

The Use of Corporate Tax Incentives:

A Guidance Note and Experience from Poland, Hungary and Latvia

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Executive summary

Targeted reductions in corporate income tax rates may in some cases increase investment by firms, which can increase employment and the incomes of employees and suppliers, improve the availability of goods to their customers, and increase access to new technology. However, tax incentives also face significant problems. It can be hard to determine if an incentive results in a rise in investment, or if firms would have made the investment even without the incentive. In the latter case, the government loses revenues for no purpose. Corporate income tax reductions that are tied to the level of investment expenditures (for example, accelerated depreciation) tend to have a greater impact on investment per dollar of revenue lost than do reductions based on the level of profit (for example, profit exemptions or a targeted reduction in the tax rate). Rigorous monitoring is necessary to ensure that deductions are declared only for eligible expenditures, which can lead to high administrative costs. Tax incentives also may help firms to reduce their tax liability, in ways unintended by policy makers, for example by using accounting techniques that shift profits to low-tax jurisdictions. Tax incentives may replace domestic with foreign investment rather than increasing total investment. And the targeting of tax relief to particular businesses can create a perception of unfairness that erodes tax compliance.

This paper summarizes the results of case studies of the impact of targeted corporate income tax reductions on investment in Hungary, Latvia and Poland. In Hungary, a change in EU policy resulted in significant changes across regions in the maximum amount of EU and state aid, including a development tax credit, that could be allocated. This change affected the relative attractiveness to investment of the regions affected. In Latvia, the government permitted firms to increase their deduction for depreciation, with even more generous deductions allowed for some kinds of new equipment and for investment in less developed areas. In Poland, small firms were allowed to deduct the full cost of machinery and equipment purchases in the first year.

All three case studies find that these policy changes were associated with increased investment. The increase in deductions for depreciation was associated with a rise in investment in Latvia, but the result is significant only for small firms. In Poland, where only small firms were eligible, the rise in deductions resulted in an increase in investment by 6 percent in the period of economic stability and by 13 percent in the period of high volatility. However, the impact of the introduction of the incentive on the firms' decision to undertake a new investment was positive only in the period of economic stability. In Latvia, we did not find evidence of a link between the introduction of the tax incentive and the decision to undertake a new investment project. In contrast, in Hungary, firms tended to open more subsidiaries in regions where the aid intensity increased or decreased less. In Hungary, an increase in aid relative to investment, referred to as aid intensity, of one percentage point in a region was associated with a rise in firms' turnover, which is used as a proxy for investment, in that region of one percent.

The impact of corporate tax incentives in the three case studies differed according to a number of criteria. The higher deductions for depreciation had the most pronounced impact on investment in manufacturing in Poland and in industries where assets tended to be of long duration in Latvia. Higher volatility of turnover was associated with a greater impact of tax incentives in Latvia. And in Poland in uncertain times

(after the global economic crisis), tax incentives increased the average level of investment more than in stable times but did not increase the probability of undertaking a new investment.

The incentives in all three cases had an impact on government revenues. Deductions for accelerated depreciation in Latvia equaled 11–12 percent of GDP in most years reviewed in the case study, though during the crisis it was about 13 percent. In Poland the costs of one-off depreciation are much smaller as the incentive is targeted only at small firms. Moreover, the annual limit for investment expenditures that could be deducted is set at EUR 50,000, with the exception of 2009 and 2010, when it was temporarily increased to EUR 100,000.. In Hungary, the yearly amount of EU funds and state aid for firms in Hungary did not change, only the distribution of the funds between the regions did.

The potential for revenue losses and uncertainty concerning the size and firm composition of the investment response underline the importance of careful monitoring and evaluation of tax incentives. The first step is to measure the revenue loss through the preparation of regular tax expenditure reports, so expenditures made through the tax system can be compared to direct government expenditures. A CIT microsimulation model is one of the best tools to be used to measure the detailed impact of the cost of tax incentives on government revenues.

A more difficult, but also important, exercise is to compare the revenues foregone due to tax incentives to their economic impact, in terms of increased investment and jobs. Forward-looking average effective tax rates (AETRs) and marginal effective tax rates (METRs) are used to assess the size of distortions imposed by the tax system, for example the average reduction in investment or misallocation of investment (across sectors, firm size or types of investment) that is driven by the corporate tax system. These indicators are generated by feeding information on tax rules (often both domestic and foreign) into an investment model, and do not require taxpayer-level information. The AETR can be used to assess how corporate taxes influence the location of investment, while the METR can measure the extent to which having to pay corporate taxes raises the minimum rate of return required to undertake an investment.

Econometric analyses build on the information provided by METRs/ AETRs to estimate the amount by which investment expenditure (or the rate of investment) responds to tax incentives. This requires measuring both the change in the effective tax rate due to the incentive, which can be problematic given that information on the actual tax burden on firms is often unknown, and the response of investment to a change in the effective tax rate, which is complicated by numerous data and identification problems.

These econometric analyses cannot capture the indirect effects of tax incentives. For example, higher investment by firms benefiting from the tax cut is likely to increase the incomes of their suppliers, as well as reduce the price or improve the quality of goods available to customers. Higher investment may also boost employment and wages, and thus household incomes and their demand for goods. General equilibrium models are used to measure such indirect effects, although these models are complex and subject to some uncertainty due to the many parameters that need to be estimated. An example of this approach is the annual assessment of the refundable tax credit provided by Massachusetts, which has had a notable impact on film industry expenditures in the state.

Introduction

High corporate income taxes can impair growth by significantly reducing investment. On the other hand, the corporate income tax can be an important source of government revenues, limiting policymakers' enthusiasm for across the board reductions in tax rates. Thus, governments have targeted tax reductions on particular expenditures that are viewed as more productive (for example, investment in machinery), on sectors where investment may be more sensitive to tax rates (for example, those where investors enjoy a wide choice of location), or on particular taxpayers in need of assistance (for example, small firms). Such targeted incentives, however, also can be costly in terms of revenues, can assist in firms' efforts at tax avoidance, and can impair productivity if investment is unduly motivated by tax considerations rather than efficiency.

This paper has two goals. The first goal is to provide a broader discussion of the major issues that should be considered in evaluating the impact of tax incentives on revenue and economic activity. The second is to summarize recent case studies of Hungary, Latvia and Poland that have provided new insights on the impact of selected tax incentives on investment. These studies are a useful contribution to the growing literature on the impact of tax incentives on investment and should be of particular interest to countries in Eastern and Central Europe, which face similar issues.

The next section provides a brief discussion of the costs and benefits of tax incentives. This is followed by a summary of different approaches to the evaluation of tax incentives. The final section presents the conclusions from the three case studies on the impact of tax incentives on investment

Benefits and costs of tax incentives

Many countries attempt to increase investment by reducing corporate taxes on particular kinds of firms or for firms making particular kinds of investments (box 1 describes different forms of tax incentives for investment). Corporate income tax incentives may be intended to encourage local firms to raise their investment expenditures (production and hence the demand for labor), or to attract investment that otherwise would go to other countries. The potential value of reducing corporate taxes is supported by econometric studies finding that taxes negatively affect investment, although estimates of the sensitivity of investment to taxation differ widely. (see Robinson, 2017 and European Commission, 2017 for recent literature review). Annex 1 provides a theoretical framework, and Annex 2 a diagrammatic presentation, for analyzing the impact of corporate income tax incentives on investment and income.

In addition to raising the profits of the firms involved, investment can have broader social benefits. Expenditures on research and development can increase knowledge throughout the economy as workers in the firm undertaking R&D take jobs in other firms, or by revealing to other firms how technology can be used (referred to in the economic literature as 'demonstration effects'). Investment that increases the scale of production can improve efficiency, thus increasing the availability of cheaper or higher-quality inputs to other firms. Workers and firms who do not directly benefit from tax incentives may enjoy increased demand for their goods and services due to increased production at the benefitting firms. These indirect benefits can, in turn, raise government revenues.¹ In general, private investors do not take into account how their investment may benefit other firms, so that investment levels for the economy as a whole tend to be lower than desirable from a social welfare perspective.

¹ A full accounting of tax revenue would include corporate income tax and non-resident withholding tax on returns paid to non-resident investors. Other revenues accompanying increased investment could include increased property taxes and VAT on sales of additional output to residents.

Box 1. Common Corporate Tax Incentives for Investment

Tax holidays provide a full exemption from certain taxes, notably corporate income tax. The exemption may be provided on a time-limited basis with 'sunset' clauses or have an indefinite duration. Taxpayers may be relieved from filing tax returns showing the amount of tax relief.

Partial profit tax exemptions provide partial relief from taxes on profit, typically limited to corporate profit (not unincorporated business profit). Taxpayers are normally required to file tax returns, and to report taxable profit and tax payable. For instance profits added to the company's share capital are exempt from corporate income tax for companies reinvesting their profits into long term assets.

Targeted lower corporate tax rates apply a reduced corporate tax rate (below the basic corporate tax rate) on profit on targeted investment. An example is taxing profit of small businesses at a reduced rate.

Special economic zones (SEZ) provide an exemption from a variety of taxes – such as import duties, excises, VAT and often other taxes, including corporate income tax – to firms located in designated zones. The geographical boundaries of SEZs may be tightly defined (e.g., ring-fenced enclaves), or not.

Accelerated depreciation provides tax depreciation (deductions for capital costs used to determine taxable profit) at rates and/or depreciation methods that allow for faster write-offs than would normally apply (increasing the present value of depreciation deductions).

Investment tax allowances provide a tax deduction (in determining taxable profit) for some percentage of qualifying investment expenditure, in addition to tax depreciation. Specific carry-forward provisions may apply for unused tax allowances (or general loss carry-forward rules may apply with investment tax allowances factored in). The value to a firm of an investment tax allowance depends on the corporate tax rate applied to taxable income.

Investment tax credits provide a tax credit (deductible against tax otherwise payable) for some percentage of qualifying investment expenditure. Specific carry-forward provisions may apply for unused credits. Tax relief from an investment tax credit is not a function of the corporate tax rate (the credit does not influence the calculation of taxable income).

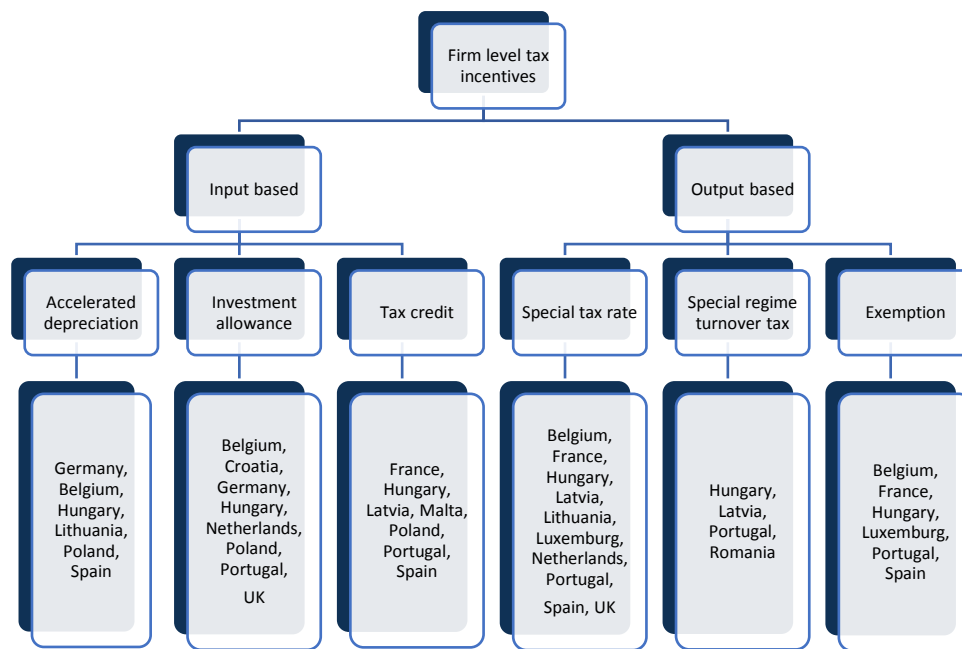
The primary cost of tax incentives is lower government revenues. Policy makers often prefer targeted tax relief to encourage investment rather than a general reduction in tax rates, which tends to have a large revenue cost. Nevertheless, tax incentives may have a significant impact on government revenues.. For example, deductions for accelerated depreciation in Latvia equaled 11–12 percent of GDP in most years reviewed in the case study, though during the crisis it was about 13 percent (see below). More than 90 percent of all firms with assets subject to depreciation applied for the scheme from 2009-14. The accelerated depreciation incentives apparently reduced firm taxable income (compared to firms using the earlier depreciation schedules) by 2.8 percent of GDP in 2008, 1.5–1.8 percent in 2009–11, and 2.4 percent in 2012–14. In both Poland and Latvia, the actual costs of accelerated depreciation are delayed government revenues, rather than foregone revenues. With one-off depreciation a firm no longer depreciates assets in years $t+1$ $t+2$... so it pays more CIT in those years. In Hungary, the policy change altered the distribution of funds between regions, but not the total amount of EU funds and state aid for firms.

A central concern with using tax incentives is the provision of tax relief to redundant investment – that is, investment that would have occurred in the absence of the tax subsidy (see Annex 3). Tax incentives can have a significant impact on investment decisions (see below), particularly with investors who have considerable flexibility in where to locate and in industries where pre-tax rates of return are roughly

similar across alternative locations.² Nevertheless, to the extent that enjoying the incentive is not the reason for making an investment qualifying for the incentive, the government loses revenues without any impact on investment. And since tax incentives are not always the determining factor in a decision to invest, this is a common problem.

