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A Patent/Innovation Box as a Tax Incentive for Domestic Research and Development

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Summary

A patent box provides a lower tax rate on income from patents, and in some cases, from other intellectual property. A number of countries, including the U.K., France, the Netherlands, and China, have adopted a patent box. Rates generally range from 5% to 15%. Patent boxes are in some cases referred to as innovation boxes because they cover income from non-patented as well as patented intellectual property. Patent boxes can have narrow coverage (providing a lower tax rate on royalties and licenses from patents) or broadly cover income attributable to intellectual property, including that used directly by the firm in production. The purpose of a patent box is to encourage research and development, and, in some cases, to encourage the location of profits from intellectual property in the country.

Proposals for a patent box in the United States include a draft proposal by Representatives Boustany and Neal, the Innovation Promotion Act of 2015; proposed legislation in the 112th Congress by Senator Feinstein; and a bill introduced by Representative Schwartz in the 113th Congress (H.R. 2605). The Feinstein proposal provided a 15% tax rate on income from patents developed and used for manufacture in the United States, whereas the Boustany-Neal proposal and H.R. 2605 allowed a 71% deduction of income, which produces an effective 10% rate for corporations. The Boustany-Neal draft proposal would allocate profit between the ordinary tax rate (35% for corporations) and the patent box rate, based on the share of (research and development) R&D spending in total spending.

Current tax law contains incentives for investment in research and development. One is the option to expense certain R&D costs (deduct immediately) rather than deduct them over the life of the investment. Expensing is the equivalent of a zero effective tax rate on the return to investment. The tax code also contains a research tax credit. R&D subsidies are justified because the average company is likely to invest less in R&D than the amount warranted by the social returns from the investment. There may be disagreement over whether tax subsidies are the best method.

The expected effectiveness of a patent box on R&D depends on its design, and particularly whether it applies to net profit, where the tax rate on the up-front deductible cost is the new, lower patent box rate, or to gross investment, where the deductible cost is still valued at the higher regular statutory rate. The Boustany-Neal draft proposal applies to net profit, which means that lower statutory rate has no effect on the incentive to invest in R&D. The effective rate is still zero under expensing regardless of the statutory tax rate, and the credit is not driven by the tax rate. Moreover, if part of the revenue cost for the lower patent box rate is offset by slower recovery of costs, the effective tax rate rises. Similarly, the R&D credit, which was recently made permanent, is more valuable in reducing effective tax rates than a lower rate applied to net profit.

It is possible to design a patent box where the lower rate applies to gross rather than net profit. This approach would produce large subsidies for R&D that could lead to negative pre-tax returns, which might be justified depending on the size of R&D spillover effects.

A global economy also raises a number of policy issues. To the extent that a patent box has been adopted to discourage profit shifting to low-tax foreign jurisdictions, the Boustany-Neal patent box proposal may not be very effective. For an additional dollar of profit, the rate is a weighted average of the regular 35% rate and the 10% patent box rate; estimates suggest that the rate would still be relatively high. The effect of a patent box when part of profits are already shifted to a low-rate country is an increase in effective rate domestic R&D, for a patent box that applies the rate to net income rather than gross income.

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Introduction

A patent box provides a lower tax rate on income from patents. In some cases, the lower rate applies to income from other intellectual property. Such a subsidy is sometimes referred to as an innovation or IP box. In this report, the term "patent box," the most popular name, will be used to refer to all of the special tax rate regimes related to income from intellectual property.

A number of countries, including the U.K., France, the Netherlands, and China, have adopted a patent box.[1] The income tax rates of those boxes generally range from 5% to 15%. Patent boxes, as noted, can have narrow coverage (providing a lower tax rate on royalties and licenses from patents) or broadly cover income attributable to intellectual property, including that used directly by the firm in production.

The purpose of a patent box is to encourage research and development, and, in some cases, to encourage the location of profits from intellectual property in the country. [2]

The design of patent boxes raises several issues. One is the breadth of coverage. Specifically, should a patent box restrict coverage to licensing fees and royalties from patented inventions or include income embedded in products produced with patented inventions? Should it include income embedded in products produced from non-patented innovations? Should it include income from items not reflecting technological innovation such as trademarks, business names, and copyrights?

Other design issues include whether to restrict the benefit to innovations developed in the United States and to income from products derived from the innovations that are produced in the United States. The European patent boxes generally do not have these restrictions. Another issue is the treatment of income from existing patents and innovations. If the objective is to encourage domestic innovation, limiting benefits to new innovations may be appropriate, although administratively difficult. Finally, as will be discussed subsequently, whether the tax rate is applied to gross or net income significantly affects the benefits of patent boxes.

Proposals for a patent box in the United States include a draft proposal by Representatives Boustany and Neal, the Innovation Promotion Act of 2015,[3] proposed legislation made by Senator Feinstein in the 112th Congress,[4] and a bill introduced by Representative Schwartz in the 113th Congress (H.R. 2605). The Feinstein proposal provided a 15% tax rate on income from patents developed and used for manufacture in the United States, whereas the Boustany-Neal proposal and H.R. 2605 allowed a 71% deduction of income, which produces an effective 10% statutory rate on income in the patent box. The Boustany-Neal proposal covers income from patents,

[1] According to a presentation by Lilian B. Faulhaber, "Taxation of Intellectual Property in a Global Economy," International Tax Policy Forum and Georgetown Law's Institute of International Economic Law, March 11, 2016, 18 countries had existing or proposed patent boxes. The details of patent box regimes for 16 countries are reported in PricewaterhouseCoopers's pamphlet "Global Research and Developments Incentives Group," February 2016, http://www.pwc.com/gx/en/tax/pdf/pwc-global-r-and-d-brochure-feb-2016.pdf. This document also summaries R&D tax credits and similar incentives in other countries.

