

## ATTACHMENT A

### Literature Summary of recent Patent Box related papers

Alstadsæter, A., Barrios, S., Nicodeme, G., Skonieczna, A. and Vezzani, A. (2015). *Patent Boxes Design, Patent Location and Local R&D*. Taxation Papers Working Paper, No. 57-2015

Luxembourg: Publications Office of the European Communities.

[http://ec.europa.eu/taxation\\_customs/resources/documents/taxation/gen\\_info/economic\\_analysis/tax\\_papers/taxation\\_paper\\_57.pdf](http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/tax_papers/taxation_paper_57.pdf)

In a 2015 European Commission taxation working paper Alstadsæter et al. (2015) examined the use of patent boxes by the global top 2,000 corporate R&D investors. This sample covers firms from the pharmaceutical, automotive, and information and communications technology (ICT) industries, and accounts for approximately 90% of all global R&D spending. This is the first empirical study to review the impact of patent boxes on patent filing location and local inventorship. It considers both tax and non-tax features of patent box regimes that may impact influence levels of both patent filing and local R&D activity. This incorporates data from 33 countries, including 12 countries that have implemented patent boxes, covering the period 2000-2011. Analysis has been done using an econometric method that links the number of patents registered in a country by each company by patent, technology and company characteristics. The results cover the financial advantage generated by patent box regimes, the impacts of patent quality and characteristics of the individual patent box regime, and the effect that patent boxes have on local innovative activity.

The report concludes that many current patent box regimes are being primarily used to create a tax advantage for the beneficiary, with very limited effects on levels of local R&D activity. This tax attractiveness is shown to increase in jurisdictions where patent box regimes have a broader scope. The report further shows that, where a requirement is imposed for real research activity in the patent filing jurisdiction, there is a real potential to mitigate the tax effect while raising local inventorship. The report's four main findings are that: 1) patent boxes have a strong effect on attracting patent filings, predominantly due to the favourable tax treatment they receive, although there is some variation by industry sector and patent quality. 2) High-quality patents (as defined by value) are more influenced by patent box tax advantages than patents of lower quality. 3) In the majority of cases, the existence of patent box regimes provides an incentive for multi-national companies to shift the location of their patents, but there is no corresponding growth in levels of local inventorship, or shifts in the locality of research activity. 4) Where development conditions have been imposed, these appear to counter the primary taxation advantage effects, while still encouraging local inventorship.

Bradley, S., Dauchy, E. and Robinson, L. (2015). *Cross-Country Evidence on the Preliminary Effects of Patent Box Regimes on Patent Activity and Ownership*.

[http://works.bepress.com/cgi/viewcontent.cgi?article=1017&context=sebastien\\_bradley](http://works.bepress.com/cgi/viewcontent.cgi?article=1017&context=sebastien_bradley)

In this paper, the authors evaluate the initial effects of patent box regimes against their objectives of stimulating domestic innovation and retaining mobile patent income to limit tax base erosion. The authors conduct a cross-country econometric test of the hypothesis that patent box regimes increase patenting activity, with a focus on the location and types of patenting activity that may increase along with the potential barriers that may prevent the intended outcomes from being reached. The research finds that patent boxes may increase new patenting activity by three percent for each percentage point decrease in taxation, but that patent boxes have been relatively unsuccessful in preventing the relocation of R&D activity. The authors also note that patent box regimes are in their infancy, and an increase in patenting activity is most likely to be attributed to the patenting of pre-existing unprotected IP, given the lead times for R&D activity and product development. They suggest that patenting increases may be a result of license shifting by co-located patent owners.

D'Andria, D. (2014). *Taxation and incentives to innovate: a principal-agent approach*. Jena Economic Research Paper No. 2014-028. <http://www.econstor.eu/handle/10419/108535>

In his study, the author conducts empirical research using an econometric model based on earlier work conducted by Hellman and Thiele. In this model the principal is the owner of a firm who can pay the agent, with compensation being a variable amount based on factors which the principal cannot directly observe. The agent is a worker who can either exploit past knowledge in a known job task or attempt to create new knowledge, and with some degree of freedom to choose how their effort is expended between these tasks. The model considers taxation variables that directly affect either principal or agent. Data analysis assumes a pre-existing tax incentive for R&D activity in the form of a patent box. The author finds that innovation is fundamentally an outcome from personal effort by the agent, and that reducing labour income taxation on profit sharing schemes may complement tax incentives for corporate profits. The author concludes in part that patent box schemes foster innovation only when external constraints are the only obstacle faced by firms. If there are also internal constraints to innovation, then mixed corporate and employee taxation reductions are likely to be more effective than corporate tax incentives alone.

