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Article

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The influence of interest on net equity and interest rates on tax neutrality – a case study of the Brazilian corporate taxation

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Abstract

In this paper we visit the capital income taxation in Brazil to know whether and to what extent interest on net equity (INE) has an influence on tax neutrality, i.e., if it helps reducing debt financing advantage over equity. The paper also addresses the persistent Brazilian high interest rates influence on the cost of capital, especially for small and medium enterprises (SME), given that big companies are usually allowed to access low interest rates from BNDES, the National Public Development Bank in Brazil. Based on King and Fullerton methodology for computation of effective tax rates, this paper derives the pre-tax and post-tax rates of return on investment, the tax wedges and the correspondent effective tax rates in Brazil, comparing three sources of finance (debt, retained earnings and new equity) and three types of assets: machinery, buildings and inventories. Our simulations show that INE reduces the cost of capital for new equity by 40% but it cannot offset the debt advantage. On the other hand, very high interest rates as found in Brazil make debt finance the worst option, forcing SME to finance themselves.

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Resumo

Este artigo analisa a tributação do capital no Brasil com o intuito de avaliar a influência dos juros sobre o capital próprio (JCP) na neutralidade tributária, isto é, se ele ajuda a reduzir a vantagem do financiamento por dívida em relação à capitalização. O artigo também analisa a influência dos juros elevados no Brasil sobre o custo do capital, especialmente para as pequenas empresas, já que as empresas maiores tem mais facilidade de acesso a recursos com juros mais baixos do BNDES. Baseado na metodologia de King–Fullerton para o cálculo de taxas efetivas, este artigo deriva as taxas de retorno do investimento antes e depois da tributação, a cunha fiscal e as alíquotas efetivas no Brasil, comparando três tipos de financiamento (dívida, lucros retidos e capitalização) e três tipos de ativos – máquinas, estoques e construções. As simulações indicam que o JCP foi capaz de reduzir o custo do capital na

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capitalização em mais de 40%, mas não anulou a vantagem tributária do endividamento. Este resultado é alterado pelas altas taxas de juros no Brasil, que tornam o endividamento a pior opção e levam as pequenas empresas a recorrerem ao capital próprio.

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Palavras clave: tributación; inversión; ganancias; interés; endeudamiento

1. Introduction

The purpose of this paper is to study the Brazilian model of capital income taxation in order to find out to what extent it is neutral to domestic investment decisions. The analysis was guided to achieve capital tax neutrality and to improve the tax system efficiency. Neutrality matters because taxes may distort investment decisions. An investment that would be chosen in the absence of taxes may be skipped when taxes are levied and the opposite is also true.

Initially, we discuss some concepts regarding the tax treatment of corporate finance such as debt and equity in Brazil. Basically, the country adopts two forms of equity relief: dividends are exempted from personal taxes and there is a deduction of what Brazilians call *interest on net equity* (INE)² of the corporate tax base. Whilst most OECD³ countries adopt a classical system, imputation or even split rates, it is clear that Brazil has chosen a different policy as the interest on net equity (INE) seems to be rare in the public finance world.

After this conceptual overview, we develop equations to compute the cost of corporate capital for domestic investors in Brazil based on the [King and Fullerton \(1984\)](#) model. We found expressions for the pre-tax and post-tax rates of return on investment, the tax wedges and the correspondent effective tax rates in Brazil. With this model, policy makers can verify how the Brazilian tax system responds to different sources of finance, namely debt, new equity (understood as the issuing of new shares), and retained earnings. Also, it is possible to compare investment decisions in three types of assets: machinery, buildings and inventories.

We try to incorporate two important idiosyncrasies of Brazilian's economy to the original model of King and Fullerton. We introduce INE as an important part of capital income taxation and we analyze the differentials in interest rates available for firms in Brazil, which can vary widely from the economy's interest base rate.

Since the work of [King and Fullerton \(1984\)](#), effective marginal tax rates (EMTR) on income from capital have been widely used by international organizations for computing the corporate tax burden, to establish comparisons between countries, and to support tax reforms.⁴ Based on EMTR, many studies found high rates for inventories and low rates for machines. Retained earnings were the most expensive alternative whereas debt was the cheaper one.

Our simulations have found similar results, with debt as the best financial choice followed by new equity and retained earnings. The role of INE as an extra stimulus for tax neutrality between equity and debt has shown a significant impact, reducing in 40% the cost of capital for new equity. Probably, that is why it seems to be so praised by the business community. For assets, machinery and buildings show similar outcomes while inventories are heavily taxed if FIFO were the most used method for stock valuation.

We verify that interest rate has a strong influence on the effective tax rates on investment. We explore this point simulating two alternatives for interest rates, instead of using the interest base rate. Our results are very sensitive of which interest rate is available for firms, since debt financing could be the best or the worst option depending on that rate.

After this introduction, in Sect. 2, we present a conceptual overview of taxing corporate capital. In Sect. 3, we develop the model and in Sect. 4, we show our results. Finally, Sect. 5, we conclude with some suggestions to policy design.

2. Taxation of corporate capital in Brazil

Countries use to choose different systems of capital taxation. The U.S. adopts the classical system while countries such as France, Italy and Germany choose integrated tax systems in order to reduce the problem of economic double taxation. In this case, some countries adopted the *imputation or credit* taxation method while others preferred the use

² It is called *Juros sobre Capital Próprio* in Brazilian law.

³ OECD – Organization for Economic Cooperation and Development.