[2] The Organization for Economic Development and Cooperation (OECD) has developed a set of proposed actions to address base erosion and profit shifting (BEPS) and identified certain types of patent boxes that do not require R&D investment as a harmful tax practice. See OECD web page, "Base Erosion and Profit Shifting," http://www.oecd.org/ctp/beps.htm. This profit-shifting issues associated with a patent box is addressed in the final section of this report.

[3] The discussion draft is at http://waysandmeans.house.gov/wp-content/uploads/2015/07/Innovation-Box-2015-Bill-Text.pdf.

[4] See Leveling the Playing Field Act of 2012, Putting America Back to Work, http://www.feinstein.senate.gov/public/index.cfm/putting-america-back-to-work.

inventions, formulas, processes, knowhow, computer software, and other similar IP, and is for domestic earnings.

This report focuses on the effects of a patent box on encouraging research and development in the United States. It begins with brief description of current research and development (R&D) incentives, and follows with a discussion of the justification for R&D subsidies. In its remaining sections, the report looks at the potential impact of a patent box as a supplement to or a substitution for current R&D tax incentives. It concludes with a discussion of the effect on patent boxes on the location of research and amount of profit-shifting by multinational corporations. All of the discussion considers a patent box that is restricted to domestic innovation and manufacture.

Current Tax Provisions Favoring Research

Current law contains two provisions that benefit research spending: expensing of intangible costs (which constitute the bulk of the cost of R&D) under Section 174 of the Internal Revenue Code and research tax credits on the same costs under Section 41. Expensing allows costs to be deductible immediately rather than being recovered over the life of the assets from investment. When the investment is marginal (earns just enough to break even), expensing is the equivalent of a zero tax rate.

The credit for research, officially termed the research and experimentation (R&E) credit, is also allowed on intangible investments. After many years of being a temporary provision that was typically extended every one to two years, the credit was made permanent in the Consolidated Appropriations Act, 2016 (P.L. 114-113). Companies generally choose between two types of credits.[5] One is a credit of 20% in excess of a fixed base that is unrelated to prior R&E spending and thus has a marginal effective rate of 20%. The other is a credit of 14% in excess of 50% of the past three years of research expenditures. Because additional research spending increases the base in the future, reducing future credits, the marginal effect of the credit is smaller, estimated (see **Appendix**) at 7.9%. Weighting the credit by the spending on the 20% and 14% credits results in an effective credit of 11.3%. A full basis adjustment is made, meaning that the amount of the deduction for research is reduced by the amount of the credit.

The patent box, rather than providing an up-front investment subsidy, provides a lower tax rate on the profits from innovation.

Why Subsidize R&D?

Economic theory indicates that the private market can invest too little or too much in R&D. The potential underinvestment in research arises from the spillover effects that benefit other firms. Even when products are patented, new innovations may give rise to similar products or direct competition following the expiration of the patent. For that reason, the true value to society is greater than the value earned by the firm, and more of these valuable investments would be desirable. It is also possible to overinvest in R&D if firms are engaged in a competitive race to make discoveries before other firms do and secure a larger share of the market, a phenomenon sometimes called product market rivalry or business stealing. In this case, the private return to the

[5] There are also special credits for contract research with a university or nonprofit and a credit for contract energy research. For a more detailed explanation of the credit, see CRS Report RL31181, *Research Tax Credit: Current Law and Policy Issues for the 114th Congress*, by Gary Guenther.

firm may displace the return to another participant and the social benefit will be below the private benefit. Which effect dominates is an empirical matter.

Empirical studies have more often found that research and development has positive spillover effects, although some studies have found negative or ambiguous effects. A 2010 review covering 20 studies found that half produced positive effects, a quarter negative effects and the remainder ambiguous effects.[6] A more recent study explicitly attempted to deal with the two opposing forces (spillovers and product rivalry). It found the social return to be 3.5 times the private return.[7] The majority of studies suggest a positive spillover effect. These positive spillover effects mean that firms, based on their own private return, will not invest in the optimal amount of R&D, even in the presence of patent protection.

Evidence indicates that R&D tax subsidies in general are effective in encouraging R&D spending, although estimates of the extent of the stimulus vary substantially across studies.[8] Patent boxes are too recent to have been the subject of more than a preliminary assessment.[9] There is a broader

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[6] Bronwyn Hall, Jacques Mairesse, and Pierre Mohnen, "Measuring the Returns to R&D" (2010), in Bronwyn Hall and N. Rosenberg, *Handbook of the Economics of Innovation*, Elsevier, 2010, pp. 1034-1076; also NBER Working Paper 15622 (December 2009), http://www.nber.org/papers/w15622.pdf.

[7] B Nicholas Bloom, Mark Shankerman, and John Van Reenen, "Identifying Technology Spillovers and Product Market Rivalry" *Econometrica*, July 2013, Vol. 81, Issue 4, pp. 1347-1393.

