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Patent Boxes: A Primer

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Summary

Economists generally agree that government support for private investment in research and development (R&D) is useful in correcting a market failure that predisposes most companies to invest less for that purpose than the overall economic benefits from R&D investments would warrant. The market failure stems from a company's inability to capture all the returns to its R&D investments as a result of the spillover effects of successful R&D investments.

Most governments offer some kind of support for R&D, including tax incentives for business R&D investments. The U.S. government provides a tax credit for qualified research under Section 41 of the federal tax code and a full expensing allowance for qualified research expenditures under Section 174, but no patent box.

As part of the debate in Congress over reforming the federal income tax, some have expressed support for the adoption of a patent box. Such a box is a tax subsidy that applies to the returns to successful R&D investments. In effect, a patent box partially compensates companies for the returns that spill over to other actors, such as competing companies.

Countries typically adopt patent boxes with three key goals in mind: (1) increasing tax revenue by encouraging the repatriation of intellectual property (IP) held abroad and discouraging domestic companies from transferring IP to foreign subsidiaries in low-tax countries; (2) expanding domestic innovative activities; and (3) stimulating growth in domestic high-paying jobs.

Every patent box now in use is built around two key elements: the nature of the tax subsidy it offers and the scope of its application. The tax subsidy typically comes in two forms: a deduction or exemption from a company's gross income or a separate, preferential tax rate for qualified intellectual property (IP) income. A patent box's scope addresses such issues as the kinds of IP and IP-related income that qualify for the tax subsidy.

At the end of 2015, 16 countries offered a patent box; all but three of them were members of the Organization of Economic Cooperation and Development. Among the nine largest patent-box countries as a location for business R&D investment, effective patent-box tax rates ranged from 5.0% to 17.1%. Each patent box applied to existing and new patented innovations. Only one of the nine countries did not offer separate tax incentives for domestic R&D investment.

It stands to reason that the industries most likely to benefit from patent boxes are those that use patents intensively. According to a 2016 report by the U.S. Patent and Trademark Office and the U. S. Department of Commerce, two industries are the most intensive users of patents, as measured by the number of patents granted to them per 1,000 full-time employees: chemical manufacturing (including pharmaceuticals) and computer and electronic equipment.

The prospect of the United States adopting a patent box raises several policy issues. One issue concerns the effectiveness of patent boxes in achieving their goals. The empirical literature on patent boxes is relatively meager, since most existing patent boxes have come into use since 2007. Nonetheless, a handful of academic studies have looked at the actual or probable effects of patent boxes on several indicators of success. They found that patent registration was responsive to cuts in tax rates on the income from patents; there is no evidence that patent boxes increase host-country revenues; and patent boxes have done little to boost investment in innovation in host countries.

Patent boxes also raise questions about the cost to companies of complying with the rules and the cost to tax authorities of issuing regulations and enforcing them; whether a patent box is warranted on economic grounds; and their incentive effect, especially when coupled with R&D tax incentives.

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Introduction

If most economists can agree on anything, it is that technological innovation is a primary engine of long-term rises in living standards and economic output. In theory, new technologies make workers more productive, and gains in productivity lift their incomes over time, enabling them to buy more goods and services. The scope and pace of innovation depend on numerous forces, one of which is public and private investments in research and development (R&D), which is widely regarded as the lifeblood of innovation.

To create, bolster, and sustain a favorable domestic climate for technological innovation, most developed countries employ a variety of policies to raise R&D investment. Most of the same countries provide tax incentives for business R&D investment, such as tax credits or enhanced deductions for R&D expenditures. These incentives are intended to encourage companies to invest more in R&D than they otherwise would. Many economists and lawmakers believe that left to their own devices, companies as a whole would be likely to invest less in R&D than its overall economic (or social) benefits would warrant. This is because the average company has little chance of capturing all the returns from such an investment, even in the presence of legal protection of intellectual property rights.

The U.S. government offers two tax incentives for R&D investment: a tax credit under Section 41 of the federal tax code and the option to expense qualified research expenditures under Section 174. Available evidence suggests that the credit has stimulated more private R&D investment than companies as a whole would have done on their own. It is unclear, however, what effect the expensing option has had on investment. What is clear is that companies that are able to benefit from both incentives face a negative effective tax rate on the returns from investing in qualified R&D above some base amount.

The Section 41 tax credit has its critics, however. Some argue that whatever gains in R&D investment can be attributed to the credit have come at a considerable cost: subsidizing R&D that tends to yield little or no social returns, or R&D that generates few or no patented innovations. Critics also maintain that the credit provides too weak and unreliable an incentive, on average, to have its intended effect. Making matters worse, say critics, much of the profit earned from the use of patented innovations developed with the aid of the credit has been shifted to lower-tax countries in recent years, depriving the U.S. government of tax revenue from the commercial exploitation of these innovations. Major American-based multinational corporations (such as Apple, Microsoft, and Google) are thought to have saved billions of dollars in income taxes by transferring ownership of patents they developed in the United States to subsidiaries in low-tax countries such as Ireland, Luxemburg, the Netherlands, and the United Kingdom.

In light of these concerns with the Section 41 tax credit and uncertainty about the effectiveness of the Section 174 expensing option, some argue that a better way to spur increased domestic investment in innovation is to adopt a different kind of tax subsidy altogether; one that would target the profits from business R&D investments instead of the cost of inputs: a patent box (which is also known as an innovation or intellectual property (IP) box).[1] By the end of 2015, 15 countries had implemented such a tax incentive. In general, a patent box imposes a lower tax rate on the profits companies earn from the commercial use of patented innovations than the top

[1] In current usage, innovation or IP boxes tend to cover more than patents and related forms of IP. So a typical such box would cover trademarks and copyrights as well. This report focuses on tax incentives for booking qualified patent income in a host country. As such, the incentives apply to intangible assets related to the development of new goods and services and ways of producing them, such as patents, inventions, formulas, knowhow, and processes.

corporate tax rate in the host country. Countries have adopted patent boxes in the hope that they will stem the transfer of qualified IP to low-tax countries, increase the domestic tax base in the host country through the transfer of qualified IP held in other countries, boost domestic investment in innovative activities, and create sizable numbers of well-paying jobs. The United States currently has no patent box.

Tax reform is a high priority in 115th Congress. Such a complex and difficult issue raises many questions that lawmakers may have to answer in order to agree on a bill. One question concerns how to reform the taxation of business income.

In recent Congresses, some lawmakers publicly backed the enactment of a patent box (or something similar) to foster greater domestic R&D investment and greater domestic production and use of the technologies derived from that investment. For example, in July 2015, Representatives Richard Neal and Charles Boustany released a draft proposal that would allow corporations to deduct 71% of their profits from "patents, inventions, formulas, processes, knowhow, computer software, and other similar intellectual property, as well as property produced using such IP." This meant that companies whose profits normally are taxed at a top rate of 35% would have their profits from this IP taxed at a rate of 10.15%. Interest in such a proposal could re-emerge in the 115th Congress as part of broader efforts to craft politically viable legislation to reform the federal income tax, especially the parts dealing with the taxation of international business income. Some lawmakers contend that Congress should act quickly to offset the tax advantages that some European nations have gained by adopting a patent box.

This report looks at several aspects of patent boxes, including their general purpose. In addition, the report looks at the key considerations in designing a patent box, identifies the countries that currently have a patent box, describes the main elements of those boxes, and sheds light on the U.S. industries that would be likely to benefit the most from such a tax subsidy if the United States were to adopt one. The final two sections discuss what is known about the effectiveness of patent boxes and several other policy issues raised by patent boxes. The report is intended to complement a 2016 CRS report on the "expected effectiveness" of patent boxes.[2]

What Is a Patent Box?