⁴ IFS (1997), [Devereux et al. \(2002\)](#), [IFS \(2010, 2011\)](#), [Polito \(2010\)](#), [European Commission \(2009\)](#) and [Australia Government \(2006\)](#).

of different rates, which is known as the *split rates* taxation method. In both cases, the idea is to make the sum of the tax paid at the corporation level and at the individual level equal to the resulting application of the basic capital tax rate on the total income.

It is interesting to note that while most OECD countries use the classical system or integrated systems with the imputation method or the split rates method, Brazil has allowed full exemption for dividends and also introduced the so called interest on net equity (INE), which is deductible from the corporate tax base.

Although INE is similar to dividends, there are significant differences between them. INE payment is conditioned to the existence of current or retained profits and its computation depends on the long-term interest rate⁵ and on the company net equity at the beginning of the fiscal term. INE taxation is similar to debt interest since INE can be deducted from the tax base and the income tax is retained at source at a 15% rate⁶ at the time of payment. INE is non-neutral to foreign investment since the tax is final for foreign companies and individuals but it can be deducted from the tax base of domestic companies.

INE provides choices for company managers to please shareholders. First, they may choose to pay the corporate tax and dividends, the latter being exempted from taxation. Second, they may deduct the INE paid to shareholders from the tax base and this is taxed at the statutory rate of 15% retained at source. Finally, they may choose a combination of both, which may satisfy the minimum dividend distribution and help managers to program financial outflows. Indeed, the revenue collected with INE taxation rose almost twenty times from its creation in 1996 till 2003.⁷

Additionally, corporations may also finance new projects with debt. The tax rates for interest vary according to the lender, the loan time, the existence of international treaty but in most cases it is 15% and the tax is retained at source at the time of payment. As most countries, Brazil allows full deduction of interest from the corporate tax base. Since dividends cannot be deducted, debt finance has a clear advantage against equity finance. This probably led Brazilian legislators to create the interest on net equity (INE), attempting to achieve a neutral tax treatment between equity and debt.

Retained profits are another financial alternative. Instead of loans or shareholders' new capital, companies may choose to retain profits to support new investment. In this case, capital gains⁸ are taxed only at the time of realization at a rate of 15% in Brazil.⁹

The corporate tax base has some items of great importance for our study. For depreciation allowances, Brazil allows the straight line (L) method only. Typical statutory rates for machinery and buildings are 10% and 4% per year, respectively and the same depreciation rate is applied until the asset is fully depreciated. For inventories, only the methods FIFO (*first in first out*) and the average cost are allowed in Brazil. The LIFO (*last in first out*) is not permitted. As a result, increases in the value of inventories due solely to inflation may be taxed.

In Brazil, there is corporate tax only at the federal level. The statutory rate is 15%, plus an additional 10% rate, which is applied whenever a company exceeds a certain profit threshold. This raises the average corporate tax rate to usually 25%. Moreover, there is another tax on companies' net profits, called the *social contribution on net profits* (CSLL) that has a 9% statutory rate and its base is very close to the corporate tax. Thus, we sum up all these rates to say that Brazilian corporate taxation is charged at a statutory rate of 34% as a general rule.

3. Developing a model for Brazil

In this section, we use the King and Fullerton methodology to find the expressions for the real required pre-tax rate of return "*p*" on Brazilian domestic investment, the post-tax rate of return on investment "*s*", effective tax rates and the tax wedges as differences between "*p*" and "*s*", by definition. We derive these variables for different types of assets, i.e. machinery, buildings and inventories; and different sources of corporations' funds, i.e. debt, new equity and retained earnings.

⁵ The long-term interest rate in Brazil is known as TJLP, which is usually lower than the official short-term interest rate SELIC.

⁶ The INE tax rate of 15% is the same tax rate on debt interest.

⁷ Data available at the Brazilian Federal Revenue (RFB) website.

⁸ The term capital gains in Brazil may refer to other forms of capital than corporate capital. In this paper though, capital gains refer to valuation of companies.

⁹ There are several rates for capital gains taxation in Brazil and we took 15% because this is the same rate for interest and INE, which favors comparisons here.

The basic idea is that a domestic investor would not finance a new corporate project unless it is offering him/her a return on investment higher than the rate one can obtain at the money market, buying government bonds, for instance.

An approximation for the equilibrium post-tax rate of return “ s ” is simply to make it equal to the nominal interest rates “ i ”.

$$s \approx i$$

Note that the first term above corresponds to the company financial behavior while the second term features the market.

Now suppose there is tax on interest which is retained at source. If the investor could buy bonds, as said, then she would have to pay the tax. This means that the opportunity cost to invest in the company would require a lower post-tax rate of return than that without the tax. Hence, the after-tax rate of return on investment should be the market interest rate reduced by the tax, thus:

$$s = \frac{i}{(1 + \omega^i)}$$

Where ω^i is the tax rate on interest retained at source.

Besides taxes, a rational investor would look at the real interest rate and take inflation into account.

$$s = \frac{1 + i + \omega^i}{(1 + \omega^i)(1 + \pi)} - 1 \quad (1)$$

Where π is the inflation rate. In order to compare King and Fullerton (1984) and in order to compare financial alternatives, we assume that all investments have the same after-tax rate of return. Differences should appear when computing the pre-tax rates of return p for different assets and sources of finance. For a given after-tax rate of return on investment, taxes will probably raise the need for capital and the required pre-tax rate of return on investment will likely rise. However, the lower the pre-tax rate of return on investment, the better for the investor. Therefore, an investor should look at the required pre-tax rate of return on investment p , which is usually higher than s , in order to check if the investment is worthwhile.