[8] There is an extensive literature on the effectiveness of the R&D credit and other R&D tax benefits, finding a range of effectiveness of provisions in increasing R&D spending. Bronwyn Hall and John Van Reenen reviewed studies and concluded that overall they suggested an elasticity (percentage change in R&D divided by the percentage change in price) of unity, which in turn implies that a tax reduction of a dollar produces an additional dollar of R&D. See "How Effective Are Fiscal Incentives for R&D? A Review of the Evidence," *Research Policy*, Vol. 29, 2000, pp. 449-469, at http://eml.berkeley.edu/~bhhall/papers/HallVanReenan%20RP00.pdf. Nick Bloom, Rachel Griffith, and John Van Reenan found a similar long term effect in a subsequent study. See "Do R&D Tax Credits Work? Evidence from a Panel of Countries 1979-1997," *Journal of Public Economics*, Vol. 85, 2002, pp. 1-31, https://people.stanford.edu/nbloom/sites/default/files/rdtaxcredits.pdf. Robert Carroll, Gerald Prante, and Robin Quek review later studies as well, which find larger elasticities. See "The R&D Credit: An Effective Policy for Promoting Research Spending, Prepared for the R&D Credit Coalition," Ernst & Young LLP, September 2011, at http://investinamericasfuture.org/PDFs/EY_R&D_Credit_Report_2011_09_16.pdf. Christian Köhler, Philippe Laredo, and Christian Rammer also review studies where elasticities range broadly from around 0.15 to 1.6. See *The Impact and Effectiveness of Fiscal Incentives for R&D*, Manchester Institute of Innovation Research, Nesta Working Paper No. 12/01, 2012, at http://www.nesta.org.uk/sites/default/files/the_impact_and_effectiveness_of_fiscal_incentives.pdf. Pierre Mohnen also summarizes findings in his presentation, "The Effectiveness of R&D Tax Incentives," Workshop on the Revision of State Aid Rules for Research and Development and Innovation (R&D&I), Brussels, January 9, 2013. He found smaller elasticities in Canada and the Netherlands. He also compares these results with a number of studies with elasticities that are largely, but not entirely, above one. Presentation at http://ec.europa.eu/competition/state_aid/legislation/workshop_rdi_pm_en.pdf. Russel Thomson, however, found smaller effects using industry observations, with a dollar of R&D incentives increasing R&D by $0.24. See "The Effectiveness of R&D Tax Credits: Cross-Industry Evidence," Melbourne Institute Working Paper Series, Working Paper No. 18/13, May, 2013, http://www.melbourneinstitute.com/downloads/working_paper_series/wp2013n18.pdf.

[9] Because patent boxes are relatively new, there is little research on their effects and it should be viewed as preliminary. Annette Alstadsæter, Salvador Barrios, Gaetan Nicodeme, Agnieszka Maria Skonieczna, and Antonio Vezzani find patent boxes affect the location of patents, but not R&D. See "Patent Boxes Design, Patents Location, and Local R&D," European Commission Joint Research Center, 2015, http://www.sbs.ox.ac.uk/sites/default/files/Business_Taxation/Events/conferences/symposia/2015/barrios-paper.pdf. Sebastien Bradley, Estelle Dauchy, and Leslie Robinson found evidence of increased patent applications, but not of the location of R&D. See "Cross-Country Evidence on the Preliminary Effects of Patent Box Regimes on Patent Activity and Ownership," *National Tax Journal*, Vol. 68, December 2015, pp. 1047-1072. In very preliminary work, Eric Ohrn found some evidence that R&D is responsive to patent boxes when R&D is deducted at the higher statutory rate, but not otherwise. See "International Royalty Flows and Research and Development Responses to International Royalty Flows, Taxation of Intellectual Property in a Global Economy," presented at a conference on Taxation of Intellectual Property, by the International Tax Policy Forum and Georgetown Law's Institution of International Economic Law, March 11, 2016, https://www.law.georgetown.edu/academics/centers-institutes/iiel/taxation-of-ip/upload/
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question of whether R&D tax subsidies are the most desirable method of subsidizing R&D (for example, as compared to government spending on R&D), although this question is beyond the scope of this report.

Assessing the Value of Current R&D Tax Benefits for Innovation

The existing tax benefits for R&D provide significantly lower effective tax rates for investment in R&D compared to the tax rates on other investments in the economy, such as investments in plant and equipment generally. A way to compare the incentive effect for investment in research and development is to examine the effective tax rate on a new investment at the margin (that is an investment that is worth making because it earns a high enough rate of return to satisfy stockholders). The effective tax rate is the share of the return that is paid in taxes. (See **Appendix** for data and methods of calculation.) If income is measured correctly (in that the present value of depreciation deductions for tax purposes equals the present value of economic depreciation), the effective tax rate is the statutory tax. If costs are recovered more rapidly than the rate of economic decline in value of the asset, or if credits are allowed, the rate can fall below the statutory rate, or even become negative. The effective tax rate captures the value of tax subsidies in a single measure, and the lower the tax rate, the greater the subsidy. Another way of capturing the effects of a subsidy is through a percentage change in the user cost of capital (also termed the rental price of capital), a measure that determines how much should be paid for the use of the investment if rented. The user cost of capital is the sum of the pre-tax rate of return on investment and its rate of economic depreciation.

Effective Tax Rates and the User Cost of Capital

Table 1 compares the effective tax rates for intangible investments in research with investments in tangible assets. The expensing of intangibles results in an effective tax rate of zero on income earned from intangibles compared to tax rates of 24% or more for tangible assets. With the research credit in place, the effective tax rate is a negative 99%. That is, with the credit the project earns a return that is below the required after-tax return: the tax system provides a subsidy. As the effective tax rate falls, the required pre-tax return falls. As the pre-tax return is pushed lower, more projects that were not otherwise profitable would now earn a large enough return to be undertaken.[10]

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Ohrn_ITPF_3_2016_Presentation.pdf. His number of observations was limited, making it difficult to generalize.

[10] To provide examples, assume an investment must earn a 5% return to satisfy investors. If taxes were effectively levied at the statutory tax rate of 35%, the firm must earn a pre-tax return of 7.69%. After paying taxes equal to 35% of the return (2.69%), the firm has an after-tax return of 5%. If the effective tax rate is 24%, the firm must earn 6.58%, and after paying a tax of 1.58% at a 24% rate, again has 5% after-tax. In both cases, the pre-tax return is above the required after-tax return. In the example of the negative 99% rate, the firm can afford to invest in a project that earns a much lower return, only 2.51% before tax. The government pays the firm 99% of that amount, which is 2.48%. The sum of the pre-tax return and the subsidy is 5%.

Table 1. Effective Tax Rates: Intangible R&D Compared to Plant and Equipment, Assuming a 35% Statutory Tax Rate

(percentage)

Asset	Effective Tax Rate
Equipment	23.6
Public Utility Structures	24.9
Other Nonresidential Structures	30.8
Residential Structures	28.2
R&D Intangibles (Without Credit)	0.0
R&D Intangibles (With Credit)	-99.0

Source: See CRS Report R44242, *The Effect of Base-Broadening Measures on Labor Supply and Investment: Considerations for Tax Reform*, by Jane G. Gravelle and Donald J. Marples.