An important distinction here is between cost-based (or input-based) incentives, based on the level of investment expenditures, and profit-based (or output-based) incentives, calculated as a percentage of corporate tax liabilities. Examples of cost-based tax incentives include accelerated tax depreciation, investment tax credits, and investment tax allowances, see Figure 1. These schemes can each be found in about a quarter of the EU Member States (Bergner (2017)). Examples of profit-based tax incentives include a reduction in the corporate tax rate targeted at certain taxpayers or kinds of investment, tax holidays and a partial/full profit exemption in calculating taxable profit. Preferential tax rates are found the most common instrument to support SMEs in the EU, if all tax incentives are considered. Worldwide, however, given the base-erosion-profit shifting strategies (BEPS), cost-based incentives are gaining ground vis a vis profit-based incentives.

Figure 1 Major income tax incentives for small and medium-sized companies in the EU, 2015



Source: Bergner (2017)

Cost-based tax incentives tend to have a larger impact on raising investment (per dollar of foregone revenue) than do profit-based incentives, because cost-based incentives are targeted directly at the goal of increasing investment. They are targeted at lowering the cost of capital and so make a greater number of investment projects more profitable at the margin—that is, may generate investments that would not

² This is observed where policy makers aim to tax more lightly business activities that are more geographically mobile, such as financial services and R&D, using targeted incentives, while taxing at full rates business activities that are largely insensitive to tax. In contrast, many developed countries take a broad-brush approach, providing tax incentives to both mobile and immobile tax bases (such as natural resources).

otherwise have been made³. Analyzed investment incentives in Poland and Latvia belong to this type. Moreover, profit-based incentives typically do not differentiate between profit from new capital and profit from pre-existing capital and are thus particularly subject to revenue losses without increases in investment.⁴ On the other hand, cost-based incentives may be more vulnerable to fraudulent efforts to declare deductions for ineligible expenditures (a classic example is misclassifying expenditures as R&D when they are actually devoted to other purposes). Rigorous monitoring is important to limit such abuses. There also is a great variety of kinds of incentives within each group. Thus, some types of cost-based incentives are more effective in raising investment than others, depending on their design and how they are implemented (the three case studies illustrate the impact of cost-based incentives).

Profit-based tax incentives reduce the tax rate applicable to taxable income and may help firms to implement tax avoidance strategies to reduce their tax liability. Investors may shift profits from one jurisdiction to another, or from business activities that do not qualify for tax incentives to activities that do qualify. This can be done by changing the prices charged on transactions in goods, services, financing, or licenses of intellectual property within a business group. Such changes will not affect the before-tax profits for the group as a whole, but can increase after-tax profits, and thus reduce government revenues. This issue was less of a concern in Poland, where tax incentives focused on SMEs, which typically are not involved in aggressive tax planning.

Tax incentives involve additional administrative costs, for example to monitor compliance with eligibility requirements, including targeting provisions. Administrative costs increase with the complexity of the tax system and the system of TIs contributes to this. Profit-based incentives require increased attention, through audits, to guard against non-arm's length transfer pricing of goods and services on intra-group trade. In general, the higher the resources devoted to monitoring compliance with tax incentive provisions, the lower the unintended revenue losses (e.g., due to profit shifting).

Tax incentives also may involve other indirect costs such as misallocation of resources and horizontal inequality. Tax incentives may create distortions on investment choices among sectors, activities, type of investment and source of funding instead of correcting market failures. Foreign investment attracted by incentives may replace domestic investment, thus reducing the net benefit of the incentive. This may include mergers and acquisitions that involve a transfer of ownership of existing capital, with no or minimal additional capital. It also includes instances where domestic firms cannot compete with firms granted special tax privileges and reduce their scale or close. In addition, targeting tax relief to certain businesses, to the exclusion of others, may create a perception of unfairness in the tax system and contribute to horizontal inequality, which tends to discourage tax compliance and increase participation in the underground economy.

It also is important to consider that the marginal cost of public funds exceeds one.⁵ That is, the loss incurred by society in raising additional revenues through a tax rate increase given the distortionary nature of taxes is often higher than 1 and depends on productivity of public spending that are financed

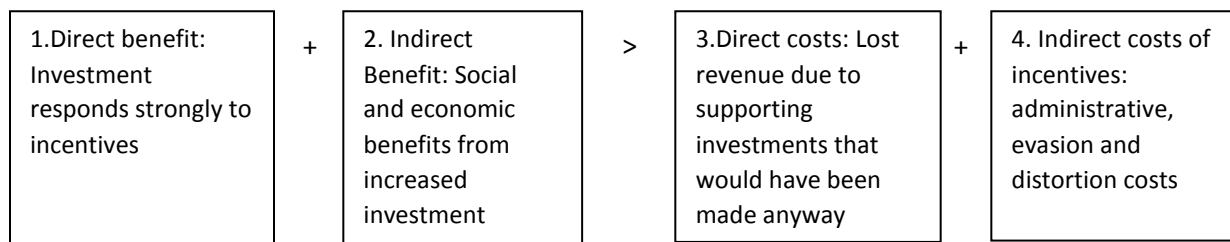
³ This finding is consistent with the general principle that when using subsidies to alter economic behavior, it is more efficient to target the subsidy as closely as possible to the target of the subsidy.

⁴ Introducing such a distinction in law would require that firms maintain separate profit accounts for new capital, and pre-existing capital. Aside from involving non-trivial compliance costs, a policy of not differentiating profit from new capital versus pre-existing capital recognizes scope that taxpayers would have for 'gaming' the system (fictitiously assigning revenues to new capital accounts, and business costs to pre-existing capital accounts).

⁵ The marginal cost of public funds in advanced economies is estimated to be in the range of \$1.20 to \$1.30. See Elgin, C. O. Torul and T. Turk, 2018. "Marginal Cost of Public Funds under the Presence of Informality", 2018/8/, online: econ.bund.edu.tr

from increased revenues.. The problems of redundancy, increased tax avoidance, administrative costs, and potential for competition with domestic investors underline the need for transparency and evaluation of tax incentive programs.

In summary, the effectiveness of a tax incentive should be evaluated by taking into account its benefits and costs. Cost-benefit analysis of TIs could show the public money is well spent. In Poland, a dollar spent by the government on the one-off depreciation scheme resulted in 5.9 dollars of additional investment made by firms. Figure 1 summarizes main elements discussed above that should be taken into account. TIs are effective in delivering on a policy objective if the costs are greater than the benefits.



Evaluating tax incentives

The above discussion highlights that corporate tax incentives can increase investment, but also can be costly. The size of these costs, in particular the amount of tax relief claimed that does not result in a real increase in investment, can be difficult to determine. This underlines the importance of careful monitoring and evaluation of tax incentives. Best practice in the use of tax incentives calls for tax expenditure reporting to monitor the size of revenues foregone, as well as an evaluation of the performance of incentives in increasing investment and jobs.

Tax expenditure reporting

Tax incentives are widely used, as they are easier to introduce and more difficult to monitor than expenditure programs. The political cost for a government of implementing a tax provision is often lower than for a corresponding direct spending program, since the former falls outside the budgetary framework. Therefore, the cost of TIs is largely hidden and subject to less control than direct spending programs. Unlike direct outlays that require an annual appropriation and the setting of a ceiling, and are subject to scrutiny, most TIs are open-ended. Moreover, the revenue losses are included in the budget law at most for the first year, and their effectiveness is rarely evaluated. Since the 1970s, however, a consensus has grown on the need to monitor the amount of government spending through the tax system, to analyze the possible effects of individual tax expenditure programs on future revenues, and to examine their impact in terms of equity and efficiency.

Tax expenditure reports provide an estimate of the amount of tax revenues foregone. These reports should be prepared on a regular basis (every 1-2 years, depending on resources) and should state the policy objective(s) of each tax incentive to provide a basis for evaluation. Without tax expenditure reports, the revenue foregone through tax incentives cannot be subject to the same scrutiny in budget preparations as are direct government expenditures.⁶ Such reporting, by increasing transparency and accountability of tax expenditures, increases public confidence in the fairness of the tax system and thus encourages tax compliance, and limits the scope for abuses of tax incentives. Moreover, estimates of

⁶ The lack of oversight of forgone revenues due to tax incentives is troubling. As direct public expenditures are financed by tax revenues net of revenues forgone by tax incentives, in effect tax incentives are given priority over direct government expenditures.

revenue foregone provided by tax expenditure reports are central to evaluating tax incentives, thus supporting better expenditure policies and improved resource allocation.

Estimating their cost is only the first step in evaluating TIs, and should be followed by examining their impact in terms of equity and efficiency. The evaluation part of the tax expenditure report should assess the success of a TI program with regard to the policy objectives and the effects on the behavior of firms (both those that benefit from the incentive and the non-targeted taxpayers).

The critical questions that need to be answered in the evaluation concern ***the assessment of additionality***: to what extent outputs (e.g., investment, jobs etc) would not have been achieved without public support (output additionality)? Do temporary incentives affect individual behavior even after the incentives have expired? Does public financing significantly modify firm behavior and strategy (e.g., type of research, degree of collaboration, and management of innovation processes - behavioral additionality)? The assessment of output and behavioral additionality is quite complex since outcomes are in general delayed and requires measuring what would have occurred in the absence of the policy intervention and understanding changes to the business decision processes of firms resulting from the government intervention.

Ministries of finance are typically responsible for preparing tax expenditure reports. This is appropriate, given their responsibilities and the need for accountability. And since whether eligibility for a tax incentive is an important factor in a decision to invest often depends on issues specific to the particular taxpayer, such evaluations require access to firm-level data from corporate income tax returns⁷ and financial statements of firms. Technically sound tools for the assessment of TIs also are essential, and investor motivation surveys can be useful.

Toolkit for the TIs analysis

There are theoretically two extreme models to assess impact of tax incentives, but often the middle solution is used. The most simplistic model relies only on the direct cost (the direct revenue loss) and benefit (the net investment increment) of a given tax incentive program (UN, 2018). This model can be calculated solely with conventional accounting, or the use of the so-called “head count” approach. However, this approach does not capture any indirect responses or changes in behavior. The other extreme is a computable general equilibrium (CGE) model, which uses the national (or regional) input-output accounts *and* output *multipliers* to simulate the impact of various specified tax and non-tax parameters and behavioral reactions. Such a comprehensive model often captures direct, indirect as well as induced economic and revenue impacts of a tax incentive. However, building and maintaining a CGE model is not easy and can be costly, so many countries use middle ground solutions that provide for a reliable cost-benefit assessment of TIs. With integrated revenue administration and computerized data it is possible to build micro-simulation models that are based on companies’ financial statements and tax returns submitted to the tax authority. Such a firm-based micro-simulation model can work wonders in the absence of sophisticated input-output accounts and a computable general equilibrium model. The other option applied in many countries, and in the three case studies presented in this note, is to estimate an elasticity of investment with respect to its tax price, based on micro level administrative data, and then use it to assess the impact of a tax incentive on the change in the marginal or effective tax rate. This

⁷ Using taxpayer-level data, analysts can determine whether a given firm that earns a tax incentive is profitable and taxable, and therefore can benefit immediately from tax relief to lower its current tax liability. This can vary widely across taxpayers, as it depends on the balances of unused tax depreciation allowances and business losses in prior years carried forward to the current year to offset tax.

enables the analyst to obtain a quasi-experimental variation to identify the policy effect in investment estimations.

Average and marginal effective tax rates

Evaluations of tax incentives should compare the revenues foregone to the increase in investment income and employment income generated by the incentive. Despite a long tradition of international organizations (including the World Bank, the IMF and the OECD) urging countries to undertake cost-benefit analyses of their tax incentives, relatively few studies are found in the literature or on government (or other) websites assessing effectiveness and efficiency.

Backward-looking average tax rate measures based on aggregate data are often used to assess the impact of corporate income taxes on an economy and to compare tax burdens across countries. However, backward-looking measures, including ‘implicit corporate tax rates’ – calculated as the ratio of corporate tax payments divided by some measure of pre-tax corporate profit – simply assess the tax rate on returns from installed capital. These indicators cannot identify the influence that a given tax parameter (for example, the depreciation rate) has on corporate taxes. Thus, such measures cannot determine the impact of changes in tax parameters, for example the introduction of accelerated depreciation, on the effective tax rate.

Evaluations of the impact of corporate income tax incentives often use measures of the ‘forward-looking’ marginal effective tax rate (METR) and average effective tax rate (AETR).⁸ METRs and AETRs do not measure the change in investment in response to tax incentives but are summary tax burden indicators that assess the size of distortions imposed by the tax system, across alternative investments. They are used to measure: (i) the reduction in investment created by the corporate income tax system, which can be compared to that of other tax systems to assess a country’s ‘international competitiveness’; (ii) the unintended tax distortions that affect the allocation of capital across sectors, firm sizes and types of capital (machinery and equipment, buildings, inventories, land); and (iii) how tax distortions affect domestic investment versus FDI.

METR/AETR analysis is routinely used to evaluate how the introduction, redesign or removal of tax incentives may affect the incentive to invest.⁹ Efforts at broadening the tax base in many countries, for example the US, the UK and Canada in the mid-1980s, relied on METR/AETR analysis to argue for scaling back tax incentives and instead reducing overall corporate income tax rates, thus lowering the dispersion in METRs across different investment types to improve economic efficiency. While METR/AETRs do not provide the information required to estimate the impact of particular tax incentives on the level or rate of investment, they can indicate the direction of change – particularly important when more than one tax policy is adjusted.¹⁰ The example in Annex7 uses METR analysis to compare effects on government revenues of a targeted cut in the corporate income tax rate versus the introduction of an investment tax

⁸ METRs/AETRs are forward-looking, based on measures of the net present value of future after-tax returns on investment. In contrast, backward-looking measures assess corporate tax paid, in a prior year, as a percentage of a pre-tax profit measure.

