Policy Forum: Effective Tax Rates for Multinationals—The Role of Tax Incentives and Tax Planning

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**PRÉCIS**
On utilise fréquemment des taux d’impôt effectifs (TIE) (marginaux et moyens) pour l’analyse et la conception de politiques fiscales touchant l’investissement; le présent article fournit divers exemples récents. Il aborde les questions soulevées lorsqu’on calcule les TIE dans un contexte international, comme pour les investissements transfrontaliers. Il explique concrètement comment des incitatifs fiscaux et des stratégies de planification fiscale peuvent être inclus dans le calcul des TIE. L’article fait ensuite état des difficultés habituelles liées à leur interprétation, dont bon nombre sont accentuées dans un contexte international. En particulier, la gamme de TIE pour un pays donné augmente, et les niveaux et les classements du pays dépendent d’hypothèses relatives à des paramètres fiscaux et non fiscaux.

**ABSTRACT**
Effective (marginal and average) tax rates (ETRs) are frequently used in the analysis and design of tax policies affecting investment, and this article provides various recent examples. The article addresses issues that arise when ETRs are calculated in an international context, such as for cross-border investments. It explains concretely how tax incentives and tax-planning strategies can be included in the calculation of ETRs. It then discusses typical difficulties in their interpretation, many of which become more severe in an international context. In particular, the range of ETRs for a given country rises, and both levels and country rankings depend on assumptions about tax and non-tax parameters.

**KEYWORDS:** EFFECTIVE INCOME TAX RATES ■ CORPORATE INCOME TAXES ■ TAX PLANNING ■ TAX INCENTIVES

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INTRODUCTION

Effective tax rates (ETRs) have become a common way to summarize corporate tax systems with simple statistics and are often used by policy makers. The European Commission, for example, regularly commissions the calculation of such tax rates.¹

A main feature of ETRs is that they provide a summary indicator of the net effect of statutory tax provisions that have an impact on net returns on investment, factoring in complex interactions of tax and non-tax parameters. In addition, unlike backward-looking tax burden measures, ETRs are transparent, since the formulas used to measure them are explicit functions of tax provisions influencing the costs of and returns to investment.² They can therefore be used to analyze incentives to invest in a country and are not affected by past decisions of taxpayers or legacies such as losses that are carried forward.

The term “effective tax rate” is not uniquely defined. For the purposes of this article, it is used only in reference to forward-looking measures of the tax rate that are built using the tax system and assumptions about profitability, investment, and financing choices. Concretely, the effective average tax rate (EATR) is defined as follows:

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EATR = \frac{PDV(tax)}{PDV(profit)}
\]  

¹ For the latest, see C. Spengel, Dieter Endres, Katharina Finke, and Jost Heckemeyer, Effective Tax Levels Using the Devereux/Griffith Methodology, Project for the EU Commission TAXUD/2013/CC/120 (Mannheim: Zentrum für Europäische Wirtschaftsforschung, Centre for European Economic Research, February 2014).

where PDV is the present discounted value and profit includes both the normal profit and any economic rent. The effective marginal tax rate (EMTR) is a special case, in which the post-tax profit covers exactly the cost of capital.

This broad definition is very general and allows ETRs to be adapted to almost any tax feature, including international tax issues, such as tax incentives or multinational tax planning. But for the definition to be operational, certain simplifying assumptions are needed. First, on the tax side, the most relevant tax laws need to be chosen, since it would be hopeless to consider the thousands of pages of tax code that depend on special circumstances. Similarly, on the investment side, certain profit rates, sources of finance, and assets need to be assumed. Devereux and Griffith\(^3\) have developed a specific proposal on how to calculate ETRs taking into account statutory tax rates, depreciation allowances, investment allowances, and interest deductibility. Their framework includes personal income taxes at the investor level, such as taxes on dividends, capital gains, and interest, which could be withholding taxes and home-country taxes in the case of international shareholders. Klemm\(^4\) has extended this framework to tax incentives, such as tax holidays and time-varying tax rates. Clark\(^5\) has introduced multinational tax-planning strategies.

