

Corporate Taxes and Intellectual Property: Simulating the Effect of Patent Boxes

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Executive summary

- The introduction of Patent Boxes policies that sharply reduce the rate of corporation tax applied to income derived from patents – in the Benelux countries is likely to reduce the share of new patents held in the UK by approximately 30%.
- The introduction of a UK Patent Box would more than double the UK's share of new patent holdings, more than offsetting this reduction.
- The effect of these reforms on tax revenue would be substantial; the UK could expect to see revenue from patent income halved.
- The interaction of Patent Boxes and Controlled Foreign Company (CFC)
 regimes could have an important impact on UK revenues; a UK CFC regime
 that effectively captured patent income held in Patent Box countries could
 mitigate some of the negative impact on revenues.
- The UK Patent Box was announced as a policy to promote innovative activity in the UK. The policy is poorly targeted at the types of activities where government intervention is justified and gives firms little additional incentive to conduct research activities in the UK. Under a UK Patent Box, a significant amount of real activity would need to accompany newly created patent income in order to outweigh the loss in revenue.

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1. Introduction

The tax treatment of intellectual property is currently in the spotlight. In 2009, the UK moved to an exemption system for the taxation of foreign-source income. Firms can now remit most forms of income earned offshore to the UK without attracting an additional UK tax liability. This brings the UK into line with most other European countries and could help UK firms make more productive use of their assets, since they will no longer face additional taxation when investing in countries with a tax rate lower than the UK's.¹ However, how offshore income from intellectual property is treated remains an unresolved issue.

On the basis of neutrality – basically, the notion that the tax system should not distort investment decisions – it is desirable for the tax system to treat the use of an idea offshore the same as the use of physical goods. However, the income from intellectual property is highly mobile and can be easily separated from real activity. The government is therefore concerned that firms might seek to hold intellectual property offshore to avoid tax. The previous government made proposals for reforms to the Controlled Foreign Company (CFC) regime – the set of rules that determine how offshore mobile income is taxed; see Box 1. These proved contentious and the current coalition government inherited an ongoing consultation process that is considering the anti-avoidance legislation that is needed to prevent firms locating income offshore for the sole purpose of avoiding tax. A key aspect of these reforms will be how intellectual property is treated.²

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¹ For further discussion, see M. Gammie, R. Griffith and H. Miller, 'Taxation of companies' foreign profits', in R. Chote, C. Emmerson, D. Miles and J. Shaw (eds), *The IFS Green Budget: January 2008*, Commentary 104, Institute for Fiscal Studies (http://www.ifs.org.uk/budgets/gb2008/08chap12.pdf).

² A 2010 discussion document sets out the objective of exempting intellectual property that is *actively managed* offshore while mitigating the 'risk that UK tax can be avoided through the artificial movement of [intellectual property] into a low tax jurisdiction'. See section 4 of HM Treasury and HM Revenue and Customs, *Proposals for Controlled Foreign Companies (CFC) Reform: Discussion Document*, January 2010 (http://www.hm-treasury.gov.uk/d/cfc_discussiondoc_260110.pdf).

Box 1. CFC regimes

Broadly, countries operate either an exemption or a credit system for the taxation of foreign-source income. Under a credit system, income earned in offshore subsidiaries is liable for additional tax when remitted back to the home country, with a credit for tax already paid. Under an exemption system, income in offshore subsidiaries is exempt from further taxation when it is remitted home.

Within both systems, many countries operate rules that aim to prevent firms from holding profits in low-tax jurisdictions in an attempt to avoid taxation in their home country, known as Controlled Foreign Company (CFC) regimes. CFC legislation basically defines the set of subsidiaries that are located offshore in low-tax countries and deemed to be subject to tax in the parent firm's residence country. Most regimes focus on identifying passive income – income resulting from non-commercial activities which can be divorced from real activity and easily moved for tax purposes; this usually includes patent royalties. Countries that operate a CFC regime include Denmark, Finland, France, Italy, Norway, Spain, Sweden and the UK.

