TEXTO PARA DISCUSSÃO Nº 13

HOW SHOULD BRAZIL TAX CAPITAL INCOME ?

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TEXTO PARA DISCUSSÃO

A série Texto para Discussão tem como objetivo divulgar resultados de trabalhos desenvolvidos pela área de pesquisa da Diretoria de Educação da Escola de Administração Fazendária, bem como outros trabalhos considerados de relevância tendo em vista as linhas de pesquisa da Instituição.

Abstract

This paper visits the Brazilian capital income taxation to know whether and to what extent it is neutral to domestic investment decisions. The analysis was guided to help Brazilian authorities in the achievement of capital tax neutrality and improvement of the tax system efficiency. Based on the King-Fullerton methodology for computation of effective tax rates, this paper develops a framework to derive the pre-tax and post-tax rates of return on investment, the tax wedges and the correspondent effective tax rates in Brazil. This is to verify how the Brazilian tax system responds to different sources of finance, namely debt, retained earnings and new equity, and also to investment in three types of assets: machinery, buildings and inventories. Simulations have shown an unbalanced tax system: debt is the best fund option, inventories the worst choice for assets and the interest on net equity has small effect on improving tax neutrality.

Key words: taxation, investment, capital, income, interest, debt, equity, neutrality, efficiency.

How Should Brazil Tax Capital Income?

Contents:

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 help Brazilian authorities in the achievement of capital tax neutrality and improvement of 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. Thus, section 2 brings some concepts regarding the tax treatment of corporate finance such as debt and equity and the problem of double taxation of dividends. Basically, Brazil 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) from the corporate tax base. Whilst most OECD[2] countries use 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. Section 2 also brings some tables with information from OECD countries regarding the tax treatment of different sources of corporate finance. Those tables allow comparisons between corporate taxation in Brazil and in OECD countries. After this conceptual overview, section 3 develops equations to compute the cost of corporate capital for domestic investors in Brazil based on the King-Fullerton model, a theoretical framework used by the OECD. 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:

[2] OECD - Organization for Economic Cooperation and Development.

machinery, buildings and inventories. In section 4, we simulate different scenarios using equations developed in section 3. The initial settings correspond to the Brazilian tax environment with the corporate tax only. Next, we add personal income taxation. For each situation, we show a nine-cell table of tax wedges, combining the three types of assets with the three finance sources. Divergences among the nine tax wedges imply an unbalanced tax system that potentially encourages investors to privilege some particular form of asset and fund. Section 4 also shows the outcomes for a set of policy alternatives such as a lower interest rate, a higher corporate tax rate, a higher tax rate on interest, a lower proportion of stocks valued with FIFO and a zero tax rate on capital gains. In the end of section 4, there is a discussion for the achievement of tax neutrality. In conclusion, this paper offers a tool for those interested in studying the impact of taxation on domestic investment in Brazil not only for academic purposes but for policy design as well. It sounds clear that the interest rate has a strong influence on the effective tax rates on investment. It is also noted that corrections on the tax system have to be carefully addressed because of the crossed-effects some variables have on others. Our simulations have shown debt as the best financial choice followed by new equity and retained earnings and the role of INE as an extra stimulus for tax neutrality between equity and debt is controversial as the results show INE has a very small impact on the cost of capital for new equity, though it seems to be 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. Assuming a small proportion of inventories valued with FIFO allows better results and even tax neutrality among assets.

Scope and Limitations

It is important to mention that this paper has some limitations though:

i. government revenues – some policy alternatives mentioned here can favor tax neutrality but their influence on government revenues is out of the scope of this paper. This study does not address this issue though it is critical for fiscal policy. Any result herein should be further complemented with the study of its impact on government revenues;

ii. empirical evidence – results would be stronger if supported by empirical evidence. This is a theoretical analysis;

iii. depreciation – further studies are needed to know effective depreciation rates in Brazil;

iv. equity and justice – this paper does not discuss equity concerns;

v. distribution of the tax burden – this paper does not discuss the distribution of the tax burden on specific people, sectors or factors of production;

vi. assumptions – sometimes we take the same assumptions as the OECD to compute the overall tax wedges. For example, in the absence of the proportion of inventories submitted to FIFO or the proportion of capital gains realized each year, we used the same as the OECD, knowing that more research shall be done to the Brazilian case;

vii. transnational investment – this work should be complemented by the study of the Brazilian tax system under international capital flows. It should be seen how far the tax system is from capital export neutrality (CEN) and capital import neutrality (CIN);

viii. evasion and avoidance – for simplicity, there is no evasion and avoidance in the model.

2. Taxation of Corporate Capital

2.1 Economic Double Taxation

The first studies on double taxation of dividends were based on the tax treatment of a classical system. Under such a system, corporate profits are taxed according to accounting procedures and dividends paid to shareholders are taxed again. Since the same profit stream is taxed first at the corporation level and secondly at the individual level, complaints pointed out the existence of the economic double taxation[3] problem, which would have negative effects on the financing of new business projects that had been based on the input of capital from shareholders. This was the reasoning of economists who supported the "old vision" as it is known in the taxation literature. For them, the classical system favors debt, which is the preferred source of financing for businesses. This is because the interest paid on loans is deductible from the corporate tax base. Thus, researchers predicted that in the long term many companies would face bankruptcy, causing the collapse of the economic system. In order to avoid it, those experts said dividends should be exempted from taxation as an important measure for preventing a differential tax treatment between the two main sources of business finance: equity and debt.