In general, a patent box is a tax break for business income arising from the commercial exploitation of qualified IP. The break consists of taxing a company's qualified IP at a relatively low rate. This reduction in taxation can be achieved directly by imposing a low tax rate on a company's income from royalties or licensing fees related to eligible IP or from the sale of such property, and indirectly by imposing the same low rate on the income a company receives from the sale of goods and services with embedded IP owned by the company. Existing patent boxes seek to promote one or more of the following aims: (1) increase tax revenues by luring IP income to a host country from abroad or keeping such income inside the host country, (2) prevent or stem a shrinkage in the host country's tax base from the transfer of intangible assets to other countries, (3) expand investment in innovation in a host country, and (4) stimulate growth in the number of well-paying jobs in a host country.

A patent box gets its name from the box on an income tax form that companies check if they have qualified IP income. And as its name implies, the tax incentive applies exclusively to the income from patented innovations. Some countries with a patent box apply it to income from IP that has

[2] See CRS Report R44522, *A Patent/Innovation Box as a Tax Incentive for Domestic Research and Development*, by Jane G. Gravelle.

nothing to do with the development of new products and processes, such as trademarks and copyrights. Because they are broader in scope than a patent box, some refer to these tax incentives as innovation or IP boxes. Since all but one of the actual patent boxes examined in this report apply to income from patented innovations, it will refer to them as a patent box, even though some of them do cover IP other than patents.

For reasons both theoretical and practical, most developed countries have adopted a variety of policies to encourage greater domestic investment in technological innovation, including tax incentives. R&D tax incentives basically come in two forms: (1) those that operate at the back-end of the innovation process by lowering the after-tax cost of key inputs into R&D such as direct labor and materials and (2) those that operate at the front-end of the process by lowering the tax burden on the returns to successful R&D investments. Tax credits or enhanced deductions for R&D expenditures exemplify the former incentive, while a patent box is a good example of the latter incentive.

At the end of 2015, 16 countries provided some kind of patent box.[3] All but two of those countries (Israel and South Korea) were European. In addition, five of the countries (Belgium, Hungary, Malta, Turkey, and the United Kingdom (UK)) provided both a tax credit and super-deduction for qualified R&D expenditures; three countries (Lichtenstein, Luxembourg, and Switzerland) provided no other R&D tax incentive, and the remaining eight countries (France, Ireland, Israel, Italy, Netherlands, Portugal, South Korea, and Spain) provided either a tax credit or a super-deduction.

What Are the Key Elements of a Patent Box?

Many considerations enter into the design of a patent box. They can be reduced to three key elements: (1) the nature of the tax incentive, (2) the IP that qualifies for this preferential tax treatment, and (3) the income to which the tax incentive applies. Each is examined below.

Nature of the Tax Incentive

At the core of every patent box lies a tax incentive. There are two basic options among the patent boxes now in use. One involves taxing a company's qualified income from qualified IP at a lower rate than other sources of income. For example, a company's qualified IP income is taxed at 10%, while all other sources of income are taxed at 20%.

Under the second option, a company would be allowed to deduct a specified percentage of its qualified IP income from its total income. In this case, the effective tax rate on the IP income is the product of the company's marginal tax rate and the percentage of that income subject to taxation. For instance, if a company's income is taxed at a marginal rate of 35% and 80% of its income from qualified IP may be deducted from taxable income, the company's effective tax rate on that income is 7%: (0.35 X .20) = .07.

Qualifying Intellectual Property

IP that qualifies for a patent box has several dimensions, which are illustrated in current patent boxes.

[3] PwC, Global R&D Incentives Group, *Global Research & Development Incentives Group*, February 2016.

First and foremost, IP qualifies for a patent box only if it is registered and held in the host country.

Second, a variety of IP can be eligible for a patent box. Current patent boxes apply to patented inventions in 15 of the 16 countries that have one; Israel is the lone exception. In Belgium, France, and the UK, the patent boxes apply to patents, supplementary protection certificates (which come into force after the patents on which the certificates are based expire), and closely related rights. Patents and software copyrights are eligible for the patent boxes in Turkey, Portugal, the Netherlands, Malta, South Korea, and Ireland. But the patent boxes in Hungary, Italy, Lichtenstein, Luxembourg, Spain, and Switzerland apply to patents and most other forms of IP, especially trademarks, copyrights, formulas, and industrial designs.

Third, where IP was developed can make a difference. Qualified IP may be developed outside the host country (subject to varying conditions) in 15 of the 16 countries with patent boxes[4]; only Turkey requires that qualified IP has to be developed through R&D activities conducted there.

Fourth, not all qualified IP must be developed after the enactment of a patent box. Acquired IP qualifies for the patent boxes (subject to varying conditions) in each of the 16 countries except Israel, Portugal, and Turkey.[5] In addition, the patent boxes of France, Hungary, Ireland, Italy, South Korea, Malta, Spain, Switzerland, Turkey, and the UK apply to IP that existed before the boxes were enacted.

Qualifying Income

A third key element of a patent box is the income to which it applies. This too varies among current patent boxes.

A patent box may or may not apply to income from the following sources: (1) royalties (including embedded and notional), (2) licensing fees, (3) gains on the sale or other disposal of qualifying IP, (4) the sales of goods and services incorporating qualifying IP, and (5) patent infringement awards.

A patent box may also apply to gross or net income from the use of qualified IP. This consideration matters because the effective rate of a patent box depends in part on how the expenses incurred or paid in earning qualified income are treated for tax purposes. Of particular importance is whether those expenses are deductible against IP income only or may be used instead to reduce a company's gross income, which in every country that has a patent box is taxed at a higher rate than IP income. Those expenses can be current or previous charges. Current expenses include marketing and other administrative costs related to improving and financing qualified IP, while previous charges concern past R&D expenses attributable to the same IP. Consequently, patent boxes that apply to gross IP income tend to lower the income tax burden for companies with IP and substantial non-IP income more than do patent boxes that target net IP income.

The 16 countries that offered patented boxes at the end of 2015 were evenly divided between targeting gross and net IP income. Belgium, Hungry, Israel, South Korea, Luxembourg, Malta,

[4] For example, In Belgium, a patent developed outside the country qualifies for the patent box only the development work was performed by a Belgian-based company or a foreign-based company with a permanent subsidiary in Belgium.

[5] Acquired eligible IP qualifies for the patent boxes in Belgium and the Netherlands if the owner further develops it. Only the value added by the owner is eligible for the preferential tax treatment for IP income.

Portugal, and Switzerland used gross income as the tax base for their patent boxes, whereas France, Ireland, Italy, Lichtenstein, the Netherlands, Spain, Turkey, and the UK taxed net income.

In four of the 16 countries, the patent-box preferential rate covers royalty payments only: Hungary, South Korea, Luxembourg, and France. The others apply their patent boxes to a broader range of IP income sources.

Key Questions in Designing a Patent Box

Lawmakers interested in adopting a patent box might consider the following questions, which address a variety of significant issues in the design of such a tax incentive:

- Should a patent box apply to income from patents only, or should it include income from other kinds of IP as well?
- Should a patent box cover embedded and notional IP royalties and, if so, how should they be measured?
- Should qualifying IP income include patent infringement awards?
- Should a patent box cover new IP income only or should it apply to income from existing IP as well?
- Should a patent box apply to self-developed IP only, or should it also cover acquired IP, and if so, under what conditions?
- Should a patent box apply only to IP developed in the host country, or should it also cover IP developed outside the country but held within it?
- Should the expenses paid or incurred to develop a patented innovation be allocated against gross IP income, or should they be deducted from a company's gross income from all sources, thereby boosting the effective rate of a patent box?
- Should a patent box take the form of a lower rate for qualified IP income or a deduction or exemption against a company's total income?
- Should the annual benefit a company derives from a patent box be capped?
- Should a patent box allow a credit against a company's tax liability for foreign withholding taxes paid on its foreign-source royalties?

