

Effective tax rates: The role of tax rates in investment decisions

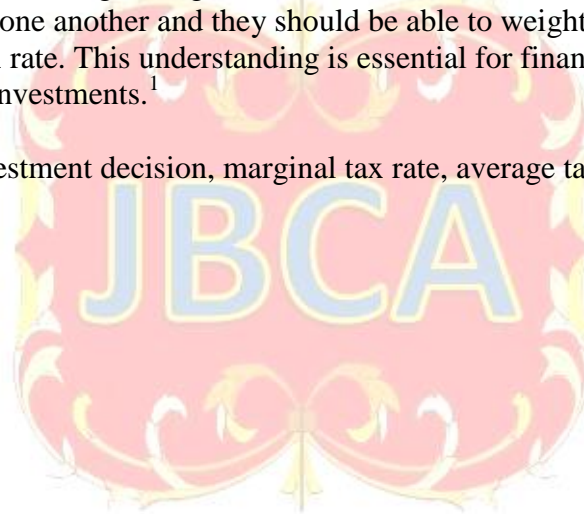
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ABSTRACT

Banana LLP is a case study about the different kinds of tax rates and investment decisions influenced by taxes. The characters in the case use statutory tax rates, average tax rates, marginal tax rates and effective tax rates for investment decisions. The case sets a special focus on the effective marginal and the effective average tax rate and their use as investment criteria. Assignments are integrated in the case so that students are able to assess if they understood the discussed concepts. After working through the case, students should know the terminology of tax rates, how these relate to one another and they should be able to weight the advantages and disadvantages of each tax rate. This understanding is essential for finance students to assess the profitability of different investments.¹

Keywords: Tax rate, investment decision, marginal tax rate, average tax rate, effective tax rate



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¹ The article uses the following abbreviations: ATR (average tax rate), MTR (marginal tax rate), EATR (effective average tax rate), EMTR (effective marginal tax rate), STR (statutory tax rate), ROR (rate of return).

1. INTRODUCTION

Most actions of economic entities are influenced by taxes. In order to obtain an unbiased valuation of investments, it is essential for companies – especially for those who operate internationally – to consider the impact of taxes. In typical undergraduate courses in finance such as international finance or investment analysis, however, investment decisions are often based on very simplistic tax models. The goal of this article is to provide an intuitive access for finance students to the different types of tax rates and their application in investment decisions. This should enable students to make valid valuations when they face international investment decisions.

Practitioners as well as researchers in the fields of finance and accounting increasingly have to deal with a variety of different taxes and types of tax rates. Hence, there is a vast amount of scientific literature dealing with the calculation of tax rates (e.g. Feldstein, 1995; Baldwin and Krugman, 2004). Most of the articles relate to the fundamental concepts developed by Devereux/Griffith (1999) and King/Fullerton (1984). Since these important tax rate concepts use a high degree of abstraction, they are rarely used in study literature. However, the implementation of these concepts in the finance curriculum enables students to assess the importance of taxes, especially in cross-border investments. This paper attempts to narrow the gap between research and practice by breaking these partly complex models down and by making them more accessible.

This case is designed to make it easy for students identify themselves with the main characters and to set them in the position of a decision-maker. Whereas traditional case studies (e.g. Barnes/Christensen/Hansen, 1994) usually provide students with verisimilar cases which try to simulate a real situation, the presented case takes place in a fictional environment: By reducing the complex reality to its fundamental components, this approach helps students to focus on the essentials and to understand the idea behind the complex research concepts.

The article is structured into two sections: The first section provides a short overview on the underlying well-known scientific concepts of tax rates which represents the learning objective. The following section applies these concepts by constructing an example case. The case itself describes a localization investment decision of the fictional company Banana LLP. The case slowly increases in complexity and simultaneously introduces the necessary terminology. Thereby, the reader is able to follow the concepts and also gets an idea of how the different types of tax rates relate to each other. After an introductory part which describes the business environment, students learn two basic types of tax rates, the statutory and the average tax rates. In the next step, the case gets more complex by the introduction of the scientific concepts of effective tax rates as a tool for investment decisions including time effects.