de Rassenfosse, G. (2014). *Patent Box Policies: a Review of the Economic Literature*. Melbourne Institute Report for the Department of Industry, Innovation and Science. 2014-0829. <http://www.industry.gov.au/Office-of-the-Chief-Economist/Publications/Documents/Patent-Box-Policies.pdf>

In 2014 a report for the Department of Industry, Innovation and Science was completed by the Melbourne Institute. Its aim was to review the literature on patent box policies and discuss the likely impacts of adopting a patent box in Australia. The paper reviews the literature and notes that over a dozen countries have adopted patent box policies, with two different objectives: attracting mobile IP income (e.g., Hungary); and incentivising innovation (e.g., Belgium). A policy aimed at attracting mobile IP income is a winner-takes-all policy and therefore requires an aggressive lowering of the headline tax rate. In addition, it opens the door to a fiscal race to the bottom as more and more countries seek to offer patent box

regimes. Regarding the latter objective, there are no solid theoretical or empirical grounds for claiming that patent box regimes induce more innovation. The researcher suggests that the implementation of a patent box policy will certainly increase the number of patent applications filed at IP Australia, noting the propensity to patent of Australian firms is low by international standards, but states that most of these additional patent applications are likely to be opportunistic (i.e., inventions that would previously have been kept secret will be patented) and will not be tied to real economic activity (i.e., the risk is high that R&D leading to these patent applications is performed abroad). The author states the most important cost associated with the implementation of a patent box regime is a fall in tax revenues collected from innovative companies. Since the fall is likely to exceed revenues collected from (re)allocation of IP income to Australia, the overall return of a patent box regime is likely to be negative.

Evers, L., Miller, H. and Spengel, C. (2013). *Intellectual Property Box Regimes: Effective Tax Rates and Tax Policy Considerations*. ZEW Discussion Paper No. 112. <http://ftp://ftp.zew.de/pub/zew-docs/dp/dp13070.pdf>

In this paper, the authors review the IP box regimes in place in 11 European jurisdictions, measure their taxation and capital effects using econometric analysis, and consider design features and incentives. The authors find that there are two types of IP boxes: those that require IP to be self-developed or substantially further developed, and those that allow IP income to be claimed without requiring any original R&D activity, with the second type generally proving to be more attractive for mobile international investments, while the former are more likely to incentivise R&D activity placed within that jurisdiction. The research concludes that in countries that have significant innovation bases, IP boxes are likely to lead to significant taxation revenue losses. Given that numerous European jurisdictions have introduced IP boxes, the authors also conclude that the benefits of an individual country's response is likely to be minimised by the response of other governments, leaving all countries worse off. The authors further note that the policy design of many IP boxes means that governments share the risk associated with new innovation investments by making expenditures tax deductible, but reduce their ability to share in any returns by minimising the tax levied on profits. They also find that patent boxes tend to have the effect of subsidising otherwise unprofitable or unviable projects. Overall, the authors conclude that IP boxes are poor policy instruments for incentivising R&D because they target the income resulting from successful projects, rather than the underlying innovative activity.

Graetz, M. and Doud, R. (2013). Technological innovation, international competition and the challenges of international income taxation. *Columbia Law Review*, 113, pp. 347-445. <http://columbialawreview.org/wp-content/uploads/2013/03/Graetz-Doud.pdf>

In this review article, the authors consider the economic and econometric evidence on the effectiveness and soundness of various R&D incentives, including patent box regimes, and make recommendations on the ways in which the United States might respond to international income tax challenges to the promotion of technological innovation. The authors note that the economic evidence on the effectiveness of patent boxes is limited,

given the relative newness of these regimes. They conclude that despite the popularity of patent box incentives, their effectiveness remains unclear. While there is some evidence that patent box incentives increase employment and production, and increase R&D and IP income (resulting from shifts from other jurisdictions), there are also considerable difficulties in assessing their efficacy and cost-effectiveness. The authors also compare the Australian R&D tax regime. They note the relative lack of concern in Australia with income-shifting, and infer that this may be due to Australia's integrated corporate taxation system, whereby franked dividends are paid to shareholders. They continue to state that because companies already pay a low-tax or tax-free dividends, there is considerably less incentive to erode their domestic tax base, unlike U.S. companies. The authors conclude that widespread calls for the adoption of a United States patent box regime are largely a response to European policy measures. However, the legal constraints faced by Europe do not apply to the United States, and the adoption European models are unlikely to succeed. Based on the economic evidence, they consider that such is model is largely unjustified for the United States.

Griffith, R., Miller, H. and O'Connell, M. (2010). *Corporate Taxes and Intellectual Property: Simulating the Effect of Patent Boxes*. IFS Briefing Note No. 112.