Exemplification can make things clear. An investment that would be profitable at, say, 2% after tax, and requires a 5% rate of return before tax, should be preferred against other with 8% rate of return before tax because the first is easier to achieve and make profits, meaning that for all rates of return higher than 5% investors will earn a profit while in the second case the rates should be higher than 8%. On the other hand, if an investment would earn 4% before tax, it should be avoided because it has to offer at least 5% in order to be profitable. In this sense, all investments that in the absence of taxes would be profitable at rates between 2% and 5% will not when taxes are involved.

The pre-tax rate of return on investment is also called the cost of capital. The King and Fullerton model takes the cost of capital as a function of the real interest rate r , and assumes that the required pre-tax rate of return is given by a function $c(r)$. The real interest rate here is an exogenous variable. As mentioned, to compare investment projects we suppose all projects should have the same after-tax rate of return s . Consider an investment project with just one dollar of initial cost. In this situation, for a certain type of asset, the cost of capital will be given by the marginal rate of return (MRR) less the economic depreciation rate for that asset (δ). Thus:

$$p = c(r) = \text{MRR} - \delta \quad (2)$$

Given our one dollar initial cost, thus, the cost of capital of that project is one minus its present discounted depreciation allowances (A):

$$C = 1 - A \quad (3)$$

Brazil has only the straight line (L) method. The expression for A is:

$$A = \frac{\delta_{\text{th}} \tau (1 + \rho)}{\rho} \left(1 - \frac{1}{(1 + \rho)^n} \right) \quad (4)$$

Where n is the number of years for which a depreciation allowance can be claimed and δ_{th} is the statutory depreciation rate. Remember ρ is the company discount rate and depends on the type of financing.

Consider V as a sum of all marginal rates of return (MRR) obtained with the asset during a given period of time. The discount factor shall encompass not only depreciation rates but also the inflation rate (assumed constant over time), which increases depreciation, and also the rate at which the company discount cash flows (ρ).

$$V = \int (1 - \tau)(1 + \pi)\text{MRR} e^{-(\delta(1+\pi)+\rho-\pi)t} dt \quad (5)$$

Where τ is the (constant) tax rate. The integral above can be computed from time zero to infinity, given:

$$V = \frac{(1 - \tau)(1 + \pi)\text{MRR}}{\rho - \pi + \delta(1 + \pi)} - 1 \quad (6)$$

For investment to be attractive, we need that the return of the project (V) would be at least equal to its cost (C). Using Eq. (3) and replacing V by $(1 - A)$:

$$\text{MRR} = \frac{(1 - A)(\rho - \pi + \delta(1 + \pi))}{(1 - \tau)(1 + \pi)} \quad (7)$$

Returning to expression (2) we find the pre-tax marginal rate of return as:

$$\rho = \frac{(1 - A)(\rho - \pi + \delta(1 + \pi))}{(1 - \tau)(1 + \pi)} - \delta \quad (8)$$

The previous expression is adequate to derive the cost of capital for investments in machines and buildings. For inventories evaluated with FIFO, the only method allowed in Brazil, there must be a correction for the effects of inflation. Remember that inventories are accounted for their acquisition values and suffer no depreciation. For this case, we get:

$$\rho = \frac{(1 - A)(\rho - \pi + \delta(1 + \pi)) + \tau\nu\pi}{(1 - \tau)(1 + \pi)} - \delta \quad (9)$$

Where ν is the proportion of inventories valued with FIFO.

Until now, we have an expression for the cost of capital ρ as a function of the company discount rate ρ . However, policymakers are interested in the cost of capital as a function of the interest rate as in expression (2). Because relations between the interest rate and the company discount rate will depend on the source of finance, it is necessary to develop equations for equity, debt and retained earnings.

A first approach or a rough idea for such equations is based on the fact that in the absence of taxes, inflation and other variables that affect the return to investment, it would be reasonable to suppose ρ equals i , meaning that an investment in the company has to return at least the market interest rate. Truly, the left term should be the effective company discount rate and for the three sources of finance it has to be changed accordingly. Notice that again the left term reflects the company behavior while the right term is dedicated to the market.

For debt finance, the left term is still the company discount rate ρ because shareholders are not directly affected in a loan as capital is borrowed from third parties, i.e. banks, financial institutions and even other corporations.¹⁰ The right term is the interest rate reduced by a percent that equals the corporate tax rate. This is because interest is deducted from the corporate tax base:

$$\rho = i(1 - \tau) \quad (10)$$

The last expression shows very important features of debt finance. First, there is no influence of the income tax at the personal level on the return to investment. Second, the only instrument tax policy has to influence debt preferences is the (effective) corporate tax rate. The interest rate is crucial but it is a Central Bank issue and it is out of control for fiscal policy authorities. Another important conclusion from this expression is that investment is easier viable with debt because a return inferior to the interest rate would satisfy.

For equity, the right term (or the market condition) change. Now there is no deduction from the corporate tax base.¹¹ Investors are now shareholders who would require at least the market interest rate freed from personal taxes,

¹⁰ In Brazil, elusive schemes appeared when shareholders “lent” money to their own companies to take advantage of interest deduction. Perhaps it could have been one of the reasons interest on net equity was created. Expression (11) does not support this special case.