⁹ For example, comparisons of effective tax rates on investment by MNEs versus small businesses are important where policy aims to avoid outcomes where SMEs are at a competitive disadvantage relative to MNEs providing goods/ services to the same domestic market. A METR/AETR analysis can identify such instances, as well as providing a basis to consider various reforms that can reduce differences in the tax burden.

¹⁰ For example, a country may combine a reduction in the corporate income tax rate with a broadening of the base, where it is unclear whether the two measures together will positively or negatively impact investment.

credit. The two policy changes are designed such that they create the same reduction in the METR, and thus have the same predicted impact on investment.

METRs and AETRs typically use information on the corporate income tax rate, tax depreciation methods and rates, investment tax credits and investment tax allowances, and the tax treatment of debt versus equity finance. METRs/AETRs for FDI incorporate both host country and home country taxes (e.g., non-resident withholding tax rates and home country taxation of dividends and interest). METRs and AETRs are derived from an investment model. A central advantage is that the tax rates and parameters in the equations are based on tax legislation, not on taxpayer-level information.

The marginal effective tax rate (METR) is used to assess how corporate tax may influence the size of the optimal capital stock of a firm, sector or economy. The METR measures the extent to which having to pay corporate income tax increases the minimum rate of return required to undertake an investment (net of depreciation), for example to ensure that financing costs are covered.¹¹ In general, the larger is the increase in the minimum rate of return due to taxation (see Annex5), the larger is the predicted reduction in the capital stock due to taxation.

Average effective tax rates are used to assess how the tax on corporate incomes may influence the location of investment, taking into account taxation of the full return on investment (and not just the impact of the tax on the last unit of profitable investment, which is the focus of the METR). When calculating AETRs, policy analysts should distinguish between a normal rate of return, say, the average rate of return in an economy, and the *economic profit*, or the rate of return on a particular investment that is in excess of the normal return. This distinction is important, because tax rates that reduce, but do not eliminate, economic profit (so the return on an investment still exceeds the normal rate of return) may affect the location of investment, but not the decision to invest. While it may be difficult to measure the rate of return, some insight in to the likely sensitivity of an investment to a change in the tax rate can be gained by considering a range of return rates.

Forward-looking METRs and AETRS, however, are generally imprecise measures of the actual tax burden on firms. They typically are not adjusted to reflect actual loss carryover claims by firms in each year. Also, they are normally constructed without regard to tax-planning strategies used by multinational enterprises, and therefore cannot be expected to provide a reliable indicator of the actual tax burden on cross-border investment.

Marginal investor method and return on investment (ROI)

The evaluation of TIs can also be based on the marginal-investment, which uses investor motivation surveys to profile the 'true' marginal investor (Thi Canh, 2013). Marginal investors could be also identified by using the Return on Investment (ROI) by sector with and without incentives. Sectors that cross the hurdle rate of return with incentives are sectors where tax incentives are beneficial. Those sectors that are above the hurdle rate even without tax incentives are those where tax incentives are redundant. In the past these surveys have revealed a severe redundancy in the tax incentive (Table 1).

¹¹ The METR/AETR framework presented here considers the small-open economy case where personal shareholder level taxation of dividends, gains and interest does not affect the required rate of return net of corporate tax.

Table 1 Redundancy of Incentives (selected examples of studies that used investor surveys)

	Country Studied	Would have invested even without an incentive, (%) (Redundancy Ratio)	Did incentives influence amount of investment? (% share saying yes)
Investment Climate Advisory (FIAS)—investor motivation surveys	Jordan (2009)	70	28
	Mozambique (2009)	78	13
	Nicaragua (2009)	15 (51 for non-exporting firms outside free zones)	17
	Serbia (2009)	71	6

Econometric measures of the impact of taxes on investment

Econometric analyses have built on the information provided by METRs/ AETRs to estimate the amount by which investment responds to tax incentives. Such estimates are a key component of cost-benefit assessments of tax incentives. Measuring the impact of a tax incentive on investment expenditure requires two pieces of information: the ‘tax elasticity’ of investment with respect to its tax price (or the response of investment expenditure to a change in an effective tax rate); and the percentage change in the effective tax rate resulting from the tax incentive.

Tax elasticity. Frameworks based on the neo-classical theory of investment predict a reduction in the tax rate, all else equal, will lead to a rise in investment. However, this prediction is challenged by analyses that take into the account the benefits of investing in ‘dense’ locations, that is, places where there are many other firms and large concentrations of consumers. Such benefits include ready access to skilled labor, easy coordination with suppliers and purchasers, and low trade costs from proximity to a large market. If profits are determined to a great extent by location, then they can be taxed up to some point without discouraging investment – implying that investment may not respond to tax incentives in some cases.

Econometric studies generally find that a rise in the effective tax rate reduces investment. However, estimates of the sensitivity of investment to taxation (tax elasticity) differ widely. This is not surprising, as numerous factors influence investment decisions, and econometric analyses of the relationship between taxation and investment are fraught with data problems, as well as difficulties in determining the direction of causation and the influence of other variables. Trying to isolate the influence of tax incentives is exceedingly difficult, as there are no clear measures of many of the factors determining investment and no precise way to account for them. This is particularly problematic in cross-country studies. The substantial variation across countries, firms and time (and thus datasets) of the determinants of investment and the impact of tax incentives makes it extremely difficult to calculate a representative tax elasticity measure. In addition, it is unclear whether tax-planning strategies are factored into investment decisions or are instead only considered afterwards to increase after-tax profit.

The most recent empirical strategies to estimate tax elasticity are based on quasi-experimental approaches to identify effects of investment policies, using administrative micro-level data (Gruber, 2007) (Dwenger, 2012), (Devereux, 2013). The ideal experiment to evaluate TIs would have required randomly assigning a tax incentive to a group of firms and comparing their performance relative to a control group. In the case of firm-level tax incentive policies, arguments related to fairness and distortion to competition completely rule out such randomly assigned interventions. Using quasi-experimental variation for identification of policy effects offers a second-best evaluation solution, for periods when an exogenous policy change is observed. When there is cross-sectional and time variation, a difference-in-differences (diff-in-diff) methodology is often applied to assess the impact of the policies. In the diff-in-diff set up, the performance of a natural treatment group is evaluated against the performance of a natural control group in response to the change in the policy environment. The impact of the policy on the level of investment for treated firms is estimated, controlling for time-invariant firm-specific characteristics (using a within groups estimator and a firm size control). Three case studies presented in the note apply this approach.

Micro-simulation models. With access to corporate tax returns, balance sheets and financial data a micro-simulation model can be built to assess the impact of tax incentives on corporate tax revenues. The main application of the model is to estimate the costs of changes in tax policies, including tax incentives, assuming no change in economic activity as a result of the incentive.¹² The model may also be used to evaluate the impact of TIs (e.g. analyze how the tax relief is distributed across firms by industry, firm size and location), in particular if it incorporates behavioral responsiveness at the firm level. A CIT micro-simulation model is essentially a firm-level CIT calculator, created using a structured programming language or software such as Excel, with parameters and equations reflecting the tax laws and regulations determining CIT liability. The output is estimated CIT liability at the firm level, which can be weighted and aggregated to give economy-wide estimates of CIT under current law and some hypothetical law (e.g. with and without a given tax incentive). The biggest advantages of microsimulation models are their simplicity and reliance on tax-payer data that facilitates detailed estimations of the impact on fiscal accounts and firms' balance sheets. Annex 34 provides more details on the structure and applications of 'microsimulation' models.

Dynamic general equilibrium analyses of the impact of taxes on investment

The econometric analyses described above focus on the direct impact of tax incentives on economic activity, for example how much investment increases as a result of a reduction in the effective tax rate. Tax incentives also can have important indirect effects on economic activity. For example, if introduction of a tax incentive significantly increases investment, then demand is likely to rise in the local economy due to increased incomes of workers in, and suppliers to, the firm making the investment (see above). A recent report by staff of the IMF, World Bank, OECD and UN provides general guidance on cost-benefit analysis of tax incentives that consider both their direct and indirect effects. The report was prepared at the request of the G20 Development Working Group, given continued interest of (mainly) developing countries in using tax incentives, coupled with concerns over the generally disappointing experience with them.¹³

¹² Microsimulation models can be also dynamic, which allows agents to adjust their behavior, but it requires incorporating elasticity of the corporate tax base to changes in the tax rate

¹³ See International Monetary Fund (IMF), World Bank, OECD and United Nations, 2015. "Options for Low Income Countries' Effective and Efficient Use of Tax Incentives for Investment." Study and Background Paper Prepared for the G20 Development Working Group. Washington.

Evaluating these effects requires a general equilibrium framework (e.g. CGE model)¹⁴ that captures the flows of payments within an economy. Such models tend to be complex, as they require detailed and reliable input-output national accounts data to derive various output multipliers. A big advantage of computable general equilibrium models is their ability to take into account all behavioral reactions to the initial changes resulting directly and indirectly from a tax incentive program. It can provide insights on the effect of TIs not only on investment but also on profits, employment and salaries and combined with microsimulations can inform on income distribution. The main weakness of CGE models concerns some uncertainty about the results due to the many parameters that often need to be estimated. In addition, CGE models rely on aggregate data, so they cannot be used to reliably estimate the revenue impact of detailed tax policy changes (e.g., to tax depreciation rules), or account for effects of business loss carryovers. Finally, in deciding whether to develop an in-house CGE model for TIs estimation, the possible applications (benefits) of the model, and the resource costs in developing and maintaining it over time, should be considered.

A notable example is the annual assessment of the refundable tax credit provided by the US state of Massachusetts to support its film industry.¹⁵ The film industry tax credit (FTC) provides a tax credit equal to 25 percent of the costs of film production. The evaluation estimates that only \$1.4 million of the film company expenditures, out of a total \$176 million, would have been made without the tax incentive. Thus, the incentive had a very significant role in increasing film expenditures. The assessment relies on a dynamic general equilibrium model to calculate the positive indirect effects of increased film production spending, and negative indirect effects from the reduction in public expenditure required to balance the state budget. These calculations exclude the value of wage and non-wage payments made to individuals and businesses resident outside of Massachusetts. The impact on GDP, taking into account effects on wages and profits in the state economy, is estimated to be \$118 million.

Economic Impact of tax incentives – case studies of Hungary, Latvia and Poland

The academic literature often finds that tax incentives in the form of accelerated depreciation, if properly designed, can increase investment. For example, the accelerated first-year depreciation allowances for equipment, available in the US between 2002 and 2004 and again between 2008 and 2013, had a positive impact on investment (House and Shapiro, 2008, Zwick and Mahon, 2017). A change in the qualifying thresholds for the accelerated first-year capital allowances for investment in plant and machinery in the UK also resulted in a positive investment response (Devereux, Maffini and Xing, 2016).¹⁶ A similar program had a strong and significant impact on business investment and employment in Germany (Eichfelder and Schneider, 2014¹⁷ and Ohrn, 2015). Moreover, the reduction in the user cost of capital prompts an extensive margin response for firms that would not have made any investment in capital goods in the absence of the policy. The extensive margin response is driven mostly by the greater incentive to upgrade

¹⁴ For a brief and practical explanation of the CGE model and its use for impact analysis, refer to the World Bank website with the entry “Computable General Equilibrium (CGE) Models”.

¹⁵ See Pitter, A., 2013. “A Report on the Massachusetts Film Industry Tax Incentives”, Department of Revenue, Commonwealth of Massachusetts.

¹⁶ Small and medium-sized enterprises (SMEs) were allowed to depreciate new equipment at a rate of 40 per cent in the first year, compared to the standard rate of 25 per cent available to larger companies.

¹⁷ The program covered investments in Eastern Germany before 1999 to promote economic convergence of Eastern and Western Germany after reunification. The effects were stronger for long-lived capital goods, large businesses, and investments before the tax incentives were cut back in 1997. Moreover, there was a significant reduction in building investment in the year after the expiration of the program.

the capital stock more frequently thanks to the lower user cost of capital (Hall and Jorgenson, 1967, Jorgenson, 1963). Further, tax incentives may relieve the cash flow constraint for firms with profitable investment opportunities but insufficient funds for investment (Myers and Majluf (1984); Kaplan and Zingales (1997); Bond and Van Reenen (2007); Devereux and Liu (2016)).

Investment incentives have been also found to have a positive impact on firm location and investment decisions, as evidenced by recent empirical literature on regional development. The UK's Regional Selective Assistance aid grant¹⁸ attracted firms to locate plants in beneficiary regions (Devereux et. al, 2003). In Italy, a program that provided for a higher tax credit for less developed regions was effective in stimulating investment in those regions (Bronzini et. al, 2008). In Poland, tax incentives granted to entrepreneurs in special economic zones had a positive impact on investment and employment (Ambroziak, 2016, and Ambroziak and Hartwell, 2017).

Recent case studies of Hungary, Latvia and Poland support the view that corporate income tax incentives can increase investment. These studies contribute to an emerging literature using firm-level data collected by government ministries responsible for tax administration to evaluate the effects of selected tax incentives (see Table 2) on firms' investment decisions. The three case studies used slightly different approaches, based on the policy changes introduced. But all three studies employ a difference-in-difference methodology, which compares the changes in outcomes over time between firms likely to benefit from the tax incentive (referred to as the treatment group) and those that are not (referred to as the control group). Thus, the studies illustrate the quasi-experimental approach to estimating the impact of tax incentives, as discussed in the section on evaluating tax incentives, above. The analyses take into account firm characteristics that do not vary by time. Similar approaches are used in some of the studies cited above. Box 2 describes the policies considered and data used in the three studies.