Which Countries Have Patent Boxes and What Are Their Key Features?

Of the 16 countries that offered a patent box at the end of 2015, all but three were members of the Organization of Economic Cooperation and Development (OECD). Not all of those OECD countries, however, are also locations for substantial investments in business R&D. In the ongoing debate over whether the United States should adopt a patent box, some lawmakers may find it useful to know which patent-box countries are among the leading locations for business R&D investment. Arguably, those countries might serve as better role models for the United States in the design of a patent box than patent-box countries where relatively little business R&D investment occurs.

Table 1 compares key elements of the patent boxes currently offered by nine OECD countries. Five of the countries (France, Netherlands, South Korea, Turkey, and the UK) provide a

preferential tax rate for qualified IP income; the others (Belgium, Italy, Spain, and Switzerland) offer either a deduction or exemption for that income

Each country can be considered a significant location for business R&D investment among OECD countries. Business R&D expenditures exceeded $7.8 billion in each country in 2012, the most recent year for which figures are available for all nine countries.[6] Their combined business R&D investments that year totaled $167.0 billion, or 55% of the amount for the United States and 23% of the amount for all OECD countries.

Table 1. Patent Boxes in OECD Countries with Substantial Business Investment in Research and Development

Country	Nature of Patent Box Tax Incentive	Qualifying Property	Qualifying Income	Year Enacted	Cap on Annual Benefit
Belgium	Deduction equal to 85% of qualifying income. It lowers the effective tax rate for that income to 5.1%. The corporate tax rate is 33.99%. (Until June 30, 2016, the deduction was equal to 80% of qualifying income.)	Patents and supplementary protection certificates, breeders' rights, orphan drugs, data and exclusivity rights, and copyrighted software. Acquired IP is eligible for the tax incentive.	Net income from royalties (including embedded royalties[a]), gains from the sale of qualified IP, process innovation income, and certain damages from infringement of qualified IP rights. Net income is adjusted by the ratio of a company's expenditures related to qualified IP (including the outsourcing of R&D to an unrelated party) to the sum of those expenditures, the cost of any acquired IP, and costs related to the outsourcing of R&D to a related party.	2007 (modified in 2017)	Deduction is limited to 100% of net patent income. If the deduction exceeds that limit, the excess may be carried forward to future tax years.

[6] Organization for Economic Cooperation and Development, *Main Science and Technology Indicators: Volume 2016/1* (Paris: 2016), Table 23, p. 42.

Country	Nature of Patent Box Tax Incentive	Qualifying Property	Qualifying Income	Year Enacted	Cap on Annual Benefit
France	Preferential tax rates of 15.5% for non-corporate businesses and 17.1% for corporations. The corporate tax rate is 33.3%.	Existing and new patents, extended patent certificates, patentable inventions, and industrial processes.	Net Income from royalties and licensing fees for patents and capital gains from the sale or transfer of patents. Embedded royalties do not qualify. The patents must be developed and registered in France or a European country. Foreign patents qualify only if France would have granted a patent for the same invention. Only IP rights owned by a French company are eligible for the preferential rates.	2001 (modified in 2005, 2010, and 2011)	None.
Italy	Exemption equal to 50% of qualifying income starting in 2017. It results in an effective tax rate for that income of 15.7%. The Italian corporate tax rate is 27.5% and the regional income tax rate is 3.9%, yielding an overall corporate tax rate of 31.4%.	Existing and new patents, trademarks, industrial designs and models, procedures, formulas, and know-how resulting from R&D conducted by Italian-based companies or the Italian subsidiaries of foreign companies. Acquired IP qualifies for the exemption, but only 30% of incurred expenses for the acquisition or licensing of the IP are covered.	Net income from qualified IP, including embedded royalties. Net income from the direct use of IP by the property owner must be determined through an Advanced Pricing Agreement with the Italian Tax Authority.	2015	50% of net income from qualified IP.

Country	Nature of Patent Box Tax Incentive	Qualifying Property	Qualifying Income	Year Enacted	Cap on Annual Benefit
Netherlands	Preferential tax rate of 5% of qualified income. The corporate tax rate is 25%. (The Dutch government has proposed that starting January 1, 2017, all companies with income eligible for the patent box cannot benefit from it unless they have R&D wage tax certificates issued by the Dutch government for R&D related to the qualifying IP.)	Internally developed and acquired patents developed or re-developed since 2007 and owned by Dutch-based companies or Dutch subsidiaries of foreign companies. Qualified IP from approved R&D projects also qualify beginning in 2008.	Net income from qualifying IP. This income includes embedded royalties and gains on the sale of qualified patents.	2007 and modified in 2010	None.
South Korea	Preferential tax rates: 5% to 11% on gains from the sale or transfer of patents to Korean nationals, and 7.5% to 16.5% on royalties. Corporate tax rates are 10%, 20%, and 22%. Small and medium-size companies are also eligible for a 25% tax credit for income from the transfer of patents, and for income from the licensing of rights to self-developed patents.	New and existing patents, utility models, and scientific technical secrets developed by small and medium-sized Korean companies.	Gains on the transfer of qualified IP by small and medium-size Korean companies to domestic companies and individuals, Royalty income earned by small and medium-size Korean companies from licensing self-developed qualified IP.	2014	Patent box benefits are subject to a minimum tax of 7% for small and medium-sized companies.

Country	Nature of Patent Box Tax Incentive	Qualifying Property	Qualifying Income	Year Enacted	Cap on Annual Benefit
Spain	Exemption equal to 60% of qualified income. It yields an effective tax rate of this income of 12%. The corporate tax rate is 30%.	New and existing patents, drawings, models, plans, secret formulas or procedures, know-how.	Net income from the transfer or licensing of qualified IP (excluding embedded royalties) multiplied by the ratio of the expenses incurred by the licensing company that are directly related to the development of the qualified IP (including those related to the outsourcing of R&D to unrelated third parties) to the total expenses incurred the by licensing company related to the creation of the IP (including those related to the outsourcing of R&D to related parties and, if applicable, the acquisition of IP).	2013	None.
Switzerland: Canton of Nidwalden only	Exemption at the cantonal level (but not at the federal level) equal to 80% of eligible income. This yields a combined federal-cantonal effective tax rate of 8.8%. In 2016, the Swiss federal corporate tax rate was 8.5%, while the cantonal corporate tax rate in Nidwalden was12.66%.	New and existing patents and comparable rights developed in Switzerland through qualifying R&D activities.	Gross income from the sale and licensing of qualified IP less income from the following sources: financing; manufacturing, trading, and other services not related to patents; routine functions; and trademarks.	2011 (modified in 2016, though the new regime is unlikely to come into effect before 2019.)	None at the federal level.