This doctrinal position was later challenged by supporters of the "new vision", who believed that dividend exemption would not provide equal tax treatment for equity and debt. Instead, it would simply generate windfall gains to shareholders, those gains disconnected from the business activity. The supporters of the new vision, however, made clear that this hypothesis would apply only to mature corporations and for new businesses the formulations of the old vision experts could be correct.

[3] Double taxation of profits can be seen in two ways: economic or juridical. While the former is the object of this paper, the latter has been used when two jurisdictions tax the income of a corporation or an individual. In general, tax treaties between countries are used to avoid the juridical double taxation.

2.2 Integration

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. Obviously, there was a strong reason to do it. Capital mobility has become intense with globalization, which raised the risk for classical system countries in Europe. This means they could have their tax bases fast eroded as long as corporations could move to lower tax jurisdictions. To avoid it, some countries adopted the *imputation or credit* taxation method while others preferred the use of different rates, which is known as the *split rates* taxation method. In the first case, a credit is allowed to the natural person on her tax return in order to compensate the withholding tax on dividends. In the second case, the withholding tax on dividends is worth less than a rate that is normally used for other income from capital. 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.

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.

The following subsections comment on the main features of the three sources of finance: equity, debt and retained earnings. Next, we address some important elements of income taxation, i.e. issues that shape the tax base and tax rates. These concepts are needed for modeling Brazilian tax system with King-Fullerton equations on section 3.

2.3 Equity

2.3.1 Dividends Exemption

The tax treatment of dividends in Brazil is ruled by Act Nr. 9249/1995, which exempts paid dividends from the individual income tax. It forbids retentions on dividends and distinctions between domestic and foreign investors. Dividend exemption occurs whatever be the amount of corporate tax paid. Other traditional solutions for the problem of economic double taxation also include the imputation or the split rate[4] methods. Table 2.1 shows a brief of dividend tax treatment in some OECD countries and in Brazil.

Table 2.1 – Dividends Taxation in Selected Countries

Country	**Dividend Taxation**	**Remarks**
Germany	Split rates	Individual income tax rate on ½ of distributed dividends.
Brazil	Exemption	-
USA	Classical system	Dividends are grossed up on the personal income tax return. The marginal rate is usually 31%. However, there is exemption in some cases.
France	Imputation	Individuals receive a credit of maximum of half of the tax paid by the corporation.
Netherlands	Exemption	-
Italy	Imputation	Individuals receive a credit of maximum of 36/64 of net dividends.

Sources: IBFD, OECD and SRF.

We have shown that scholars of the new view believed dividends exemption does not encourage investment for mature companies but for young corporations only. In spite of it, Brazil and the Netherlands adopted dividend exemption, perhaps supporting a clear

[4] A good description of the split rate and imputation methods with examples can be seen in the IMF Tax Policy Handbook.

advantage of this policy in terms of administrative simplicity. In fact, credit systems have been criticized for being costly and complex.

2.3.2 Interest on Net Equity

Act Nr. 9249/1995 also created the interest on net equity (INE)[5], which similarly to dividends, is paid to shareholders. There are significant differences, however. INE payment is conditioned to the existence of current or retained profits and its computation depends on the long-term interest rate[6] and the company net equity at the beginning of the fiscal term. INE taxation is similar to debt interest. INE can be deducted from the tax base and the income tax is retained at source at a rate[7] of 15% 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 twelve times from its creation in 1996 till 2002.[8]

[5] The Portuguese term for INE is "juros sobre o capital próprio".
[6] The long-term interest rate in Brazil is known as TJLP, which is usually lower than the official short-term interest rate SELIC.
[7] The INE tax rate of 15% is the same tax rate on debt interest.
[8] Data available at the SRF website.

2.4 Debt

Besides equity alternatives, 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. This paper addresses this issue on section 4.

In 1991, fourteen OECD countries taxed interest paid to residents with rates varying from 10% to 35%. Some countries provided no tax at interest at all and all jurisdictions allow deduction of interest paid from the corporate tax base. Taxation of interest paid to non-residents usually depended on the existence of an international tax treaty. Table 2.2 shows a brief of interest tax treatment in Brazil and in some OECD countries.

Table 2.2 – Interest Taxation in Selected Countries

Country	**Tax Rate (%)**	**Deduction From Tax Base ?**
Germany	Zero	Yes
Brazil	15 - 25	Yes
USA	Zero – 30	Yes
France	Zero	Yes
Netherlands	Zero	Yes
Italy	12,5 – 30	Yes
Portugal	10 – 25	Yes

Sources: OCDE and SRF.

2.5 Capital Gains

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, taxation on shareholders is imposed on capital gains[9], which are taxed only at the time of realization at a rate of 15% in Brazil.[10]

Most OECD countries tax capital gains at a rate equal or close to the corporate tax rate. Some countries exempt capital gains invested in the company while others provide relief considering the time the share capital was held.

Table 2.3 – Capital Gains Taxation in Selected Countries

Country	Tax Rate (%)*	Remarks
Germany	Zero	Ordinary shares are exempted
Brazil	15%	-
USA	7%	-
France	26%	-
Netherlands	Zero	Ordinary shares are exempted
Portugal	3,6% - 12%	Rates decrease as time increases

Sources: IBFD, OCDE and SRF.
* considering ordinary shares only.