Table 2 Selected TIs analyzed in the case studies.

Accelerated depreciation scheme in Poland	Accelerated depreciation scheme in Latvia	Aid intensity in Hungary
Accelerated depreciation (AD) provision 'Lump Sum Depreciation' introduced in 2007, which enabled companies with less than 800,000 Euros in turnover in the preceding year to benefit from 100 percent expensing of the cost of certain capital goods. The scheme was extended to a group of medium-sized firms with turnover below 1.2 million Euros (2009).	The AD policy, introduced in 2006, consisted of: (1) the general AD scheme, (2) incentives to acquire new technological equipment, and (3) investment incentives in SAAs. The general AD scheme doubled depreciation rates (that originally ranged from 5 to 20 percent). The incentives for new technological equipment concerned new production equipment and used a 1.5 multiplier for the general AD scheme. Investment incentives in SAAs introduced a coefficient varying from 1.3 to 2.0 depending on the category of assets applied to the general AD scheme.	Changes to aid intensity introduced in 2014 at the regional level. Aid intensity was reduced by 5-30 percent in Central Hungary region; by 5 percentage points in the Western and Central Transdanubia regions; and remained unchanged at a high level - 50 percent - in the less developed 4 regions. Aid intensity is a ratio of the total amount of EU and state aid and development tax credit relative to the present value cost of new investment. The development tax credit can be used to reduce CIT tax payments in 10 years after the completion of the investment.
<i>Source: World Bank Staff</i>		

¹⁸ A grant is more favorable than a tax relief to firms that are making losses and thus are currently unable to claim tax relief.

Box 2 – Background information for the case studies

For Poland, the case study analyzed the impact of special depreciation provisions on investment. In 2007, the government allowed companies with turnover below 800,000 euros to deduct 100 percent of the cost of certain capital goods in the year purchased (the threshold was raised to 1.2 million euros in 2009). Before this change straight line depreciation was used with average depreciation period around 7 years. The study uses a difference-in-differences methodology combined with an instrumental variable approach.

The case study for Latvia analyzed the effect of accelerated depreciation policy on firm investment using administrative firm-level data for 2007-2014, as well as industry (2-digit NACE) level data for 2008-2015. From 2006-17, firms could use a larger asset depreciation value for tax purposes than for balance sheet purposes. The policy consisted of three components: (i) the general scheme had five asset categories subject to depreciation rates ranging from 10 to 40 percent (compared to the earlier range of 5 to 20 percent); (ii) for new equipment the value of the deduction was increased by 50 percent; and (iii) in specially assisted areas¹⁹ the value of the deduction was increased by different multiples, depending on the type of investment. The government also provided a 100 percent write off of expenditures on research and development, and beginning in January 1 the value of the write off was multiplied by three.

The case study for Hungary analyzed firms' location decisions based on the municipality business tax registry, which contains administrative microdata on subsidiaries for 2013–2016. In 2014, the European Commission changed the maximum amount of development aid, including assistance from the EU and from the country, that can be provided to each subnational region (the ceiling differed across regions). This resulted in significant changes in the allocation of assistance and of Hungary's development tax credit across regions.

Error! Reference source not found.provides summary information on data used in the three case studies.

. Table Tax experiments – data overview

Country	Number of firms (in the database)	Treatment group (no of firms)	Control sample (no of firms)	Time period covered
Latvia	128,459	Treatment 1: 10,649 Treatment 2: 11,669	Control 1: 30,872 Control 2: 14,915	2008-2014
Hungary	864,896	437,935	426,961	2013-2016
Poland	91,212	Treatment 1: 34,177 Treatment 2: 7,799	Control 1: 15,389 Control 2: 11,774	2005-2010

Source: World Bank Staff

¹⁹ The least developed municipalities in Latvia, listed in the Cabinet regulations amending the Regional Development Law.

The introduction of accelerated depreciation allowances in Poland in 2007 was associated with a rise in average investment of around 6 percent and an increase in the probability to invest by around 4 percentage points (the extensive margin effect was estimated with a non-linear model). In the period of high economic uncertainty, the impact of the tax incentive on investment is even stronger (14 percent), but there is no effect on the probability of investing. Together, these results suggest that: (1) some firms “wait and see” during periods of high uncertainty, even in the presence of generous incentives; and (2) periods of stability offer an important policy opportunity to encourage investment.

The case study for Latvia finds a positive effect of accelerated depreciation policy on a firm’s investment rate in 2011-2014, and the impact is significantly stronger for firms with less than 6 employees. Both profitable and loss-making firms²⁰ invest more due to the tax incentive; the investment rate increases in line with the previous year’s profit or the absolute size of the last year’s loss. However, the impact of the policy on the probability of a firm undertaking a new investment, while positive, is not statistically robust. Moreover, the impact of the accelerated depreciation scheme for new equipment on investment was weaker, with no evidence of a positive impact on the probability to invest. Also, the accelerated depreciation scheme did not increase investment in specially assisted areas (although the policy did have a significant impact on investment in these areas after a cumbersome application requirement²¹ was lifted in 2010). The stronger investment impact for the general scheme than for the schemes directed at new equipment or specially assisted areas raises the question of whether the program was too general and/or too generous, resulting in over-investment in less productive firms or industries.

The case study for Hungary finds that modifications in regional development assistance from the EU and the government were correlated with the choice of where to locate subsidiaries within the country. An increase in aid intensity (the ratio of EU and state aid plus a development tax credit to the present value of the cost of new investment in the region) of one percentage point increased firms’ turnover, which is used as a proxy for investment due to the lack of investment data at the municipality level, by one percent.²² A reduction in aid intensity had a greater (negative) impact on turnover in municipalities where the aid intensity was reduced more. The increase in turnover resulted from firms opening more subsidiaries in regions where the aid intensity increased or decreased less. However, changes in aid intensity had no significant impact on the reallocation of business activity between subsidiaries. Interestingly, the correlation between changes in aid intensity and the opening of subsidiaries breaks down for Budapest, indicating that the advantages of locating in the capital, and a dense urban environment, are more important than benefiting from subsidies. While investment tended to rise in firms immediately after the reform was introduced, the relationship between tax incentives and investment was very weak 2 years after the reform. These results should be interpreted carefully, as no microdata is available to check investment trends prior to the reform.

The impact of corporate tax incentives in the three case studies differed according to a number of criteria. In Poland, the accelerated depreciation allowance had the most pronounced impact on investment in manufacturing; the investment response was more than double the overall effect for all firms (the rise in the level of investment was 12.2 percent in stable times, and 34 percent in the high volatility period). In Latvia, the impact of accelerated depreciation was stronger in industries with most of their assets in long-

²⁰ The positive response of loss-making firms presumably reflects the expectation that they would become profitable in the near term and able to claim the tax incentive.

²¹ The requirement was that taxpayers submit a project application to benefit from accelerated depreciation.

²² The authors verify that turnover is highly correlated with investment, based on a different dataset with data by firm, but not municipality.

duration categories. As noted above, the Latvian tax incentives had the most significant impact on small firms (less than 6 workers).

The case studies provide some evidence on how the impact of tax incentives on investment are affected by volatility. In Latvia, the incentives had a stronger impact on investment in firms where turnover was highly volatile. Indeed, for firms with medium to high volatility of turnover, the investment impact rose as turnover became more volatile. Similarly, the investment response to tax incentives may depend on demand conditions that increase volatility. In Poland, the response of the average level of investment to tax incentives was significant in both stable times (2007 compared to 2005) and uncertain times (2010-16, after the global economic crisis, compared to 2005-06). In addition, the increase in investment was stronger in uncertain times. However, the probability of investing was not affected by tax incentives in the period of higher uncertainty, in contrast to the period of stability. This indicates that in uncertain times firms prefer to wait and evaluate market conditions before making new investments. These results are insightful for governments that consider investment tax incentives as a part of stimulus package during a downturn.

While the three case studies provide evidence that tax incentives can be associated with increased investment, the above analysis cannot take into account all of the costs and benefits of tax incentives cited in the second section of this paper. The strengths of the method used in the three case studies relies on measuring an investment response to the incentives by using counterfactual setting, thus controlling for the problem of *redundant investment* discussed above. While the studies do test for the significance of the relationship between higher investment and the tax incentive programs, it does not capture indirect benefits (that could be measure in general equilibrium framework). Data on the rise in investment may understate the benefits of the tax incentive programs, because the social benefits from higher investment are not measured. The size of the social benefits may vary, depending on the form of investment undertaken. For example, investment in manufacturing sectors by firms domiciled in more advanced economies may play a greater role in introducing more competitive practices or higher technology than does investment by domestic firms. On the other hand, the studies also cannot fully measure the increased administrative costs involved in the incentive programs or the incidence of fraudulent claims. Thus, while the case studies provide an important perspective on the impact of the tax incentive programs, they cannot answer all of the questions relevant to an evaluation of these programs.

Annex 1. Theoretical framework for assessing effectiveness and efficiency of tax incentives

The most basic approach assesses whether a tax incentive is effective in increasing investment, without necessarily addressing social costs. To illustrate this, let K^N denote redundant investment (observed in the absence of the tax incentive), and let ΔK denote incentive-driven investment. A tax incentive is effective in increasing investment if ΔK is positive. Such analysis has limited value, as it ignores revenues forgone and other social costs of tax incentives which depend on the type of tax incentive, rates of redundancy, and other factors.

A relatively simple framework recognizing the cost side of incentives calculates the amount of CIT relief provided to incentive-driven investment (ΔK) and redundant investment (K^N), divided by some corresponding measure of economic activity – for example, the number of jobs.

Consider an investment tax allowance that subsidizes investment expenditure at rate (c), and let $J(K^N+\Delta K)$ measure the number of jobs corresponding to total investment. With this, the ratio of costs and economic activity can be written as:

$$\frac{c(K^N + \Delta K)}{J(K^N + \Delta K)} \quad (1)$$

Such calculations of the ‘dollar cost per job created’ are often used as indicators of effectiveness. However, the interpretation of such ratios is difficult when comparing results across different tax incentives or investments. The ratio may be similar in two cases of TIs analyzed where the fraction of investment that is redundant ($K^N/(K^N+\Delta K)$) differs significantly between the two.

A ratio that provides greater insights focuses on forgone CIT revenues on redundant investment (K^N), which modifies ratio shown in (1) as follows:

$$\frac{c(K^N)}{J(K^N + \Delta K)} \quad (2)$$

An alternative ratio focuses on foregone CIT revenues on redundant investment relative to the number of jobs created by incentive-driven investment:

$$\frac{c(K^N)}{J(\Delta K)} \quad (3)$$

A more comprehensive framework for assessing the effectiveness of tax incentives applied in numerous reports by S. James and colleagues (World Bank Group) compares benefits (B) from marginal investors (incentive-driven) with foregone tax revenues (T) from infra-marginal investors (redundant investment).²³ In particular, a tax incentive is estimated to be effective where the following condition holds:

$$\sum_{i=1}^N B_i = f(J_i) > \sum_{s=1}^M T_s \quad (4)$$

²³ The framework also includes on the benefit side other (non-exempt) taxes collected from marginal investors, and indirect costs (costs of administering tax incentives, and costs linked to tax evasion and avoidance). Where these additional elements are relatively small amounts, they may be ignored.

where index (i) is used to sum benefits for N marginal (incentive-driven) investments, index (s) is used to sum foregone tax revenues for M infra-marginal (redundant) investments, and J_i denotes (new) jobs created by marginal investments.

Assuming that total benefits (B) from marginal investments can be represented as a linear function of jobs created and other benefits (in addition to jobs), then the condition for a tax incentive to be effective can be expressed as follows:

$$B = \alpha_0(J) + \alpha_1(K) > T \quad (5)$$

where (J) measures total jobs created by marginal investments and (K) measures other benefits in addition to jobs created. Dividing condition (5) through by J, we have:

$$\left(\frac{B}{J}\right) = \alpha_0 + \alpha_1\left(\frac{K}{J}\right) > \left(\frac{T}{J}\right) \quad (6)$$

Such indicators have been used by the World Bank (FIAS) and USAID.²⁴

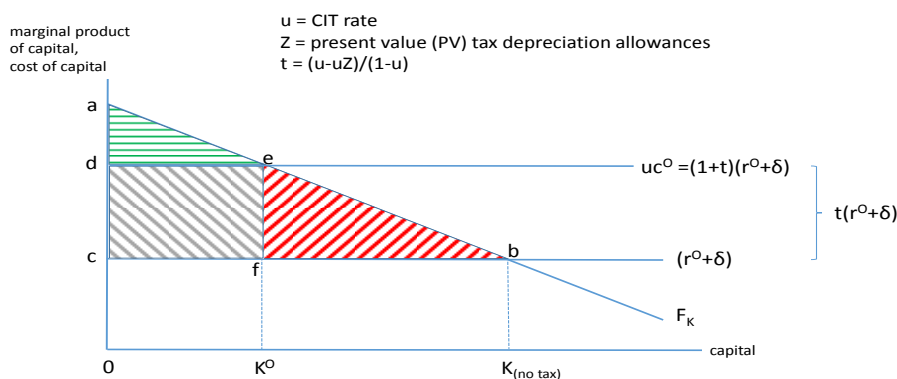
²⁴ Examples include: Foreign Investment Advisory Services (FIAS), 1999, "Kingdom of Thailand – A Review of Investment Incentives"; and Nguyen Thi Canh et. Al, 2004, "An Empirical Study of Corporate Income Tax Investment Incentives for Domestic Companies in Vietnam, USAID Report for the Vietnam Competitiveness Initiative.