At the end of 2009, the previous government proposed the introduction of a 'Patent Box'. In November 2010, the coalition government announced that a Patent Box will be introduced in 2013. This reform will reduce the rate of corporation tax applied to the income derived from patents to 10%. Precise details will form part of a broader consultation on the taxation of intellectual property.³ The UK proposal follows the introduction of Patent Box regimes in Belgium, Luxembourg, the Netherlands and Spain.⁴

The income derived from intellectual property is highly mobile and anecdotal evidence suggests that multinational firms are increasingly choosing to hold intellectual property (and the resulting revenue stream) in subsidiaries outside of the home country. For example, *The Guardian* recently ran a two-week report on companies' tax practices, highlighting that firms '[move] the rights to their intellectual property to tax havens'

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³ See HM Treasury, *Corporate Tax Reform: Delivering a More Competitive System*, 2010 (http://www.hm-treasury.qov.uk/corporate_tax_reform.htm).

⁴ Ireland also operates a system whereby certain patent royalties are tax exempt. Qualifying patents are required to have had an element of the underlying research or processing carried out in Ireland.

allowing them to 'reduce their UK-based profits and hence their British tax bills by paying royalties to the subsidiary in the tax haven'.⁵

In light of these issues, there is considerable interest in understanding how taxes affect firms' choices over where to hold patents for tax purposes. In a forthcoming paper,⁶ we estimate the responsiveness of European multinationals' patent holdings to corporate taxes. We consider firms' decisions over which subsidiary to hold each of their patents in. This choice is crucial for determining the jurisdiction under which the patent income will be taxed.⁷ We consider taxes in the country where intellectual property is held as well as interactions with taxes in the home country via CFC regimes. We simulate the effects of introducing Patent Boxes, in terms of both the location of income and the resulting government revenues, under alternative assumptions about how CFC regimes will interact with Patent Boxes.

This Briefing Note summarises the main results from that paper (Griffith, Miller and O'Connell, 2010) and discusses our findings in relation to the current policy issues.

2. The location of patent income and corporate taxes

We estimate an econometric model that captures the impact of corporate taxes on the location of patent holdings; we pay careful attention to controlling for potentially confounding observed and unobserved factors. We consider the choices of European firms over which country – out of 14 European countries and the US⁸ – to hold their patent applications in.

Perhaps unsurprisingly, we find that if a country lowers its corporate tax rate, firms are more likely to locate their intellectual property in that location. We also find a large variation in the responsiveness of location

⁵ See 'Offshore – and out of reach to the Revenue', http://www.guardian.co.uk/business/2009/feb/03/offshore-tax-avoidance.

⁶ R. Griffith, H. Miller and M. O'Connell, 'Corporate taxes and the location of intellectual property', Institute for Fiscal Studies, mimeo, 2010.

⁷ This country can be distinct from both the one in which the underlying technology was created (i.e. where research activity occurs) and the patent office in which protection is sought (which is related to where the technology will be used).

⁸ The 14 European countries are Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Norway, Spain, Sweden, Switzerland and the UK.

choice to tax across different patents. A useful way of summarising this is to consider the own-tax elasticity. This tells us the percentage change in the probability that a firm chooses a location (say, the UK) if the tax rate it faces there decreases by 1%, holding all other tax rates, as well as everything else, constant. It is therefore a measure of the sensitivity of the firm's location choice to the tax rate, all else equal.

We estimate own-tax elasticities that range from -0.3 to -1.6 and average -1.0. Figures differ across countries. For the UK, the mean own-tax elasticity is -1.2. That is, a 1% decrease in the UK statutory rate of corporate tax will lead to a 1.2% increase in the proportion of new patents held in the UK.

A change in tax in one country also affects the share of patents held in other countries. This is captured by cross-tax elasticities, which differ between pairs of countries according to countries' characteristics and how similar they are to each other: countries with more similar characteristics will be seen as closer substitutes by firms, and therefore the cross-tax elasticity will be higher. We find large variation in cross-tax elasticities. For example, a 1% decrease in the Belgian tax rate leads to a 0.05% decrease in the proportion of new patents held in the UK, while the same decrease (1%) in the French tax rate decreases the UK share by 0.26%. This is because firms see France as a closer substitute for the UK than Belgium.