¹¹ Though there is deduction for INE in Brazil.

i.e. $i/(1 + \omega^i)$, where i is the nominal interest rate and ω^i is the income tax rate for interest income, considering retention at source.¹²

The left term for retained earnings shall consider the income tax rate on capital gains and the effects of inflation. The company discount rate is reduced by the capital gains taxation as shareholders have to pay it at the time of realization and inform it when filling their tax returns (no retention at source). Thus

$$\rho(1 - z) + z\pi = \frac{i}{(1 + \omega^i)} \quad (11)$$

where z is the effective tax rate on capital gains. Because capital gains are taxed only at the time of realization¹³ the term $z\pi$ has to be added.

Assuming λ as a number that represents the proportion of capital gains realized each year, King and Fullerton present the following expression for conversion of the statutory tax rate on capital gains (z_s) to the effective rate z .

$$z = \frac{\lambda z_s}{\lambda + s + \pi} \quad (12)$$

For new capital from shareholders, King and Fullerton developed the following expression:

$$\rho(1 - m_d)\theta + z\pi = \frac{i}{1 + \omega_i} \quad (13)$$

Where m_d is the marginal income tax rate on dividends and θ is the *tax discrimination variable* that represents the opportunity cost of profit retention expressed in terms of non-distributed dividends. Variable θ is defined as the additional dividend shareholders could receive if one real of retained earnings were distributed. Thus, if \$1 (one real) in profits were distributed, shareholders receive θ and $\$(1 - \theta)$ are paid as taxes. Consequently, $(1 - \theta)/\theta$ is the additional taxation per unit of distributed dividends. Note that θ is taken at the corporate level and does not consider tax incidence at the personal level. Hence, in a classic system, as in the USA, there is no additional taxation on distributed dividends at the corporate level and θ equals one. In a system with credits though, θ can be greater than one.

This expression has to be changed for Brazil because dividends are exempted from taxation. Furthermore, there is INE as a new way to pay shareholders. Considering first the only existence of exempted dividends:

$$\rho = \frac{i}{1 + \omega_i} - z\pi \quad (14)$$

As $\theta = 1$ and $m_d = 0$. The term $z\pi$ is still here because of the effects on inflation on capital gains till the time dividends are distributed (distribution occurs usually once or twice per year). However, if we suppose there is only INE, the expression is:

$$\frac{\rho\theta}{1 + \omega_j} + z\pi = \frac{i(1 - \tau)}{1 + \omega_i} \quad (15)$$

The company discount rate is reduced by the retention at source of the income tax on INE, which gives the term $1 + \omega_j$ at the denominator, where ω_j is the income tax rate on INE, which is retained at source. The term $z\pi$ means the effect of inflation on retained profits till INE is paid. The right term appears with the component $(1 - \tau)$ because INE is deductible from the corporate tax base. Similarly as in the debt case, this term pushes down the required return for investment.

Now a closer look at θ , which is now the net INE in hands of shareholders after the income tax, is paid. The expression for θ considers the retention at source on INE:

$$\theta = \frac{1}{1 + \omega_j} \quad (16)$$

¹² The King–Fullerton's original expression is $i(1 - m^i)$, where m^i is the marginal rate on interest income paid to natural persons when filling their tax returns. In Brazil, the tax on interest is charged as a retention at source and the expression shall be changed accordingly.

¹³ At least this is the general rule.

Table 1
Pre-tax and post-tax rates of return expressions for the Brazilian tax system.

| Variable | Expression |
|---|---|
| After-tax rate of return to capital | $s = \frac{i}{(1+\omega_j)}$ |
| Pre-tax rate of return to capital | $p = \frac{(1-A)(\rho-\pi+\delta(1+\pi))+\tau\pi}{(1-\tau)(1+\pi)} - \delta$ |
| Company discount rate debt finance | $\rho = i(1 - \tau)$ |
| Company discount rate retained earnings | $\rho = \frac{(i/(1+\omega_i)-z\pi)}{(1-z)}$ |
| Company discount rate equity finance – new shares | $\rho = \varepsilon \left(\frac{i}{1+\omega_i} - z\pi \right) + (1 - \varepsilon)(1 + \omega_i)(i(1 - \tau) - z\pi)$ |

Adapted from the King and Fullerton work to the Brazilian income taxation.

Thus, expression (16) becomes:

$$\frac{\rho}{(1 + \omega_j)^2} + z\pi = \frac{i(1 - \tau)}{1 + \omega_i} \quad (17)$$

Considering tax rate as the same as the interest tax rate, then ω_j is equal to ω_i :

$$\rho = (1 + \omega_i)(i(1 - \tau) - z\pi) \quad (18)$$

Now expressions (14) and (18) have to be integrated for equity as dividends or INE as both can be distributed at the same time. Variable ε indicates the proportion of distributed profits as dividends while $(1 - \varepsilon)$ is the proportion of distributed profits that corresponds to INE. Thus, combining expressions (14) and (18) the company discount rate ρ for contribution of new capital from shareholders is:

$$\rho = \varepsilon \left(\frac{i}{1 + \omega_i} - z\pi \right) + (1 - \varepsilon)(1 + \omega_i)(i(1 - \tau) - z\pi) \quad (19)$$

In sum, according to the King and Fullerton model, the cost of domestic capital in Brazil can be computed by expressions (8) and (9) in terms of the company discount rate, which, in turn, can be expressed as a function of the nominal interest rate according to expressions (10), (11) and (19), considering the source of finance debt, retained earnings or new shares, respectively. Table 1 summarizes the main expressions for Brazil.