2.6 The Corporate Tax Base

The following items are some of the most important elements to define cross-countries differences at the corporate tax base.

i. Treatment of Losses: In Brazil, trading losses may be carried forward as it is the case in all OECD countries. However, Brazil imposes a limit of 30% of loss compensation per fiscal year. Brazil does not allow losses to be carried back.

[9] The term capital gains in Brazil may refer to other forms of capital than corporate capital. In this paper though, capital gains refer to company´s valuation.
[10] 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.

ii. Depreciation Allowances: Brazil allows the straight line (L) method only. The declining balance method (D), which is used in most OECD countries, is not permitted in Brazil. Table 2.4 presents depreciation methods and rates of selected countries. Regulation IN SRF 162/98 establishes statutory depreciation rates for several kinds of assets in Brazil. Typical statutory rates for machinery and buildings are 10% and 4% per year, respectively. The same depreciation rate is applied until the asset is fully depreciated and there are no first year special rates.[11] regions or projects in industry or agriculture.

Table 2.4 – Depreciation Allowances in Selected Countries

Country	**Method**		**Typical Rates**	
	Machines	Buildings	Machines	Buildings
Germany	L/D	L	10% or 3L[12]	2.5% – 10%
Brazil	L	L	10%	4%
Canada	D	D	25%	4%
USA	L/D	L	14.3% or 2L	3.2%
France	L/D	L	10% - 20% or 1.5L	5%
Netherlands	L/D	L/D	10% - 15% or 2L	3.3% or 2L
Japan	L/D	L/D	10% or 3L	2.2% – 4.3% or 3L

Sources: OCDE and SRF.

iii. Tax Incentives: Investment Relieves and Deferrals: As a general rule, Brazil does not provide allowances or credits as investment relief and no deferrals are permitted.

iv. Inventories: Table 2.5 shows inventories treatment in selected countries. Only the methods FIFO (*fisrt 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.

[11] Brazilian tax code has also special depreciation rates for some projects in industry or agriculture. However, such incentives are exceptions to the general depreciation rule.
[12] In the declining balanced method, the book value of an asset is multiplied by a fixed rate, usually two or three times the straight line depreciation rate.

Table 2.5 – Inventories Tax Treatment in Selected Countries

Country	FIFO	LIFO
Germany	No	Yes
Brazil	Yes	No
Spain	Yes	No
USA	Yes	Yes
Japan	Yes	Yes

Source: OCDE and SRF.

v. Research and Development (R&D): in Brazil, the cost of research is usually not deductible in the first year as it is the case in most OECD countries but must be spread over a number of years. It is notable, however, that incentives for research and development are usual in many countries. Japan and the US, for example, have incentives for R&D for a long time.

2.7 The Corporate Tax Rate

In Brazil, there is corporate tax only at the federal level. However, countries such as the USA and Canada allow corporate taxation to subnational governments as well. The statutory rate in Brazil is 15%, the same for capital gains, interests and rents. However, an additional 10% rate 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. Table 2.6 shows some countries statutory corporate tax rates. Note that Brazil has one of the lowest rates among selected countries.

Table 2.6 – Corporate Tax Rates in Selected Countries

Country	Corporate Tax Rate* (%)
Germany	56.5
Brazil	34
Italy	47.8
Netherlands	35
USA	38.3

Source: OCDE and SRF.
*includes all levels of government.

2.8 Withholding Taxes

Some countries make use of withholding taxes as specific taxes on interest or capital gains. In Brazil, the income tax code encompasses the individual income tax, the corporate tax and it has provisions for retention at source on interest and capital gains, usually at a rate of 15%. It means that though Brazilian tax code does not have specific withholding taxes, the economic effect of its provisions is the same as in other countries that adopt withholding taxes. [13]

3. Developing a Model for Brazil

In this section, we use the King 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.

[13] Remember that the Brazilian interest on net equity (INE) is also subject to retention at source at a rate of 15%.

3.1 - The Post- Tax Rate of Return

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. Thus, a rough idea for the equilibrium post-tax rate of return "s" is simply to make it equal to the nominal interest rate "i", considering no taxes and no inflation in the economy at this moment, for simplicity.

$$s \approx i$$

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 he or 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. Thus:

$$s = \frac{1 + \dfrac{i}{(1 + \omega^{i})}}{1 + \pi} - 1 \qquad \text{or}$$

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

Where π is the inflation rate.

Following King and Fullerton steps and in order to compare financial alternatives, we assume that all investments have the same after-tax rate of return "s". 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. How to derive "p" for Brazil is the task we do next.

3.2 - The Pre-Tax Rate of Return

The pre-tax rate of return on investment is also called the cost of capital. The King-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" and 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:

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

Function c(r) returns a percent value for a given r. The monetary value C shall be computed as the product of c(r) per the cost of the asset expressed in real currency. Because the model works with marginal values, the acquisition cost of an asset is taken as one ($ 1.00). Thus, at the margin, the cost of capital of a given asset (C) is one minus its whole marginal depreciation (A):

$$C = 1 - A \tag{3}$$

Be V the current marginal value of a profit stream obtained with the asset. The minimum value of V that makes investment on that asset worthwhile is simply C, the marginal cost of capital. Thus:

$$V\min = C = 1 - A \tag{4}$$

We also may think of V as a sum of all marginal rates of return (MRR) obtained with the asset during a given period of time. To be precise, these marginal rates of return shall be clean of taxes and consider inflation. For a given project or asset, the initial MRR will fall in time as depreciation advances. The exponential function usually represents the effects of depreciation in time. Thus, we get expression 5 as:

$$V = \int (1-\tau)(1+\pi) MR\, \mathrm{Re}^{-xt} dt \tag{5}$$

Where τ is the tax rate. The exponent of the exponential function shall encompass not only depreciation rates but all that affects the rates of return in time. It means it has the economic depreciation rate but it also has the inflation rate, which increases depreciation and the rates of return in the future, and also the discount rate (ρ) that decreases the rates of return. Thus expression 6 is:

$$V = \int (1-\tau)(1+\pi) MR \, \mathrm{Re}^{-(\delta(1+\pi)+\rho-\pi)t} dt \tag{6}$$