This article presents an overview of how to calculate ETRs in an international context and how to interpret them, avoiding some common pitfalls. We begin by reviewing the basics of how to calculate ETRs in the presence of tax incentives, and then extend the discussion to cross-border issues and multinational tax planning. We provide examples of how ETRs have been used by government as an instrument of tax policy, review the analysis of the impact of ETRs in the academic literature, and point to some pitfalls in the interpretation of ETRs. A brief concluding section summarizes our views on the usefulness of ETRs in developing and analyzing tax policy.

### EFFECTIVE TAX RATES AND TAX INCENTIVES

Tax incentives have become a major component of tax systems, especially in developing countries. Typical incentives include tax holidays, reduced tax rates, and special investment allowances and credits. Here we consider only incentives relating to corporate income taxes, although in practice they can also cover other taxes, such as value-added or personal income taxes.

The first article that discussed tax incentives in terms of their impact on ETRs was by Mintz,\(^6\) who found that tax holidays may have the unexpected effect of raising

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EMTRs in the last few years of the holiday. This is because under a tax holiday, depreciation allowances are worthless. If an investment takes place in the last few years of a tax holiday, the loss of the allowance—particularly if allowances are front loaded, as in the case of accelerated depreciation—can outweigh the short-term saving of the remaining holiday. Klemm\(^7\) discusses the main incentives and their costs and benefits, as indicated by ETRs, and shows how the relative attractiveness of tax holidays compared to investment allowances and reduced tax rates changes over time and depends on the expected profitability.

The appendix to this article shows how tax incentives can be formally incorporated into ETRs. Intuitively, the key is to consider a long-term horizon, though this requires an adjustment to the Devereux and Griffith framework,\(^8\) which is based on a one-period perturbation of the capital stock. Under many incentives, such as the typical tax holiday, the investor knows in advance that tax rates will change, and at the same time, the tax holiday is contingent on the investment. To take this into account, Klemm\(^9\) considers an increase in the capital stock that is permanent—except that it is undone over time by depreciation—and that yields a constant rate of pre-tax profit.\(^10\) With this assumption, it is possible to calculate the PDV of taxation, even for changing tax rates.

Figure 1 shows how different tax incentives affect ETRs by comparing two common incentives: a tax holiday and accelerated depreciation. For the tax holiday, a full tax exemption for eight years is assumed, but the figure also shows ETRs in the remaining years of the holiday. After two years, for example, only six years of the tax holiday remain, so the rate that applies to any further investment then is equivalent to a six-year holiday. When the holiday expires (when 0 years remain), the standard ETR applies to any new investment. On accelerated depreciation, the rate shown allows for full expensing in the year of investment, which is also known as a cash flow tax. (This is not the extreme case; some countries offer even more by combining depreciation with investment allowances, resulting in PDVs of depreciation that can exceed 100 percent of the investment.)

The ranking of tax incentives in terms of their effect on ETRs changes over time, as shown in figure 1. The ranking in terms of the EATR also depends on the expected level of profitability.

First consider the marginal case—a project that just breaks even. Under cash flow tax treatment, the EMTR is zero, as expected, because such a tax is theoretically neutral in its impact on investment; that is, any project that is worthwhile.


\(^8\) Devereux and Griffith, supra note 3.

\(^9\) Klemm, supra note 4.

\(^10\) This assumption is not required; the ETR could be calculated for any development of future rates of profitability. The greater the profitability in the early years, the greater is the advantage of incentives such as tax holidays, where the benefit is time limited.
before tax remains so after tax. The tax holiday does not achieve the same reduction in the EMTR. While no tax is paid for eight years, the PDV reflects tax payments after that period. Over time, as the tax holiday expires, the EMTR for any additional investment rises, as more of the tax-paying years enter the calculation. In the final year, the figure illustrates the Mintz\textsuperscript{11} result of the EMTR rising above its level in the absence of a tax holiday. This is because the loss of the depreciation deduction (which exceeds true economic depreciation by assumption) outweighs the benefit of not paying tax for one year.