4. Policy analysis

In this section, we compute the after-tax rate and the pre-tax rate of return on investment for the Brazilian tax system, considering three financial sources: debt, retained earnings and new equity; and three kinds of assets: machineries, buildings and inventories. We also compute the effective tax rates and the tax wedges, i.e., the differences between the pre and the post-tax rates of return on capital. In the end of this section we test the tax system neutrality under some hypothesis.

In our analysis we consider two cases. The first case we suppose the absence of interest on net equity (INE) and so ε equals one. In the second case, we include INE assuming that ε is 50%.¹⁴ Our goal with this comparison is to have an intuition about the effect of INE on the cost of capital.

The initial settings for some of the model parameters are:

- i. The nominal interest rate (i) – the nominal interest rate in Brazil is taken as 12%.¹⁵
- ii. The corporate tax rate (τ) – this is assumed to be 34%, as a result of the sum of 15% of the statutory corporate tax rate plus its 10% additional rate (almost always applied to big companies) and 9% of the statutory rate of social contribution on net profit.
- iii. The inflation rate (π) – this is assumed as 6.5%, following the Brazilian official forecast for 2011.

¹⁴ That is half of distributed profits in Brazil each year is on the form of dividends and the other half is INE.

¹⁵ As currently defined by the Brazilian Central Bank for October, 2011.

Table 2
Company discount rate (%).

| | Without INE | With INE |
|-------------------|-------------|----------|
| Retained earnings | 10.8 | 10.8 |
| New equity | 10.0 | 9.3 |
| Debt | 7.9 | 7.9 |

Table 3
Present value of depreciation allowances (A).

| | Machinery | | | Buildings | | |
|-------------|-------------------|------------|-------|-------------------|------------|-------|
| | Retained earnings | New equity | Debt | Retained earnings | New equity | Debt |
| Without INE | 0.224 | 0.230 | 0.247 | 0.129 | 0.136 | 0.158 |
| With INE | 0.224 | 0.238 | 0.247 | 0.129 | 0.146 | 0.158 |

Author's computation.

- iv. Statutory depreciation rates (δ_{th}) – these are 10% for machinery and 4% for buildings. For inventories the rate is zero.
- v. Proportion of capital gains realized each year (λ) – this is assumed as 10%.
- vi. Statutory tax rates on capital gains (z_s) – this is 15% according to Brazilian Law.
- vii. Statutory tax rate on interest retained at source (ω^i) – this depends on how long the money will be invested. If it is applied for less than 180 days, the rate will be 22.5%, between 181 days and 360 days, 20%, between 361 and 540 days, 17.5% and more than 540 days, 15%.

Initially, we can calculate the post-tax rate of return. Using expression (1), we find: See (Table 2)

$$s = 3.69\%$$

The statutory income tax rate on domestic interest was taken as 15%. As a general rule, the tax is retained at source. Because “ s ” is a high rate, at least relatively to the world standards after the crisis of 2008/2009, we could expect that most investors would buy Brazilian bonds rather than invest in the real economy. Moreover, high after-tax rates of return mean that required pre-tax rates can be even higher. Thus, the tax system may discourage direct investment in Brazil as long as it requires very high rates of return. Indeed, disregarding risks involved, a rational portfolio investor could give up a high bond rate in favor of real investment only if this could offer him/her an even higher rate of return, which can be hard to achieve. It should be noted, however, that this high after-tax rate of return is strongly influenced by the interest rate and in coming-up sections we simulate the effect of a lower/higher interest rate. Another point is that income tax incentives to foster investment can be of poor effectiveness with such a high after-tax rate of return.

4.1. Finding the company's discount rate (ρ)

Using the expressions of Table 1, we find the company's discount rate for the three sources of finance. It is important to remember that Brazil imposes no personal taxes on dividends. We find the following results for the company discount rate:

In both cases, it is clear that there is no neutral treatment between the three options above. Debt is the best financial option and dividends exemption has a higher impact on the company discount rate than capital gains taxation.

4.2. Finding the present value of depreciation allowances (A)

From Eq. (4) see (Table 3).

The present value of depreciation allowances is bigger for machinery than it is for buildings and the source of finance matters too. It is lower for retention and higher for debt.

Table 4
Pre-tax rates of return in Brazil (%).

| | Without INE | | | | With INE | | | |
|---------|-------------|--------|---------|---------|----------|--------|---------|---------|
| | Mach. | Build. | Invent. | Average | Mach. | Build. | Invent. | Average |
| R.E. | 6.13 | 6.13 | 9.19 | 6.80 | 6.13 | 6.13 | 9.19 | 6.80 |
| N.E. | 5.15 | 5.08 | 8.06 | 5.77 | 4.29 | 4.16 | 7.06 | 4.86 |
| Debt | 2.68 | 2.45 | 5.16 | 3.16 | 2.68 | 2.45 | 5.16 | 3.16 |
| Average | 4.82 | 4.73 | 7.67 | 5.42 | 4.74 | 4.64 | 7.57 | 5.33 |

Author's computation.