There are different approaches (OECD, 2000) to measure the effective tax burden of an investment; however, most of them refer to the basic approach from King/Fullerton (1984) and Devereux/Griffith (1999).

Subject of the 1984 developed model of the effective marginal tax rate (EMTR) from King and Fullerton is the tax burden of a marginal investment. It provides evidence, whether taxes have an impact on an additional investment. However, it only applies to investment decisions with a limited capital expenditure. Since the King-Fullerton-model has been applied extensively in further research approaches and in practice (e.g. OECD (1991), Jorgenson and Landau (1993)), the understanding of its basic concept is necessary for students as well as for practitioners.

The approach presented by Devereux and Griffith in 1999 is also based upon the model of King and Fullerton. By using the concept of effective average tax rates (EATR) it is possible to rank different mutually exclusive investment opportunities with a positive rate of return.

2. CASE STUDY: LOCALIZATION DECISION OF BANANA LLP

The following case section is designed to explain the basic concept of tax rates.

2.1 The scientific concepts of effective tax rates

The technical student Steve J. invented a new technology that allows users to use smartphones underwater. In order to realize his idea, he and his best friend Roland P. who majors in business strategy founded the company Banana LLP. Since their investment budget is limited, Roland P. suggests that from a strategic point of view it would make sense to produce either in country A or in country B. Expected costs and revenues are the same in both countries. The production requires a production plant including a special machinery which costs \$1000 and working capital of \$1000. These necessary \$2000 will be financed by a loan with an interest rate of 10%. Thus, the company has to pay interests amounting \$200 per year. Each smartphone has variable costs of \$100. He also forecasts that the company would maximize its profit by selling 100 units at a price of \$110.

Therefore – as shown in Table 1 (Appendix) - Roland estimates that the annual income in both countries totals \$800. Thus, it wouldn't matter whether to invest in country A or B.

During a college party Roland wants to impress his fellow student, Earnestine Y. by telling her about his new business. As one of the best tax accounting students in her class, she tells him about her concerns that localization decisions are strongly influenced by local taxes and offers him to take a look at their investment plans the next day. Since Roland and Steve didn't include taxes in their planning so far Roland doesn't want to make a fool of himself and goes home early. During his nightly internet research he finds various types of tax rates and finally decides to use statutory tax rates of country A (25%) and B (15%) for his calculations. After considering a depreciation rate of 10% he applies the statutory tax rate. On that account, he calculates the respective aftertax income as shown in Table 2 (Appendix).

The next day he proudly announces that – based on his calculations – he decided to invest in country B. After taking a look at his notes, Earnestine breaks out in laughter. Roland is humiliated and wondering what he did wrong.

Questions to the students:

Why is Earnestine amused? What is the statutory tax rate and which problems arise with using solely statutory tax rates?

Terminology:

The statutory tax rate is the legally imposed tax rate (the percentage rate appearing in the tax law).

The statutory tax rate alone doesn't reflect the calculation of the final tax burden. Tax systems have many features, which are not yet taken into account. We also need to consider that

the income doesn't equal the tax base. There are many more factors that influence the taxable income such as depreciation, which results in time effects, or the valuation of inventories.

She tells him that the tax system in the real world isn't that simple and offers her help. Since Roland doesn't want to admit that made a mistake in his calculation, he pretends to be surprised by telling her an excuse. He claims that he missed to print out the second page of his calculations and promising her to bring it the next day.

In the evening, Roland runs to his former accounting professor Tac S. and explains his desperate situation. Tac feels sympathy for Roland and explains him in a few words that the tax base is influenced by non-deductible expenses and tax exemptions. Usually the taxable profit is composed differently than the actual business profit. On the one hand, a company might have expenses that are not recognized for tax purposes (non-deductible expenses, on the other hand, part of the company's earnings might be tax exempted.