The integral above can be computed from time zero to infinity, given:

$$V = \frac{(1-\tau)(1+\pi) * MRR}{\rho - \pi + \delta(1+\pi)} - 1 \tag{7}$$

Replacing V by (1 – A) and rearranging, we get:

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

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

$$p = \frac{(1-A) * (\rho - \pi + \delta(1+\pi))}{(1+\tau) * (1+\pi)} - \delta \tag{9}$$

Expression 9 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. Expression 10 is then:

$$p = \frac{(1-A) * (\rho - \pi + \delta(1+\pi)) + \tau \upsilon \pi}{(1+\tau) * (1+\pi)} - \delta \tag{10}$$

Where ν is the proportion of inventories valued with FIFO.

Expression 10 gives the cost of capital "p" 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 = 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.

3.3 - The Company Discount Rate

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.[14] 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:

$$\rho = i * (1 - \tau) \tag{11}$$

[14] 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.

Expression 11 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 expression 11 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) changes. Now there is no deduction from the corporate tax base.[15] Investors are now shareholders who would require at least the market interest rate freed from personal taxes, 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. [16]

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 if realization and inform it when filling their tax returns (no retention at source). Thus:

$$\rho(1-z)+z\pi=\frac{i}{(1+\omega^{i})} \qquad (12)$$

Where z is the effective tax rate on capital gains. Because capital gains are taxed only at the time of realization[17], the term $z\pi$ has to be added.

[15] Though there is deduction for INE in Brazil.
[16] 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.
[17] At least this is the general rule.

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

$$z = \frac{\lambda * z_s}{\lambda + s + \pi} \tag{13}$$

For new capital from shareholders, King-Fullerton developed expression 14:

$$\rho * (1 - m_d)\theta + z\pi = \frac{i}{1 + \omega_i} \tag{14}$$

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 - θ) will be paid as taxes. Consequently, (1 - θ) / θ is the additional taxation per unity 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.

Expression 14 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:

$$\rho = \frac{i}{1 + \omega_i} - z\pi \tag{15}$$

As θ = 1 and $m^d = 0$. The term zπ 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:

$$\frac{\rho\theta}{1+\omega_j} + z\pi = \frac{i(1-\tau)}{1+\omega_i} \tag{16}$$

The company discount rate is reduced by the retention at source of the income tax on INE, which gives the term 1 + ωj at the denominator, where ωj is the income tax rate on INE, which is retained at source. The term zπ means the effect of inflation on retained profits till INE is paid. The right term appears with the component (1 - τ) 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:

$$\theta = \frac{1}{1+\omega_j} \tag{17}$$

Thus, expression 16 becomes:

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

Considering INE tax rate as the same as the interest tax rate, then ωj equals ωi:

$$\rho = (1+\omega_i) * (i * (1-\tau) - z\pi) \tag{18}$$

Now expressions 15 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 - ε) is the proportion of distributed profits that corresponds to INE. Thus, combining expressions 15 and 18 the company discount rate ρ for contribution of new capital from shareholders is:

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

In sum, according to the King-Fullerton model, the cost of domestic capital in Brazil can be computed by expressions 9 and 10 in terms of the company discount rate, which, in turn, can be expressed as a function of the nominal interest rate according to expressions 11, 12 and 19, considering the source of finance debt, retained earnings or new shares, respectively. Table 3.1 summarizes the main expressions for Brazil.

Table 3.1 – Pre-tax and Post-tax Rates of Return Expressions for the Brazilian Tax System

Variable	Expression
After-tax rate of return to capital	$s = \frac{1 + i + \omega^i}{(1+\omega^i)*(1+\pi)} - 1$
Pre-tax rate of return to capital	$p = \frac{(1-A)*(\rho - \pi + \delta(1+\pi)) + \tau\upsilon\pi}{(1+\tau)*(1+\pi)} - \delta$
Company discount rate debt finance	$\rho = i*(1-\tau)$
Company discount rate retained earnings	$\rho = [i/(1+\omega^i) - z\pi]/(1-z)$
Company discount rate equity finance - new shares	$\rho = \varepsilon*(\frac{i}{1+\omega_i} - z\pi) + (1-\varepsilon)*(1+\omega_i)*(i*(1-\tau) - z\pi)$

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

4. Policy Analisys

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.

4.1 Computing Tax Wedges without Personal Taxation

In the starting point, we assume there is only corporate taxation and there are no personal taxes and no retentions at source. Also, there is no interest on net equity (INE). 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 16%[18]. However, sometimes we should also use the real interest rate of 5% in order to compare our results with OECD countries. This is important because one may want to evaluate the potential distortions the Brazilian tax system have on investment.

ii. the corporate tax rate (τ) – this is initially assumed to be 25%, as a result of the sum of 15% of the statutory corporate tax rate and its 10% additional rate (almost always applied to big companies). In the following sections we discuss variations on τ.[19]

iii. the inflation rate (π) – this is assumed as 4.5%, following the Brazilian official forecast for 2004.[20]

iv. statutory depreciation rates (δ) – these are 10% for machinery and 4% for buildings. For inventories the rate is zero.