- Then consider the case of a highly profitable investment. The cash flow tax also reduces the EATR, but by far less, because even after deducting the full investment, there remains a lot of economic rent that can be taxed. Under the tax holiday, however, the EATR is reduced significantly, because all of the rent will go untaxed for a long time.

\textsuperscript{11} Mintz, supra note 6.
To sum up, tax holidays are particularly attractive for highly profitable investments, especially if the profits accrue early. Over time, the incentive to invest falls, and for low-profitability investments, there may even be a disincentive. For other incentives, similar analysis is possible. A reduced tax rate, for example, will be very attractive for high-profitability investments, since it permanently reduces the tax take from rents.

**CROSS-BORDER ETRS AND INCORPORATING MNE TAX PLANNING**

ETRs for simple cross-border investment are conceptually relatively easy. Standard modelling practice assumes a direct holding structure, with conventional sources of finance. The structure involves a parent company (PCo) in a home country using retained earnings, borrowed funds, and new equity capital to invest in equity shares and debt securities of a foreign operating affiliate (OpCo) in a host country. OpCo uses capital injected by PCo, together with its retained earnings, to purchase physical capital used in production. The standard modelling approach assumes immediate payment of net earnings to the parent (that is, no deferral). Interest payments by OpCo are deductible (as are interaffiliate royalty payments and service fees), reducing host-country corporate tax, while receipts by PCo may be subject to home-country tax.

Even such a simple approach requires a lot of data collection. Information is needed on withholding taxes, home-country taxation (that is, exempt treatment of foreign dividends or a credit for foreign tax paid on foreign profit), and any special provision under a double taxation agreement. Examples of research that covers cross-border investment include studies by the Organisation for Economic Co-operation and Development (OECD),12 Chennells and Griffith,13 and Spengel et al.14 Tax planning in such a setting is limited to shifting profits from the high-tax to the low-tax country by using transfer pricing or leverage.

Multinational enterprises (MNEs), however, typically use more complicated structures than simple cross-border investment. Triangular structures involving an intermediate financing/holding affiliate in a no/low-tax country and the use of hybrid securities can fundamentally alter tax results.

Triangular structures may significantly reduce host-country tax, while also enabling avoidance of home-country tax. Suppose that PCo injects equity to capitalize a wholly owned intermediate affiliate (IntCo) in a no/low-tax country. IntCo is capitalized with equity rather than debt, to avoid home-country tax on interest income. IntCo capitalizes OpCo with equity and debt, and OpCo uses the capital to purchase physical capital used in production. IntCo also licenses to OpCo intangible property

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14 Spengel et al., supra note 1.
(for example, patents), transferred to IntCo under a cost-sharing agreement with PCo under which the buy-in for IntCo’s rights to the intangible reflects only a fraction of PCo’s research and development (R & D) expenditure used to create it.

Such a structure provides tax savings by enabling avoidance of home-country tax on foreign interest, royalty, and other payments deductible against the host country’s tax base. Compared with the direct structure, tax-planning incentives are increased to thinly capitalize OpCo with debt and strip out earnings as deductible interest. The incentive to overcharge (use non-arm’s-length prices) on interest and royalty payments to IntCo also rises.

A central tax-planning advantage offered by triangular structures is the avoidance of home-country corporate tax on interest income on an interaffiliate loan, assuming use of a conventional debt instrument. Another strategy is to use a hybrid instrument that is regarded as conventional debt, with deductible interest, by the host country but as equity, with exempt or lightly taxed dividends, by the home country.