Therefore, the taxable income differs from the income in a tax free world. Since Tac is very busy, he gives Roland a bulky book summarizing the tax systems of all countries. Roland is very thankful and promises Tac to give him one of the recently developed underwater smartphones.

Since Roland is very keen to impress Earnestine, he skims the first chapters until he finds a summary of all non-deductible expenses and tax exemptions of both countries.

Country A provides tax incentives for newly established technology companies on returns totaling 20% of the pretax income and therefore reduces the taxable income by \$160. Under the tax system of country B, however, only 50% of the capital expenditures are tax deductible and therefore \$100 have to be added again to the taxable income. With this new information, Roland makes a new calculation as shown in Table 3 (Appendix).

Relieved that the localization decision is still in favor of country B, he expects Earnestine's arrival. He confidently tells her that the calculations confirm the results of the "first page" with the statutory tax rate. While reading it her look becomes more and more skeptical.

Questions to the students:

Is there anything missing in Roland's calculations that he might have overseen in the book? (The question is supposed to make students think about the factors that influence the tax base: non-deductible expenses and tax exemptions).

Earnestine asks him for a pen and a calculator to check his results. After taking a thorough look at the book she finds that Roland didn't consider that the tax system of country A has progressive tax rates. Until now, Roland used the highest statutory tax rate. However, there are three statutory tax brackets in country A (5%, 15%, 25%), used for different steps of income (Table 4, Appendix).

Earnestine tells him that most tax rates are either progressive (which means that the tax rate increases with an increasing tax base) or proportional (which means that the tax rate remains constant) and explains him the calculation of the final tax burden in country A by using Table 5 (Appendix).

Starting with a tax base of \$540 the first \$200 would be taxed with 10%, the next \$200 would be taxed with 15% and the remaining \$140 would be taxed with 25%, so finally there is a tax burden of \$75. Roland shrugs his shoulders and points out that this can't be such a big deal. Since the tax rate in country B is proportional, his calculations in this country were at least right.

Earnestine disagrees and shows Roland the final result of her calculations which now clearly prefer country B as indicated in Table 6 (Appendix).

2.2 Terminology of tax rates

She explains him that even though tax systems can be quite complicated, they are highly critical to valuate investment decisions. Roland is deeply frustrated about the various difficulties and the confusing terminology of tax rates. Finally, he gets himself together and asks her to tell him the different types of tax rates.

She begins by pointing out that besides statutory tax rates there are also average tax rates, effective average tax rates and marginal tax rates. The tax burden results from the combination of the tax base and the tax rate. The average tax rate (ATR) is the ratio of the tax burden to the tax base.

$$\text{ATR} = \frac{\text{tax burden}}{\text{tax base}} \quad \text{Equation 1}$$

This ratio gives us an idea about the actual tax rate applied to the taxable income. It may differ from statutory tax rates since it might also include tax rate progressions. The ATR also factors in tax incentives that may reduce the tax rate or the final tax burden.

However, the information that can be derived from the ATR is quite limited since the tax base might vary. In an investment decision it would only be useful if the tax base would equal the income. In reality, however, the tax base usually strongly differs from the income because of tax exemptions and non-deductible expenses. In an investment decision, it is reasonable to relate the tax burden to the respective taxable income. This ratio is defined as the effective average tax rate (EATR).

$$\text{EATR} = \frac{\text{tax burden}}{\text{income}} \quad \text{Equation 2}$$

Each tax rate represents a certain level of information: The statutory tax rate is the most specific one since it applies on a clearly specified tax base. The ATR summarizes information about the tax rate structure (progressive or proportional) and possible tax reliefs (on the tax rate or tax burden). The EATR extends the ATR by also including the effects of non-deductible expenses and tax exemptions on the tax base (as visualized in Figure 1).