Step 1: Finding the post-tax rate of return to investors

According to expression (1) and without personal taxes, the post-tax rate of return "s" equals the real interest rate: s = 11.0%. The statutory income tax rate on domestic interest was taken as zero.

Step 2: Finding the company discount rate for each type of finance

For retained earnings and new equity, the company discount rate equals the nominal interest rate ($\rho = i = 16\%$), since there are no taxes on dividends, capital gains or INE. For debt, $\rho = (1-\tau)i = 12\%$. Observe that the company discount rate is lower for debt than for equity and retention.

Step 3: Finding the present value of depreciation allowances (A)

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

[18] As currently defined by the Brazilian Central Bank for May, 2004.
[19] For a while we ignore the effect of the CSLL, the social contribution on net profit.
[20] As the Brazilian Central Bank website http://www.bacen.gov.br/?SISMETAS, site visited at June 9, 2004.

$$A = \frac{\delta_{th}\tau(1+\rho)}{\rho} * (1 - \frac{1}{(1+\rho)^n}) \quad (20)$$

Where "n" is the number of years for which a depreciation allowance can be claimed. Remember ρ is the company discount rate and depends on the type of financing. Thus, we have:

Table 4.1 – Present Value of Depreciation Allowances (A) – Basic Assumptions

Machinery			**Buildings**		
Retained earnings	New equity	Debt	Retained earnings	New equity	Debt
0.140	0.140	0.158	0.071	0.071	0.088

Author´s computation.

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

Step 4: Finding the required pre-tax rate of return on capital

The pre-tax rate of return is computed according to expression 10. Now, δ is the economic depreciation, which is assumed to be 8.2% for machinery, 2.7% for buildings and zero for inventories. [21] The proportion of inventories valued using the FIFO method (ν) is assumed as 100% in Brazil, where LIFO is not permitted. Therefore, we have:

Table 4.2 – Pre-tax Rates of Return in Brazil (%) – corporate taxation only

	Machinery	**Buildings**	**Inventories**
Retained earnings	13.8	14.3	16.1
New equity	13.8	14.3	16.1
Debt	9.1	9.3	11.0

Author´s computation.

[21] Depreciation rates as in Feu (2004).

These results show that in the absence of personal taxes the Brazilian tax system would favor debt though it would be neutral to retained earnings and new equity. Also, it would give a similar treatment to machinery and buildings while inventories are heavily taxed. Debt advantage comes mainly from the possibility of interest deduction from the tax base. The high values of "p" indicate the tax system imposes a high cost on capital investment.

Step 5: Finding the average pre-tax rates of return

Weights are necessary to get an overall "p", which comes from a weighted average 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 the tax systems in the OECD area. 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. Table 4.3 shows the results.

Table 4.3 – Average Pre-Tax Rate of Return in Brazil (%) – Corporate tax only

	Machinery	Buildings	Inventories	Average
Retained earnings	13.8	14.3	16.1	14.5
New equity	13.8	14.3	16.1	14.5
Debt	9.1	9.3	11.0	9.6
Average	12.2	12.5	14.3	12.7

Author´s computation

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.[22] 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.

Step 6: 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". Based on steps 1 and 5, we have the following tax wedges in each cell of the table:

Table 4.4 – Tax Wedges (p-s) for Brazilian tax system (%) – Corporate taxation only

	Machinery	Buildings	Inventories	Average
Retained earnings	2.8	3.3	5.1	3.5
New equity	2.8	3.3	5.1	3.5
Debt	-1.9	-1.7	0.0	-1.4
Average	1.2	1.5	3.3	1.7

Author´s computation

In the absence of taxation on interest, there are negative tax wedges on debt finance, which 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.

Step 7: 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

[22] To get more details about the limitations and the use of these weights, please consult the section C, chapter four of the OECD publication "Taxing Profits in a Global Economy", Paris, 1991.

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:

Table 4.5 – Effective tax rates for Brazil (p-s)/p (%) – Corporate taxation only

	Machinery	Buildings	Inventories	Average
Retained earnings	20.4	23.0	31.7	23.6
New equity	20.4	23.0	31.7	23.6
Debt	-21.4	-18.1	0.0	-15.8
Average	5.8	8.6	20.6	9.8

Author´s computation

4.2 Computing Effective Tax Wedges with Personal Taxes

Above we suppose the absence of personal taxes. Now, we include personal taxes to reach a more realistic computation of tax wedges in Brazil. Without such taxes, the tax system gives the same treatment for retained earnings and new equity and machinery and buildings results are very close. However, with personal taxes this neutrality disappears.

Step 1: Finding the post-tax rate of return to investors

Using expression (1), we find:

$$s = 9.0\%$$

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 (higher than any other OECD country in 1991), 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 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.

Step 2: Find the company's discount rate

Using the expressions of table 3.7, we find the company´s discount rate for the three sources of finance. Consider ω^i the tax rate on interest retained at source as 15%. Note that it is true that Brazil has more than one income tax rate on interest (depending on the operation). But we use 15% here because it is the same rate used for capital gains. As we are testing for neutrality, if we suppose statutory tax rates are identical then different tax wedges are clearly not due to rates but to the tax system design.