Analysis by Clark signals the need to address MNE tax-planning strategies when measuring and interpreting the impact of ETRs on foreign direct investment (FDI). ETRs shown in figure 2 assume that PCo borrows in the home country to finance investment in OpCo in the host country. PCo deducts interest against domestic income, taxed at a 30 percent statutory corporate rate. Business profit is subject to host-country corporate tax at a 15 percent statutory rate, with a 5 percent dividend withholding tax. Tax depreciation is assumed to match economic depreciation.

The first case (EATr_1, EMTr_1) assumes direct investment by PCo in equity shares of OpCo, with tax-exempt treatment of dividends received by the parent. EATr_1 is 4.1 percent, and EMTr_1 is −16 percent. The low EATr and negative EMTr (implying a tax subsidy) arise with FDI financed by debt, interest expense deducted at 30 percent, and earnings taxed at 18.8 percent. In the second case (EATr_2, EMTr_2), PCo capitalizes OpCo with equity and a hybrid instrument, with financing weights of 65 percent and 35 percent respectively. Payments on the hybrid are deductible as interest and received as tax-exempt dividends yielding lower ETRs.

15 Thinly capitalizing OpCo provides tax savings where the home country operates a dividend exemption or dividend credit system, regardless of the statutory corporate tax rates in the home and host countries. Avoidance of home-country tax on earnings retained by IntCo assumes the absence or avoidance of controlled foreign company (CFC) rules in the home country that would tax PCo on a current basis on interest and royalty income, paid out of active business income, received by IntCo. Many countries do not have CFC rules or do not apply them to such income (instead targeting income earned on portfolio securities and possibly other income, such as foreign-based company income). Even with CFC rules, hybrid entities or other structures or instruments may enable avoidance. Other provisions may be in place to safeguard host- and home-country tax bases. The host country may have thin capitalization rules that limit leveraging; the home country may have interest allocation rules that limit interest deductions against domestic taxable income (for example, on interest paid on funds borrowed to capitalize IntCo); or tracing rules may be used (though these are difficult to enforce, given the fungible nature of capital) to assign to foreign income interest costs on funds used to finance foreign direct investment.

16 Clark, supra note 5.
The third case assumes a triangular structure in which OpCo is capitalized with equity and conventional debt, and 50 percent of earnings are paid out as deductible interest and received tax-free by IntCo. ETRs fall even further then. These results illustrate how aggressive tax planning can significantly lower the corporate-level tax burden on investment.

The implication is that standard ETRs may not be particularly informative about incentives faced by MNEs that have access to advanced tax planning. And while the structures considered here go beyond the standard modelling of ETRs, they are still highly stylized, since MNEs may use even more complicated structures involving additional countries and intangibles.¹⁷

**POLICY APPLICATIONS OF ETR ANALYSIS**

**International Comparisons of Tax Systems**

ETRs are often used as indicators of the relative “competitiveness” of tax systems. The federal government of Canada, for example,¹⁸ presents EMTR analysis comparing the Canadian and US tax systems. Cross-country EMTR analysis took a prominent

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role in Canada’s 2006 federal budget,\textsuperscript{19} where the federal government announced its goal of having the lowest EMTR among Group of Seven (G7) countries by 2010. This target initiated a tax reform agenda for successive budgets, including accelerated depreciation (capital cost allowance) for investments by manufacturing and processing firms. The measures were calculated to reduce Canada’s EMTR to 28.6 percent by 2011, as shown in figure 3. The analysis detailed further reforms that would be necessary to reduce Canada’s EMTR further to be the lowest among G7 countries.\textsuperscript{20}

The US President’s Framework for Business Tax Reform\textsuperscript{21} uses detailed ETR analysis to build a case for proposed tax reform measures to support the competitiveness of US businesses. The analysis shows that while the statutory corporate tax rate in the United States is relatively high, the EMTR on investment, at 29.2 percent, is competitive and below the average of other G7 countries. Bilicka and Devereux\textsuperscript{22} report a cross-country ranking analysis using ETRs for 2012, as well as for future years based on proposed tax reforms. The University of Calgary School of Public Policy\textsuperscript{23} provides an annual comparison of EMTRs.