Country	Nature of Patent Box Tax Incentive	Qualifying Property	Qualifying Income	Year Enacted	Cap on Annual Benefit
Turkey	Preferential tax rate of 10% on qualifying income. The corporate tax rate is 20%.	New and existing patents developed from R&D conducted in Turkey and certified by the Turkish Patent Institute.	Net income from the sale or transfer, licensing, or marketing of inventions created through R&D performed in Turkey, and from the sales of goods and services produced in Turkey that also use qualified IP developed in Turkey. This includes compensation from the breach of a company's IP rights.	2015	None

Country	Nature of Patent Box Tax Incentive	Qualifying Property	Qualifying Income	Year Enacted	Cap on Annual Benefit
United Kingdom	For qualified IP registered before July 1, 2016, a preferential tax rate of 10% tax on net Income from the sale or licensing of qualified IP rights or an exclusive license to such rights held by companies subject to the UK corporate income tax. The corporate tax rate is 20%. For patent applications filed on or after July 1, 2016, only profits from IP developed through a company's R&D activities qualify for the patent-box tax incentive, which remains unchanged. The qualified profits depend on a company's "nexus fraction," which is the ratio of its qualified expenditures to its total expenditures for qualified IP. Qualified expenditures are a company's direct spending on R&D activities related to the development of the IP, as well as its payments for third-party R&D for the same purpose. Total expenditures consist of qualified expenditures plus its expenditures to acquire qualified IP and to support R&D related to eligible IP performed by related parties.	Patents and related know-how, trade secrets, and software copyrights. Acquired IP is eligible, provided it is further developed or actively managed by the acquiring company.	Worldwide net income from the sale of items protected by a qualifying IP right; the licensing of such a right (including embedded royalties); the sale of a qualifying IP right; infringement awards; and notional royalties from the use of a qualifying IP right.	2013 (modified in 2016)	None.

Source: PwC, *Global Research & Development Incentives Group*, February 2016; American Action Forum, *Patent Boxes, Technological Innovation & Implications for Corporate Tax Reform*, February 22, 2016; and Deloitte, *2015 Global Survey of R&D incentives*, December 2015.

a. Embedded royalties refer to payments to owners of IP (especially patents) for income from the sale of goods and services that can be attributed to the IP they contain or are derived from.

What stands out among the patent boxes in the table is the diversity in their tax incentives and scope. This diversity can be summarized as follows:

- The effective tax rates at the end of 2015 for income from qualified IP among the nine patent boxes ranged from 5.0% to 17.1%; the average rate (excluding South Korea, which was the only country among the nine that taxed corporate income at more than a single rate and for which the actual average effective rate was unknown) was 10.6%. By contrast, the average corporate rate (again excluding South Korea) for the nine nations was 25.8%.
- One country (Belgium) offered a deduction for qualified income; three countries (Switzerland, Spain, and Italy) had a limited exemption for that income; and five countries (UK, France, Netherlands, South Korea, and Turkey) applied a preferential tax rate to qualifying income.
- Belgium and Italy were the only countries that capped the amount of income that qualified for the patent box tax incentive.
- In six countries (UK, Spain, the Netherlands, Italy, France, and Turkey), the patent box targeted net IP income. As a result, affected companies had to value the tax savings from the deduction of IP-related expenses at the lower patent box tax rate. As a result, the average effective tax rates for the six patent boxes were lower than they would have been if the tax savings from the deduction of IP-related expenses were valued at the higher corporate tax rate. Gross income is the basis for the patent box tax incentive in Switzerland and Belgium.
- Six of the nine countries (Belgium, France, the Netherlands, South Korea, Spain, and Turkey) restricted the patent box tax incentive to income from patents and related forms of IP. By contrast, the Swiss, British, and Italian patent boxes applied to income from patents and certain other kinds of IP.
- Three countries (South Korea, Switzerland, and Turkey) required that qualified IP must be developed and registered inside the country. Swiss-based companies, however, could apply the Swiss patent box to income they received from acquired IP, regardless of where it was developed. Where qualified IP is developed is an important issue in the economics of patent boxes. It raises the question of whether there should be a physical link between the country offering a patent box and the R&D activities contributing to the development of qualified IP.
- In a rare display of unanimity, each patent box covered new and existing IP, bestowing a windfall benefit on qualified IP registered before the patent boxes took effect that still was earning qualified income for the rights holder.
- One country (Switzerland) offered no tax incentive for R&D investment, in addition to a patent box. Five countries (France, Italy, the Netherlands, South Korea, and Spain) provided both an R&D tax credit and a patent box. In the other three countries (Belgium, Turkey, and the UK), companies investing in eligible R&D projects could claim both an R&D tax credit and a super-deduction for qualified research expenditures; they could also benefit from the patent boxes if they had qualified IP income.

- Belgium, Italy, the Netherlands, Switzerland, and the UK all took steps in 2016 to modify their patent boxes to bring them into conformity with the main recommendations for countering or avoiding "harmful tax practices" in a report issued by the OECD in October 2015.[7] The main recommendation was to establish a guideline (known as the "modified nexus approach") for determining the maximum amount of IP income that could qualify for such an incentive. Spain's patent box included a modified nexus requirement when it was launched in 2013. Such a requirement was also a key element from the start in the patent boxes available in South Korea and Turkey. As of March 2017, France has not indicated whether it will enact a similar change to its patent box.

Which Industries Are Likely to Benefit the Most from a Patent Box?

By now it should be clear that any company that owns intellectual property is likely to benefit from a patent box. What may not be as clear is that such a company can come from a range of industries. One empirical question for lawmakers with an interest in establishing a patent box is whether some industries are more likely than others to benefit from such a tax incentive. Since investment in R&D is closely associated with the creation of patented innovations, it seems reasonable to assume that research-intensive industries, which are likely to benefit the most from research tax incentives like the Section 41 research tax credit and the Section 174 expensing allowance for research expenditures, would be likely to benefit the most from a patent box.

Is there any empirical support for this assumption? A 2012 report by the Economic & Statistics Administration at the U.S. Department of Commerce and the U.S. Patent and Trademark Office (USPTO) identified the U.S. industries that are the most intensive users of patents, trademarks, and copyrights. It also examined the contributions of those industries to certain measures of U.S. economic activity, such as total employment and exports. What the report did not attempt to do is measure the contribution of these forms of IP to the performance of the economy or of IP-

[7] The report was the final report on Action Plan 5 from the OECD's Base Erosion and Profit Shifting (BEPS) project, which encompassed a total of 15 Action reports. Action Plan 5 expanded the role of the OECD's Forum on Harmful Tax Practices (FHTP) by requiring the Forum to define "substantial activity" as a requirement for preferential tax regimes, to improve transparency through the creation of a framework for the exchange of information on taxpayer-specific rulings, and to evaluate member country preferential tax regimes according to the BEPS criteria. All OECD countries have endorsed the report and agreed to allow the FHTP to monitor and review member countries IP tax subsidies.

A key recommendation of the report was for each country to limit the amount of IP income that can benefit from a patent or innovation box to the extent that the income is connected to the company's "qualifying expenditures" in the host country. Under this method, which was called the "modified nexus approach," these expenditures had to be made by the company claiming the patent-box tax benefit, directly connected to the qualified IP asset, and similar to the expenditures that typically qualify for research tax incentives. There was no requirement that the related R&D activities take place in the host country where the qualified IP is held. Such a requirement would have violated the EU Treaty and thus unenforceable in OECD countries that are members of the EU. According to the Action Plan 5 report, only income from IP owned or licensed by a company should qualify for a tax incentive like a patent box. For any company, the amount of income from each IP asset eligible for the tax incentive should be equal to the total income for each multiplied by the company's nexus ratio, which showed the percentage of total expenses for that income accounted for by a company's expenditures for in-house R&D and R&D performed by unrelated third parties under contract. Qualified IP should be limited to patents and copyrighted software. In addition, the report specified that starting in July 2016, all patent boxes offered by OECD countries should be based on the modified nexus approach, but that pre-existing boxes could remain in effect through 2021.

intensive industries. As a result, a strong correlation between an industry's IP-intensity and its share of U.S. employment or exports did not constitute conclusive evidence that the former was a major cause of the latter. Still, the report's findings indicate which U.S. industries would be likely to benefit the most from a patent box, if the U.S. government were to adopt one.