3. The effects of introducing Patent Boxes

In recent years, a number of countries have introduced special tax provisions for the income derived from patents – Patent Boxes – which act to lower the tax liability on patent income; see Box 2. At the end of 2009, the Labour government announced proposals to introduce a UK Patent Box in 2013 at a rate of 10%; in November 2010, the coalition government confirmed that a Patent Box will be introduced in 2013. In Griffith, Miller and O'Connell (2010), we use the econometric model that

Fiscal Studies (http://www.ifs.org.uk/budgets/gb2010/10chap10.pdf).

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⁹ For more information and analysis of the UK proposals, see section 10.2 of R. Griffith and H. Miller, 'Support for research and innovation', in R. Chote, C. Emmerson and J. Shaw (eds), *The IFS Green Budget: February 2010*, Commentary 112, Institute for

we estimate to predict how firms will respond to the Patent Boxes in the Benelux countries and to the possible introduction of one in the UK. We

Box 2. Patent Boxes

A Patent Box is a policy that reduces the rate of corporation tax levied on the income derived from patents. Belgium and the Netherlands introduced Patent Boxes in 2007, followed by Luxembourg and Spain in 2008.

The Netherlands applies a reduced rate of 10% to the income derived from patents, which is calculated as the associated revenue net of costs. The UK proposal is also for a 10% rate. The Patent Boxes in Belgium and Luxembourg exempt 80% of patent income from corporate tax. The effective rate of this policy is 6.8% in Belgium and 5.9% in Luxembourg. Spain exempts 50% of patent revenue, with development costs being deducted from the revenue that is not tax exempt.

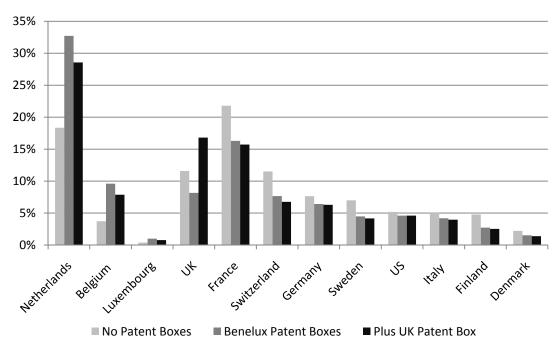


Figure 1. Share of new patent applications across countries

Notes: The first bar for each country shows the predicted shares of patents held in each location before any Patent Boxes have been introduced. The second bar shows the predicted shares of newly created patents after the Benelux countries have introduced Patent Boxes (Belgium at 6.8%, Luxembourg at 5.9% and the Netherlands at 10%). These can also be interpreted as the steady-state shares. The final bar shows predicted shares of newly created patents when the UK additionally introduces a Patent Box, at a rate of 10%. Our analysis includes three additional countries (Ireland, Norway and Spain) not shown here because changes in their small shares are hard to ascertain on this scale.

also consider how CFC regimes may interact with Patent Boxes, under a number of different scenarios.

Our results suggest that the introduction of Patent Boxes leads to significant shifts in patent holdings towards those countries operating favourable regimes and away from other countries. Figure 1 shows the predicted share of newly created patent holdings across countries as Patent Boxes are introduced.

Following the introduction of Benelux Patent Boxes, the shares of new patent applications filed from Belgium, the Netherlands and Luxembourg increase substantially. The largest absolute increase is in the Netherlands, although proportionately the increases are twice as large in Belgium and Luxembourg. The UK's share decreases from 12% to 8%, a fall of almost a third.

When the Benelux countries operate Patent Boxes and the UK introduces a Patent Box, the UK's share of newly created patents more than doubles to 17%. This more than offsets the loss in share that occurred when the Benelux Patent Boxes were introduced. The shares in the Benelux countries fall back, but remain higher than before they introduced Patent Boxes. Non-Patent-Box countries experience a further fall in their share of new patent holdings as firms substitute towards the UK.