ETRs have also been used to analyze comparative developments of tax systems over time. Devereux et al.,\textsuperscript{24} for example, find that the net impact of tax reforms in advanced countries has tended to raise EMTRs and lower EATRs, as tax bases have been broadened and tax rates narrowed. Loretz\textsuperscript{25} uses more recent data and finds that the downward trend in EATRs has continued, but that tax bases have stabilized. Abbas and Klemm\textsuperscript{26} consider developing and emerging economies and find that the general developments have mirrored those in advanced economies, but that the presence of tax incentives has created parallel tax systems, with ETRs close to zero.

\textsuperscript{19} Canada, Department of Finance, 2006 Budget, Budget Plan, May 2, 2006, at 73-75.

\textsuperscript{20} The suggested harmonization of sales taxes (see figure 3) has still not been completed; three provinces—Manitoba, Saskatchewan, and British Columbia—continue to levy their own retail taxes.

\textsuperscript{21} United States, White House and the Department of the Treasury, The President’s Framework for Business Tax Reform (Washington, DC: White House and the Department of the Treasury, February 2012).

\textsuperscript{22} Katarzyna Bilicka and Michael Devereux, CBT Corporate Tax Ranking 2012 (Oxford: Oxford University Centre for Business Taxation, 2012).


for qualifying investment. Abramovsky et al.\textsuperscript{27} also document trends among developing and emerging economies and find that those with the lowest incomes have particularly steep reductions in EMTRs, driven by narrowing tax bases.

**Identifying Tax Distortions to Investment**

Another use of ETRs is to identify non-uniform tax distortions to investment, where one type of investment has a different ETR from another. While this is sometimes intended (for example, in the case of an R & D incentive), it is often the accidental result of the interaction of many tax provisions. Tax systems may distort investment decisions regarding what assets to invest in, what sectors to invest in, whether to structure a business in corporate or non-corporate form, what location to invest in (which country or region), and how to finance an investment.

Figure 4, for example, shows EMTR variations in the United States by asset type, business form, and type of finance. The deduction for interest expense combined with accelerated depreciation for capital costs can even result in a negative EMTR,

\textsuperscript{27} Laura Abramovsky, Alexander Klemm, and David Philips, “Corporate Tax in Developing Countries: Current Trends and Design Issues” (2014) 35:4 Fiscal Studies 559-88.
EMTR = effective marginal tax rate.
Note: EMTR includes corporate income tax and individual income tax.


implying a tax subsidy. A negative EMTR indicates a tax distortion that favours investment relative to the no-tax case (that is, a larger capital stock than would be observed with no corporate tax on investment).

**Analyzing Effects on Investment of Detailed Tax Reform**

Tax reform often involves a number of tax-rate and base changes, some encouraging and others discouraging investment, while ETRs allow gauging of the net effect. A recent EMTR study by Ernst & Young, for example, analyzes the net effect of a reduction in the statutory corporate tax rate in the United States, financed by a limitation on corporate deductions for interest expense. The proposal reduces allowable interest expense deductions of corporations by 25 percent, by limiting interest deductions to the non-inflationary (real) component. The resulting revenue gain is estimated to cover the cost of reducing the statutory corporate tax rate by 1.5 percentage points. The net combined effect is an overall increase in the corporate

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EMTR of 2.1 percentage points (a 6.7 percent increase in the EMTR)—a result that is not surprising since depreciation allowances are particularly valuable for marginal investment.

Cost-Benefit Analysis of Tax Incentives

ETRs are also a key input to cost-benefit analysis of tax incentives, where they are used to estimate the investment response to tax relief. This then allows comparison of the cost to society of forgoing corporate tax revenue when providing tax relief with benefits linked to additional investment resulting from the incentive.