In the 2012 report, an industry's IP-intensity was measured by its number of IP holdings in a certain period divided by its total employment. An industry was considered IP-intensive if its ratio of IP holdings to employment exceeded the average for all industries. There was nothing special about the use of industry employment as the basis for comparison. Other indicators of industry performance could also have been used, such as value added, R&D investment, and gross output.

Since existing patent boxes generally lower the tax burden on the income from patented technologies, this section focuses on patent-intensive industries only. The USPTO grants utility, plant, and design patents, which give the recipient the right to prevent "others from making, using, offering for sale, or selling the invention throughout the United States or importing the invention into the United States."[8] A utility patent protects the use of an invention and how it is made; a design patent protects an invention's appearance; and a plant patent protects plants that have been invented or discovered and asexually reproduced into a distinct and new variety of plant, excluding a tuber propagated plant or a plant found in an uncultivated condition. Utility patents of both foreign and domestic origin accounted for 91.5% of all patents granted by the USPTO in 2015, and 52.0% of all patents granted that year were foreign in origin.[9]

The USPTO organizes patents into over 450 "technology classes," according to their inventive content. It also has developed a mapping scheme (or concordance) that links each technology class to 30 industry codes under the North American Industry Classification System. Owing to the limitations of the mapping scheme, the linkages cover only utility patents and manufacturing industries. In the 2012 report, an industry's patent-intensity was measured as the ratio of the total number of patents associated with the industry from 2004 to 2008 to the industry's average annual payroll employment in that period.

This measure has several noteworthy shortcomings. First, there is no certainty that the most patent-intensive industry in a period is also the industry with the largest number of patents. Second, the measure can assign relatively low patent-intensity ratings to industries for which patents serve as critical mechanisms for appropriating the returns to investment in innovation. Such an incongruity is likely to arise in the case of an industry that has a few firms that employ large numbers of workers and invest substantial amounts in developing or acquiring patents; automobiles is a good example of such an industry. Third, the measure says nothing about the use of patents in non-manufacturing industries, which accounted for 91% of the U.S. workforce and 88% of gross domestic product in 2015.

According to a 2016 update of the 2012 report, 12 industries qualified as patent-intensive from 2009 to 2014, or one fewer than the number of industries that qualified from 2004 to 2008. The 12 industries are listed in **Table 2**, along with the data used to calculate their patent intensity.

Two industries are well-represented: chemicals (including pharmaceuticals) and electronic equipment (including computers). The ranking of the top patent-intensive industries changed somewhat from 2004-2008 to 2009-2013, but the same industries appeared in both.

[8] 35 U.S.C. § 154(a)(1).

[9] See https://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm.

There was a not a strong correlation between the industries' patent intensities and their research intensities. It is unclear from available data why that was the case. One possible explanation is that patent-intensive industries differ in their reliance on their own R&D to generate patented innovations. A majority of companies in some of these industries may have a higher propensity to acquire patents rather than to create patentable innovations through their own R&D activities. According to a 2000 study by Valentina Meliciani, research expenditures were more effective in generating patents in "science based industries" (e.g., pharmaceuticals and semiconductors) than they were in "supplier dominated and production-intensive industries (e.g., fabricated metals and aerospace)."[10] In the latter industries, innovation was driven primarily by the acquisition of capital goods incorporating advanced technologies. Another possible explanation is that some research-intensive industries have a greater propensity to not seek patents for their innovations than others are. Additional research would be necessary to uncover the actual explanation for the weak correlation between the two industry intensity measures.

Table 2. Leading Patent-Intensive Industries from 2009 to 2013

Industry	Total Patents Awarded (number)	Average Employment from 2009 to 2013 (000s)	Patent Intensity (total patents awarded to companies per 1,000 jobs)	Industry Rank in 2004 to 2008	Research Intensity in 2013 (ratio of domestic research and development paid for and performed by companies to domestic sales) (%)
Computer and Peripheral Equipment	105,476	160.2	658.40	1	10.6
Communications Equipment	65,854	113.2	581.75	2	9.0
Other Computer and Electronic Products	11,412	44.7	255.30	4	5.2
Navigational, Measuring, Electro-medical, and Control Instruments	59,266	406.6	145.76	5	8.3
Semiconductor and Other Electronic Components	55,072	381.5	144.36	3	18.5
Basic Chemicals	16,223	143.3	113.21	6	0.6
Other Miscellaneous Manufactured Products	27,872	318.3	87.57	9	2.7

[10] Valentina Meliciani, "The Relationship between R&D, Investment and Patents: A Panel Data Analysis," *Applied Economics*, vol. 32, no. 11, 2000, pp. 1429-1437.

Industry	Total Patents Awarded (number)	Average Employment from 2009 to 2013 (000s)	Patent Intensity (total patents awarded to companies per 1,000 jobs)	Industry Rank in 2004 to 2008	Research Intensity in 2013 (ratio of domestic research and development paid for and performed by companies to domestic sales) (%)
Electrical Equipment, Appliances, and Components	29,729	371.9	79.94	7	2.9
Medical Equipment and Supplies	23,678	315.5	75.05	11	4.4
Pharmaceutical and Medicines	20,317	276.7	73.43	8	10.3
Other Chemical Products and Preparations	15,123	286.2	52.84	10	2.7
Machinery	50,978	106.9	47.69	12	3.4
Average for All Manufacturing Industries	**21,365**	**462.4**	**46.20**	**—**	**3.9**

Source: U.S. Department of Commerce, Economics and Statistics Administration and U.S. Patent and Trademark Office, *Intellectual Property and the U.S. Economy*: *2016 Update* and National Science Foundation, National Center for Scientific and Engineering Statistics, *Business Research and Development and Innovation: 2013*, NSF 16-313 August 2, 2016.

In a 2016 report on innovation boxes, Peter Merrill identified the 10 U.S. industries that would be affected the most by the proposed Boustany-Neal innovation box. In this case, the box's effect was measured by an industry's effective tax rate on overall income under the proposal. Under the terms of the Boustany-Neal proposal, the effective tax rate on qualified IP income held in the United States for a corporation taxed at a rate of 35% can be determined using the following formula: ETR = 0.35[(1 – 0.71) (SRD/STC)], where ETR is the effective tax rate, 0.71 is the share of each dollar of qualified IP profit that can be deducted from a company's total income, SRD refers to the sum of a company's total R&D expenditures in the five previous years, and STC denotes the sum of the company's total costs in the same period. As one might expect, an industry's ranking hinges on the amount it spends on R&D to its total costs in a year. There is some overlap between the industries shown in **Table 2** and Merrill's list, which is shown in **Table 3**. At least some of the discrepancy between the two sets of industries is due to the fact that the Boustany-Neal proposal would apply to a broader range of IP than just patents and related forms of IP.