Annex 2. Efficiency losses from CIT

A central concern with corporate income tax, is that it discourages investment and thereby creates efficiency losses – reduced income, and thus reduced private consumption and welfare. In general, lowering the effective corporate income tax (CIT) rate (using tax incentives), reduces investment and income less, compared to the case where CIT is not imposed (indefinite CIT holiday). A central reason for tax incentives (relieving CIT) is to avoid the discouraging effects of the tax on investment.

The discouraging effects of CIT on investment and income, which incentives are intended to alleviate, are illustrated in Figure 1. In the absence of CIT, the profit-maximizing capital stock is at the point where the marginal product of capital (F_K) equals the marginal cost of a unit of capital ($r^0 + \delta$), which is the sum of the normal rate of return to investors (r^0), plus the rate of economic depreciation of physical capital (δ). The profit-maximizing capital stock in the no-tax case is shown as $K_{(no\ tax)}$. Profit on investment is shown by the triangular-shaped area [abc], where benefits exceed costs.

Figure 1. Efficiency loss resulting from corporate income tax



With CIT, the marginal cost of a unit of capital increases to $(1+t)(r^0 + \delta)$, referred to as the ‘user cost of capital’. The CIT premium (t) measures the percentage amount that the marginal product of capital must exceed the cost of capital in the no-tax case ($r^0 + \delta$) to cover CIT payments. Prior to the introduction of an investment tax allowance, $t = (u - uZ)/(1 - u)$ where (u) is the statutory CIT rate, and (Z) measures the present value of tax depreciation allowances per unit of investment. The profit-maximizing capital stock is lower with CIT (K^0 in Figure 1). Under the assumption of declining marginal productivity of capital, the marginal product of capital (F_K) is inversely related to the size of the capital stock. A lower capital stock yields a higher pre-tax rate of return (F_K), required to cover the CIT liability (in addition to the cost of funds and economic depreciation ($r^0 + \delta$)). CIT is shown to create an efficiency loss – reduced profit shown by the area [ebf] on a reduced capital stock – which lowers consumption and welfare. Pre-tax profit is shown by the area [aefc].²⁵ CIT on the normal return to capital at K^0 is shown by [cdef], while CIT on economic profit (above-normal returns) equals the statutory CIT rate times profit in excess of the normal return shown by area [aed].

²⁵ Pre-tax return equals pre-tax revenues shown by the area [0aek⁰] minus the normal return on K^0 , covering the cost of finance and economic depreciation, shown by the area [0cfk⁰].

Annex 3. Redundancy and implications for efficiency of tax incentives

A central concern with using tax incentives is the provision of tax relief to redundant investment – that is, investment that would have occurred in the absence of the tax subsidy. In the past, and even today amongst non-tax policy experts, a common misconception is that there is no revenue loss. This assumes that all investment qualifying for an incentive is incentive-driven (would not be observed in the absence of the incentive) and ignores the redundancy problem.

The problem of redundancy is illustrated in Figures 2 and 3, which considers the introduction of an investment tax credit, alongside other (non-tax) factors that encourage investment. The example considers a reduction in the cost of finance²⁶ from r^0 to r , which reduces the user cost of capital from $uc^0=(1+t)(r^0+\delta)$ to $uc^1=(1+t)(r+\delta)$. This is shown in Figure 2 where the capital stock at the beginning of the year is K^0 . A lowering of the user cost of capital is shown to increase investment expenditure in the amount $K^N=(K^1-K^0)$, increasing the capital stock from K^0 to K^1 .

Figure 2. Investment K^N resulting from a decline in the cost of funds

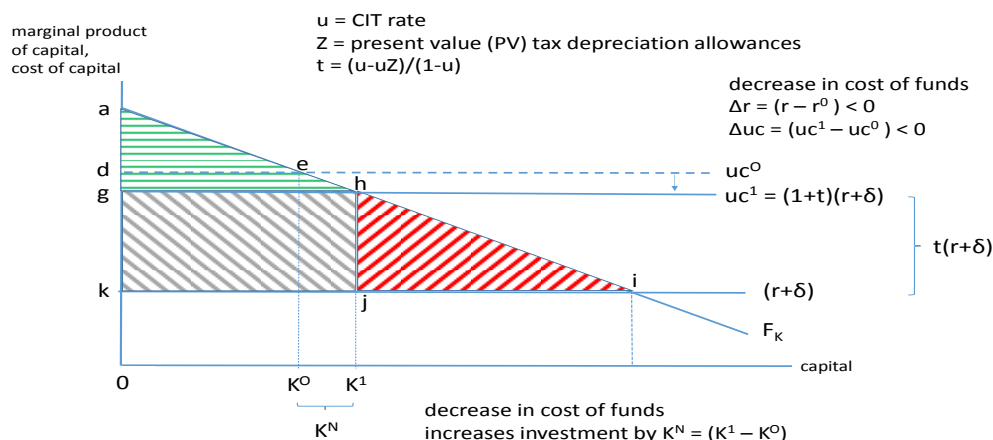
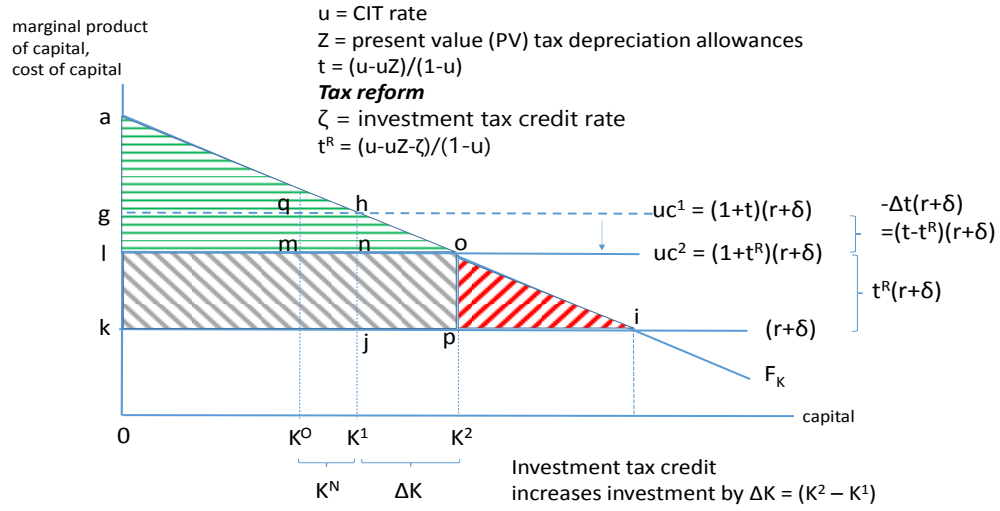


Figure 3 introduces an investment tax credit (ITC) provided at rate (ζ) on total current investment. The ITC lowers the CIT premium from $t=(u-uZ)/(1-u)$ to $t^R=(u-uZ-\zeta)/(1-u)$. This lowers the user cost of capital from uc^1 to uc^2 which stimulates additional investment $\Delta K=(K^2-K^1)$, increasing the capital stock from K^1 to K^2 . Thus, beginning with a capital stock of K^0 , current year investment consists of $K^N=(K^1-K^0)$ motivated by a decrease in the cost of funds, plus $\Delta K=(K^2-K^1)$ driven by the investment tax credit. The total current year expansion of the capital stock is (K^2-K^0) . The ITC is granted to ΔK (the incentive-driven component of investment), and to redundant investment K^N that would have occurred in the absence of the incentive.

Welfare implications of this scenario are discussed in section D. The main point here is that, when using tax incentives, a central cost consideration is forgone CIT on redundant investment K^N . As total investment $(K^N+\Delta K)$ receives the investment tax credit, the unavoidable extension of this relief to K^N creates an efficiency loss. Forgone CIT on normal profit earned on K^N , resulting from the tax subsidy in purchasing K^N , is shown by area [qhnm].

Figure 3. Investment ΔK resulting from an investment tax credit

²⁶ A reduction in the cost of finance (r^0 to r) could result from expansionary monetary policy that lowers interest rates generally in the economy.



Annex 4. Microsimulation modeling of forgone CIT revenues²⁷

CIT Microsimulation models (MSMs) may be used to support tax expenditure reporting,²⁸ but also in cost benefit analysis of TIs. Reliable estimates of CIT revenues forgone by tax incentives require the use of taxpayer-level data (the population of taxpayers, or a representative sample drawn from a stratified data-set). For the model, information is required not only on amounts of qualifying investment, but also on the profitability and tax-status of companies receiving tax incentives.²⁹ Typical application of the model include:

- CIT MSMs provide a detailed and flexible framework to estimate CIT revenues forgone by CIT expenditures. Programmed to calculate CIT according to actual (and hypothetical) tax rules, a CIT MSM can be used to analyze the influence on CIT liability of basic and preferential CIT rates, tax depreciation rates and methods (with separate calculations for different categories of depreciable assets), other tax allowances and credits. Indeed, calculations in a CIT MSM may be as detailed as deemed necessary for analytical purposes.³⁰
- CIT MSMs may be used to analyze how the tax relief is distributed across firms (e.g. by industry, firm size and location). This may be helpful in addressing the political economy of tax reform involving removal or a scaling back of an incentive or other form of tax expenditure. Distributional analysis is facilitated by the choice of ‘dimensions’ used to stratify a taxpayer population dataset into relatively homogeneous sub-groups of firms.
- CIT MSMs also are useful for audit purposes. A firm-level MSM may be used to assess ‘normal’ ranges of various ratios, such as taxable income to assets, for firms of a given size, in a given industry, for example. Such information may be used to identify outliers (firms whose ratios do not fall within normal ranges) to be examined more fully to ensure tax compliance).

Structure of CIT micro-simulation models

A CIT micro-simulation model (MSM) is essentially a firm-level CIT calculator, created using a structured programming language or software such as Excel, with parameters and equations reflecting the tax laws and regulations determining CIT liability. The input to a CIT MSM is firm-level tax and financial data drawn from corporate tax returns. Other sources may be used to impute certain values. The output is estimated CIT liability at the firm level, which can be weighted and aggregated to give economy-wide estimates of CIT under current law or hypothetical law (e.g. with and without a given tax incentive). Estimates can be generated for various other aggregates (e.g. estimates by industry, or firm-size, or other dimensions).

²⁷ This section draws on a report to the G20 on tax incentives by the IMF, OECD, World Bank, United Nations, 2015.

²⁸ A common approach in tax expenditure reporting is to ignore behavioral effects of taxation, with an implicit assumption that all (100 percent) of investment that qualifies for a tax incentive is redundant. In the CBA model used here, forgone revenue relates to only the percentage of current investment that is redundant. CIT revenues (if any) net of tax incentive relief from non-redundant investment is treated as a social benefit of the incentive.

²⁹ Whether current tax relief can be realized by a firm depends on whether the firm is currently profitable or loss-making. Also, for profitable firms, whether an investment tax allowance (for example) is claimed depends on whether the firm has positive taxable income or not. For example, a profitable firm may have zero taxable income on account of loss carryforward claims (that if not claimed, would expire).

³⁰ Limits to modeling may be posed by data. While data constraints are normally not a problem when modeling the CIT revenue impact of removing an existing CIT expenditure, problems may arise when modeling effects of a new CIT policy. For example, estimating the CIT revenue impact of introducing a research and development (R&D) tax credit requires information on R&D expenditure, for which there may be no separate data reported in CIT returns. In such cases, other sources of information (e.g., survey data) would need to be found and incorporated into the dataset.

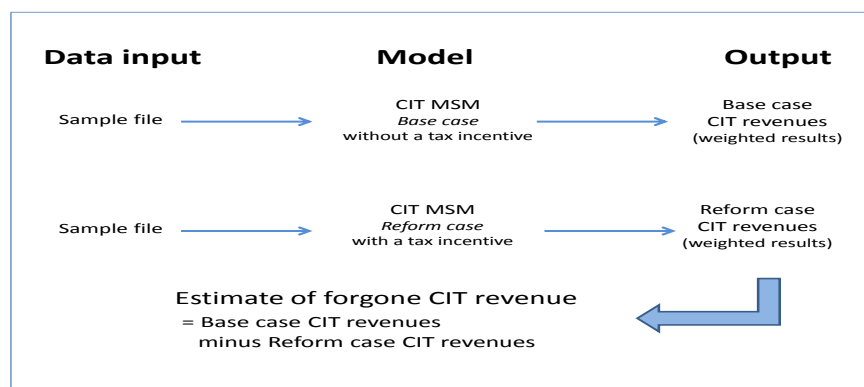
Estimating the impact on CIT revenues of a given corporate tax incentive involves three main steps, depicted in Figure 4. Figure 4 considers an ex-post estimate of CIT revenue forgone by a tax incentive. The estimation procedure involves first a ‘base case’ calculation of CIT revenues under current law with the incentive. Next, the MSM is used to estimate CIT revenues under tax reform that removes the tax incentive. The difference in the revenue estimates provides an estimate of the CIT revenue forgone by the incentive.

A CIT MSM captures key elements of a CIT calculation, which vary by country but typically include deductions for tax depreciation (capital cost) allowances, deductions for losses carried forward from prior years, other deductions and inclusions determining taxable income, and tax credits. Many types of data that are input to a MSM calculation, including receipts and most expenses, are exogenous to the model and are held fixed when calculating CIT under alternative tax policies. These data, copied in from firm-level tax returns, are held fixed where there is no intention on the part of the modeler programming the MSM to calculate the CIT implications of changes to that data.³¹

Figure 4 depicts steps in estimating CIT revenues that would be forgone by introducing a tax incentive. The estimation procedure involves first a ‘base case’ calculation of CIT revenues under the current law without the incentive. Next, the MSM is used to estimate CIT revenues under tax reform that includes the tax incentive. The difference in the revenue estimates provides an estimate of the CIT revenue reduction resulting from the tax incentive.