3.1 Interactions with CFC regimes

CFC regimes set out provisions under which income held in low-tax countries is taxed at the home country's tax rate. This reduces the incentives for firms to hold income in low-tax countries and may have direct consequences for the effects of Patent Boxes. CFC regimes define a low-tax country based on the standard (i.e. non-Patent-Box) statutory corporate rate. As a result, in the analysis underlying Figure 1, the Benelux countries have not been deemed to be low-tax when they introduced Patent Boxes. However, it is possible that countries could treat Patent Box regimes as low-tax for the purposes of their CFC rules. This is a particularly relevant issue for the UK, where the form and nature of the UK CFC regime is currently under consideration; it is uncertain how the reformed CFC regime will treat Patent Box countries and whether the CFC regime would continue to be in place for patent income if the UK introduced a Patent Box.

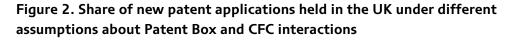
In our analysis, we consider the impact of assuming that Patent Box rates are used to determine whether countries are deemed low-tax by CFC rules. This means, for instance, that because the Benelux Patent Box rates fall below the UK's low-tax threshold, UK firms with a patent in one of the Benelux countries would be subject to the UK rate and not the lower Patent Box rate. It also means that the 10% rate of the UK Patent Box could be deemed low-tax in other countries' CFC regimes.

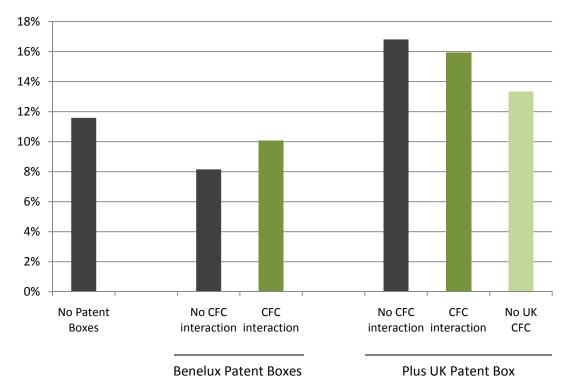
For the Benelux countries (which do not operate CFC regimes), the effect of this assumption is straightforward. They experience smaller gains in the share of new patents because firms from countries operating a CFC regime have a reduced incentive to substitute towards the Benelux countries. In terms of magnitude, the proportional gains in share are reduced by around half when CFC interactions are accounted for.

For the UK, the effect is less clear since the inclusion of CFC considerations has two opposing impacts. On the one hand, the move away from the UK is dampened because UK firms cannot access the low taxes offered in the Benelux countries (without being captured by the CFC regime and taxed at the UK rate). This means that when the Benelux Patent Boxes are introduced, the UK experiences a smaller fall in share: the UK share of new patent applications falls to 10% (rather than 8% without CFC regime considerations). On the other hand, when the UK introduces a Patent Box, substitution towards the UK is dampened by the reduced incentive for firms from other CFC countries to locate there.

Our research suggests that the second effect dominates, but only by a small amount. When all four Patent Boxes are in operation, the UK share is 16%, which is lower than the 17% shown in Figure 1 when no CFC interactions are accounted for. That is, the lower propensity of UK firms to substitute out of the UK is offset by the lower propensity of firms based in other countries operating CFC regimes to come to the UK. These results are shown in the third and fifth bars of Figure 2.

Countries that operate CFC regimes but not Patent Boxes, such as France, see smaller losses in share when CFC interactions are included; the operation of a CFC regime that effectively captures income held in Patent Box countries reduces the incentive for home firms to locate in such countries.





Notes: The bars represent the predicted share of patents held in the UK. The first, second and fourth are repeats of those shown in Figure 1; they assume that CFC regimes do not apply to Patent Box rates. The third and fifth bars include interactions with CFC regimes, i.e. they allow Patent Box countries to be deemed low-tax. The final bar assumes that the UK CFC regime ceases to operate for patent income. The difference between the fifth and sixth bars is that the latter excludes the positive effect of the UK operating a CFC regime that captures income held in Patent Box countries.