<http://www.ifs.org.uk/bns/bn112.pdf>

This article studies the effects of introducing patent boxes, including considerations of other tax policy arrangements. The authors use an econometric model to assess the effect of corporate taxes on choice of patenting location. Results suggest that patent boxes lead to movement of patent holdings towards countries with patent box regimes and away from those that do not. However, these benefits are unevenly distributed to the largest patentees. The authors find that patent box regimes have an overall negative effect on tax revenue despite encouraging patent holdings in a country. 2010 predictions from the UK Treasury indicate that the introduction of a UK patent box would cost £1.1 billion a year in foregone tax, and the authors question whether sufficient additional benefits can be found to offset this loss. The authors conclude that patent boxes raise serious questions relating to tax competition, with governments effectively engaging in a race to the bottom. They further conclude that patent boxes do not necessarily induce research and development, and that patent boxes may speed the trend for firms to separate patent income from underlying R&D activity, because of the increased tax incentives for mobile income.

Griffith, R., Miller, H. and O'Connell, M. (2014). Ownership of intellectual property and corporate taxation. *Journal of Public Economics*, 112, pp. 12-23.

<http://www.sciencedirect.com/science/article/pii/S0047272714000103>

This paper addresses how influential corporate income taxes are in determining where firms choose to patent. Using data from the European Patent Office from 1985 to 2005, the authors use an econometric model to determine the impact of policy reforms on the location of intellectual property. Importantly, in reviewing the patent box regimes of the Benelux countries (Belgium, Luxembourg, and the Netherlands) and the United Kingdom, the authors comprehensively demonstrate that the increase in tax revenue from a greater

number of patents in each country is not offset by the reduced tax revenues from patent box tax breaks. Across all new patent filings, IP taxation revenue decreases by 50-71% of pre-reform levels. When focusing on a smaller set of 'high quality' patents, the results are similar, with tax revenues ultimately decreasing between 45-62% following patent box introduction. The flow-on effect of patent box introduction in other jurisdictions is significant. For example, IP tax revenues for high-quality patents in the United Kingdom decreased by 10% after the introduction of the Benelux patent box. However, the introduction of the UK patent box is far more profound, with revenue decreasing to 38% of pre-reform levels. Similar statistics are demonstrated for the Benelux countries. The authors conclude that corporate tax rates are important in determining choice of patenting jurisdiction, but that other factors are also influential. This includes a propensity to co-locate R&D and patenting activity, as well as other non-tax factors.

Hervás, F., Siedschlag, I. and Tübke, A. (2014). *Boosting the EU's attractiveness to international R&D investments: What matters? What works?*. JRC Policy Brief.

<https://www.esri.ie/pubs/OPEA134.pdf>

This Policy Brief is a literature review that considers both survey and econometric research on trends in internationalisation of European R&D activities, and the factors that drive the choice of location. It then considers the implications for European research and innovation policies. Based on the evidence, the authors suggest that to increase international investment in R&D, a combination of policy measures is needed to enhance the knowledge base of locations and tailor investment promotion policies to investors from many jurisdictions. The authors also note that while governments predominantly focus on fiscal incentives, both European and United States businesses consider this the least important factor when making decisions on the location of R&D investment. The authors conclude that a comprehensive policy approach is more appropriate, with a focus on improving national and regional innovation systems to: increase the quality of educational systems and skills; foster regional innovation capacity; promote entrepreneurship and R&D-friendly cultures; facilitate R&D clustering; encourage R&D investment by locally-based companies.

Siedschlag, I., Smith, D., Turcu, C. and Zhang, X. (2013). What determines the location choice of R&D activities by multinational firms?. *Research Policy*, 42(8), pp. 1420-1430.

<http://www.sciencedirect.com/science/article/pii/S0048733313001078>

This research examines questions around the location of R&D by multinational firms, who the main foreign investors in R&D are, and what factors drive R&D location choices. The authors use an econometric model to analyse data on location decisions by European and American headquartered multinational enterprises from 1999 to 2006. The authors find that the probability of a firm locating R&D activity in a region is dependent on that region's knowledge base, as measured by human capital, proximity to centres of research excellence, and research and innovation capacity, while market potential, employee compensation levels and unemployment rates are not significant. The authors also found that corporate taxation rates are not significant in attracting R&D activity to a particular region, partially because multinational enterprises locate foreign subsidiaries in multiple regions, and

taxation is optimised on a global, rather than regional, basis. The authors conclude that policy initiatives to increase a region's knowledge are more likely to increase that region's attractiveness to foreign R&D investors. They further conclude that clustering of R&D foreign affiliates outweighs competition effects, and that given the behaviours of foreign investors are not uniform, greater successes may be achieved by implementing differentiated policies that are tailored to the targeted partner country.