

Taxes and investment decisions

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This note provides an overview of the main investment effects of tax rules using simple net present value (NPV) calculations and basic economics. In these calculations, the main taxation effects of tax rates and some main tax-base elements are incorporated. In many countries, there are also other tax incentives and effects that can affect investments, such as investment or R&D tax credits. Such incentives are explained and covered in other technical notes on taxes.

Basics of the investment effects of taxes

In an ideal world, taxes do not affect the economic decisions of businesses. While it seems unthinkable that this happens, it is possible, as illustrated in **Figure 1**. Consider a simple supply and demand framework. In a world without taxes, firms invest as long as the marginal benefits (MB_0) are equal to the marginal costs (MC_0). For any additional investments, marginal revenues decline and marginal costs increase (i.e., the next investment is less profitable than the previous one). Firms choose the level of investments Q_0 for which marginal costs and benefits are the same ($MB_0 = MC_0$).

Now, a **neutral tax** with the tax rate τ is introduced. This means that the marginal revenues are taxed so that the firm receives $MB_t = MB_0 \times (1 - \tau)$ from its sales. At the same time, costs are deductible so that the marginal costs after taxes MC_t equal $MC_0 \times (1 - \tau)$. This implicitly assumes that all economic costs are tax deductible. If this is the case, **Figure 1** shows that the after-tax level of investment Q_t is equal to the level of investments before tax Q_0 . Put differently, taxes do not affect investment decisions. But how is this possible when profits decrease because of taxes? This is very simple: The level of investment is based on profit maximization. Even if the absolute level of profits declines because of taxes, the firm's optimal choice of investments is the same level of investments in the world with taxes Q_t as in the world without taxes Q_0 . Taxes cut revenues in the same way that they reduce costs. The downward shift in the marginal benefit curve is equal to the downward shift in the marginal cost curve. This downward shift is represented by the difference between the solid and dashed lines. Ultimately, when weighing marginal costs against marginal benefits, the pretax and the after-tax levels of investments are the same (i.e., $Q_t = Q_0$).

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All of the material contained in this document has been developed by the author unless otherwise stated.

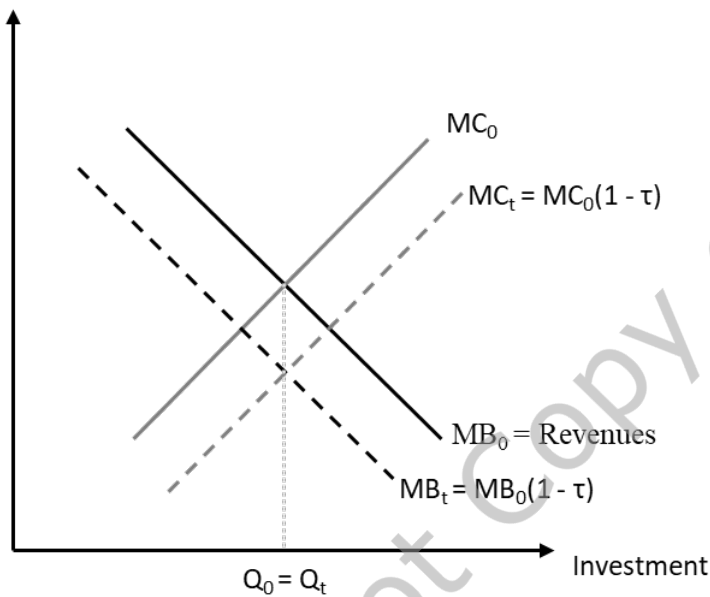
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One key assumption of this finding is that all economic costs are tax deductible. One should always be allowed to deduct all costs, right? While this may sound reasonable at first glance, it is not the case in reality for most industries. The economic costs of businesses cover many items, such as the costs of goods sold or wages. These are, of course, tax deductible in many countries, and they are easy to measure. If firms, for example, have only wage expenses (e.g., consulting businesses), the decision to hire an additional worker is unlikely to be affected by the tax on the company's profits. **Figure 1** illustrates the investment decision of such very labor-intensive firms.