Estimating the investment response to a tax incentive requires, in broad terms, two measures. One is the percentage change in investment, resulting from a change in the ETR on investment. The other is the change in the ETR caused by the tax incentive. ETRs are used as explanatory variables in econometric work examining determinants of investment, with estimated coefficients on an ETR providing a measure of the sensitivity of investment to tax changes. Also, formulas used to measure ETRs allow calculation of the change in an ETR with the introduction of an incentive.

INTERPRETATION OF ETRS

Because ETRs are used in so many contexts, it is important that analysts and policy makers understand their meaning. This is complicated by various pitfalls in the interpretation of ETRs. The points are of a general nature, but they become particularly acute when taking into account tax holidays and MNEs, which increase the possible range of ETRs, as well as the likelihood of negative rates.

The EMTR is the simpler rate to interpret. It shows by how much the tax system affects the cost of capital. This is therefore the relevant rate determining tax effects on investment at the margin. A lower EMTR would mean greater incentives to invest and typically lead to a greater capital stock. The precise interpretation of an EMTR depends on whether it is calculated using in the denominator the tax-inclusive cost of capital or the tax-exclusive cost of capital. In case of the tax-inclusive denominator, the EMTR can become extremely high in absolute value, because the after-tax cost of capital can be close to zero. The EMTR may be negative, since the combination of interest deductibility and depreciation allowances can provide tax relief that more than offsets tax on the entire return on investment. Negative tax rates imply

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29 In addition to estimates of the sensitivity of investment to taxation (tax elasticity—the change in the ETR on investment caused by the tax change), cost-benefit analysis requires information on the marginal social cost of funds (taking into account efficiency losses incurred when higher taxes are levied to finance a tax incentive) and an assessment of spillover effects of the incentive (for example, on real wages/employment income) and possibly other effects (for example, effects on pre-tax rates of return resulting from technology spillovers), depending on the host country in question and whether investment is by domestic or foreign investors.

30 This is the case in Devereux and Griffith, supra note 3, and the appendix to this article.
that investment is subsidized, but they are meaningful only for firms that are able to claim tax losses (against profits from other or future activities). Otherwise, the tax rate cannot be less than zero, since (with very few exceptions) treasuries do not pay out tax refunds to loss-making firms.

The EATR is relevant for a firm expecting to earn an economic rent from a discrete investment—for example, because of a patented technology. Investors would be interested in the extent to which the pre-tax rent is reduced by the tax system. In practice, it is hard to think of a completely discrete investment project. Even if rents are earned from a given project, the scale of the project (in terms of size or quality of the investment goods) is determined by the EMTR. Because the EMTR differs across countries, the scale of a discrete investment project will also differ, and in turn the expected pre-tax rent will differ. Assuming a fixed pre-tax rate of profit in international comparisons is therefore a shortcut.31

All ETRs depend not only on tax but also non-tax parameters, such as inflation rates, which determine the real value of depreciation (since this is given in nominal terms). Whether non-tax parameters should be variable in an analysis depends on the purpose of a study. If the aim is to compare tax systems, imposing common non-tax factors may help in revealing differences in the tax code that would otherwise be mixed up with macroeconomic differences. An investor considering an international venture, however, would be interested in the actual ETRs as they apply given the macroeconomic environment in different markets.

Interpretation of ETRs can also become difficult when shareholder-level taxes are included. In the Devereux and Griffith framework,32 adding interest taxation typically reduces ETRs, because this has the effect of reducing the discount rate of investors, whose alternative is a financial investment in an interest-bearing instrument. The overall impact of shareholder-level taxes depends on the interplay of taxes on dividends, capital gains, and interest.