Notes: Tax rate for equipment does not include effects of bonus depreciation, which would reduce the effective tax rate for equipment to 14%.

Most investment in R&D is in intangibles (such as salaries for scientists and supplies) and subject to a zero or negative rate, but a portion reflects tangible investment A Canadian study used to compare taxation of intangibles across countries used a 7.3% share for equipment and a 6.6% share for structures.[11] Assuming the equipment category of instruments, with an estimated effective tax rate of 27% and industrial structures with an effective tax rate of 36.6%, the weighted overall effective tax rate is estimated at 6.1% without the credit and -57% with the credit.[12]

Although tax rates provide a useful comparison, the negative tax rates are not as large as they appear because they are a percentage of the pre-tax rate of return, which can be very small. Another way of considering the effect of these subsidies is based on the effect on the rental price (or user cost) of capital. This measure is the price of using capital, which must cover not only the required return, but the decline in the value of the asset. It is the sum of the pre-tax return and the economic depreciation rate. The effect of the 6.1% effective tax rate (as compared with a 35% rate) is the equivalent of a reduction of 10% in the cost of capital.[13] The -57% rate reduces the cost of capital by 19.2%. Thus the research credit alone is responsible for a decrease in the cost of capital (given that expensing exists) of around 10%.

Note that the tax rates capture only the corporate tax on equity investment. A total tax rate that captures debt-financed investment (and its deductibility) along with taxes on shareholders and creditors would produce lower tax rates.[14] The tax rate falls because nominal interest is deductible

[11] Canadian Department of Finance, "An International Comparison of Tax Assistance for Investment in Research and Development," 2009, http://www.fin.gc.ca/taxexp-depfisc/2009/taxexp0902-eng.asp.

[12] Note that composite tax rates are estimated by weighting the estimating pre-tax required return by the asset shares and then computing an effective tax rate. See **Appendix** for details of calculations.

[13] The rental price of capital is $R/(1-t)+d$, where R is the after-tax real rate of return, t is the effective tax rate and d is the economic depreciation rate. R is assumed at 5% and economic depreciation is assumed at 17%. See CRS Report R44242, *The Effect of Base-Broadening Measures on Labor Supply and Investment: Considerations for Tax Reform*, by Jane G. Gravelle and Donald J. Marples. They would be larger with larger after-tax returns.

[14] If calculated assuming 36% debt the estimated tax rates would be 17.5% for equipment, 29.1% for structures, a minus 12.7% for intangibles without the credit and a minus 109.2% with the credit. For a discussion of the assumptions and methodology, see the appendix in CRS Report R44242, *The Effect of Base-Broadening Measures on Labor Supply and Investment: Considerations for Tax Reform,* by Jane G. Gravelle and Donald J. Marples.

to the firm but largely not taxed to creditors because a significant share of assets is in tax exempt retirement funds. The effect of shareholder-level taxes is also small because of the share held in tax exempt forms, the lower tax rates, and the taxation of only realized capital gains.

The Potential Effects of Patent/Innovation Boxes on Innovation

The incentive effect of a patent or innovation box depends on its design. A narrowly focused patent box might restrict coverage to licensing fees and royalties from patented inventions, while a broader box would include income embedded in products produced from patented inventions. An even broader box would extend the benefits to income embedded in products produced from non-patented innovations. The benefits could also be extended further to assets not reflecting technological innovation such as trademarks, business names, and copyrights. The scope is also affected by whether the patent box rate is applied to innovations developed outside the United States and whether it is restricted to income from innovations used to manufacture within the United States.

For a given eligible activity, the incentive effect on the patent box depends on whether R&D expense deductions are valued at the patent box rate (patent box rate applied to net income, that is, gross income less expenses) or the regular rate (patent box rate applied to gross income). If valued at the patent box rate in the Boustany-Neal proposal each dollar of R&D spending that is deducted saves $0.10 in taxes, while if valued at the regular rate, each dollar of R&D spending that is deducted saves $0.35 in taxes. An innovation box's rate can be designed to apply to net income or gross income and that choice is important for the incentive effects.[15]

Incentive Effects with Expenses Deducted at the Patent Box Rate (A Net Income Box)

To consider a case with the statutory rate applying to net income, consider the approach in the Boustany-Neal draft. Net profit from production using a qualified innovation would be allocated to the patent box based on the ratio of expenses for intangible R&D to all expenditures.[16] As shown in the **Appendix**, this approach achieves the goal of separating income from the innovation from income from production and taxing net income at the statutory patent box rate under reasonable assumptions. This proposal would apply to production of domestic goods.

The estimates in **Table 2** use a 10% rate to estimate the effective tax rates on an innovation, with and without the research credit. It also estimates the effective tax burden on a new investment when the innovation box is financed by capitalizing intangible R&D costs and writing them off over five years, as was proposed by then Chairman of the Ways and Means Committee Paul Ryan.[17]

[15] The importance of gross versus net income is discussed in Lisa Evers, Helen Miller, and Christoph Spengel, "Intellectual Property Box Regimes: Effective Tax Rates and Tax Policy Considerations," *International Tax and Public Finance*, vol. 22, no. 3, June 2015, pp. 502-530, http://link.springer.com/article/10.1007/s10797-014-9328-x.

[16] Congressman Charles W. Boustany, Jr., "Boustany & Neal Release Innovation Box Discussion Draft," July 29, 2015, http://boustany.house.gov/114th-congress/boustany-neal-release-innovation-box-discussion-draft/.

[17] Luca Gattoni-Celli, "Ryan Eyeing Research Cost Recovery to Pay for Innovation Box," *Tax Notes*, August 24, 2015, p. 824.