Table 3. U.S. Industries with the Lowest Effective Tax Rates on Qualified IP Income under the Boustany-Neal Innovation Box

(based on data from 2008-2012)

NAICS Industry[a]	Effective Tax Rate on IP Profits (%)	Research and Development as a Share of Total Costs (%)
Internet Search Providers and Data Processing services	27.2%	31.4%
Computer and Electronic Product Manufacturing	28.2	27.3
Publishing Industries (except the Internet)	29.5	22.1
Chemical Manufacturing	30.4	18.5
Transportation Equipment Manufacturing	30.8	16.9
Other Information Services	31.2	15.3
Leather and Allied Product Manufacturing	31.3	14.9
Miscellaneous Manufacturing	31.4	14.5
Machinery Manufacturing	31.8	12.9
Non-Metallic Mineral Product Manufacturing	32.4	10.5

Source: Peter Merrill, "Innovation Boxes: BEPS and Beyond," *National Tax Journal*, December 2016, Table 2.

a. The industries listed here are based on the North American Industrial Classification System as it is used by the IRS and the National Science Foundation.

Have Patent Boxes Been Effective?

For at least some lawmakers interested in adopting a patent box, a key consideration would be its likely effectiveness. In this case, effectiveness refers to the extent to which a patent box achieves its primary objectives. Among the countries with a patent box, three broad objectives have been paramount: (1) to promote increased domestic investment in innovation, (2) to create high-paying jobs, and (3) to stem or reverse the erosion of the domestic tax base that can occur when mobile sources of income (e.g., intangible assets) are transferred to tax havens or other low-tax countries through transfer pricing or licensing agreements.[11] Some patent boxes are intended to achieve all three.

The degree to which a particular patent box achieves its main goals hinges, in large part, on its design. Two design elements are especially influential in this regard: (1) the nature of its tax incentive and (2) the scope of eligible IP and IP income. For example, if the location of mobile assets like patents is sensitive to differences among countries in effective tax rates for income from those assets, then an enhancement of a country's patent box tax incentive, all other things being equal, could be expected to lead to an increase in the share and number of qualified intangible assets registered there. Similarly, if a patent box seeks to spur increased investment in

[11] Bradley, Sebastian, Estelle Dauchy, and Leslie Robinson, "Cross-Country Evidence on the Preliminary Effects of Patent Box Regimes on Patent Activity and Ownership," *National Tax Journal*, vol. 68, no. 4, December 2015, p. 1048.

innovation in the host country, then it would make sense to include in the box a requirement that companies holding qualified IP in that country have to invest in R&D related to that IP in the host country in order to benefit from the box's reduced tax rate on IP income.

Most of the patent boxes shown in **Table 1** have been implemented since 2007. Consequently, little is yet known about their effects on such indicators of patent-box success as employment, investment in innovation, ownership of IP rights, and tax revenues in patent-box countries.

Still, there is a small (but growing) body of empirical research on the actual or likely economic effects of patent boxes. This literature has largely focused on three outcomes: (1) a host country's tax base, (2) its climate for investment in innovation, and (3) the registration of patents and other qualified IP in the host country, regardless of where the R&D that led to the development of the patented technologies was undertaken. The main findings of the most-cited studies are reviewed below.

Starting in 1997, Irish taxpayers (individuals and corporations) that received royalty income from patents they developed as a result of R&D activities done in Ireland could exempt that income from the national income tax. In 2010, the Irish Finance Minister announced that the exemption would be terminated starting in 2011.[12] To justify this action, the Minister cited a finding by the Irish Tax Commission that the exemption did not have its intended effect in improving the domestic climate for innovation. In the commission's view, the tax relief was poorly targeted and had not fostered to an increase in domestic R&D investment. Instead, according to the commission, some companies had used the exemption as a "tax avoidance device to remunerate employees."

A 2014 study by Rachel Griffith, Helen Miller, and Martin O'Connell examined the impact of patent boxes on the geographic location of qualified IP and on government revenues in host countries. Employing a flexible-choice model to simulate how firms determined where to locate legal patent ownership, they found that corporate tax rates had a significant influence on those decisions. More specifically, Griffith et al. found that a company was more likely to locate patents in countries with relatively low effective tax rates on patent income than in countries with relatively high effective tax rates.[13] On the question of how patent boxes affected tax revenue in host countries, their analysis indicated that although a new patent box was likely to lure qualified IP income from other host countries, the revenue loss from the box's preferential tax rate tended to outweigh the revenue gain from the rise in the number of patents registered in the host country.[14]

Another 2014 study (by Sebastien Bradley, Estelle Dauchy, and Leslie Robinson) looked at how patent boxes affected the extent and geographic location of innovative activities and patent

[12] Michael J. Graetz and Rachel Doud, "Technological Innovation, International Competition, and the Challenges of International Income Taxation," *Columbia Law* Review, vol. 113, no. 347, p. 372.

[13] Griffith, Rachel, Helen Miller, and Martin O'Connell, "Ownership of Intellectual Property and Corporate Taxation," *Journal of Public Economics*, vol. 112 (2014), p. 22.

[14] Griffith, Miller, and O'Connell used their model to simulate the revenue effects of the adoption of patent boxes by four European countries: Belgium, Luxembourg, the Netherlands, and the United Kingdom. All four experienced a decline in tax revenue in 2006 relative to 2005, when none of them had a patent box tax incentive. While each country realized an increase in its share of new patent applications after the introduction of the box, the increase proved insufficient to offset the revenue loss from the decrease in the tax rate on patent income. In addition, there was a ripple effect on other countries in the simulation with patent boxes: they experienced a decline in IP-related tax revenue because many companies chose to re-locate their patents to Belgium, the Netherlands, Luxembourg, and the United Kingdom

registration.[15] Their analysis was based on worldwide new patent applications from 1990 to 2012. According to their findings, the likelihood a patent would be registered in a host country hinged on the generosity of its patent box and whether or not the inventor and the patent owner both were located there. Specifically, Bradley et al. estimated that a 1% decrease in the effective tax rate for patent income led, on average, to a 3% increase in new patent applications in the countries with a patent box in 2012. The study also found that this effect on new patent applications was even larger in host countries that provided tax subsidies for R&D expenses. At the same time, the results produced no evidence that a patent box had a significant effect on the cross-border transfer of patent ownership. As a result, the researchers concluded that the 12 patent boxes available in 2012 had no measureable effect on a multinational company's incentives for booking income from intangible assets in low-tax countries. It should also be pointed out, according to the researchers, that the time frame for the study was too short to permit any conclusions about the impact of the patent boxes on innovative activity in the host countries. In their view, much of the rise in new patent applications found in the study involved the patenting of previously unpatented IP rather than newly developed IP.

Lisa Evers, Helen Miller, and Christoph Spengel examined the size of the tax advantage provided by the patent boxes offered by 12 European countries in 2014.[16] To do so, they estimated the effective tax rate for each of those boxes and compared them to the top corporate tax rate in each country. According to their results, the average effective corporate tax rate for the 12 countries was far above the average effective tax rate for income eligible for the patent boxes: 17.25% compared to -0.7%. The patent box rates were calculated on the assumption that a company relied completely on equity to finance its investments in the development of a patented technology. The patent was then licensed to another party, producing royalty income for the patent holder. On the whole, the relatively low patent-box rate reflected both the low statutory rates for qualified IP income in the 12 countries, as well as the preferential tax treatment of expenses incurred or paid in generating that income.