A particularly important point, however, is the multitude of ETRs. In making international comparisons, it is tempting to speak of the EMTR or the EATR of a particular country. But instead there is an infinite number of rates depending on the details of an investment, such as the choice of assets, the expected profitability, and the source of financing. And the ranking of countries is not stable across measures; some tax systems are particularly attractive at the margin, others at high rates of profitability. Most systems encourage debt finance, but some may have limiting rules. It is possible to come to an average rate by using an economy-wide average of the discount rate, the leverage ratio, asset allocation, etc. But such an average rate would not capture the incentives for any actual investment project, which depend on its particular characteristics.

31 More generally, the pre-tax rate of profit would also differ depending on production costs, such as labour costs or access to infrastructure.

32 Devereux and Griffith, supra note 3.
CONCLUSION

In this article, we have discussed how ETRs can be calculated in the presence of tax incentives and tax planning by multinationals. Our main conclusion is that these additional considerations pose no theoretical problem, but that some of the general difficulties in interpreting ETRs become even more acute.

Specifically, while policy analysts may often wish to know the EATR or EMTR of a particular country, there is instead a multitude of ETRs. Not only the level of the ETR, but even the ranking of countries, depends on various assumptions about the assets invested in, rates of profitability, sources of finance, qualification for tax incentives, and access to tax-planning strategies. A high-tax country, for example, could have low ETRs when debt finance is used and no limitation on interest deductibility applies. Tax incentives can have dramatic effects and reduce tax rates to close to zero for qualifying investment.

Still, ETRs can play a very important role in policy analysis. In the cross-country context, they can be useful, provided that researchers do not look at single rates but at a broad range of tax rates. ETRs can provide insights into which types of investment are favoured in what countries, and to what extent tax incentives or tax planning undo the effect of the underlying tax system. Also, for the purposes of analyzing a particular reform—for example, the introduction of a tax incentive—ETRs conveniently put together the sometimes offsetting effects of various aspects.

APPENDIX DERIVATION OF EFFECTIVE TAX RATES

Following the Devereux and Griffith approach and notation, as extended by Klemm, we define the effective average tax rate (EATR) as follows:

$$EATR = \frac{R^* - R}{p / (r + \delta)}$$

(1)

where $R^*$ is the present discounted value (PDV) of the economic rent earned in the absence of taxation, $R$ is the same in the presence of taxation, $p$ is the pre-tax net profit, $r$ is the real interest rate, and $\delta$ is true economic depreciation. The PDV of the economic rent must be equivalent to the change in the value ($V$) of the firm, where $d$ indicates the change:

$$R = dV = \sum_{j=0}^{\infty} \frac{\gamma D_{j+1} - dN_{j+1}}{(1 + \rho)^j}$$

(2)

where $D$ are dividends; $\gamma = (1 - m^d)/(1 - z)$ is a factor measuring the difference in treatment of new equity and distributions, with $m^d$ representing the personal tax

33 Ibid.
34 Klemm, supra note 4.
on dividends and $z$ the tax on capital gains; $N$ is new equity issues; and $\rho = i(1 - m')/(1 - z)$ is the investor’s discount rate, with $m'$ representing the personal tax rate on interest and $i$ the nominal interest rate. Dividends are determined by the flow of funds equation

$$D_t = (p + \delta)(1 + \pi)K_t - (1 - \tau)I_t + B_t - (1 + i(1 - \tau))B_{t-1} + \tau\phi(I_t + K_{t-1}) + N_t$$

(3)

where $\pi$ is the inflation rate, $K$ is the capital stock, $\tau$ is the corporate tax rate, $I$ is the investment undertaken, $B$ is new debt issued, $\phi$ is the official depreciation allowance, and $K^T$ is the tax-written-down value of capital.