Under current law, the tax rate on intangible investments is zero without the credit and a negative 99% with the credit. An overall R&D project including depreciable equipment and structures is subject to an effective tax rate of 6.1% without the credit and a negative 57% with the credit. These numbers are unchanged by the innovation box because the effective tax rate on intangibles without the credit is zero, regardless of the tax rate applied. The credit, if retained, is not affected by the statutory rate. Thus the innovation box results in no additional incentive when investments are already expensed and is largely a windfall for preexisting innovations.

Table 2. Firm-Level Effective Tax Rates on Returns from Equity-Financed R&D Investment, with Net Income Innovation Box at 10%, With and Without the Research Credit

(percentage)

	Current Law	With Innovation Box	With Innovation Box and Five-Year Amortization
Equipment	27.0	27.0	27.0
Structures	36.6	36.6	36.6
Intangibles Without Credit	0.0	0.0	7.1
Intangibles With Credit	-99.0	-99.0	-75.3
Total Without Credit	6.1	6.1	11.5
Total With Credit	-57.0	-57.0	-43.8

Source: See **Appendix** for calculations and data. Assumes the patent box rate of 10% applies to income and costs.

Notes: Negative values indicate subsidies.

Table 2 also shows that the financing of an innovation box with five-year amortization of intangible expenses raises the overall effective tax rate to 11.5% without the R&D credit, and the -43.8% without the credit (a smaller negative compared to current law). In both cases, these effects raised the user cost of capital (compared to current law) by 1.5%. If an innovation box replaced the R&D credit, the effective tax rate would rise from a negative 57% to a positive 6.1%, and the user cost of capital would rise by about 10%.

If part of the investment is financed by debt, the total effective tax rate on earnings from intangible R&D would rise with the innovation box because the lower statutory rate reduces the value of interest deductions. The effective tax rate for intangibles without the credit would rise from -12.7% to -0.4% (still negative but a smaller negative and thus a smaller subsidy). With the credit the tax rate would rise from -109.2% to -74.2%.

Is Expensing the Same as a Zero Tax Rate?

The finding that adopting a patent box that taxes net profits from intangibles at a lower rate has no effect on R&D incentives rests on the equivalence of expensing to a zero tax rate regardless of the statutory tax rate. To explain this effect, consider a simplified example, where an investment of $100 is made, earning a return of $110 in one year. The rate of return on this investment is 10%. If the investment is subject to economic depreciation, $100 of the $110 in the future will be deducted as a recovery of principal, and the remainder subject to tax. If the tax rate is 35%, the remaining $10 is subjected to tax, reducing the after-tax amount by $3.50. With a net of $106.50, the rate of return is 6.5%, and the effective tax rate is 35% ($3.50 is 35% of $10). If the cost is deducted when incurred, however, the firm saves $35 on its investment for a net cost of $65 and earns $71.5 ($110 times 0.65), for a return of 10%.

Still the result is not precisely the same as no tax at all, because the scale of the investment has been reduced. That is, the investment can now be seen as a partnership between the government (who finances 35% of the cost) and the firm (who finances 65%). The firm earns the pre-tax return on its share. Although this treatment reduces the scale of the investment, the firm could expand its R&D investment by grossing the size of the investment by dividing by one minus the tax rate (0.65), and investing $154.86 rather than $100. This change would leave a net investment of $100 and the outcome would be identical to a zero tax rate.

Some arguments have been made that expensing at a lower statutory tax rate is better than expensing at a higher statutory rate, i.e., that the higher statutory rate is more burdensome, for two reasons.[18] The first is that the tax system does not allow perfect loss offset; that is a start-up firm with no other taxable income or a firm with a history of losses cannot take the deduction immediately. This delay in deduction has a smaller impact with a lower statutory tax rate. The other argument is that reducing the scale of the investment is burdensome to the firm, because there may not be other innovations that earn the same rate of return available. That is, it may not be possible to find an additional investment that could restore its net investment to $100 and still earn the same return.

There are, however, arguments that can be made expensing at a lower statutory rate is worse than expensing at a higher statutory rate. First, much of the research in the United States is by multinational firms. If these firms are successful in artificially shifting profits abroad to tax havens with low or no tax countries so that expenses are deducted at 35% but the earnings are taxed a lower, perhaps 0% rate, then a higher statutory tax rate is better than a lower one because the amount of tax savings from the investment is larger. Much of profit shifting is associated with intangible assets, and this phenomenon may be more typical of today's larger firms that engage in most innovation than being in a loss position and affected by imperfect loss offset.[19]

The second issue is more fundamental to tax policy. While, from the firm's point of view, the scale of its investment is reduced, the total investment is not reduced, and it is the total size of the investment that is relevant to the social value of the investment. The investment, and all of its potential spillover effects, has nevertheless been made, although part of the investment is financed by taxpayers. In addition, to the extent that R&D tends to be more risky than other investments, the presence of taxes, while reducing the return, also reduces the variance of returns. In order for firms to get back to their original risk-return preferences, they are likely to expand the size of their R&D investments relative to other investments. This incentive is larger with higher tax rates. So from both of these perspectives, a higher statutory tax rate encourages investment in R&D in the presence of expensing.

Incentive Effects When Costs Are Deducted at Higher Statutory Rates (A Gross Income Box)

Effective tax rates change dramatically when the patent box is designed to apply to gross rather than net income. This effect would be the case in narrow patent box proposals that apply only to

[18] Tom Neubig, "Expensed Intangibles Have a Zero Effective Tax Rate ... NOT!" *Tax Notes*, September 10, 2007, pp. 959-968.

[19] For a discussion and empirical evidence on profit shifting see CRS Report R40623, *Tax Havens: International Tax Avoidance and Evasion*, by Jane G. Gravelle.

royalties and licenses from patented products, where the owner does not manufacture goods or services that use the innovation. That is, when all income comes from royalties and license fees, the tax falls on gross income and expenses are deducted at the higher regular tax rate.[20]

It would also be possible to design a patent/innovation box similar to the Boustany-Neal proposal where expenses are nevertheless deducted at the statutory rate. Expenses could be used to split net profit into patent box and non-patent box shares. Then the research expenses could be added back to the net patent box profit and subtracted from the non-patent box profit. Alternatively, a credit could be added equal to 25% (the difference between the regular rate of 35% and the patent box rate of 10%) of research expenses.