Key tax parameters, such as statutory corporate tax rates, tax depreciation rates, tax allowance and tax credit rates, are assigned values, depending on the assumed tax policy (e.g., current law (base case) versus reformed law).³² Certain elements to a CIT calculation are ‘modeled’ (that is, specified in computer language) as a function of tax parameters, according to rules stipulated in tax laws/ regulations. These elements are endogenous to the model (calculated by the MSM).

Figure 4. Estimating forgone tax revenues



³¹ For example, deductible interest expense is normally taken as fixed (exogenous) in an MSM. If there is policy interest in estimating the CIT revenue impact of a change in interest rates (e.g., nominal rates that are 5% higher), then the deduction in calculating taxable income could be modeled as $INT_1 = (1.05) \times INT_0$, where INT_0 is the actual interest expense as reported in a CIT return, and INT_1 is an estimated notional interest expense with nominal interest rates higher by 5%. Whether a value used in an MSM calculation is fixed or variable (parameterized) depends on the intended applications of the policy modeler.

³² Coding a parameter (e.g., basic statutory CIT rate) means assigning a name (e.g., taxrate) to the parameter (using the Excel ‘name’ facility, for example) and then linking the name to a numeric value (e.g., taxrate=0.25). By using the parameter name (rather than the 0.25) in a CIT MSM tax calculation, rather than a column letter in Excel, complex equations can be more readily understood (when being analyzed by someone other than the original modeler).

In general, the values of elements of a CIT calculation that are modeled (endogenous to the model) change when policy changes. Examples include claims for depreciation allowances, which change when the tax depreciation rate changes, investment tax credit claims, which change with investment tax credit rates change, taxable income (which is modeled since a number of its component parts are modeled), and final CIT liability.

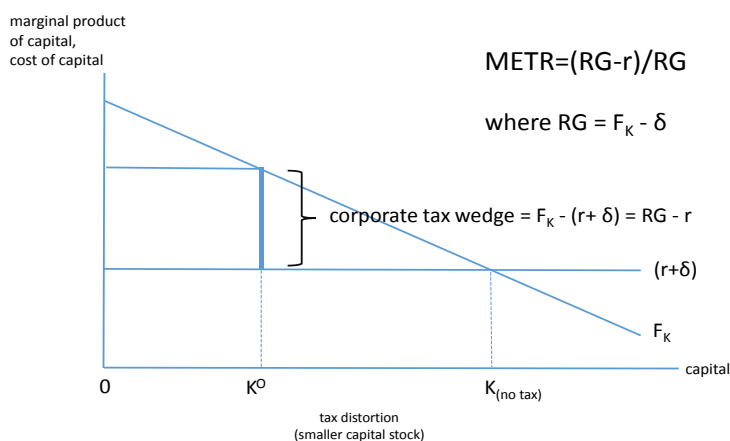
Annex 5. Effective tax rate analysis of tax effects on investment

Tax economists routinely rely on marginal effective tax rate (METR) and average effective tax rate (AETR) analysis to assess the effects of corporate taxation (and effects of corporate tax incentives) on investment. This annex provides a review of the methodology and some applications.

1. Measurement and interpretation of METRs

Marginal effective tax rates are used to assess how corporate tax may influence the size of the optimal capital stock of a firm, sector or economy. A marginal effective tax rate (METR) measures the extent to which corporate tax causes the required pre-tax hurdle rate of return on investment (net of depreciation) to increase above financing costs, in order to cover CIT.³³ In general, the larger is the increase in the hurdle rate of return due to taxation (see Figure 5), the larger is the predicted reduction in the capital stock due to taxation. This follows from the assumption that the pre-tax rate of return on capital is inversely related to the size of the capital stock.

Figure 5. Illustration of METR measurement



A corporate METR may be measured as follows:

$$METR = \frac{RG - r}{RG} = \frac{(F_K - \delta) - r}{F_K - \delta} \quad (8)$$

or alternatively as:

$$METR = \frac{RG - r}{r} = \frac{(F_K - \delta) - r}{r} \quad (9)$$

where RG is the pre-tax hurdle rate of return on capital, net of depreciation, required to pay CIT and earn the normal (minimum) rate of return to investors (r^0). When examining generous tax incentives, the denominator of the version given by equation (8) may be negative, in which case the METR is not readily interpreted. In such cases, the version given by equation (9) is used.

³³ The METR/AETR framework presented here considers the small-open economy case where personal shareholder level taxation of dividends, gains and interest does not affect the required rate of return net of corporate tax.

The basic METR/AETR framework rests on the neo-classical theory of investment that predicts that firms maximize profit by investing in physical capital up to the level where the after-tax marginal product of capital just equals the after-tax cost of capital:

$$F_K(1-u) = (r + \delta)(1-uZ - \zeta) \quad (10)$$

where (u) is the statutory CIT rate, Z measures the present value of tax depreciation allowances per unit of capital, and (ζ) is the rate of investment tax credit (if applicable). The cost of acquiring a unit of capital is reduced by depreciation allowances and an investment tax credit earned as a percent of investment expenditure. These two tax reliefs lower the after-tax acquisition cost to $(1-uZ-\zeta)$.³⁴

Dividing the profit-maximizing condition (10) through by $(1-u)$ gives the following formula for gross income from an additional unit of capital (F_K), at the level of the optimal capital stock:

$$F_K = UC = \frac{(r + \delta)(1-uZ - \zeta)}{(1-u)} \quad (11)$$

where the user cost (UC) of capital measures the pre-tax marginal product of capital, at the margin, that is just sufficient to cover the costs of finance, depreciation and taxation. In theory, tax policy influences the optimal level of investment by influencing the marginal benefit and/or marginal cost of investment. Tax incentives to stimulate investment include reducing the tax rate (u) on targeted returns, or by lowering the cost of acquiring capital by accelerating depreciation allowances and/or providing an investment tax credit or allowance (or some combination of these).

Substituting the user cost expression into (8) (or (9)) gives the METR. In the absence of tax, the METR is zero.³⁵ In the presence of CIT, $METR > 0$ signaling that corporate tax is discouraging to investment (results in a lower capital stock than what would be observed in the absence of tax). With generous tax incentives, the METR may be negative ($METR < 0$), implying that the profit-maximizing capital stock exceeds the level that would be observed in the absence of tax.

2. Measurement and interpretation of AETRs

Average effective tax rates are used to assess how corporate tax may influence the location of investment, factoring in taxation of the full return on investment (and not just the impact of tax on the last unit of profitable investment (the focus of the METR)). Average effective tax rates measure the present value of corporate tax on net returns on investment, divided by the present value of profit on investment:³⁶

$$AETR = \frac{PVT}{PVY} = \frac{u(p + \delta) - (r + \delta)(uZ + \zeta)}{p} \quad (12)$$

where the present value of pre-tax income on K units of investment, and the present value of CIT on the investment are as follows:

³⁴ If a country offers an investment tax allowance (ITA) at rate (τ), rather than an investment tax credit (ITC), then the after-tax cost of acquiring a unit of capital is measured by $(1-uZ-u\tau)$ rather than $(1-uZ-\zeta)$.

³⁵ In the absence of tax, $F_K = (r + \delta)$.

³⁶ The modelling approach used in this report differs from the standard approach of deriving the AETR by modelling a temporary (single-period) perturbation to the capital stock. Modelling returns and taxation over the life of newly acquired capital, rather than for a single period, is helpful in the interpretation of the AETR, and enables calculations of the present value of tax (PVT) on returns on investment.

$$PVY = \frac{pK}{r} \quad (13)$$

$$PVT = \frac{u(p-r)K}{r} + \frac{u(1-uZ-\zeta)(r+\delta)K}{r} \quad (14)$$

where (p) measures the pre-tax average rate of return on capital, net of depreciation.

Equation (14) shows the present value of corporate tax (PVT) on a project to consist of three parts. The first term measures the present value of CIT on economic profit; the second term together with the third term measure the present value of CIT on the normal return to capital. While METRs assess tax on returns and costs of the last unit of profitable investment expenditure, AETRs assess tax on the total stream of profits from a project. The total stream includes returns on infra-marginal investment expenditure (economic profit) where returns exceed normal returns. A relatively high AETR in a given location indicates a tax distortion discouraging mobile investment from locating there.

When calculating AETRs, policy analysts should consider a range of possible values of parameter (p).³⁷ For a given normal rate of return (r), the larger is (p), the greater is the rate of economic profit (p-r). Distinguishing between tax on normal returns versus tax on economic profit is important, as while the taxation of economic profit affects the AETR, it does not affect the METR (and thus does not affect the profit maximizing level (scale) of investment).

3. METR/ AETR analysis to assess CIT distortions

METR/AETR analysis is routinely used to assess how corporate tax policy reform, including the introduction, redesign or removal of tax incentives, may impact the incentive to invest. Because METRs and AETRs are parameter-based, they can be applied to separately examine tax effects on different types of capital (e.g., machinery, equipment, buildings, inventories), and different sectors.

METR/ AETR analysis is used to assess how tax incentives and other CIT provisions may distort the allocation of capital across sectors and firms by size. Assessments of variation in ETRs across different investments identify potentially undesirable distortions (raising efficiency and other concerns) and provide a basis for considering how unintended distortions could be reduced.³⁸

METR/AETR analysis provided a basic ‘workhorse’ framework to steer tax reform in many countries, aimed at broadening the CIT base and reducing statutory CIT rates. This was the case in major reform exercises in the US, UK and Canada in the mid-1980s. Base broadening, much of it through scaling back tax incentives, was aimed at reducing CIT rates and reducing the dispersion in METRs across different investment types to improve economic efficiency. METRs/AETRs have also been used extensively in empirical work estimating the investment response to tax incentives, a key consideration in cost-benefit analysis of main tax incentives.

Forward-looking marginal and average effective tax rates (METRs/ AETRs) provide valuable insights into the directional impact of tax incentives. Short of estimating the amount by which tax incentives impact the level or rate of investment, it is informative to know the direction of change – particularly when more than one tax

³⁷ It is not necessary to specify a production function $F(K)$ and measure p directly. Instead, different values for p are considered (which implicitly relate to a production function that remains unspecified), with different AETRs calculated for different possible values of p .

³⁸ Comparisons of effective tax rates on investment by MNEs versus small businesses are important where policy aims to avoid outcomes where SMEs are at a competitive disadvantage relative to MNEs providing goods/ services to the same domestic market. A METR/AETR analysis can identify such instances, as well as providing a basis to consider various reforms that can reduce differences in the tax burden.

policy is adjusted. A country may combine a reduction in the statutory CIT rate with a broadening of the CIT base, where it is unclear whether the two measures together will positively or negatively impact investment. METR/AETR analysis is used routinely in this way.

4. METR/ AETR analysis of tax holidays

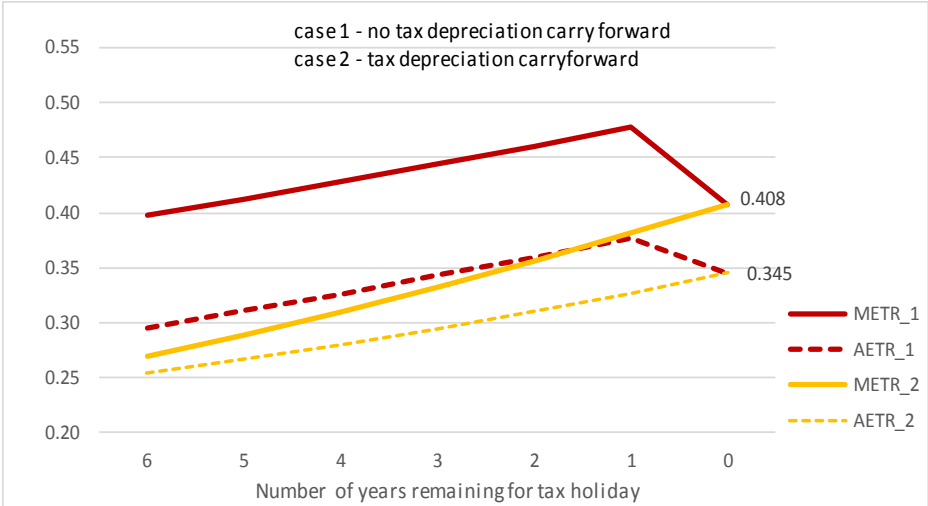
METR/ AETR analysis sheds light on unintended consequences of tax incentives. As an example, the following considers an application that analyzes the introduction of a tax holiday that exempts profit from CIT for 6 years. Figure 6 shows METRs and AETRs for two cases.

Case 1 assumes that investment during a tax holiday qualifies for tax depreciation allowances that can be carried forward and deducted following the tax holiday. Case 2 considers the opposite, where investment over the holiday period does not qualify for tax depreciation allowances.

In Case 1, the METR and AETR on new investment are lower each year than in the post-holiday period – at 26.9 and 25.4 percent in the first year, increasing gradually the holiday to the post-holiday values of 40.8 and 34.5 percent.

In Case 2, the AETR is below the post-holiday value during the first four years of the tax holiday. However, in the fifth and sixth (final) year, the AETR is above the post-holiday value, as the loss of depreciation allowances more than offsets the tax exemption on returns in the final two years. The METR in the first year, at 39.7 percent, is lower than following the tax holiday. But for the remainder of the tax holiday, its value exceeds the post-holiday value. The impact is more pronounced than the AETR, as the METR considers only the tax treatment of returns and costs at the margin and does not factor in the CIT exemption on economic profit. In all but the first year, the inability to claim relief for depreciation more than offsets the savings from the exemption on the normal return to capital.