It is unclear how the UK CFC regime would treat offshore patent income if the UK operated a Patent Box. In the analysis discussed above, we assumed that the UK CFC regime would capture income held in the Benelux countries and tax it at the full UK statutory rate, 28%. This implies that when the UK has a Patent Box, offshore patent income held in the Benelux countries would potentially be taxed at 28% while patent income in the UK would be taxed at 10%.

Alternatively, the UK CFC regime could cease to operate for patent income. This would mean that all UK firms face the statutory (or Patent Box) tax rate in the chosen location. We simulate the effect of this, assuming that the UK Patent Box could still be deemed low-tax in the CFC regimes of other countries. In this case, the predicted UK share is higher than initially

- there is still a boost from operating a Patent Box - but is lower than when the UK CFC regime operates, because UK firms face greater incentives to locate patents in low-tax countries. This is shown in the final bar of Figure 2.

These different scenarios highlight the importance of considering the potential interactions between CFC regimes and Patent Boxes; the extent to which governments are able to operate a CFC regime that effectively captures patent income held in low-tax countries – including those that offer special tax treatments – greatly affects the distribution of patent income across countries.

3.2 The impact on tax revenue

The change in the location of patent holdings in response to Patent Boxes will affect government tax revenues from patent income; revenue is a function of the share of patent income in a country and the rate at which tax is levied. We consider the likely effects assuming, for illustration, that there are no interactions with CFC regimes (as in Figure 1).

Figure 3 displays the tax revenue raised from newly issued patents in response to the introduction of Patent Boxes, assuming the level of patenting in 2005. As a point of reference, we index government tax revenue prior to the introduction of any Patent Boxes to 100. The second bar for each country shows how revenue from new patents changes when the Benelux Patent Boxes are introduced: revenue is reduced in all countries. In non-Benelux countries, this is driven simply by the reduction in the share of patent income. In the Benelux countries, the positive effect of an increase in the share of income is outweighed by the lower tax rate applied to income.

The third bar represents revenue from new patents when the UK additionally introduces a Patent Box. Again, revenue falls in all countries. As was the case for the Benelux countries, UK revenue falls because the effect of the lower tax rate (10%) on all patent income outweighs any income gained from the increased share of patent income. When all four Patent Boxes are in place, UK revenue from newly created patent income is half its initial level.

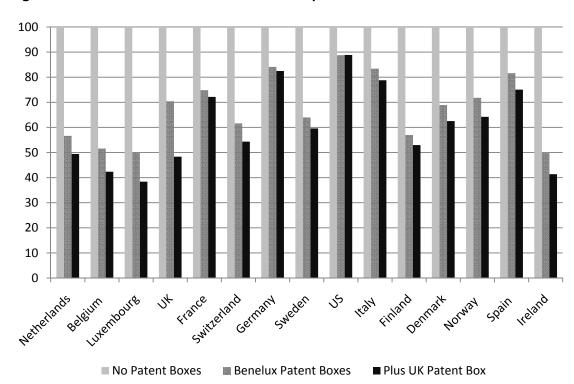


Figure 3. Government tax revenues from new patent income

Notes: The graph shows government tax revenue from new patents (= tax rate × share of new patents), assuming the 2005 level of patenting. Initial revenue (before any Patent Box introductions) is indexed to 100 (first bar). Shares used are those reported in Figure 1. Figures do not include revenue gained from applying CFC regimes to patents held in low-tax countries. The second and third bars show relative revenue when the Benelux countries and also the UK respectively introduce Patent Boxes.

The Patent Box policies that have been introduced in the Benelux countries and are planned in the UK apply the reduced tax rate to newly granted patents. Figure 3 shows our projections of the tax revenue that will be raised from newly created patents after the introduction of Patent Boxes. These can also be interpreted as the steady-state revenues – that is, revenue from all patents after the income from those that were granted in the preceding tax regimes falls to zero (either because the patents are no longer valuable or because the patent protection has expired). Since patent protection lasts for 20 years and at least some patents will continue to create taxable revenues, there will be an interim period in which governments raise revenue from both the previous stock of patents (taxed at the full rate) and the new stock that accumulates following the introduction of a Patent Box (taxed at the lower rate). It will therefore take time for tax revenues to reach the new steady-state level.