Thus, each rate helps the investor to isolate different effects of a country's tax system on a specific investment. Table 7 summarizes the different types of tax rates for Banana LLP.

The statutory tax rates are pretty easy to look up and reveal information on the range at which taxable income is taxed in country A or B. The ATR provides the specific tax rate that needs to be applied to the taxable income (country A: 540; country B: 800). In country B the statutory tax rate and the ATR are the same (15%), since the amount of non-deductible expenses and depreciation equal themselves out. Whereas the ATR of country A is just slightly lower than in country B (13.89% < 15%), the EATR of both countries differ more strongly (9.38% << 15%).

In an investment decision, it is most common to use the EATR since it summarizes all possible aspects of the tax system. Pondering between these two countries from a tax point of view, Banana LLP should invest in country A because it has to pay fewer taxes for its income than in country B.

2.3 Introducing time effects

The former example is a simplified case since it doesn't consider a multi-periodic investment. The primary goal was to help students to understand the basic terminology of tax rates. Referring to the scientific concept of Devereux/Griffith (1999), the case is now extended by introducing time effects. Different depreciation periods under the same tax system affect the investment decision and therefore also tax rates.

A few weeks later, Earnestine reads in a scientific journal that country A wants to introduce tax incentives for research and development (R&D). The draft bill allows a shorter depreciation period for companies with innovative patents. Since underwater smartphones are an innovative product, the depreciation period for machines of Banana Inc. may be reduced from 10 to 5 years.

Questions to the students:

Calculate the EATR assuming a 10 year investment period with a constant pretax income of \$800, an after-tax discount rate of 8% and linear depreciation. Which changes in the EATR occur if the depreciation period can be reduced by 5 years?

The EATR is the ratio of tax burden and pretax income. In a more-periodic investment, a calculation of the present value is needed in order to calculate the EATR

$$\text{EATR in a more – periodic investment} = \frac{\text{Present value of the tax burden}}{\text{Present value of the income}} \quad \text{Equation 3}$$

For better comparison, firstly a calculation of the EATR is needed without the shorter depreciation period due to tax incentives. When both components - income and tax burden - are constant over time, the same result as in an one-periodic case occurs, the EATR is still 9.38% (Table 8).

Considering a shorter depreciation period due to government tax incentives, the investment and depreciation period are not equal anymore. Therefore, there exist two different tax bases for the reduced depreciation period (year 1-5) and the remaining 5 years. Table 9 presents the calculation of the tax base of each investment period.

As indicated in Table 10 (Appendix), the progressive tax rate on the respective tax base is applied to get the tax burden of each period.

Finally, it is possible to calculate the present values of the pretax income and the tax burden. Table 11 (Appendix) illustrates the cashflow and present value of the investment.

A reduced depreciation period decreases the EATR from 9.38% to 7.53%.

2.4 Effective marginal tax rates: Assessing the scale of the Banana LLP investment

The following example provides an exemplary application of marginal tax rates and effective marginal tax rates (developed by King/Fullerton).

It was assumed that both investments are profitable. Roland and Steve had to decide between mutually exclusive investment opportunities. Therefore, the concept of the effective average tax rate was applied.

Now is the time to take a closer look at the question whether an investment is profitable at all. In our story, Steve and Roland have to decide between an additional investment in Banana LLP and an opportunity investment. They could also deposit their money in a bank account which currently yields interest payments of 8% p.a.

During the past ten years the company became enormously successful. Roland goes on an award ceremony for the most successful start-up entrepreneurs in the technology sector (Steve is currently too busy to attend since he's working on a new top-secret smartphone technology). At the ceremony speech, Roland announces the release of a totally new type of smartphone. After the official awarding, he meets Earnestine and Tac who heard that he was being honored. They haven't seen for years and talk about all sorts of things. After graduating Earnestine passed the CPA exam and works now at one of the biggest accounting companies in the world. Tac is retired now and dedicates all his time on his research focus which is still in the field of cross-border taxation. Glad about the unexpected reunion, Roland invites them for dinner.