Figure 6. METR and AETR: 6-year Tax Holiday



5. METR/AETR analysis of tax effects on FDI (with BEPS)³⁹

³⁹ The acronym BEPS stand for ‘base erosion and profit shifting’.

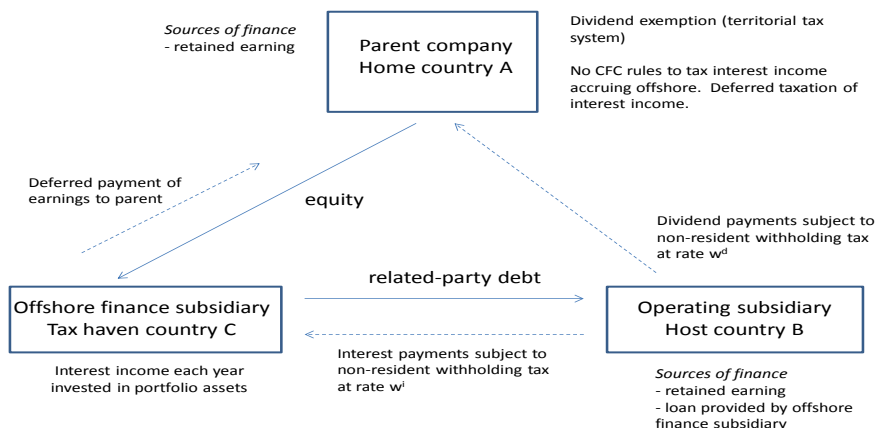
METR/AETR frameworks provide a basis to analyze implications of base erosion and profit-shifting (BEPS) techniques used by multinationals. While this is a relatively new application, the framework has proven to be a powerful tool to assess the implications of (complex) international taxation. This application is highly relevant to the study of tax incentives, as the results show the extent to which MNEs can largely engineer their own low effective tax rate.

The simplest FDI case is a direct holding structure, where a parent company invests directly in a foreign operating affiliate using a combination of debt and equity. The affiliate uses the capital to purchase physical capital used in production. The standard approach assumes direct payment of dividends and interest to the parent, with no deferral.

These assumptions may be considered naïve as they ignore cross-border tax planning strategies (BEPS strategies that strip taxable income out of a host country, while also avoiding home country taxation. To illustrate, consider a ‘triangular structure’ involving an intermediate financing/ holding affiliate in a no/low tax country, depicted in Figure 7.

Consider FDI involving a parent company resident in home country A, a foreign operating subsidiary resident in host country B, and an offshore finance subsidiary resident in tax haven country C. The parent company finances FDI using a combination of retained earnings of the subsidiary, and equity capital of the parent. Rather than investing directly in the subsidiary, the parent invests its capital in equity shares of an offshore finance subsidiary, which loans the capital to the operating subsidiary (so that the return to the parent on its invested capital is paid out in the form of interest to the finance sub).

Figure 7. Triangular financing structure



The host country allows the operating subsidiary to deduct the interest payments on the intra-group loan provided by the offshore finance subsidiary. These deductible payments erode the host country CIT base. Avoidance of home country tax on operating income paid out as interest to the offshore financing subsidiary assumes that anti-deferral (controlled foreign company-type) rules do not apply that would tax this income in home country A on a current basis.

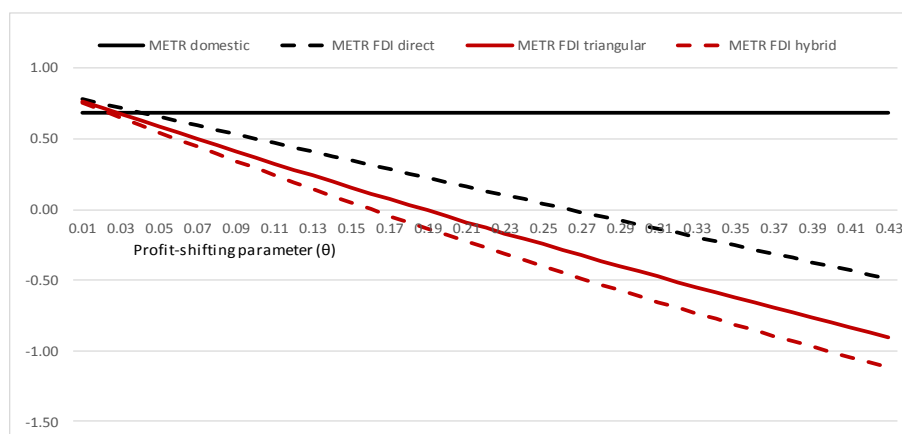
Dividends paid by the operating subsidiary to the parent are subject to dividend withholding tax in the host country B. Dividends received by the parent are free of home country corporate tax, assuming territorial treatment of foreign dividend income. Interest paid by the operating subsidiary (some percentage of its pre-tax operating income) is subject to withholding tax in the host country. Home country corporate taxation of

foreign earnings paid out as interest is deferred by retaining and investing these earnings offshore in portfolio (or other) assets.⁴⁰

In the domestic investment case, a parent invests in a domestic subsidiary using debt and equity, which the subsidiary invests in productive capital. The percentage of cash-flow of the subsidiary earned on the investment, paid out to the parent as interest rather than dividends, is measured by a profit shifting parameter θ ,⁴¹ shown on the horizontal axis in Figures 8 and 9 (which also consider hybrid financing).⁴²

If both the parent and the subsidiary are taxable, with profits taxed at the 30 percent CIT rate, variations in parameter θ do not affect the combined tax burden of the parent and its subsidiary. Every additional Euro of cash-flow paid to the parent as interest, rather than dividends, reduces CIT of the subsidiary by 0.30 Euro, while increasing the CIT of the parent by 0.30 Euro. With the combined CIT on returns on investment unchanged as θ increases, the METR for domestic investment shown in Figure 8 and the AETR shown in Figure 9 are unchanged as θ increases (moving left to right on the horizontal axis).

Figure 8. METR on Domestic Investment and FDI under Alternative Financing Scenarios



In the direct FDI case, where a foreign parent invests directly in its foreign subsidiary using a combination of debt and equity, the AETR for FDI is higher than the AETR for domestic investment if the subsidiary is capitalized with equity (only) – which corresponds to the case where $\theta=0$. The AETR is higher due to the burden of withholding tax at 10 percent on cash-flow paid out as dividends, which does not apply in the domestic

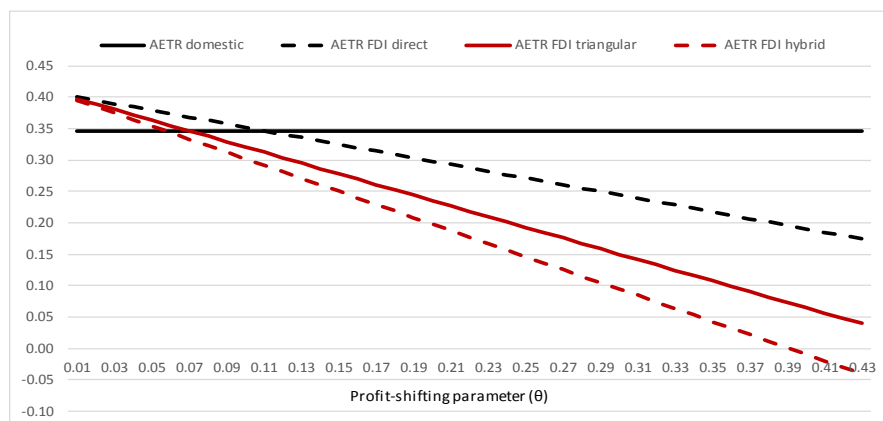
⁴⁰ At the end of each year, inter-affiliate interest (paid by the operating subsidiary and received by the offshore finance subsidiary) is assumed to be invested by the offshore subsidiary in portfolio assets, held for (n) years. Portfolio income earned on portfolio assets is free of corporate tax in tax haven country C. At the end of the holding period, the principal amount invested plus the compound return on the portfolio investment is assumed to be distributed to the parent and (possibly) subject to home country CIT. The net nominal rate of return on portfolio assets exceeds the nominal after-corporate tax required rate of return (the parent's nominal discount rate). This difference in rates captures the benefit of deferral – the ability to earn returns on investment (e.g. in portfolio assets, financed by foreign earnings) free of corporate income tax. With deferral, returns compound at gross rates of return (no corporate tax on reinvested earnings).

⁴¹ The illustration shows METRs calculated using equation (2) ($METR=(RG-r)/r$) given that with profit stripping, the denominator of equation (1) is quickly reduced to zero in the FDI triangular and FDI hybrid cases as θ increases (with RG reaching zero with $\theta=0.3$ approximately).

⁴² In the hybrid instrument case, investment in a foreign operating subsidiary is financed using retained earnings of the subsidiary and hybrid securities, issued to the parent, which are regarded by host country tax authorities as debt instruments, while the home country regards them as akin to equity shares. Payments on the hybrid security are deductible against the host country CIT base, and subject to non-resident withholding tax on interest. On the other hand, the home country treats the same flows as exempt dividend income (assuming a territorial tax system), with no credit for host country withholding tax on these payments.

investment case. As profit shifting parameter θ rises, with θ measuring once again the percentage of cash-flow paid out as interest rather than dividends, the AETR decreases. This is because paying out cash-flow using interest rather than dividends avoids dividend withhold tax.⁴³ While withholding tax applies on interest, the tax is offset by a foreign tax credit in the home country.

Figure 9. AETR on Domestic Investment and FDI under Alternative Financing Scenarios



Figures 8 and 9 illustrate the dramatic effects that BEPS can have on lowering the METR and AETR on investment. The analysis of effective tax rates on FDI, when taking into account BEPS strategies, has stark implications for host country tax incentive policy. At a fundamental level, the analysis reveals that MNEs are largely able to engineer the effective tax rate on FDI, using a variety of strategies. Indeed, various strategies can be employed.

In addition to interest on related-party debt, another channel for stripping profit out of a host country is through deductible royalty payments. Royalties may be paid on licenses of intellectual property (IP), provided by related parties located in offshore IP holding companies, or by parent companies residing in countries with so-called IP Box regimes). Such structures have been examined using METR/ AETR frameworks that incorporate both physical capital and intellectual property.⁴⁴

6. The use of METRs and AETRs in econometric studies

METRs and AETRs are often used as explanatory variables in econometric studies that assess the sensitivity of investment expenditures to various drivers of investment, including tax rates.

When attempting to quantitatively assess the impact of a CIT incentive on investment using METRs or AETRs (or both), two types of information are required. One is an estimate of the tax elasticity of investment measuring the response of investment to a change in an effective tax rate on investment resulting from the introduction of the incentive. Estimates of the tax elasticity of investment may be derived from own-empirical

⁴³ The AETR for the FDI direct case falls below the AETR for domestic, once the profit stripping parameter θ increases (in the illustrative case) above $\theta=0.28$. The AETR for FDI is higher than that for domestic investment for values of θ over the range $0 \leq \theta \leq 0.28$, due to the assumption in the model that the equity portion of the investment in the subsidiary is financed out of retained earnings of the subsidiary (other financing options can be modelled). With retained earnings used to finance FDI, the cost of finance is lower in the FDI case than the domestic investment case (assuming that both face the pre-tax discount rate), as cash-flow earned on the retained earnings cannot escape dividend withholding tax ('trapped equity'). This lowers the opportunity cost of funds for FDI relative to that in the domestic investment case where non-resident withholding tax does not apply.

⁴⁴ See for example, OECD, 2013. *Supporting Investment in Knowledge Capital, Growth and Innovation*, chapter 2, Taxation and knowledge-based capital, Paris.

analysis, or by referencing such work done by others.⁴⁵ The second is a measure of the percentage change in effective tax rate.⁴⁶ The estimation procedure for measuring the impact on investment of a tax incentive—for example increasing an investment tax credit rate by an amount $\Delta\zeta$ —may be presented as follows, using (15) or (16) where Δ denotes change (difference):

$$\frac{(\Delta INV / INV)}{\Delta METR} * \frac{\Delta METR}{\Delta \zeta} \tag{15}$$

$$\frac{(\Delta INV / INV)}{\Delta AETR} * \frac{\Delta AETR}{\Delta \zeta} \tag{16}$$

The first measure considers the change in the METR caused by the tax incentive ($\Delta METR/\Delta\zeta$) and applies this to a semi-elasticity measuring the sensitivity of the rate of investment to a one percentage point change in the METR. The second measure considers instead the AETR. In practice, policy-makers (in countries without active tax research departments) would normally look to the academic literature to obtain a ‘representative’ tax elasticity.

⁴⁵ A variety of empirical (econometric) approaches have been taken to assess tax effects on investment, including time series analysis of investment equations relating investment to a corporate ETR and other factors thought to affect investment, cross-sectional data studies, panel data studies, discrete choice models, and meta-analyses).

⁴⁶ Backward-looking average tax rates measured as total CIT as a percentage of adjusted operating surplus, cannot be used for this purpose, since the numerator is a single number and the impact of the tax incentive on this number is unclear (‘black-box’).

Annex 6. Difficulties in measuring tax elasticities

In empirical assessments of the sensitivity of investment to taxation, problems are encountered in relation to capital data, tax data, and identification. In principle, the capital data that policy analysts typically wish to explain is data on the real physical capital stock or investment flow in a host country, while the tax data in principle aims to measure the actual tax burden on investment along different margins and in different locations. In practice the capital and tax data used by researchers are highly imperfect measures, given difficulties in obtaining information needed to construct ideal measures. Problems of identification are encountered as well, given difficulties in adequately identifying, measuring and incorporating key explanatory variables in addition to tax.