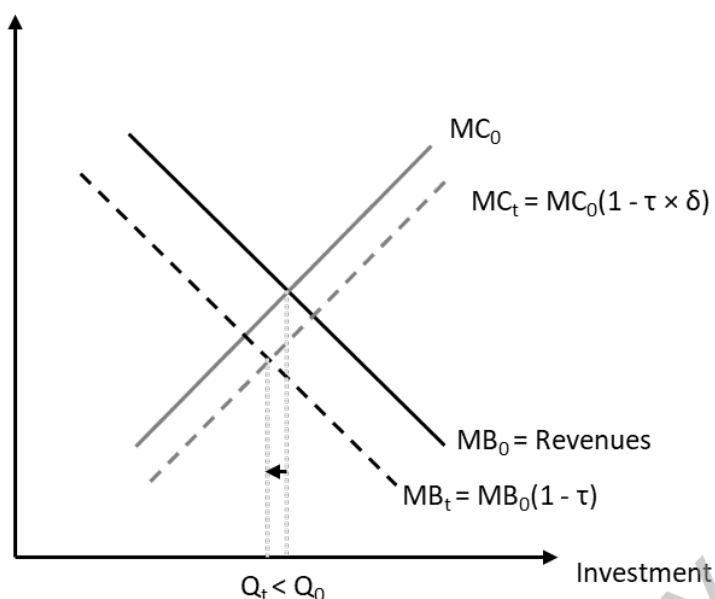
Figure 1
Neutral tax without an effect on investment



Normal distortive tax: Several items that are not fully or not at all tax deductible. For example, tax accounting rules define very specific depreciation rules for tax purposes that may not reflect the actual wear and tear of a machine. More importantly, any cost of equity financing—while economically important through the cost of capital—is not tax deductible. The true cost of equity financing is very hard for tax authorities to determine. Hence, for any type of larger capital investment, the investment costs are not fully deductible (*limited deductibility*). That is, only a portion δ of a firm's marginal costs are tax deductible. As a result, the marginal costs after tax are now $MC_t = MC_0 \times (1 - \tau \times \delta)$, with $\delta < 1$.



Figure 2
Tax with an effect on investment



Limited deductibility of investment costs has severe consequences for investment decisions, as shown in **Figure 2**. Because of limited deductibility, the downward shift in the marginal cost curve is smaller than that in **Figure 1**. Intuitively, this occurs because the tax shield that a firm receives from the deduction of costs is smaller in **Figure 2** (limited deductibility) than in **Figure 1** (full deductibility). However, the marginal benefits (i.e., marginal revenues) continue to be fully taxed. Hence, the tax-induced downward shift in the marginal benefit is larger than the downward shift in the marginal cost curve. As a result, firms reduce their investments ($Q_t < Q_0$) to ensure that the marginal benefits after tax are equal to the marginal costs after tax.

In the following, the tax effects on investments are illustrated using simple NPV calculations. The tax effects of tax rates on profits, depreciation rules, and loss offset rules are all rooted in the notion of limited deductibility.

Investments of sole proprietorships

In the first step, an example of a sole proprietor is used. The same logic applied in this section can also apply to the owners of a partnership. The case of a sole proprietor is the simplest because the cash flows generated by the sole proprietor are legally owned by the person running the business. Moreover, the profits from the business are immediately subject to the owner's personal income tax rate. The goal of the business owner is to maximize their after-tax NPV.

To illustrate the tax effects, a simple example of a three-period investment is used. The investment cost of 300 is financed by equity, and the payoffs are shown in **Table 1**. To calculate the NPV after tax, a few assumptions are necessary: the cost of capital is 7.5%, the owner's personal income tax rate is 45%, and the depreciation is in a straight line, with a useful life of 3 years.