Under some simplifying assumptions, we consider what the path of UK tax revenue would be under the scenarios set out above: (1) no Patent Boxes; (2) Benelux Patent Boxes are introduced in 2007, but no other countries adopt Patent Boxes; (3) the UK also introduces a Patent Box, in 2013. In addition, we simulate the likely impact if France were also to introduce a Patent Box, in 2019.

There are many factors that will affect the path of revenue, including how the world stock of patents develops and how much revenue comes from patents at different points in their life cycle. For illustration and comparison between the four scenarios, we assume that there is no growth in the worldwide stock of patents¹⁰ and that the revenue attributable to a patent remains constant throughout the patent's lifetime. Figure 4 shows the path of UK revenue from patent income in the four scenarios. As in Figure 3, we index UK tax revenue in scenario 1 (no Patent Boxes) to 100 and measure revenue under all other scenarios relative to this baseline.

Figure 4 illustrates that it will take time for the revenue raised from taxing patents to reach the new steady-state level. For instance, if the UK government introduced a Patent Box in 2013, the new steady state will not be reached until something like 2032. In each scenario, the loss in revenue following the introduction of Patent Boxes increases over time as the stock of pre-Patent-Box patents is replaced with patents issued and taxed under the new tax regime.

In our analysis, we also considered the situation in which either France or Sweden introduced a Patent Box at the rate of 10%. Unsurprisingly, we found that, in either case, the country introducing the Patent Box would gain share while other countries, including the UK, would lose share. As a

¹⁰ The abstraction from growth in the worldwide patent stock explains why the 'No Patent Boxes' baseline in Figure 4 is horizontal. If instead we assumed that the value of the patent stock increased over time (for example, due to an increase in the number of patents granted), then the gradient of all lines would be increased by the same amount but the relative positions would be unaffected.

¹¹ To the extent that more revenue is derived from patents closer to the point at which they are granted (and not equally across the 20-year period for which protection is valid), we will overestimate how long it will take for revenue to reach the new steady-state level.

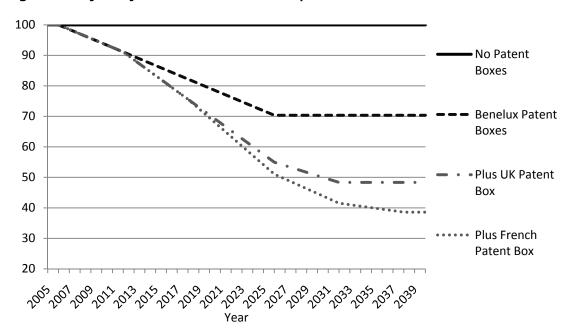


Figure 4. Trajectory of UK tax revenue from patent income

Notes: Yearly UK government tax revenue from patent income is calculated as in Figure 3 and again indexed to 100 when no Patent Boxes are in place. This figure accounts for the revenue from the pre-Patent-Box stock of patents (taxed at the full statutory rate) and the post-Patent-Box stock (taxed at 10%), assuming (i) there is no growth in the world stock of patents and (ii) revenue is derived from all patents held in the UK equally across the 20-year period for which protection is in place. The steady-state levels (when indexed revenue no longer changes) are those shown in Figure 3.

result, UK government revenue from new patents would also fall. As shown in Figure 4, if France introduced a Patent Box six years after the UK, the long-run revenue prospects for the UK exchequer would worsen.

4. Benefits from a UK Patent Box

Our research shows that even though the UK would become a more attractive location for the income derived from patents, a Patent Box would likely lead to a substantial fall in revenue from patent income. The UK Treasury's own estimates in the June 2010 Budget predicted that a Patent Box would cost £1.1 billion a year. Can the UK expect additional benefits from introducing a Patent Box that are sufficient to offset this?