After some glasses of wine, he tells them in private that he's unsure about the profitability of his announced product release. His brother Lee – a successful investment banker – offered him to invest the money in an equally risky portfolio that is supposed to yield 8% per year. Earnestine explains him that a decision between those alternatives does not just depend on differences in return but also in taxation which should be measured by the marginal tax rate. Excited for having an audience, Tac starts giving them a private lecture about the King/Fullerton model (1984).

According to the basic definition, the marginal tax rate is the tax rate applied to an additional monetary unit. However, the calculation and interpretation of marginal tax rates differs sometimes. Again, it can be distinguished between statutory and effective tax rates.

Roland who remembers Earnestine's explanation about progressive tax systems cuts Tac off. Being excited that he maybe can contribute to the discussion, he eagerly brings forward an example:

Under the progressive tax system in country A, for an income of \$400, an additional monetary unit of income is taxed by 25%. Table 12 (Appendix) shows the progressive tax rates of country A.

Tac explains him that these 25% are the statutory marginal tax rate (SMTR).

The SMTR is the statutory tax rate (STR) applied to an additional unit of pretax income without considering any changes in the tax base.

$$SMTR = \frac{\partial \text{tax burden}_{STR}}{\partial \text{income}} \quad \text{Equation 4}$$

Earnestine intervenes that from her experience, the marginal tax rate (MTR) is defined as the effective average tax rate (EATR) for an additional unit of pretax income.

$$MTR = \frac{\partial \text{tax burden}_{EATR}}{\partial \text{income}} \quad \text{Equation 5}$$

If the pre-tax return for an investment in the Banana business generates 9% and the investment portfolio yields 8%, a pre-tax income of \$90 and \$80 (Table 13, Appendix) occurs. For a MTR of the investment of 25% and a MTR of an opportunity investment of 10%, the after-tax income of the investments changes to \$67.50 and \$72. Apparently, the after-tax return of the opportunity investment is now higher (7.20% > 6.75%) which means that – given the respective rate of returns – the portfolio investment is more attractive.

Roland suggests that there are more potential investment locations with different marginal tax rates.

Tac is happy about the great interest of his former students. He tells them that there is a more general way to compare the attractiveness of two mutually exclusive investments, the so called effective marginal tax rate (EMTR). The concept of the EMTR – which refers to the basic

approach of King/Fullerton (1984) – allows us to compare a marginal investment with a marginal opportunity investment considering the respective tax burden.

Other than the MTR that measures the tax burden of an additional unit of income, the EMTR is the specific effective average tax rate that applies to an additional marginal investment. In other words, the EMTR is the tax proportion of the pretax rate of return of an additional marginal investment.

$$\text{EMTR} = \frac{\text{ROR}_{\text{pretax}} - \text{ROR}_{\text{aftertax}}}{\text{ROR}_{\text{pretax}}} \quad \text{Equation 6}$$

The numerator is the difference between the pre-tax rate of return and the after-tax rate of return. Thus, it is the additional rate of return which has to be generated in order to compensate the tax burden, the so-called tax wedge ($\text{ROR}_{\text{pretax}} - \text{ROR}_{\text{aftertax}}$). The denominator is the pretax rate of return ($\text{ROR}_{\text{pretax}}$).