Table 5
Tax Wedges (p-s) for Brazilian tax system (%).

| | Without INE | | | | With INE | | | |
|---------|-------------|--------|---------|---------|----------|--------|---------|---------|
| | Mach. | Build. | Invent. | Average | Mach. | Build. | Invent. | Average |
| R.E. | 2.44 | 2.43 | 5.50 | 3.11 | 2.44 | 2.43 | 5.50 | 3.11 |
| N.E. | 1.45 | 1.38 | 4.46 | 2.07 | 0.59 | 0.47 | 3.37 | 1.17 |
| Debt | -1.02 | -1.25 | 1.47 | -1.54 | -1.02 | -1.25 | 1.47 | -1.54 |
| Average | 1.13 | 1.04 | 3.97 | 1.73 | 1.04 | 0.95 | 3.87 | 1.64 |

4.3. Finding the required pre-tax rate of return on capital

The pre-tax rate of return is computed according to expressions (9) and (10). Now, δ is the economic depreciation, which is assumed to be 8.2% for machinery, 2.7% for buildings and zero for inventories.¹⁶ The proportion of inventories valued using the FIFO method (ν) is assumed as 100% in Brazil, because LIFO is not permitted. Therefore in Table 4.

These results show that the Brazilian tax system would favor debt, and retained earnings would be the worse option. Also, it would give a better tax treatment to machinery and buildings while inventories are heavily taxed. Debt advantage comes mainly from the possibility of interest deduction from the tax base.

We also compute the average pre-tax rates of return giving weights to each of the nine possibilities in the table above. Weights are given as the proportion of investment on each type of asset and the proportion of company finance from each source of funds. Unfortunately, data from Brazilian assets and finance sources are not available and we take the OECD average weight instead. This approach has the advantage of making the Brazilian tax system model comparable to other countries' tax systems. Thus, these come out with 50% for machinery, 28% for buildings and 22% for inventories; and 35% for debt, 10% for new equity and 55% for retentions. The line and columns "average" show the results in Table 4. The use of weights has some limitations though. For instance, it supposes an equiproportional increase in the capital stock, financed in the same way as the existing stock.¹⁷ In spite of it, it is possible to conclude that the system potentially distorts finance decisions in favor of debt. Also, it is clear that investing in inventories requires a higher cost of capital.

4.4. Finding the tax wedges

The tax wedge is defined by the difference between the pre and the post-tax rates of return, i.e. " $p-s$ ". Using information from Table 4 we can find the tax wedges for Brazil (Table 5).

The negative tax wedges on debt finance means government would be funding projects financed by debt together with the private sector. Note that a zero tax rate on interest in this situation implies more than revenue resigns but a truly incentive to debt funding, perhaps not granted according to the will of government.

¹⁶ Depreciation rates as in FEU (2004).

¹⁷ To get more details about the limitations and the use of these weights, please consult OECD (1991).

Table 6
Effective tax rates for Brazil $(p - s)/p$ (%).

| | Without INE | | | | With INE | | | |
|---------|-------------|--------|---------|---------|----------|--------|---------|---------|
| | Mach. | Build. | Invent. | Average | Mach. | Build. | Invent. | Average |
| R.E. | 39.75 | 39.71 | 59.80 | 44.15 | 39.75 | 39.71 | 59.80 | 44.15 |
| N.E. | 28.19 | 27.21 | 54.13 | 33.62 | 13.83 | 11.22 | 47.67 | 20.54 |
| Debt | -38.11 | -50.98 | 28.46 | -27.07 | -38.11 | -50.98 | 28.46 | -27.07 |
| Average | 11.34 | 6.72 | 48.27 | 18.17 | 9.91 | 5.12 | 47.62 | 16.86 |

Author's computation.

4.5. Finding effective tax rates

King and Fullerton compute effective tax rates under two ways: first, dividing tax wedges by “ p ” and, second, dividing tax wedges by “ s ”. In the first case, denominator “ p ” includes taxes and in the second case the effective tax rate is based on net income. Thus, taking the first case, these are the following effective tax rates (see Table 6).

The above results are close to what the literature have found. For example, IFS (1997) estimates the effective marginal tax rate (EMTR) for a group of ten OECD countries in 1994 and found an average of 20.5%. The EMTR for buildings, machinery and inventories were 25.4%, 9.3% and 39.8%, respectively. On the financing side, EMTR for retained earnings, new equities and debt, were 50.7%, 16.1% and -25.6%.

Later, Devereux et al. (2002) derive EMTRs for investments in plant and equipment, and industrial buildings financed by either equity or debt for nineteen OECD countries. These estimates have been updated and published on the Institute of Fiscal Studies (United Kingdom) website (IFS, 2010, 2011). They found an EMTR for investment in plant of 21.5% for equity and -31.7% for debt.

More recently, Polito (2010) calculate the EMTR for USA and UK for financing machinery and plants. In the U.S. case, he found an EMTR of 22% for equity and -42% for debt. In the U.K. case, he found an EMTR of 21% for equity and -35% for debt.

Turning to INE analysis, we can see that INE causes some change in new equity results. Without INE, new equity has results very close to the retained earnings, but as we introduce INE its numbers become halfway between debt and retained earnings. INE is able to approximate equity to debt, but it cannot provide tax neutrality between them.

How can it be possible if INE is assumed to have the same tax treatment as interest from loans? We have seen from Sect. 3 that INE expressions are very different from debt expressions for the company discount rate. The essential difference is that INE is used to compensate shareholders while interest is paid to third parties. When the legislation allowed deduction from the tax base for INE and imposed the same retained at source tax rate of 15%, one can imagine INE warrants a neutral tax treatment between equity and debt. However, this thought does not take into account the different opportunity costs of such financial alternatives as for lenders the company discount rate is given while for shareholders this rate varies according to their decisions. Such differences can be confirmed observing expressions (11) and (19) for the company discount rate for debt and equity, respectively. For debt, the influence of deduction from the tax base is straight while for INE this effect is cushioned by other variables.