It has been argued that there are benefits (over and above tax revenue) related to patents. That is, not only income but real activity may be

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¹² Table 2.4 of HM Treasury, *Budget 2010*, June 2010 (http://www.hm-treasury.gov.uk/d/junebudget_complete.pdf).

attracted to, or discouraged from leaving, the UK in response to the Patent Box. Indeed, the policy was announced with the aim to 'strengthen the incentives to invest in innovative industries and ensure the UK remains an attractive location for innovation'. 13

However, as we argued in an earlier publication, a Patent Box is poorly targeted at the types of activity where government intervention is justified and provides only limited incentives for firms to conduct additional research in the UK.14

The main rationale for policies that encourage innovation is that markets fail to provide sufficient incentives for investment in research activities, which generate benefits not only to the individuals and firms carrying them out but also to third parties who do not bear the associated costs. In relation to patents, the largest source of external benefits will be associated with the creation of the underlying technology. However, Patent Boxes are not targeted at research but at the income that results many years after the discovery of a commercially valuable technology. Indeed, the granting of a patent is designed to ensure that the firm can capture the returns to a successful invention. Once the patent is in place, the firm faces the correct incentives to maximise the income stream from the technology. That a Patent Box may increase activities aimed at commercialising and creating additional income from a technology does not in itself represent an adequate justification for government policy. In addition, to the extent that a Patent Box entails reducing the tax rate for activity that would have occurred in the absence of government intervention, the policy includes a large deadweight cost. Meanwhile, important external benefits may also arise from relatively unsuccessful research: not all research leads to large income streams, and even failed research provides lessons that others can learn from.

Patent Boxes may spur some new innovation and incentivise firms to create more patentable technologies. This may produce benefits for the

¹³ Paragraph 4.40 of HM Treasury, *Pre-Budget Report 2009*, December 2009 (http://www.hm-treasury.gov.uk/prebud_pbr09_repindex.htm).

¹⁴ For a full discussion of these issues, see section 10.2 of R. Griffith and H. Miller, 'Support for research and innovation', in R. Chote, C. Emmerson and J. Shaw (eds), The IFS Green Budget: February 2010, Commentary 112, Institute for Fiscal Studies (http://www.ifs.org.uk/budgets/gb2010/10chap10.pdf).

UK. However, while patents and the inventors who create the underlying technology are often co-located and the tax system can encourage firms to locate intellectual property alongside real activity, ¹⁵ it is not clear that a UK Patent Box would incentivise firms to conduct any additional research activities in the UK. Assuming the UK abides by European law and operates a Patent Box in a similar fashion to the Benelux countries, eligibility criteria for inclusion in the Patent Box could not include restrictions that patentable technologies be created in the UK. It would therefore be possible to hold patent income in the UK without co-locating any associated real activity. Indeed, there is an increasing trend towards holding intellectual property separately from both production and research. In addition, the time lags and uncertainty inherent in creating a patentable technology will likely mute the incentives that Patent Boxes provide to increase investment in research.

Benefits to the largest patentees

The largest share of the tax savings entailed in a UK Patent Box would accrue to those firms with the largest taxable profits attributable to patents. The distribution of patent holdings is highly skewed: the majority of patent applications are filed by a small number of firms. Consider the patent applications filed by UK-based applicants, i.e. those that would most likely be eligible for the Patent Box (see Table 1).

In the five years from 2001 to 2005, UK-based companies filed a total of 14,313 patent applications to the European Patent Office (EPO). The five largest filers – Unilever plc, GlaxoSmithKline, BT Group plc, Rolls-Royce plc and QinetiQ Limited – accounted for 20% of this total. These are also likely to be the firms that are most able to commercialise patented technologies and generate large revenue streams.

¹⁵ In particular, CFC rules may exempt offshore subsidiaries from tax in the home country if a sufficient amount of real activity is conducted alongside intellectual property holdings. In addition, countries operate transfer pricing rules which determine the size of the payments that can be made to a low-tax country for the use of intellectual property held there. This prevents large payments to subsidiaries that do nothing more than own and collect income from a patent and again encourages colocation with real activity.