Another 2015 paper (by Annette Alstadsater, Salvador Barrios, Gaetan Nicodeme, Agnieszka Maria Skonieczna, and Antonio Vezzani) assessed how patent boxes affected the geographic distribution of patent applications made by the 2,000 largest corporate R&D investors from 2000 to 2011 among 33 countries and within three industries: pharmaceuticals, motor vehicles, and information and communication technology. Twelve of the countries had patent boxes. The study also examined the effect of the patent boxes on local R&D activity.[17] It found that investors reacted to the tax advantages of the patent boxes by increasing the total number of patent applications in host countries; but their findings also showed that the rate of increase varied by industry and quality of patent. Moreover, the location decisions for high-quality patents proved to be more sensitive to the tax advantages of a patent box than were the decisions for low-quality patents, perhaps because the former were more likely than the latter to earn substantial profits. This sensitivity was even larger when a patent box covered a wide range of IP and when it applied to acquired and pre-existing patents and embedded royalties. In addition, they unexpectedly found that patent boxes tended to deter local inventive activity, perhaps because they offered no

[15] Bradley, Sebastian, Estelle Dauchy, and Leslie Robinson, "Cross-Country Evidence on the Preliminary Effects of Patent Box Regimes on Patent Activity and Ownership," *National Tax Journal*, vol. 68, no. 4, December 2015, pp. 1047-1072.

[16] Evers, Lisa, Helen Miller, and Christoph Spengel, "Intellectual Property Box Regimes: Effective Tax Rates and Tax Policy Considerations," *International Tax and Public Finance*, 2015, vol. 22, pp. 502-530.

[17] Alstadsalter, Annette, Salvador Barrios, Gaetan Nicodeme, Agnieszka Maria Skonieczna, and Antonio Vezzani, *Patent Boxes Design, Patents Location and Local R&D*, CESifo working paper no. 5416, Center for Economic Studies and the Ifo Institute, June 2015.

incentives for domestic companies to invest in the development of new technologies. The results of their simulations, however, did suggest that the imposition of a local development requirement on the income eligible for a patent box could negate some of that tendency.

On the basis of these studies, one could come to the following conclusions about the effectiveness of patent boxes:

- Patent registration has been responsive to the preferential tax rates provided by these boxes.
- There is no evidence that a patent box necessarily increases tax revenues in the host country; rather, countries that adopt a patent box may find that the added revenue from new patenting activity is eclipsed by the loss of revenue from the reduced tax rates for patent income.
- As more countries adopt a patent box, the risk grows of an inter-government tax competition triggering a race to the bottom of the ladder of effective tax rates on patent income.
- Patent boxes have had little impact on innovative activity in host countries in the absence of a local development requirement.
- Multinational corporations have been willing to shift mobile assets like IP to countries with patent boxes, without any apparent decrease in their propensity to transfer ownership of those assets to countries with low corporate tax rates. This tendency can be seen from the results in **Table 3**, which indicate that the effective tax rates for the overall profits of the industries affected the most by the Boustany-Neal proposal, including those from repatriated IP, would not be much lower than the top corporate tax rate.

Other Policy Issues

Several other policy issues are likely to play a role in any future congressional debate over whether the United States should adopt a patent box. They concern the cost of administering and complying with such a tax preference, the economic justification for it, and the size of the subsidy in light of current tax law. Each is discussed below.

Administrative and Compliance Costs

As some have pointed out, a key issue in adopting a patent box is to identify the income that qualifies for it in a manner that avoids subsidizing the returns from unqualified IP and prevents companies from re-characterizing other income as qualified IP income. Drawing a clear line between qualified and unqualified income is a particular challenge because the distinction must be at once "politically viable, economically defensible, and reasonably administrable."[18]

Depending on how broadly qualified IP is defined, administration of and compliance with the rules of the patent box could be relatively simple and straightforward or it could be complicated, time-consuming, and costly. Some argue that the best way to minimize compliance and administration costs is to limit a box to patents and related forms of IP, or to apply a box to a wider range of IP, such as the IP that would qualify for the Boustany-Neal patent box (see page

[18] Martin A. Sullivan, "A History Lesson for a Future Patent Box, *Tax Notes*, September 7, 2015, p. 1038.

two).[19] The worst option, in the view of some, would be to enact an intermediate approach, under which the patent box would apply to a narrowly targeted mix of IP like patents, formulas, and inventions that add insignificant value to the economy.

Distinguishing between qualified and unqualified IP income when a patent box applies to patents only is unlikely to impose costly burdens on the IRS to issue and enforce regulations, or on most large companies to comply with those regulations. Income from the sale of a patent or licensing fees and royalty payments from the use of a patent is relatively easy to identify and report on tax returns. The accurate identification of income from patents, however, becomes more difficult when a patent box covers embedded royalties, which refer to the share of income from the sale of goods and services that can be attributed to patents embedded in them. In this case, the tax authority in the host country would face the difficult task of issuing rules that would enable companies to determine which flows of income can be attributed to which particular patents.

Separating qualified from unqualified IP income may be harder still if a patent box targets IP that has substantial spillover benefits for the economy. In this case, the IRS would have to issue regulations that clarify how a company could prove that its patents or other qualified IP have added significant value to the economy. Given the difficulties many companies have experienced in getting the IRS to endorse their claims for the research tax credit under Section 41 without adjustment, it seems reasonable to say that such an option for a patent box would serve as a prescription for numerous legal disputes between the IRS and companies over the proper identification of value-added and the evidence a company would have to provide to substantiate claims for the preferential tax rate on qualified IP income.

Further complicating the task of administering a patent box is finding cost-effective ways to counter efforts by companies seeking to benefit from the tax incentive by re-classifying income to make it eligible for the patent box. Tax planning of this sort could increase the revenue cost of the patent box without bringing commensurate gains for the host country in form of achieved objectives.

Economic Rationale for a Patent Box

Another policy issue raised by a patent box is whether it can be justified on economic grounds. Opinions among economists and other analysts are divided on this issue. Regardless of one's beliefs, the starting point for a discussion of the matter is current federal tax subsidies for investment in R&D.

As noted earlier, current U.S. tax law contains two incentives for R&D investment. One is an unlimited expensing allowance for qualified research expenditures under Section 174; the other is a nonrefundable tax credit for increases in qualified research expenditures above a base amount under Section 41. A primary rationale for both incentives is that they are intended to correct a market failure associated with private R&D investment. The failure arises because the average company investing in R&D is unlikely to capture all the returns to that investment, even if the R&D results in intangible assets with intellectual property protection. Some of the returns will be captured by competing companies through efforts to exploit the new knowledge and knowhow resulting from the R&D investment; other returns will be captured by consumers in the form of improvements in the quality and reductions in the prices of goods and services they consume. Since the social returns to R&D typically exceed the private returns by a substantial margin and technological innovation is a primary engine of long-term growth in living standards, most

[19] Ibid., p. 1038.

economists support government policies that boost private R&D investment, including tax subsidies. Of course it is possible in theory for research tax incentives to encourage too much investment in certain kinds of R&D projects, but available evidence suggests that underinvestment is more likely within the private sector than overinvestment.

Can the same be said of a patent box? As noted earlier, a patent box increases the after-tax returns from the commercial use of successful innovations. The two federal R&D tax incentives, by contrast, apply to inputs in the R&D process: they lower the after-tax cost of labor and materials used to conduct qualified research in the hope that the reduction in cost will convince companies to spend more on such research. Given that patent boxes apply to the profits resulting from successful R&D investments, and that they can lead to substantial reductions in the cost of capital if R&D costs can be deducted at regular corporate tax rates, it seems likely that a patent box could encourage companies to perform more R&D than they otherwise would. As a result, a case can be made for applying the economic rationale for current federal R&D tax incentives to patent boxes. But they are an indirect (and perhaps costly) way of remedying the market failure associated with R&D investment in general. In effect, a patent box rewards companies through the tax code for profiting from the commercial exploitation of IP. In the case of patents, such a benefit comes on top of the temporary exclusive right a patent confers on the inventor to profit from the commercial use of a patented invention.