4.6. Different interest rates

As an emerging market, the Brazilian economy has some volatile economic variables and the interest rate has changed a lot in the recent period. In addition, companies are affected by some specificities when they borrow from banks. We will consider in this section different financing schemes that firms can access and a lower interest rate that has prevailed in Brazil since 2012.

Let us now consider two sharp different situations that Brazilian companies may be exposed to. In our previous exercise we use the basic rate of interest in Brazil, which is called Selic. This is the rate an investor typically receives for investing in federal government bonds, and it is appropriate to reflect the opportunity cost of an investor. However, for debt finance, a company will probably pay a different rate to borrowing from a bank.

Table 7
Pre-tax rates of return in Brazil (%) – TJLP.

| | Without INE | | | | With INE | | | |
|---------|-------------|--------|---------|---------|----------|--------|---------|---------|
| | Mach. | Build. | Invent. | Average | Mach. | Build. | Invent. | Average |
| R.E. | 6.13 | 6.13 | 9.19 | 6.80 | 6.13 | 6.13 | 9.19 | 6.80 |
| N.E. | 5.15 | 5.08 | 8.06 | 5.77 | 4.29 | 4.16 | 7.06 | 4.86 |
| Debt | -1.92 | -2.33 | -0.47 | -1.72 | -1.92 | -2.33 | -0.47 | -1.72 |
| Average | 3.21 | 3.06 | 5.70 | 3.72 | 3.13 | 2.97 | 5.60 | 3.63 |

Author's computation.

Table 8
Tax wedges ($p - s$) for Brazilian tax system (%) – TJLP.

| | Without INE | | | | With INE | | | |
|---------|-------------|--------|---------|---------|----------|--------|---------|---------|
| | Mach. | Build. | Invent. | Average | Mach. | Build. | Invent. | Average |
| R.E. | 2.44 | 2.43 | 5.50 | 3.11 | 2.44 | 2.43 | 5.50 | 3.11 |
| N.E. | 1.45 | 1.38 | 4.46 | 2.07 | 0.59 | 0.47 | 3.37 | 1.17 |
| Debt | -5.61 | -6.02 | -4.16 | -5.41 | -5.61 | -6.02 | -4.16 | -5.41 |
| Average | -0.48 | -0.63 | 2.00 | 0.02 | -0.57 | -0.72 | 1.90 | -0.07 |

Author's computation.

To compute the difference, suppose first that a company is qualified to borrow from BNDES, the Brazilian public national bank of development. Indeed, the company will pay a more favorable rate than Selic, called TJLP.¹⁸ For example, since July, 2009 this rate has been at 6% while Selic is around 12% in October, 2011. In this situation, we have a new equation for debt financing:

$$\rho = i_{TJLP}(1 - \tau) \quad (20)$$

And this changes our results (see Tables 7 and 8).

This type of loan is more accessible for large companies. According to BCB (2011), large companies received 67% of BNDES' total loans¹⁹ (an amount close to R\$ 168 billions), whereas small and medium companies received R\$ 45.7 billions. The availability of a subsidized rate like TJLP worsens the neutrality of tax system. The favorable tax treatment for debt increases a lot, even pre-tax rates become negative. Not surprisingly, this is the first and best option for large companies in Brazil.

Now suppose that a company will not qualify to borrow from BNDES and needs to raise funds from a commercial bank. In this case, according to the Brazilian Central Bank's Inflation Report (BCB, 2011), companies paid a rate of 35% as interest in December, 2010, and commercial banks lent R\$ 556 billion for firms in 2010. Now we have another equation for debt financing:

$$\rho = i_{COM}(1 - \tau) \quad (21)$$

And our results change accordingly (see Tables 9 and 10).

Then, we have an interesting result. Debt financing is no longer the best option for a company in this situation. Although there still is a favorable tax treatment for debt, the interest rate is so high that a company will not choose it. This is the case for medium and small companies in Brazil, which have huge difficulties to raise money, and in most cases the only option is to use their own resources.

In a recent survey from the Sao Paulo branch of the Brazilian Service to Support Micro and Small Enterprises (SEBRAE-SP, 2009)²⁰ with owners of SME, 63% have never borrowed money from a bank. For 58% of respondents, the main reason for this difficulty is the high interest rates charged (taxes is just the third reason with 14%).

¹⁸ Long-term interest rate.

¹⁹ BCB (2011).

²⁰ It is the regional branch of São Paulo of the Brazilian Service to Support Small Enterprises, which is a federal agency.

Table 9

Pre-tax rates of return in Brazil (%) – commercial rate.

| | Without INE | | | | With INE | | | |
|---------|-------------|--------|---------|---------|----------|--------|---------|---------|
| | Mach. | Build. | Invent. | Average | Mach. | Build. | Invent. | Average |
| R.E. | 6.13 | 6.13 | 9.19 | 6.80 | 6.13 | 6.13 | 9.19 | 6.80 |
| N.E. | 5.15 | 5.08 | 8.06 | 5.77 | 4.29 | 4.16 | 7.06 | 4.86 |
| Debt | 22.13 | 23.01 | 26.76 | 23.39 | 22.13 | 23.01 | 26.76 | 23.39 |
| Average | 11.63 | 11.93 | 15.23 | 12.51 | 11.55 | 11.84 | 15.13 | 12.42 |

Author's computation.