Consider now the impact of a one-time permanent investment (that is, $dl_t = 1$, $dl_{t+s} = 0$, for any $s > 0$). Using this and substituting (3) into (2), the tax-free PDV of profits can be easily derived by setting all taxes to zero:

$$R^* = \frac{p - r}{r + \delta}.$$  

(4)

In the presence of taxation, the derivation is more complicated. Assume initially that the investment is financed by retained earnings (that is, $B = N = 0$),\textsuperscript{35} which yields

$$R^{\text{RE}} = \gamma \left[ \sum_{t=1}^{\infty} \frac{(p + \delta)(1 - \tau)(1 + \pi)^t}{(1 + \rho)^t} - \sum_{s=0}^{\infty} \frac{dl_{t+s}}{(1 + \rho)^t} + \tau\phi \sum_{s=0}^{\infty} \frac{dl_{t+s} + dK_{t+s}^T}{(1 + \rho)^t} \right]$$

(5)

$$= \gamma \left( \frac{(p + \delta)(1 + \pi)(1 - \tau)}{\rho - \pi + \delta(1 + \pi)} \right)^{1 + A}$$

where $A$ is the PDV of depreciation allowances.\textsuperscript{36}

Starting from equation (5), it is then possible to add special regimes. As an example, consider a reduced tax rate of $\tau'$ (zero in case of a tax holiday), which applies for $Y$ years:

$$R = \gamma \left( \frac{(p + \delta)(1 + \pi)}{\rho - \pi + \delta(1 + \pi)} \right)^{1 - \tau' - (\tau - \tau') \left( \frac{(1 - \delta)(1 + \pi)}{1 + \rho} \right)^Y} - 1 + A.$$  

(6)

\textsuperscript{35} Additional financial effects apply if debt $F^D = \frac{\gamma(1 - \tau)(\rho - i(1 - \tau))}{\rho + \delta(1 + \pi) - \pi}$ or new equity $F^{\text{NE}} = (\gamma - 1)(1 - \tau\phi)$ is used to finance the investment.

\textsuperscript{36} This depends on the depreciation scheme: for example, for declining balance: $A = \frac{\tau\phi + 1}{\rho}$; for straightline, $A = \frac{\tau\phi(1 + \rho)}{\rho} \left( 1 - \left( \frac{1}{1 + \rho} \right)^{1/\phi} \right)$. More complicated schemes are also possible.
Similarly, the PDV of depreciation allowances and any financial effects need to reflect the change in the tax rate.\textsuperscript{37} Other special regimes can be added equivalently. An investment allowance, for example, would enter into the calculation of $A$. (Care needs to be taken to distinguish between investment allowances, which are in addition to depreciation, and first-year allowances, which reduce the tax-written-down value of an asset.)

To calculate the EMTR, the post-tax economic rent $R$ (equation (6) plus any financial effect $F$) is set equal to zero. Solving for the required level of pre-tax net profit ($\hat{p}$),

\begin{equation}
\tilde{p} = \frac{(1 - A - F/\gamma)(\rho + \delta(1 + \pi) - \pi)}{(1 + \pi)\left(1 - \tau' - (\tau - \tau')\left(1 - \delta\right)(1 + \pi) \right) - \delta}.
\end{equation}

The EMTR can then be calculated by obtaining $R^*$ for $\tilde{p}$ and substituting into (1), or equivalently as

\begin{equation}
EMTR = \frac{\tilde{p} - r}{\hat{p}}.
\end{equation}

\textsuperscript{37} Declining balance depreciation, $A = \phi \frac{1 + \rho}{\rho + \phi}\left(\tau' + (\tau - \tau')\left(1 - \phi\right)\right)$; straightline depreciation, $A = \phi \frac{(1 + \rho)}{\rho}\left(\tau' + (\tau - \tau')\left(1 - \phi\right)\right)$; $F^{NE} = (\gamma - 1)(1 - \tau\phi)$, and $F^{DD} = \frac{\gamma(1 - \tau')}{\rho - \pi + \delta(1 + \pi)}\left(\rho - i(1 - \tau') + i(\tau - \tau')\right)\left(1 - \delta\right)(1 + \pi) \right)$. 