This treatment results in very generous subsidies. These subsidies can no longer be reasonably compared using effective tax rates as, in some cases, pre-tax returns become negative (investments lose money). Therefore, **Table 3** compares current law with a lower rate on gross investment using changes in pre-tax returns. For intangible R&D investments it produces negative returns with the innovation box. The five-year amortization provision results in a small (almost zero) positive pre-tax return without the credit and a negative return with the credit.

Table 3. Firm-Level Pre-Tax Rates of Return on R&D Investment, 10% Gross Profit Rate, With and Without the Research Credit

(percentage)

	Current Law	With Innovation Box	With Innovation Box and Five-Year Amortization
Equipment	6.9	6.9	27.0
Structures	7.9	7.9	36.6
Intangibles Without Credit	5.0	-1.1	0.2
Intangibles With Credit	2.5	-2.9	-1.7
Total Without Credit	5.3	0.1	2.2
Total With Credit	3.2	-1.5	-0.5

Source: See **Appendix** for calculations and data. Assumes the patent box rate of 10% applies to gross income and 35% applies to costs. Assumes 5% real after-tax return.

Notes: Values below 5% indicate subsidies; that is, the pre-tax return is below the after-tax return.

The effect on the cost of capital, which is a comparable number, is much larger. With the patent box rate applying to gross profit, the user cost of capital falls by 25% (with or without the credit). With a five-year amortization provision the user cost of capital falls by 15% without the credit and 19% with the credit. This effect is larger than the effects of the R&D credit.

[20] In very preliminary work, Eric Ohrn found some evidence that R&D is responsive to patent boxes when R&D is deducted at the higher statutory rate, but not otherwise. See "International Royalty Flows and Research and Development Responses to International Royalty Flows, Taxation of Intellectual Property in a Global Economy," presented at a conference on Taxation of Intellectual Property, by the International Tax Policy Forum and Georgetown Law's Institution of International Economic Law, March 11, 2016, https://www.law.georgetown.edu/academics/centers-institutes/iiel/taxation-of-ip/upload/Ohrn_ITPF_3_2016_Presentation.pdf. His number of observations was limited, making it difficult to generalize.

Relationship of Patent/Innovation Boxes to International Earnings Abroad

The analysis above is focused on the incentive for additional unit of investment. In an international environment, the tax system can affect the location of investment as well.

Some of the interest of U.S. multinationals in a U.S. patent box may reflect their concerns about international efforts to address profits shifted by firms to countries with low or no taxes, such as Bermuda and the Cayman Islands.[21] A patent box may offer an alternative to locating profits in these countries. The Organization for Economic Development and Cooperation (OECD) has developed a set of proposed actions to address base erosion and profit shifting (BEPS).[22] In addition, one of the action items on harmful tax practices addresses patent boxes and the concern that preferential tax regimes be applied to income that involves real economic activity, raising concerns among some U.S. policymakers that R&D might be relocated abroad to satisfy these requirements.

There are choices that could be affected by a patent box in a global economy.

First, the analysis above has not concerned itself with infra-marginal investments (investments that earn a return in excess of that required to break even at the margin), since such investments would be undertaken in any case. With a location choice, the rate can matter even when the patent box is applied to net investment because a lower rate does benefit infra-marginal investment by lowering the tax imposed on super-normal profits. So the net income patent box could have an effect on the location of investment because an investment expected to yield a large return would face a lower tax and encourage location in the United States.

Second, as noted earlier some multinational firms engage in profit shifting (artificially moving the earnings from investment to another jurisdiction) while retaining the investment in the United States. Two issues arise here. The first is the extent to which lower rates will attract profit from abroad without making any real changes. The second is how the patent box regime will affect marginal investment in the United States when profits have already been shifted to low-tax jurisdictions.

Evidence suggests a significant amount of shifting of profits out of the United States, which may arise in large part from an inability to enforce arms-length pricing between related parties. If a U.S. parent sells the rights to difficult-to-value intangible assets (such as drug formulas, search algorithms, and design of communication devices) to its foreign subsidiary, it is easier than with other assets to set the price too low and reduce profits in the United States.[23] By offering a lower tax rate in the United States, more profits appropriately attributable to U.S. investments would be retained (or brought back) to the United States.

Design is an important issue in this case as well. Under the Boustany-Neal proposal, if an additional dollar is shifted to a U.S. firm it would be taxed not at the 10% patent/innovation box

[21] For a discussion of profit shifting by U.S. firms, see CRS Report R40623, *Tax Havens: International Tax Avoidance and Evasion*, by Jane G. Gravelle.

[22] See OECD web page, "Base Erosion and Profit Shifting," http://www.oecd.org/ctp/beps.htm.

[23] See CRS Report R40623, *Tax Havens: International Tax Avoidance and Evasion*, by Jane G. Gravelle.

rate, but at the rate between 35% and 10% that arises from the cost allocation formula. Peter Merrill estimated that the lowest tax rate across the industries he examined was 27%.[24]

It is possible to design a patent box so that the marginal dollar of profit would be taxed at 10%. A way to achieve this effect is to make the patent box income equal to total profit minus an imputed return on tangible assets (and perhaps non-research intangibles, such as advertising). Since the imputed return is fixed in the absence of real changes in investment, any additional profit would be taxed at the 10% rate. This change could also be combined with treatment that would apply the rate to gross profit through the mechanisms described earlier.

Another issue that arises with profit shifting is the incentive effect of a patent box at the margin if part of profits are already shifted abroad, perhaps to a zero-rate country. It is possible for R&D to take place in the United States but have profits allocated abroad through cost-sharing arrangements, where the firm's foreign subsidiary contributes to the cost of U.S. R&D in exchange for a share of the profits. When the transaction is the equivalent of an arms-length one, and the cost-sharing payment is equal to the present value of the expected profits, nothing in the analysis above changes. If, however, the cost-sharing payment is too small, profits are shifted abroad.