If the EMTR is equal to the MTR of the investment, both – the investment and the opportunity investment – are equally attractive. In this case, the after-tax return of both investment opportunities $\text{ROR} \cdot (1 - \text{MTR})$ is the same:

$$\text{ROR}_1 \cdot (1 - \text{MTR}_1) = \text{ROR}_2 \cdot (1 - \text{MTR}_2) \quad \text{Equation 7}$$

After transposing this equation, it becomes evident that the EMTR must equal the marginal tax rate of investment 1.

$$1 - \text{MTR}_1 = \frac{\text{ROR}_2(1 - \text{MTR}_2)}{\text{ROR}_1}$$

$$\text{MTR}_1 = 1 - \frac{\text{ROR}_2(1 - \text{MTR}_2)}{\text{ROR}_1}$$

$$\text{MTR}_1 = \frac{\text{ROR}_1}{\text{ROR}_1} - \frac{\text{ROR}_2(1 - \text{MTR}_2)}{\text{ROR}_1}$$

$$\text{MTR}_1 = \frac{\text{ROR}_1 - \text{ROR}_2(1 - \text{MTR}_2)}{\text{ROR}_1} = \frac{\text{ROR}_{\text{pretax}} - \text{ROR}_{\text{aftertax}}}{\text{ROR}_{\text{pretax}}} = \text{EMTR} \quad \text{Equation 8}$$

Comparing the EMTR with the “real” MTR_1 shows whether an investment is attractive or not (after-tax return of one investment is higher/lower than the opportunity investment). If the EMTR is higher than the MTR_1 , the following equations apply:

$$\text{MTR}_1 < \frac{\text{ROR}_1 - \text{ROR}_2(1 - \text{MTR}_2)}{\text{ROR}_1} = \text{EMTR}$$

$$\Rightarrow \text{ROR}_1(1 - \text{MTR}_1) > \text{ROR}_2(1 - \text{MTR}_2) \quad \text{Equation 9}$$

This means that the after-tax return of the first investment is advantageous. The opposite applies vice versa.

Roland is completely confused by Tac’s equations and wonders how that these formulas apply to his problem. Earnestine, however, is enthusiastic about the concept and offers Roland to help him applying the model to his decision problem.

Question to the students:

Apply the King/Fullerton model to Roland's investment decision. Therefore, calculate the pretax-return for the new investment so that the after-tax return of both investment opportunities is equal. How will Roland decide?

Roland and Steve's assume that the new investment generates a marginal rate of return of 9% while the portfolio generates annual after-tax returns of 8%. The marginal tax rate for the planned investment (MTR_1) is 25%, the tax rate for the portfolio investment (MTR_2) totals 10% since capital income is taxed differently.

$$EMTR = MTR_1(\text{dependent on the } ROR_1) = \frac{ROR_1 - 8\%(1-10\%)}{ROR_1} \quad \text{Equation 10}$$

The graph illustrates the relationship of the rate of return of the new investment (ROR_1) and the EMTR. An increasing rate of return of the new investment (ROR_1) leads to a higher EMTR. If the combination of a certain ROR_1 and a certain MTR_1 is below the grey field, the investment is profitable, since the EMTR is then higher than the MTR_1 . If the combination is a point above the grey area, the alternative investment (in our case the portfolio investment) is more attractive. Figure 2 (Appendix) demonstrates the relationship between the EATR and the ROR.

If the marginal tax rate of the investment is 25%, the minimum rate of return for Steve's investment would be 9.6%.

$$EMTR = MTR_1(\text{dependent on the } ROR_1) = MTR_1 \Rightarrow \frac{ROR_1 - 8\%(1-10\%)}{ROR_1} = 0.25$$

$$\Rightarrow ROR_1 \frac{8\%(1-10\%)}{0.75} = 9.6\% \quad \text{Equation 11}$$

Roland feels concerned since Steve was so enthusiastic about the new project but apparently the smartphones don't generate more (after-tax) profit than the portfolio investment ($9.6\% > 9\%$). In this very moment, Roland's phone is ringing. It is Steve telling him that he developed a new even more innovative way of producing the smartphones that would cut production costs by half. Roland is excited about these great news. This would increase their investment's rate of return drastically.