About dividends, Brazil imposes no personal taxes on dividends. Remember that for a while there is no interest on net equity (INE) and ε equals one. This is to check the isolated effects of dividend exemption or how this policy compares to the other sources of finance. Nevertheless, we will look at INE afterwards. Thus, expression of the company discount rate for new equity is simply:

$$\rho = \frac{i}{1+\omega_i} - z\pi$$

The last expression is a simplified version of expression 19, without INE. The term "z" is the effective capital gain tax rate, which is computed from the expression:

$$z = \frac{\lambda * z_s}{\lambda + s + \pi} \qquad (13)$$

Where λ is the proportion of capital gains realized each year in Brazil, taken as 10%, as said in section 3; "s" is the after-tax rate of return on investment found as 9% in step one; zs is the statutory capital gains tax rate, which is 15% and π is the inflation rate of 4.5%. Thus, the value of z is 6,4%.

Note that the effective tax rate on capital gains is lower than the statutory rate as expected, basically because capital gains are taxed only at the time of realization. Although this may be source of criticism this policy is used in almost all developed economies.

Now we are able to revisit table 3.7 expressions for the company discount rate:

retained earnings: $\rho = 14.6\%$,

new Equity: $\rho = 13.6\%$,

debt: $\rho = 12.0\%$, the same as in the last section.

Hence, personal taxation does not change the company discount rate for debt finance but for equity and retention. In Brazil, we have seen that the company discount rates were equal for retained earnings and new equity in the absence of personal taxation. By computing personal taxes on capital gains and the dividend exemption, it is clear that there is no longer neutral treatment between them, though both have now lower discount rates (the previous section showed the discount rate of 16% for both new equity and retention). Dividends exemption has a higher impact on the company discount rate than capital gains taxation. Still, debt continues to be the best financial option till this point.

Step 3: Finding the present value of depreciation allowances

We use expression 20 again and the results are:

Table 4.6 – Present Value of Depreciation Allowances (A) – with Personal Taxes

Machinery			Buildings		
Retained earnings	New equity	Debt	Retained earnings	New equity	Debt
0.146	0.150	0.158	0.076	0.080	0.088

Author´s computation

Step 4: Finding the required pre-tax rate of return

From table 3.7 and the previous steps, we have:

Table 4.7 - Pre-tax Rates of Return with Personal Taxes (%)

	Machinery	Buildings	Inventories
Retained earnings	12.1	12.5	14.3
New equity	11.0	11.3	13.1
Debt	9.1	9.3	11.0

Author´s computation

Step 5: Finding the average pre-tax rates of return

Again, the weights are 50% for machinery, 28% for buildings and 22 % for inventories; and 35% for debt, 10% for new equity and 55% for retentions. The following table shows the results.

Table 4.8 - Pre-tax Rates of Return (%) - with Personal Taxes - Average

	Machinery	Buildings	Inventories	Average
Retained earnings	12.1	12.5	14.3	12.7
New equity	11.0	11.3	13.1	11.5
Debt	9.1	9.3	11.0	9.6
Average	10.9	11.3	13.0	11.5

Author´s computation

Interestingly, the inclusion of personal taxes reduces the overall cost of capital (p) from 12.7% to 11.5%. In spite of it, the table shows high required rates of return and this may discourage investment, as mentioned. As in most countries, debt is the best financial choice, followed by new equity and retained profits. Buildings and machinery have basically the same return while investment in inventories requires higher rates.

Note that dividend exemption is not enough to make new equity finance as attractive as debt. Nevertheless, dividend exemption makes the option for new equity less costly than retaining profits.

Step 6: Finding the average tax wedges

This is done by simply subtracting from each cell of the last table the value of "s" = 9.0%.

Table 4.9: Tax Wedges (p – s) (%) with personal taxes, dividends exempted

	Machinery	Buildings	Inventories	Average
Retained earnings	3.1	3.5	5.3	3.7
New equity	2.0	2.3	4.1	2.5
Debt	0.1	0.3	2.0	0.6
Average	1.9	2.2	4.0	2.5

Author´s computation

As derived, the overall averaged tax wedge in Brazil is almost the same as in OECD (2.5% for Brazil against 2.3% for OECD). This time there are not negative tax wedges on debt finance because of the influence of the tax on interest. Equity and retention have now lower tax wedges under the influence of dividend exemption and capital gains taxation only at the time of realization. The above results show an unbalanced tax system that requires higher costs of capital than in OECD countries. Next, we include INE in our computations.

4.3 Computing Tax Wedges with INE

Interest on net equity (INE) is not usual in OECD countries. Nevertheless, it has been seen as a successful policy for most Brazilian tax experts. From expression 19, we derive the cost of capital for new equity with INE included, assuming that ε is 50%, that is, half of distributed profits in Brazil each year is on the form of dividends and the other half is INE. Thus, following all the previous steps we come up with the values of "p" and the tax wedges, INE included:

Table 4.10a: Pre-tax Rates of Return "p" (%) with Personal Taxes and INE

	Machinery	Buildings	Inventories	Average
Retained earnings	12.1	12.5	14.3	12.7
New equity	10.9	11.2	13.0	11.4
Debt	9.1	9.3	11.0	9.6
Average	10.9	11.2	13.0	11.5

Author´s computation

Table 4.10b: Tax wedges (p-s) with Personal Taxes and INE (%)