Table 1. Patent applications made by UK-based companies

	Number of	Percentage of	Percentage of
	EPO patent	EPO patent	inventors
	applications	applications	in the UK
	made by UK	made by UK	
	applicants	applicants	
Five largest filers	(1)	(2)	(3)
Unilever plc	1,120	7.8%	38%
GlaxoSmithKline	713	5.0%	71%
BT Group plc	385	2.7%	90%
Rolls-Royce plc	349	2.4%	95%
QinetiQ Limited	271	1.9%	98%
Total of top five	2,838	19.8%	

Notes: Patent applications are those made to the European Patent Office (EPO) with an application priority date in 2001–05. The table shows patent applications where the applicant is based in the UK (regardless of where the parent firm is based). In total, UK-based companies filed a total of 14,313 patent applications to the EPO; percentages in column 2 are relative to this total. Column 3 shows the percentage of all the inventors who created the patent applications in column 1 who were located in the UK.

Source: Authors' calculations using the EPO Worldwide Patent Statistical Database, PATSTAT.

Patent Boxes in other European countries will make holding patents outside of the UK more attractive for large firms. A UK Patent Box may help to ensure that firms continue to hold patents in the UK or even hold more there. However, as highlighted above, it is less clear what effect this would have on the level of research conducted in the UK. A significant share of the patent applications held by some UK firms are created by offshore inventors. The location of the inventors provides a better indicator of where the research activity was conducted than the location of the firm making the patent application (see column 3 of Table 1).

In summary, much of the tax benefit will accrue to a small number of firms and possibly for patents resulting from research conducted outside the UK.

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¹⁶ The figures in Table 1 show the patent applications of UK-based companies. When considering all of the applications of UK multinationals – including those filed from offshore subsidiaries – an even greater proportion are created by inventors outside the UK.

5. Conclusions

The taxation of intellectual property is currently receiving a great deal of policy attention. This has arisen in part because the income associated with intellectual property is highly mobile and governments have been grappling with how to prevent firms from shifting income offshore with a view to reducing tax payments.

The UK government has been considering how to amend its Controlled Foreign Company (CFC) regime following the move to an exemption system for the taxation of foreign-source income. Intellectual property is an important part of this. In addition, Patent Boxes, which explicitly make some countries more attractive locations for patent income, now operate in a number of European countries.

As a result, there is interest in knowing how firms' decisions over where to locate intellectual property are affected by corporate taxes. Broadly, firms' location decisions will be affected by a number of elements of the corporate tax system, including statutory rates and how governments tax foreign-source income.

Griffith, Miller and O'Connell (2010)¹⁷ estimate a model of firm behaviour that accounts for the important interactions that exist between tax jurisdictions as a result of CFC regimes. We use this model to simulate the effect of introducing Patent Boxes. We show that where firms choose to hold patents is affected by corporate tax and that Patent Boxes can be expected to attract patent income.

We find that Patent Boxes will reduce tax revenues: even in the countries introducing Patent Boxes, the increase in patent holdings is not sufficient to outweigh the lower rate of tax levied on each patent. There are potentially important interactions between Patent Box regimes and CFC regimes that could influence the impact of tax reforms.

The introduction of Patent Boxes raises questions relating to tax competition in Europe and whether governments are engaging in a 'race to the bottom' in an attempt to attract mobile patent income. The issue of tax competition is especially pertinent given that using a Patent Box to attract patent income may have little effect on the amount of research conducted

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¹⁷ R. Griffith, H. Miller and M. O'Connell, 'Corporate taxes and the location of intellectual property', Institute for Fiscal Studies, mimeo, 2010.

in a country. We highlighted that for the UK to be better off under a Patent Box, there would need to be substantial benefits, over and above tax revenue, that accompany patent income. The majority of such benefits would stem from the research activity underlying the creation of patentable technologies.

Firms can and do separate patent income from the underlying research. At present, many patents are held alongside research activities. However, firms are increasingly choosing to hold intellectual property separately from both production and research. Patent Boxes may accelerate this change: looking forward, firms may be more likely to separate income from real activity in the face of greater tax incentives for mobile income.