In this case, a patent box based on net profit is likely to discourage investment in the United States because research and development costs are now being deducted at a 10% rate rather than a 35% rate with no corresponding decrease in the tax rate on the profit that has been shifted to another jurisdiction. This penalty is offset (but only partially) because additional R&D spending also produces a benefit in that it reduces the weighted average tax rate on all profit. This effect is larger, the larger the share of non R&D spending.

[24] Peter Merrill, PricewaterHouse Coopers, Patent Box Briefing, Tax Analysts, Washington DC, October 13, 2015.

Appendix. Calculating Effective Tax Rates

Estimating the Effective Tax Rate on an Investment, Firm-Level Equity Investment

Estimates of effective tax rates use a discounted cash flow approach to estimate the required output of an investment to attract capital to earn enough profit to break even, given tax rules and a required after-tax return. Then the taxes are removed and the flow of income is used to determine the pre-tax return. The share of the pre-tax return that is paid in taxes is the effective tax rate and it is equal to the pre-tax return minus the after-tax return divided by the pre-tax return. The formula for the pre-tax return, r, is:

(1) $r = (R+d)(1-uz)(1-k)/(1-v)-d$

where r is the pre-tax return, R is the after-tax real return, d is the economic depreciation rate, u is the tax rate applied to deductions, z is the present value of depreciation deductions (discounted at the nominal after-tax rate, which is the real rate, R, plus the inflation rate p), k is the tax credit, and v is the tax rate applied to gross income. Under current law, u and v are both equal to 35%. Under the net income patent box that has been discussed in this report, both u and v are reduced to 10%; under a gross income patent box, u remains 35% while v falls to 10%.

When z is equal to economic depreciation ($d/(R+d)$) and k is equal to zero, the effective tax rate is the statutory rate. When z is equal to one (when capital investments are expensed) and k is equal to zero, the effective tax rate is zero.

Most investment in R&D is in intangibles (salaries for scientists and supplies) but a portion reflects tangible investment. A Canadian study used to compare taxation of intangibles across countries relied on an R&D investment comprised of 7.3% equipment, 6.6% structures, and the remainder intangible investments (such as scientists; salaries and supplies).[25] These shares were used to calculate effective tax rates in **Table 2** and **Table 3**. In these calculations, it was also necessary to identify a particular type of equipment and of structure. The equipment category of instruments is used and the structures category of industrial structures is used.

For purposes of estimates using equation (1), based on estimates in the National Income and Product Accounts, the economic depreciation rate (d) for instruments is 13.50%, the rate for industrial structures is 3.14%, and the rate for research intangibles is 17.00%.[26] To determine z, a tax life is needed. Instruments are depreciated largely under the 7-year life although small shares are estimated to be depreciated under a 5-year or a 20-year life.[27] These methods are accelerated (larger deductions in the earlier year). The present value of depreciation, z, is estimated at 81.4 cents per dollar of investment for equipment. Structures are depreciated over 39 years at a straight line basis (equal amounts in each year) and the estimated value of depreciation is 34.2 cents per

[25] Canadian Department of Finance, "An International Comparison of Tax Assistance for Investment in Research and Development," 2009, http://www.fin.gc.ca/taxexp-depfisc/2009/taxexp0902-eng.asp.

[26] Bureau of Economic Analysis, "BEA Depreciation Rates," http://bea.gov/national/FA2004/Tablecandtext.pdf. Depreciation rates on R&D intangibles are taken from Charles Ian Mead, *R&D Depreciation Rates in the 2007 R&D Satellite Account*, Bureau of Economic Analysis/National Science Foundation, 2007 R&D Satellite Account Background Paper, http://faq.bea.gov/papers/pdf/Mead_RD_Paper_wp.pdf.

[27] Assets are assigned classes based on the industry and these estimates reflect the distribution of the instruments category across industries. See Jane G. Gravelle, *The Economic Effects of Taxing Capital Income*, Cambridge, MA, MIT Press, 1994, for a discussion.

dollar of investment. Intangible assets are expensed (deducted when incurred). Research expenditures are also eligible for a research and experimentation (R&E) credit. This credit, which was a temporary provision extended a year or two at a time (and effective in place almost every year since 1981) was made permanent. The discount rate, R, is set at 5% and inflation at 2%.[28] The effective tax rate is relatively insensitive to real discount rates, but is sensitive to inflation. With the 5-year amortization of intangible R&D expenses, z is 84.4 cents per dollar.

For the calculation that incorporates the research tax credit, firms may choose between two credits. One is a credit of 20% in excess of a rolling base that is unrelated to prior spending and thus has a marginal effective rate of 20%. The other is a credit of 14% in excess of 50% of the past three years of research expenditures. Because each dollar of research today increases the base in each of three future years (by 50 cents divided by 3) it reduces future credits, this offset must be taken into account. The credit is 14% times (1 minus 0.5 times the sum of $1/(1+R+p)$, $1/(1+r+p)^2$, and $1/(1+R+p)^3$ divided by 3). Given the weighted real discount rate of around 0.05, the result is an effective marginal rate of slightly more than half, or 7.9%. According to data on the research credit in the IRS Statistics of Income, the share claiming the 20% credit was 28%, leading to an average rate of 11.3%.

When aggregating different assets into a single tax rate, the pre-tax returns are weighted by investment shares to produce an overall return, which is then used to calculate the effective tax rate.

Estimating the Total Effective Tax Rate

To estimate the total tax rate, the total discount rate, R_T, is used in equation (1) which is a combination of the firm's equity discount rate and the interest rate on debt net of taxes:

(2) $R_T = f(i(1-u)-p)+(1-f)R$

where f is the share of debt finance, i is the nominal interest rate, and the other variables are as described above.