3. EDUCATIONAL GOAL

After working through the case, students should be able to understand the five important types of tax rates: the statutory tax rate (STR), the average tax rate (ATR), the effective average tax rate (EATR), the marginal tax rate (MTR) and the effective marginal tax rate (EMTR). They should also know how to distinguish between the two concepts of effective tax rates (EATR and EMTR):

The effective average tax rate (EATR) provides information on the impact of taxation on investment decisions like localization decisions. It measures the effective tax burden on profitable investments.

The effective marginal tax rate (EMTR) can be interpreted as a theoretical tax rate that is useful to assess the scale of an investment. In other words, it describes a special case when the after-tax profit compared to an alternative investment is zero.

A final discussion about the applications of effective tax rates might be useful for students to get a general idea of how tax rates can become useful. Effective tax rates can, for instance, help us compare alternative investments with different characteristics. They also allow us to assess investments in different tax systems. When comparing effective tax rates with the statutory tax rate, it is possible to find out whether an investment is favored or discriminated by the existing tax law.

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APPENDIX

Figure 1. Summary of the ATR and EATR

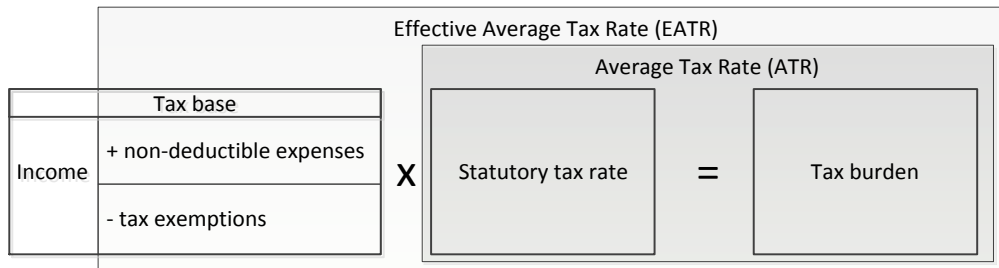


Figure 2. The relationship between the EATR and the ROR

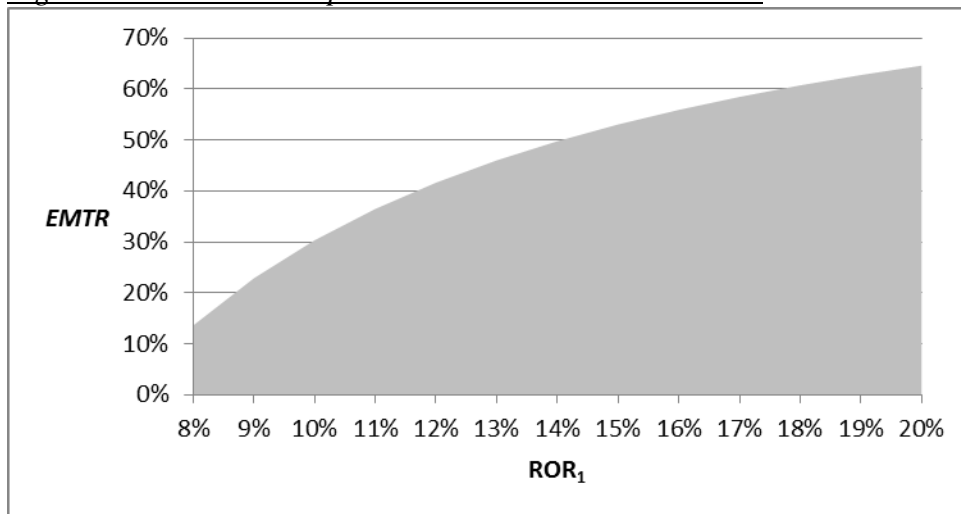


Table 1. Profitability of the investment without considering taxes

Country A		Country B	
revenue	\$11000	revenue	\$11000
-variable costs	\$10000	- variable costs	\$10000
-interest payments	\$200	- interest payments	\$200
pretax-income	\$800	pretax-income	\$800

