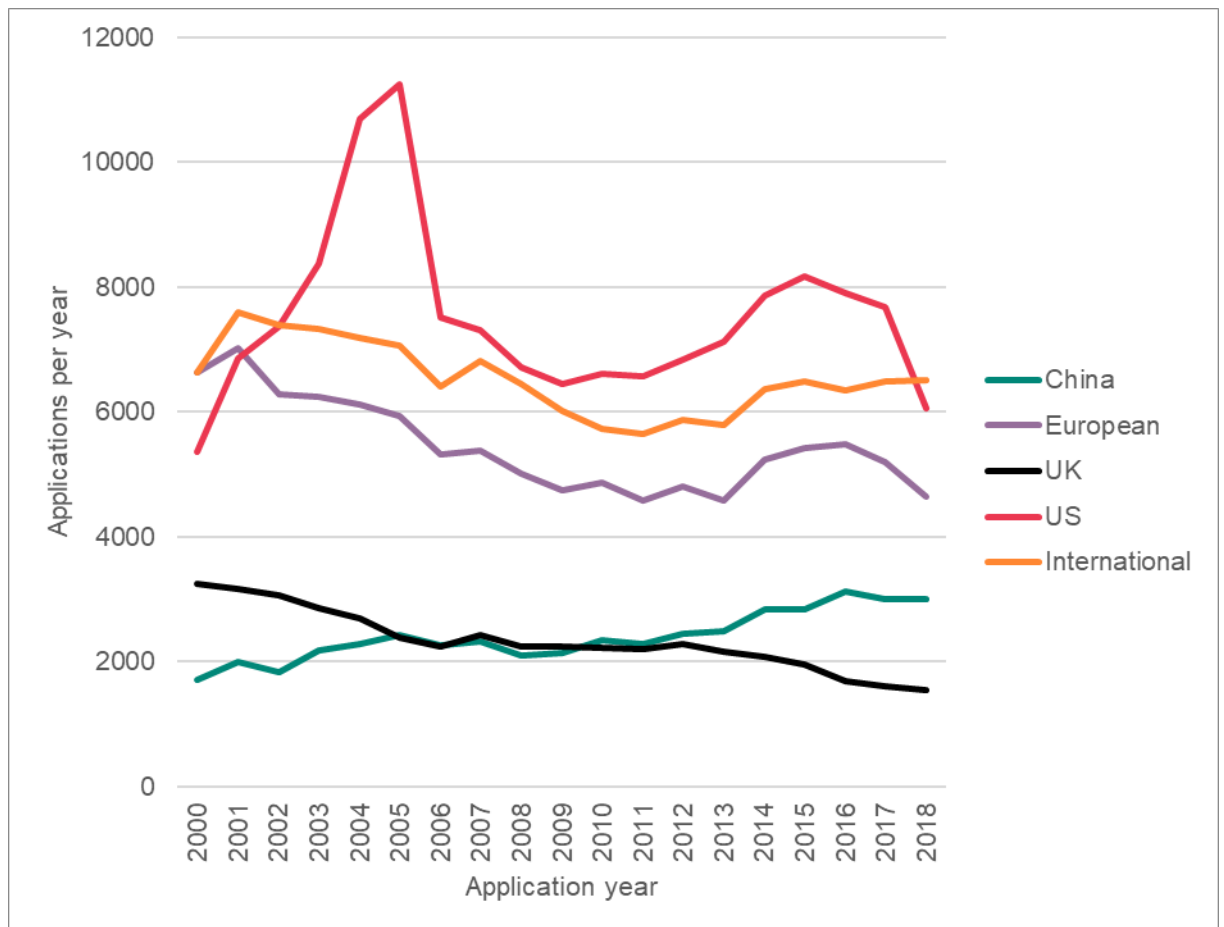


Source: UK patent register/PATSTAT

Applications of this type have generally made up 35-40% of total IPO applications, but in 2018 made up 42% of IPO input.

³⁶ Under the Paris Convention

Figure 26: Main countries in which subsequent applications are filed claiming priority from a UK application. Note that multiple applications may claim priority from each UK priority application



Source: PATSTAT

Some subsequent applications are made to the IPO, but these account for less than 20% of the total; it is clearly more common for priority applications to be used as a basis for protection elsewhere. These types of applications form a significant and consistent component of demand, but are less likely to be granted (16% grant rate between 2000 and 2019) than overall applications at the IPO (28%).

9. Conclusions

The picture that emerges from this study is that the decline in applications to the IPO seen over the last twenty years arises out of a complex mixture of components. Identifying these components shows they each include different patterns, so a continued future downward trend in use of the IPO would not be expected based on these factors.

A large part of the loss is in applications from one-off customers or customers with very small portfolios. These customers are much more likely to be individuals than businesses, and their applications are more likely to fail to proceed to publication or grant. Applications from these customers have declined steadily with no clear link to events or factors that influence the behaviour of business applicants, notably the Great Recession of 2008. A proportion of one-off customers, or customers with small portfolios, are in fact businesses but they have more in common with other businesses than individuals, and applications from these types of businesses remain steady.

Applications from larger customers, who tend to be businesses, declined steadily until 2010, when a turning point was reached, and have recovered since. These applications are more likely to proceed to publication, and make up most of the granted patents. Detailed analysis of the portfolios of these customers suggests the turnaround in 2010 results from a turnover of applicants which was accelerated by the Great Recession of 2008, so that incumbents disappeared more quickly than they were replaced for a period, but very shortly new entrants made up the difference so that applications recovered.

Most patents in force in the UK are European patents, at 91% of the stock of patents in force, and 93% of all patents entering into force in 2018. The EPO's Early Certainty scheme appears to be linked to growth in European patents granted since 2015, so the percentage of patents in force in the UK that are European is likely to increase yet further. Renewal rates of European patents in the UK are lower than in Germany or France.

International applications to the UK provide a small, but relatively consistent input to the IPO, and are more likely to reach grant.

The majority of applications to the IPO are still from domestic applicants, but the number has fallen. Applications from elsewhere have remained steadier, and applications from China have increased rapidly since 2013. Use of the EPO by domestic applicants has increased, but detailed analysis of the portfolios does not suggest a direct shift of applicants from using the IPO to the EPO is particularly common. Evidence suggests there may be such a shift in specific technology areas, and comments from customer feedback sometimes criticise UK practice in relation to computer program inventions. The IPO is attractive because of its low fees, and in the past because of its speed, but this may be changing with the effects of the EPO's Early Certainty scheme.

The biggest technical fields at the IPO are Civil Engineering, Computer Technology, Transport, Measurement, and Electrical Machinery, Apparatus, Energy. There have been declines in IPO applications into Telecommunications,

Furniture, Games, Audio-Visual Technology. This decline is shared to some extent at the EPO, despite the overall trend of strong growth at the EPO.

A significant part of the IPO's attractiveness to applicants is as an office of first filing. Applications that are double filed with the IPO and EPO are more likely to be granted at the EPO, but still have a grant rate at the IPO similar to IPO applications overall. Other applications used as a first filing for subsequent applications elsewhere are less likely to be granted, indicating these customers are exploiting the relatively low-cost search provided by the IPO.

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Published: August 2021

SR00124152