The pre-tax return is derived from that discount rate. The effective tax rate is $(r-R_i)/r$, where r is the estimated pre-tax return and R_i is the after-tax return to the suppliers of capital (stockholders and creditors).

(3) $R_i = f(i(1-ati)-p)+(1-f)R(1-v)$

where a is the share of interest taxed, t is the marginal tax rate on interest, and v is the effective tax rate on dividends and capital gains for corporation stock.

In addition to the data used above, data are needed for the rates of return (R and i), the inflation rate, the share of debt finance, and the tax rates. Note again that the effective tax rates are not very sensitive to real rates of return but are quite sensitive to the inflation rate.

The equity rate of return is based on historical trends and is after corporate tax but before individual tax is set at 7%, allowing a 4% dividend rate and a 3% real growth rate. (The rate of growth in real GDP from 1965 to the last year before the recession, 2007, was 3.2%.) The nominal interest rate is set at 7.5%, reflecting recent experience with the Baa bond rate prior to the recession (for a real interest rate of 5.5%).[29] Debt is weighted at 36% and equity at 64% based

[28] The inflation rate is consistent with recent experience prior to the recession. See data in *Economic Report of the President*, February 2016, https://www.whitehouse.gov/administration/eop/cea/economic-report-of-the-President/2016.

[29] See data in *Economic Report of the President*, February 2016, https://www.whitehouse.gov/administration/eop/cea/ (continued...)

on data from the Flow of Funds Accounts.[30] The overall discount rate is close to the 5% rate used above.

The marginal rates for interest, dividends, and capital gains, respectively, are 22%, 14.6% and 15.4%. A large fraction of interest and dividends paid do not appear on individual income tax returns, according to Tables 7.1 and 7.2 of the National Income and Product Accounts and IRS Statistics of Income. In previous years a direct reconciliation had been prepared, and the current amounts included, 19% and 25%, are slightly lower than in the past, but similar.[31] The same share for dividends is used for capital gains. Rosenthal and Austin find a similar share (24%) using data from the Federal Reserve.[32] The small share reported is largely due to the large share of assets in pension, retirement, and insurance plans. In addition, half of the capital gains held privately is assumed to be untaxed because it is held until death.[33]

Estimating the Statutory Rate for Patent Box Income

While the patent box proposal specifies a statutory rate for patent box income, this rate is applied to income depending on a formula, and the rate may not be precisely the statutory rate implied. This section derives the statutory tax rate that would be applied to investment in R&D under the proposal to allocate net profit based on the share of research expenditures and shows that, under reasonable assumptions, the statutory rate will be equal to the patent box rate.

The objective of this derivation is to obtain a measure of $dT/d\prod_{R,}$ where T is taxes and $\prod_R$ is profits on investments in research, with d times any variable referring to a small change in that variable. This measure will provide the rate of tax imposed on a change in research profits.

Total taxes of the firm are:

(4) $T = (xu+(1-x)v)\ (\prod + \prod_R)$

where x is the share of costs associated with non-research spending, u is the ordinary tax rate, v is the patent box rate and $\prod$ is profits from non-research activities.

Totally differentiating (2) while holding ordinary profits and costs constant:

(5) $dT = dx(u-v)(\prod + \prod_R) + (xu+(1-x)v)\ (d\prod_R)$

The variable x will be a function of the costs of investment of each type. In order to relate to spending and costs, they are expressed as the cost of an additional unit of capital, either K for ordinary capital or K_R for research capital.

(6) $x= C_K K/(C_K K+C_{KR} K_R)$

(...continued)

economic-report-of-the-President/2016.

[30] See http://www.federalreserve.gov/Releases/Z1/Current/z1r-4.pdf.

[31] The most recent reconciliation study was Mark Ledbetter, "Comparison of BEA Estimates of Personal Income and IRS Estimates of Adjusted Gross Income, New Estimates for 2005, Revised Estimates for 2004," *Survey of Current Business*, November 2007, https://www.bea.gov/scb/pdf/2007/11%20November/1107_pi_agi.pdf.

[32] Steven M. Rosenthal and Lydia S. Austin, "The Dwindling Taxable Share of U.S. Corporate Stock," *Tax Notes*, May 16, 2016, pp. 923-934, at http://www.taxpolicycenter.org/sites/default/files/alfresco/publication-pdfs/2000790-The-Dwindling-Taxable-Share-of-U.S.-Corporate-Stock.pdf.

[33] Based on historical comparisons of realizations and accumulations. See CRS Report 91-250, *Limits to Capital Gains Feedback Effects*, by Jane G. Gravelle (out of print, available from author).

where C_K is the cost of a marginal investment in K, K is the stock of ordinary capital, C_{KR} is the cost of a marginal investment in research capital, and K_R is the stock of research capital.

Differentiating (6):

(7) $dx = (-C_K K C_{KR} dK_R)/(C_K K + C_{KR} K_R)^2$

Multiplying the bottom and top of the right hand side of (7) by K_R and substituting from (6)

(8) $dx = -x(1-x)dK_R/K_R$

Since the rate of profit is constant for a small change,

(9) $dK_R/K_R = d\prod_R/\prod_R$

Thus substituting (9) into (8) and the subsequent equation for (8) into (5):

(10) $dT = [-x(1-x)(u-v)(\prod + \prod_R)/\prod_R + (xu+(1-x)v)]\ (d\prod_R)$

If the share of net profits is equal to the share of costs, then $(\prod + \prod_R)/\prod_R = 1/(1-x)$ and:

(11) $dT/\ d\prod_R = -x(u-v) + (xu+(1-x)v) = v$

In the estimated effective tax rate analysis, the statutory rate for both deductions and income is assumed to be v. If profits are a smaller share than costs, the rate will be less than v and if profits are a larger share the rate will be greater than v.

The derivation above suggests that the effective statutory tax rate on income from R&D is equal to the patent box rate of 10% under the assumption that the shares of net profit and the shares of costs are equal and this rate is used in the effective tax rate calculations.

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