Table 2. Profitability of the investment considering statutory tax rates

Country A		Country B	
pretax-income	\$800	pretax-income	\$800
- depreciation	\$100	- depreciation	\$100
tax base I	\$700	tax base I	\$700
- tax burden	\$175	- tax burden	\$105
aftertax-income	\$625	aftertax-income	\$695

Table 3. Profitability of the investment considering deductible expenses and tax exemptions

Country A		Country B	
pretax-income	\$800	pretax-income	\$800
tax base I	\$700	tax base I	\$700
+non-deductible expenses	\$0	+non-deductible	\$100
- tax exemptions	\$160	- tax exemptions	\$0
tax base II	\$540	tax base II	\$800
- tax burden (at 25%)	\$135	- tax burden (at 15%)	\$120
aftertax-income	\$665	aftertax-income	\$680

Table 4. Progressive tax rates of country A

Income	tax rate
\$0 - \$200	5%
\$201- \$400	15%
from \$401	25%

Table 5. Tax burden in country A

Income	tax	calc. tax burden	
\$0 - \$200	5%	\$200 at 5%	\$10
\$201 - \$400	15%	\$200 at 15%	\$30
from \$401	25%	\$100 at 25%	\$25
	sum	\$500	\$65

Table 6. Profitability of the investment considering a progressive tax system

Country A		Country B	
pretax-income	\$800	pretax-income	\$800
tax base II	\$540	tax base II	\$800
-tax burden	\$75	-tax burden	\$120
aftertax-income	\$725	aftertax-income	\$680

Table 7. Summary of tax rates

	Country A	Country B
Statutory tax rate	5%, 15%, 25%	15%
ATR	13.89%	15%
EATR	9.38%	15%

Table 8. Cashflow and present value of the investment

discount rate	8%									
Periods	1	2	3	4	5	6	7	8	9	10
income	\$800	\$800	\$800	\$800	\$800	\$800	\$800	\$800	\$800	\$800
tax burden	\$75	\$75	\$75	\$75	\$75	\$75	\$75	\$75	\$75	\$75
discount factor	0.9259	0.8573	0.7938	0.7350	0.6806	0.6302	0.5832	0.5403	0.5002	0.4632
PV tax burden	\$503.26									
PV income	\$5368.07									
EATR	9.38%									

Table 9. Tax base of each investment period

Year	1-5	6-10
pretax-income	\$800	\$800
- depreciation	\$200	\$0
+non-deductible	\$0	\$0
- tax exemptions	\$200	\$200
tax base	\$400	\$600

Table 10. Tax burden of each investment period

Annual tax burden			Annual tax burden		
Tax rate	year 1-5	Tax	year 6-10	Tax burden	
5%	applied on \$200:	\$10	applied on \$200:	\$10	
15%	applied on \$200:	\$30	applied on \$200:	\$30	
25%	applied on \$0:	\$0	applied on \$200:	\$50	
sum		\$400		\$600	\$90

Table 11. Cashflow and present value of the investment

discount rate	8%									
Periods	1	2	3	4	5	6	7	8	9	10
income	\$800	\$800	\$800	\$800	\$800	\$800	\$800	\$800	\$800	\$800
tax burden	\$40	\$40	\$40	\$40	\$40	\$90	\$90	\$90	\$90	\$90
discount factor	0.9259	0.8573	0.7938	0.7350	0.6806	0.6302	0.5832	0.5403	0.5002	0.4632
PV tax burden	\$404.27									
PV income	\$5368.07									
EATR	7.53%									

Table 12. Progressive tax rates of country A

income	tax rate
0 - \$200	5%
\$201 - \$400	15%
from \$401	25%

Table 13. After-tax return of smartphones and the portfolio investment

	Smartphones	Portfolio
investment amount	\$1000	\$1000
pre-tax return	9%	8%
revenue	\$1090	\$1080
pre-tax income	\$90	\$80
tax burden	\$22.5	\$8
after-tax income	\$67.5	\$72
after-tax return	6.75%	7.20%