	Machinery	Buildings	Inventories	Average
Retained earnings	3.1	3.5	5.3	3.7
New equity	1.9	2.2	4.0	2.4
Debt	0.1	0.3	2.0	0.6
Average	1.9	2.2	4.0	2.5

Author´s computation

Table 4.10c: Effective tax rates (p-s)/p with Personal Taxes and INE (%)

	Machinery	Buildings	Inventories	Average
Retained earnings	25.5	27.8	36.9	28.6
New equity	17.3	19.8	30.6	20.9
Debt	0.6	3.3	18.1	5.2
Average	15.9	18.4	29.7	19.7

Author´s computation

Clearly, INE causes a small change in new equity results. Though INE is deductible from the tax base as debt, it cannot provide tax neutrality between equity and debt. If we suppose all profits are distributed with INE, then new equity results above change slightly, a reduction of 0.1 p.p. for each type of asset. These results suggest that INE causes a small reduction on the cost of capital for new equity.

How can it be possible if INE is assumed to have the same tax treatment as interest from loans ? We have seen from section 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.

If the Brazilian tax system favored debt, INE design seemed to oppose this trend. But perhaps the main reason investors preferred bonds rather than shares had nothing to do with taxes but with the high interest rates in Brazil.

In sum, further studies shall be undertaken to understand the role of INE in the economy. In this paper though, INE contribution to tax neutrality seemed to be small.

4.4 Simulations

Until now we have been computing the cost of capital and tax wedges inserting parameters in the King-Fullerton equations that approach the Brazilian economic environment. In this section we try to analyze policy alternatives to reach tax neutrality by changing the model parameters.

4.4.1 Changing the Interest Rate

As noted, the very high required pre-tax rates of return in Brazil may be a barrier to investors. This is not a surprise, given the high real interest rate in that country. In the

previous calculations, we used a nominal interest rate of 16% and inflation rate of 4.5%. This leads to a real interest rate of 11%, which is more than two times the rate of 5% used by the OECD. If Brazil could reduce its real interest rate to 5%, then the results would be[23]:

Table 4.9a: Pre-tax Rates of Return at 5% of real interest rate

	Machinery	Buildings	Inventories	Average
Retained earnings	5.3%	5.4%	6.9%	5.7%
New equity	4.4%	4.5%	5.9%	4.8%
Debt	3.6%	3.6%	5.0%	3.9%
Average	4.6%	4.7%	6.2%	5.0%

Author´s computation

Table 4.9b: Tax Wedges with 5% of real interest rate

	Machinery	Buildings	Inventories	Average
Retained earnings	1.6%	1.6%	3.1%	1.9%
New equity	0.7%	0.7%	2.1%	1.0%
Debt	-0.2%	-0.2%	1.2%	0.1%
Average	0.9%	0.9%	2.4%	1.2%

Author´s computation

These results suggest that a reduction in the interest rate would benefit real investment in Brazil because the tax wedge would be half reduced, from 2.8% to 1.4%. Note that the higher the interest rate, the higher the tax wedge, confirming the influence of the interest rate on the tax burden. This would not be visible without taking into account opportunity costs, which are key in the King-Fullerton method. With eyes closed to opportunity costs, one could compare the taxation of financial alternatives such as debt and equity by simply looking at the tax bases and tax rates and conclude wrong. It is vital to understand that rational investors should always compute opportunity costs and as long as the money market arises as an option for them, it is inevitable to have the interest rate as an important variable with influence on the tax system, even though its administration is out of control of fiscal authorities.

[23] The starting point for tables 4.9 were tables 4.8, i.e. including INE and personal taxation.

A reduction of the interest rate, as supposed, is not as simple though. If, on one hand, it can benefit real investment, on the other hand it can be catastrophic for economic stability. Because of this, monetary authorities are very careful given the recent history of persistent high inflation rates in Brazil. In fact, after a long period of very high interest rates[24], this year the Brazilian Central Bank started reducing the official rate as inflationary pressures seemed to be under control. However, the imminent rise of rates in the US and mounting oil prices are threatening further decreases in the Brazilian interest rate.

4.4.2 Taxing Dividends at a Rate of 15% (moving to a classical system)

Some critics say that dividends should be taxed in Brazil. For them, dividends are well included in the income concept and there is no reason for being exempted. Furthermore, they use to call for equity reasons as far as capitalists receive dividends and they are often at the top of the income distribution pyramid. Critics also say that to compensate loss in revenues, government tax heavily workers and the poor.

As it is said in the Introduction, it is not under the scope of this work to discuss equity. Nonetheless, we are interested to know what happens to tax wedges when dividends are taxed. For this purpose, we revisit expression 14:

$$\rho\,(1 - m^{d})\,\theta + z\pi = i\,/(1 + \omega^{i}) \qquad (14)$$

If we suppose a retained at source tax on dividends we get:

$$[\rho * \theta\,/\,(1+ \omega^{d})] + z\pi = i\,/(1 + \omega^{i}) \qquad (14a)$$

[24] Nominal interest rates reached 26% a year.