Table 10

Tax wedges ($p - s$) for Brazilian tax system (%) – commercial rate.

| | Without INE | | | | With INE | | | |
|---------|-------------|--------|---------|---------|----------|--------|---------|---------|
| | Mach. | Build. | Invent. | Average | Mach. | Build. | Invent. | Average |
| R.E. | 2.44 | 2.43 | 5.50 | 3.11 | 2.44 | 2.43 | 5.50 | 3.11 |
| N.E. | 1.45 | 1.38 | 4.46 | 2.07 | 0.59 | 0.47 | 3.37 | 1.17 |
| Debt | 18.43 | 19.32 | 23.07 | 19.70 | 18.43 | 19.32 | 23.07 | 19.70 |
| Average | 7.94 | 8.24 | 11.53 | 8.81 | 7.85 | 8.15 | 11.43 | 8.72 |

Author's computation.

This is true also for large companies that for some reason don't have access to subsidized money. Some companies prefer to issue new equity, as we have seen in Brazil in the last decade of stock market rapid growth, or to retain their earnings. Of course, some large companies in Brazil find better rates than small companies, but still above Selic.

A second extension to our baseline simulation is to change our calculations to consider what happened to Selic after October 2011. Since then, this interest rate has fallen to 7.25%, and then risen to 8.5% in July 2013. For Brazil, this is a low interest rate environment, since the country has never had a one-digit nominal interest rate for more than twenty-years.

In our last exercise, we will consider the rate of July 2013 instead of October 2011. As one can see in the next tables, our results are sensitive to this change (Tables 11 and 12).

Table 11

Pre-tax rates of return in Brazil (%) – Selic July 2013.

| | Without INE | | | | With INE | | | |
|---------|-------------|--------|---------|---------|----------|--------|---------|---------|
| | Mach. | Build. | Invent. | Average | Mach. | Build. | Invent. | Average |
| R.E. | 2.14 | 1.88 | 4.53 | 2.60 | 2.14 | 1.88 | 4.53 | 2.60 |
| N.E. | 1.38 | 1.07 | 3.61 | 1.78 | 0.78 | 0.44 | 2.88 | 1.15 |
| Debt | -0.05 | -0.41 | 1.88 | 0.27 | -0.05 | -0.41 | 1.88 | 0.27 |
| Average | 1.30 | 1.00 | 3.51 | 1.70 | 1.24 | 0.94 | 3.44 | 1.64 |

Author's computation.

Table 12

Tax wedges ($p - s$) for Brazilian tax system (%) – Selic July 2013.

| | Without INE | | | | With INE | | | |
|---------|-------------|--------|---------|---------|----------|--------|---------|---------|
| | Mach. | Build. | Invent. | Average | Mach. | Build. | Invent. | Average |
| R.E. | 1.31 | 1.05 | 3.70 | 1.76 | 1.31 | 1.05 | 3.70 | 1.76 |
| N.E. | 0.54 | 0.24 | 2.78 | 0.95 | -0.06 | -0.39 | 2.05 | 0.31 |
| Debt | -0.88 | -1.25 | 1.04 | -0.56 | -0.88 | -1.25 | 1.04 | -0.56 |
| Average | 0.46 | 0.16 | 2.67 | 0.87 | 0.40 | 0.10 | 2.60 | 0.80 |

Author's computation.

These results do not show a qualitative difference when compared to our baseline numbers of [Tables 4 and 5](#). The Brazilian tax system still favors debt, and retained earnings would be the worse option. Machinery and buildings also receive a better tax treatment than inventories. The negative tax wedges on debt finance persist and the only noticeable difference is that new equity under INE also receives such a benefit.

More important, the low interest rate environment has reduced the tax distortions not only between the three sources of finance, but also between the three types of assets.

The results of this section suggest that the interest rate is the main source of distortion in corporate finance with taxation playing an important role in amplifying such distortions.

5. Conclusion

In this paper we have developed a tool for the analysis of the Brazilian corporate capital taxation at both the corporate and personal levels in terms of its impact on domestic investment decisions. Based on the King and Fullerton equations, our model computes the rates of return to capital before and after taxation, the correspondent tax wedges and effective tax rates. Next, we investigate the role of the interest rate, computing the tax wedges for two different rates available in Brazil. Finally, we study how the results change when considering the low interest rate environment of the last two years of Brazilian economy.

In our simulations, we found that Brazilian income tax system distorts incentives for allocation of capital among assets and sources of funds. Companies have a better return if they choose to finance their projects with debt and the cost of inventories is probably higher than purchasing machinery and buildings. These results follow closely what the literature has found in OECD countries, with the same pattern.

Our previous results depend heavily on the interest rate available, though this is not under the control of fiscal authorities. The lower the interest rate, the higher the advantages of debt financing and the inverse is also true. For instance, if a firm can borrow with a favorable interest rate, such as the TJLP, the tax wedge for debt financing becomes negative. Big companies in Brazil use to have access to borrow paying TJLP. On the other hand, if a firm can only borrow from a commercial bank, then debt financing is no longer the best option and this is usually the case for small and medium size business.

Another conclusion is that the interest on net equity (INE) has shown a moderate impact on the cost of capital for new equity. It reduces the tax wedge at roughly 40%, and probably this is why INE has been well accepted by the business community.

It is important to have in mind that tax variables have cross effects. For instance, a change in the statutory tax rate on interest influences not only debt but the three sources of finance. In the same way, the statutory tax rate on capital gains has influence not only on capital gains but on the incentive for new equity too. Changes in the corporate tax rate affects return on inventories. Indeed, according to our model, policy makers should be very careful when considering changing tax policy. Special care has to be taken by legislators when granting tax incentives affecting debt finance because they are easily co-sponsored by taxpayers, as negative tax wedges have come out in our simulations.

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