FDI capital and tax data problems

In measuring FDI, most studies rely on FDI financial flows, as opposed to measures of physical capital. While some studies (mainly for the U.S.) explain purchases of plant, property and equipment (PP&E), these tend to be the exception, as most researches facing limited access to such series. FDI data may include not only amounts used to purchase real property, but also amounts reinvested abroad. FDI data include mergers and acquisitions representing a change in ownership as opposed to an expansion of the productive capital stock. FDI financial flow data are also imperfect where the figures do not include new capital financed by local debt or debt borrowed in third countries (typically FDI measures include retained earnings, new equity transfers plus debt capital loaned by the foreign direct investor).

The interpretation of FDI financial data and elasticity estimates obtained from the use of such data is made difficult by non-uniform practices across countries in reporting FDI flows. For example, where a direct investor in country A invests in a subsidiary in country B using a special purpose (conduit) vehicle in country C, the FDI flow may be recorded as a direct investment from country A into C, or instead A into B where the national accountant is aware of the financing structure. Country A tax treatment may also differ in an intermediated as opposed to direct investment structure (for example, the application or not of controlled foreign company-type rules; non-resident withholding tax rates applied by host country B will typically depend on whether profit (or interest) is repatriated to country A, or is directed to country C.

With respect to the tax data, some studies regress investment on statutory corporate income tax rates. To the extent that investors look beyond the 'headline' statutory tax rate in formulating investment plans, and consider provisions influencing the tax base, then some form of effective corporate tax rate is called for. Some studies utilise forward-looking (equations-based) average effective tax rate (AETR) or marginal effective tax rate (METR) measures, while others rely on backward-looking (accounting-based) rates computed at the aggregate, disaggregate or firm-level that measure corporate tax paid (subject to loss carry-forward claims) to some measure of corporate profit.

Forward-looking and backward-looking effective tax rate measures have their particular advantages and disadvantages. Average tax rates based on actual financial and tax data may be more informative than effective tax rates based on tax codes, as the latter do not pick up all elements of the tax code, firm-level tax planning, and discretionary tax administration practices. However, backward-looking average rates may create endogeneity problems (e.g., in reflecting the profitability of host locations).

Also, by relying on actual tax paid, backward-looking measures involve inconsistencies between tax paid in the numerator (reduced by loss carry-forwards and increased by domestic tax on foreign profit) and profit measures in the denominator. In principle, one would want an adjusted measure of the true amount of profit derived by direct investors (or the MNE group to which the direct investor belongs) on capital employed in the host country (e.g. gross of profit shifting from transfer pricing, and gross of interest on inter-affiliate loans where such interest is received tax free in a tax haven financing sub), but lack of data generally prohibits these type of adjustments.

Identification problems

Another difficulty in empirical studies of tax effects on investment involves identification. A regression equation explaining FDI as a linear function of an effective tax rate may give misleading or difficult to interpret results. First, aggregate FDI data reflects investment projects involving multiple sectors and decisions over various margins (e.g., alternative locations, the size of the capital stock) where tax may factor in, but in different ways, rendering it difficult to determine the possible tax effects in a given sector in a given location. Even when working with firm-level data, an FDI decision may compare net profits under several options (e.g. FDI versus production and export from the home country, or from subsidiaries operating in other countries), implying a more complicated set of decision margins than assumed for empirical analysis.

Second, the influence of host country taxation (and tax incentives) in influencing decisions of foreign parent companies on where to locate an operating subsidiary may depend on the tax regimes in the home countries of parent companies. Host country taxation is more likely to influence decisions of parent companies that reside in countries with territorial systems that exempt foreign dividends, compared with parent companies that reside in countries with worldwide tax systems.

Third, biased elasticity estimates will result where regression equations omit important non-tax variables correlated with the effective tax rate (e.g. transportation costs, influenced by the network of roads, airports, seaports and possibly other infra-structure financed by tax revenues). Where these variables are omitted, their effects are captured by the error term – which will not be independent but correlated with the tax explanatory variable. Where this occurs, and regression analysis suffers from omitted variable bias, difficult interpretation problems arise.

Lastly, as emphasized in the new economic geography literature, the relationship between an effective tax burden and FDI may be non-linear. In empirical specifications that assume a linear relationship, non-trivial identification problems may be present. Attempts to capture non-linearities would also be fraught with difficulties.

Most of the empirical studies estimating tax elasticities have been undertaken in advanced economies. Similar results are found for developing countries, although the investment response to tax incentives tend to be smaller on average (see James and Van Parys (2009), and Abbas and Klemm (2013)). One possible reason is that in poorer countries where non-tax factors important to investors are often discouraging (limited infrastructure, macroeconomic instability, uncertain property rights, weak governance), tax incentives do not effectively offset these and are largely ineffective (Kinda, 2014).

Research results and meta-analysis

Using meta-analysis, De Mooij and Ederveen (2008) provide a synthesis of research results (up to 2007) examining the responsiveness of investment to taxation. They compute semi-elasticities from 37 studies and use meta regression analysis to explain systematic variations in study results.⁴⁷ A semi-elasticity ('tax rate elasticity') measures the percentage change in investment (FDI) in response to a 1 percentage point change in

⁴⁷ The heterogeneity of empirical approaches and datasets observed in the literature makes it impossible to simply compare across studies estimates of tax elasticities. De Mooij and Ederveen (2008) divide empirical studies on tax effects on investment (FDI) into four main categories, distinguished by the type of capital data used: time series data on FDI; cross-section data on the allocation of FDI across countries; panel data (time series combined with cross-sectional data) on FDI; and discrete choice models where count data on location choice is regressed on tax rate variables. Comparable semi-elasticities from 37 studies are regressed on variables relating to the underlying characteristics of the empirical studies (tax data, foreign capital data, and various control variables) to explore the systematic impact of the study characteristics on the size of the reported elasticities. See De Mooij, R. and S. Ederveen, 2008. "Corporate Tax Elasticities: A Reader's Guide to Empirical Findings," *Oxford Review of Economic Policy*, 24 (4); 680-697.

the tax rate (e.g. a decline from 30% to 29%), defined as $\partial \ln(\text{FDI}) / \partial t$.⁴⁸ The meta-analysis finds a 'typical' AETR tax elasticity of 4.0, and a 'typical' METR tax elasticity of 1.69.

⁴⁸ An ordinary elasticity results measures the percentage change in FDI in response to a 1% change in the tax, e.g. a decline from 30% to 29.7%. It is defined as $\partial \ln(\text{FDI}) / \partial \ln(t)$.

Annex 7. Relative efficiency analysis of CIT incentives

This annex applies METR/AETR analysis to assess the relative efficiency of cost-based versus profit-based tax incentives.

The analysis considers a base case (pre-reform) scenario with parameters shown in Table 3. In the base case, current (redundant) investment is taken to be 100 units. The analysis assumes no pre-existing capital (the implications of relaxing this assumption are considered).

Table 3. Base case tax and non-tax parameters and METR

	r	π	δ	α	Z	u	ζ	METR
base case	0.05	0.06	0.25	0.25	0.767	0.200	0.000	0.259
reform Δu	0.05	0.06	0.25	0.25	0.767	0.125	0.000	0.167
reform $\Delta \zeta$	0.05	0.06	0.25	0.25	0.767	0.200	0.020	0.167

The relative efficiency of cost-based versus profit-based tax incentives in influencing scale decisions is assessed by considering two alternative tax incentive reforms. The first reform involves a targeted reduction in the CIT rate from 20 to 12.5 percent denoted by $\Delta u=0.200-0.125=-0.075$.⁴⁹ The second alternative reform introduces an investment tax credit (ITC) at a 2 percent rate ($\Delta \zeta=+0.02$). Both reforms reduce the METR from 0.259 to 0.167. The reforms are ‘METR-equivalent’, as they involve identical METRs both pre- and post-reform. The reforms are therefore predicted to create the same stimulus to the level of investment and result in the same post-reform capital stock.⁵⁰

Table 2 compares the impact of the incentive reforms on CIT revenues, under two scenarios – one where there is no investment response (unchanged at 100) shown in columns J and K, and another where investment responds positively, based on a METR semi-elasticity of 1.69, shown in columns L and M. Additional investment in this case is $\Delta K=15.6$.⁵¹

In the case of no investment response ($\Delta K=0$), the impact of the ITC on CIT revenue is (-12), independent of the rate of profit). With investment unchanged at $K^N=100$ and no additional CIT revenue, forgone revenue is limited to the cost of providing the incentive to redundant investment.

Where the pre-tax profit rate net of depreciation (p) is 5 percent, forgone CIT revenue under the CIT rate reduction (11 units, column J) is lower than under the ITC (12 units, column K). Where (p) is 15 percent, forgone revenue is 26 units, more than double that with the ITC (12 units). Where (p) is 35 percent, forgone revenue is 56 units or more than four times that with the ITC.

While revenue forgone under the cost-based ITC is tied directly to the level investment, revenue forgone under the profit-based CIT rate reduction increases with the pre-tax profit rate. Moreover, the revenue loss is exponential (non-linear).

⁴⁹ In the base case, the statutory CIT rate (20 per cent) is assumed to apply generally. With the introduction of a targeted CIT rate reduction, the reduced CIT rate applies to returns on qualifying (targeted) investment.

⁵⁰ The initial capital stock is assumed to be zero (no pre-existing capital) and investment in the base case is $K^N=100$ units. With the introduction of an incentive, additional investment due to the incentive (if any) is denoted by ΔK and total investment is $(K^N+\Delta K)$, where K^N is redundant investment that would be observed in the absence of an incentive.

⁵¹ Additional investment due to tax incentive relief is calculated as $\Delta K=15.6$, using $\Delta K=-\epsilon^M(\text{METR}^{\text{ref}}-\text{METR})K^N$ where $\epsilon^M=0.0169$, the base case $\text{METR}=0.259$, the post-reform METR is $\text{METR}^{\text{ref}}=0.167$, and $K^N=100$. The METR semi-elasticity of 1.69 is an average across various empirical studies (see de Mooij and Ederveen (2008)).

When investment responds to the reduced METR ($\Delta K > 0$), additional CIT revenues from increased profits from a larger capital stock act to offset revenue losses from the granting of tax incentives to redundant investment. With a METR semi-elasticity of 1.69, the ITC reduces CIT revenues for projects with pre-tax rates of return of 0.15 or less. However, the overall impact on CIT revenues is positive and increasing for projects with higher pre-tax profit rates (column (M)). In contrast, with the CIT rate cut, CIT revenues are lower at all pre-tax rates of return (although by less than when investment does not respond ($\Delta K = 0$)). With the CIT rate cut, revenues forgone on redundant investment more than offset additional revenues from a larger capital stock.

Table 4. Comparison of revenue effects of a METR-equivalent incentive reform

A	B	C	D	E	F	G	H	I	J	K	L	M
base case						METR-equivalent reforms			$\Delta K = 0$		$\Delta K > 0$	
y	p	u	ζ	METR	CITR	Δu	$\Delta \zeta_{equiv}$	METR_ref	CITR_Δu-CITR	CIT_Δζ-CITR	CITR_Δu-CITR	CIT_Δζ-CITR
0.30	0.05	0.20	0.00	0.259	28.0	-0.075	0.020	0.167	-11	-12	-8	-10
0.40	0.15	0.20	0.00	0.259	68.0	-0.075	0.020	0.167	-26	-12	-19	-3
0.50	0.25	0.20	0.00	0.259	108.0	-0.075	0.020	0.167	-41	-12	-30	3
0.60	0.35	0.20	0.00	0.259	148.0	-0.075	0.020	0.167	-56	-12	-41	9
0.70	0.45	0.20	0.00	0.259	188.0	-0.075	0.020	0.167	-71	-12	-52	16
0.80	0.55	0.20	0.00	0.259	228.0	-0.075	0.020	0.167	-86	-12	-63	22
0.90	0.65	0.20	0.00	0.259	268.0	-0.075	0.020	0.167	-101	-12	-74	28
1.00	0.75	0.20	0.00	0.259	308.0	-0.075	0.020	0.167	-116	-12	-85	34

1/ Note: Δ CITR calculations assume METR semi-elasticity=1.69.

These results show that a cost-based ITC is more efficient than a CIT rate cut, for projects above a low threshold rate of return, both when investment does not respond and when it does. This result suggests that reducing the AETR by relying on cost-based tax incentives is an incentive strategy that may have the greatest impact on the size of the capital stock.

The preceding assumes no pre-existing capital from prior investment, so profit and CIT are derived from current year investment only. When pre-existing capital is introduced, the relative efficiency of the ITC compared with a CIT rate cut (with identical changes to METR) is increased. This follows if the CIT rate cut forgoes tax revenues on profit derived from pre-existing capital – either because profit on both new and pre-existing capital qualify for the incentive, or because of tax-planning by firms where pre-existing capital is ‘recharacterized’ as new capital, to qualify.

If the statutory CIT rate is relatively high, decreasing the rate may be attractive in reducing tax-planning pressure on the CIT base, and attracting mobile business activities earning significant economic rent.⁵² However, reductions in the CIT to attract investment should be tempered by the fact that other instruments are more efficient in promoting investment, by subsidizing the cost of investment, and not cutting into tax on economic profit. In general, tax on economic profit should not influence investment scale decisions. Therefore, surrendering tax on economic profit should be avoided on efficiently grounds, in particular where profits are location-dependent.

⁵² Incentives for multinationals to strip out taxable profit depend on the setting of the statutory CIT rate and non-resident withholding tax rates on outbound payments of interest, royalties, technical service and management fees all deductible against the CIT base.

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