Is there another economic rationale for a patent box? Some maintain that such a tax incentive is justified on economic grounds because it is needed to ensure that valuable innovative activities will continue to be undertaken.[20] Such a view has two sides. First, a patent box can lower the cost to companies of the spillover effects from their R&D investments by increasing the potential profits from investing in innovation. As such, according to patent box proponents, a patent box should be seen as a complement to R&D tax incentives. Second, the same individuals contend that global competition for investment in the development of new commercial technologies demands that a country adopt tax incentives to discourage domestic companies from moving mobile assets like IP to subsidiaries in low-tax countries, and to encourage foreign-based companies to undertake local R&D activities and to produce locally goods and services derived from those investments. The actual effects of any patent box depend critically on its design.

Critics of patent boxes counter the first argument by noting that patent boxes explicitly subsidize profits captured by companies. In their view, instead of targeting investments in underdeveloped technologies with large and hard-to-capture returns, patent boxes encourage companies to invest in new technologies with relatively few external benefits and large potential profits.[21] With regard to the second argument, critics note that there are simpler ways to discourage U.S. companies from transferring intangible assets to foreign subsidiaries, such as lowering the U.S. corporate tax rate.

Incentive Effect

Most countries with a patent box also provide one or more tax incentives for R&D investment. If the United States were to adopt such a box, it would find itself in the position of offering both a patent box and two tax incentives for R&D investment. In addition, manufacturing companies that benefit from a U.S. patent box would also be able to take advantage of the current deduction

[20] Jones, Cherie L., Adam A. Rogers, and Damian J. Smyth, "Should the United States Enact a Patent Box?" *The Tax Adviser*, Vol. 47, no. 11, November 2016, p. 806.

[21] Fichtner, Jason J. and Adam N. Michel, *Don't Put American Innovation in a Patent Box: Tax Policy, Intellectual Property, and the Future of R&D*, Mercatus Center, George Mason University, December 2015, p. 3.

for domestic production activities income under Section 199. Since patent boxes can be designed to boost investment in innovation and production in host countries, it makes sense to take into account current tax incentives for R&D investment and domestic production in estimating the incentive effect of any proposed U.S. patent box. How large would the incentive effect of a U.S. patent box be under current law?

One measure of the incentive effect of a tax subsidy is its effective tax rate. This shows the extent to which the subsidy reduces the income tax burden on the returns to an investment eligible for the subsidy. All other things being equal, the larger the difference between the statutory tax rate and the effective tax rate for those returns, the greater the subsidy's incentive effect.

Another way to measure the incentive effect of a tax subsidy is to calculate how it changes the user cost of capital for an eligible investment. In general, the user cost of capital for an investment is the sum of its pre-tax rate of return and the rate of economic depreciation for the assets used in the investment.

In a 2016 report, Jane Gravelle estimated the incentive effect of a patent box based on the Boustany-Neal proposal.[22] In her analysis, qualified income from qualified IP was taxed at a flat rate of 10%. A key consideration was how the expenses incurred in developing qualified IP were treated for tax purposes. There were two options. One was to deduct the expenses from a company's qualified IP income, in which case a dollar of expense lowered the company's tax liability by $0.10. The other option was to deduct the expenses from a company's gross income, in which case each dollar of expense saved $0.35 in taxes, since the company was taxed at the top U.S. corporate tax rate of 35%.

Gravelle compared the effective tax rates for the key cost elements of an equity-financed R&D investment, with and without both the research tax credit under Section 41 and full expensing of research expenditures under Section 174. She assumed that the expenses were deducted from qualified IP income and not gross income. As a result, the tax savings from the deduction were equal to 10% of the total deduction. The results are summarized shown in **Table 4**.

Table 4. Effective Tax Rates on Returns From an Equity-Financed R&D Investment Under a Patent Box with a 10% Tax Rate on Net Income

(%)

Asset	Current law	With Patent Box and Full Expensing of Qualified Research Expenses	With Patent Box and Five-year Amortization of Qualified Research Expenses
Equipment	27.0%	27.0%	27.0%
Buildings	36.6	36.6	36.6
Supplies and wages for R&D personnel without the credit	0.0	0.0	7.1
Supplies and wages for R&D personnel With the credit	-99.0	-99.0	-75.3
Total without the credit	6.1	6.1	11.5

[22] CRS Report R44522, *A Patent/Innovation Box as a Tax Incentive for Domestic Research and Development*, by Jane G. Gravelle.

Asset	Current law	With Patent Box and Full Expensing of Qualified Research Expenses	With Patent Box and Five-year Amortization of Qualified Research Expenses
Total with the credit	-57.0	-57.0	-43.8

Source: CRS Report R44522, *A Patent/Innovation Box as a Tax Incentive for Domestic Research and Development*, Table 2.

Note: Negative values represent a tax subsidy.

As the table shows, current tax law provides a significant subsidy for the returns to an equity-financed R&D investment. Total returns are taxed at an effective tax rate of 6.1% without the credit and -57.0% with the credit. Adding a patent box with a 10% tax rate for IP net income and IP expenses deducted at that rate does not alter current-law rates because the marginal effective tax rate under full expensing is 0%. And adding a patent box but writing off qualified research expenses over five years increases the effective tax rates for the total returns. As Gravelle noted, the patent box did not boost the incentive to investment in R&D when a company elected to expense its qualified expenditures under Section 174.[23] The box would, however, represent a windfall gain for pre-existing qualified IP.

How did the patent box affect the user cost of capital for the investment? When the box was added with full expensing and with a five-year amortization period for qualified research expenses, the cost of capital rose 1.5% relative to current law. Replacing the research tax credit with the patent box raised that cost by 10%.

By contrast, the user cost of capital decreased dramatically when the patent box expenses were deducted at the top corporate tax rate. In this case, adding the box with or without the credit lowered the cost of capital under current law by 25%. The reduction shrank to 15% when the patent box was accompanied by a five-year amortization for qualified research expenses.

In Gravelle's assessment, how the expenses incurred in developing qualified IP are treated under a patent box can make a substantial difference in the box's incentive effect.

There is also some preliminary evidence that the Boustany-Neal patent box may lack the needed incentive effect to prevent further erosion in the domestic tax base for IP income. Peter Merrill found in a 2016 study of innovation boxes that the Boustany-Neal patent box would be unlikely to accomplish two of its objectives: (1) keeping IP in the United States and (2) promoting a migration of foreign-held IP to the United States. This was because the estimated average effective tax rate under the proposal for qualified IP income for the 10 U.S. industries with the lowest effective rates for that income was 30.4% from 2008 to 2012.[24] By contrast, the average top corporate tax rate for all OECD member countries in 2015 was about 25%. This suggested that in the absence of a significant cut in the top U.S. corporate tax rate, a Boustany-Neal patent box would do little to alter current tax incentives for companies to hold intangible assets in the United States.

[23] Ibid., p. 10.

[24] The lowest rate among the 10 industries was 27.2% for Internet search providers and data processing services, followed by 28.2% for computer and electronic product manufacturing; the highest rate was 32.4% for nonmetallic mineral product manufacturing. In Merrill's analysis, an industry's average effective tax rate under the Boustany-Neal proposal was computed under the assumption that its non-IP income was taxed at the top corporate tax rate of 35% and its IP income at 10.15%. The rate also took into account an industry's ratio of domestic research expenses to its total costs in the previous five years. See Peter Merrill, "Innovation Boxes: BEPS and Beyond," *National Tax Journal*, vol. 69, no. 4, December 2016, Table 2, p. 851.

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