Where ω^d is the tax rate on dividends which we can suppose is 15%, the same rate we used for capital gains and interest. Note that we have been using the same rate for different sources of finance (debt, equity and retention) to show that even though rates may be the same, the tax system is not necessarily neutral as we have seen in previous tables. The *tax discrimination variable* (θ) can be expressed as:

$$\theta = 1 / (1 + \omega^d) \qquad (22)$$

Remember that θ is now the net dividend in the hands of shareholders and it takes into account the 15% retention at source at the corporate level (ω^d).[25] Hence, the expression for the company discount rate when there is a retained at source 15% tax on dividends is:

$$\rho = [i /(1 + \omega^i) - z\pi] * (1+ \omega^d)^2 \qquad (21)$$

Now we are able to find the pre-tax rate of return to capital "p" for new equity with dividends being taxed. Suppose, for a while, there is no INE. Using our initial parameters the results are:

Table 4.10a: The Cost of Capital "p" with 15% withholding tax on dividends

	Machinery	**Buildings**	**Inventories**	**Weighted avg.**
Retained earnings	12.1%	12.5%	14.3%	12.7%
New equity	16.2%	16.8%	18.7%	16.9%
Debt	9.1%	9.3%	11.0%	9.6%
Weighted avg.	11.4%	11.8%	13.6%	12.0%

Author´s computation

Table 4.10b: Tax Wedges (p – s) with 15% withholding tax on dividends

[25] Note that if dividend taxation were such as in the USA, that is, dividends are subject to income tax at the personal level (the individual must register received dividends on his/hers tax return), then θ would equal one (1) because there would not have additional dividend taxation at the corporate level. Since different values of θ lead to differences on the return to capital, we understand that for investment analisys retention at source makes difference when computing tax wedges.

	Machinery	Buildings	Inventories	Weighted avg.
Retained earnings	3.1%	3.5%	5.3%	3.7%
New equity	7.2%	7.8%	9.7%	7.9%
Debt	0.1%	0.3%	2.0%	0.6%
Weighted avg.	2.4%	2.8%	4.6%	3.0%

Author´s computation

These tables show that a 15% tax on dividends would worse the return to investors and the tax system would be even far from neutrality. In particular, new equity would now be the worst option for investors.

Dividend taxation as close to a classical system as we have simulated is no longer usual in the world unless the case of a big economy such as the USA. Moving away from a classical system would probably not change investors behavior in the USA. In opposition to it, for small open economies it is sometimes mandatory to change their monetary or fiscal policies so as to achieve their investment and growth goals. In fact, many European countries are using integrated systems with imputation or split rates rather than exemption.

For Brazil, imputation or split rates would probably raise the complexity of the tax system, which is already very complex. Of course, the complex is the tax system, the higher its administrative cost and the larger the breaches for corruption.

Anyway, from tables 4.10 it is clear that taxing dividends at 15% would only change the return on new issues, which become less attractive. This policy alone would not correct any distortions among financial alternatives.

4.4.3 Raising the Corporate Statutory Tax Rate

In our previous computations we took $\tau = 25\%$ as if as though Brazil has a single rate. This is not true. Brazil corporate tax schedule is such that a 15% rate applies to all companies and additionally a 10% rate applies on the profits that exceeds R$ 240,000.00. Thus, the rates vary according to companies' profits. Also, since all corporations are required to pay the social security contribution on net income (CSLL) at a rate of 9% before the corporate tax, we find that corporations are indeed taxed at a higher rate, which is close to 34%. If we use this rate ($\tau = 34\%$) and the actual nominal interest rate (16%), we find:

Table 4.11a: Pre-tax rate of return to capital "p" with 34% of corporate tax rate

	Machinery	Buildings	Inventories	Weighted avg.
Retained earnings	13.4%	14.0%	16.8%	14.3%
New equity	11.0%	11.5%	14.1%	11.8%
Debt	8.2%	8.5%	11.0%	8.9%
Weighted avg.	11.4%	11.8%	14.5%	12.2%

Author´s computation

Table 4.11b: Tax Wedges (p – s) with 34% of corporate tax rate

	Machinery	Buildings	Inventories	Weighted avg.
Retained earnings	4.4%	5.0%	7.8%	5.3%
New equity	2.0%	2.5%	5.1%	2.8%
Debt	-0.8%	-0.5%	2.0%	-0.1%
Weighted avg.	2.4%	2.8%	5.5%	3.2%

Author´s computation

It seems that this policy would enhance the existing distortions among financial alternatives and raise the overall tax wedge. It would also warrant a negative tax wedge on buildings and machinery financed by debt. A negative tax wedge means that the tax system is supporting part of the cost of capital for debt investors. Obviously, this does not seem to be good policy and though it is desirable to have a low tax wedge on investment it cannot be negative since taxpayers should not be responsible for private investment.

Because interest is deductible from the tax base, the higher the corporate tax rate, the lower the tax wedge for debt finance. Though INE has the same privilege, the effect for new equity is pervasive as the average tax wedge for this source of capital raises from 2.8% to 3.3%. As mentioned, the effect of INE on new equity is not as powerful as interest for debt. Hence, increasing corporate tax rates, as sometimes advised to raise government revenues and favor the tax system equity, may have side effects as, for instance, an unexpected stimulus to debt finance.

4.4.4 The Effect of a Higher Inflation in Brazil

A higher inflation rate has usually an ambiguous effect. It is worth study what would happen if inflation in Brazil went up to 10%.

Table 4.12a: Pre-tax rates of return with $\tau = 34\%$, $i = 16\%$, $\pi = 10\%$

	Machinery	Buildings	Inventories	Weighted avg.
Retained earnings	7.2%	6.4%	10.4%	7.7%
New equity	4.9%	4.1%	7.9%	5.3%
Debt	2.7%	1.8%	5.5%	3.1%
Weighted avg.	5.4%	4.6%	8.4%	5.8%

Author´s computation

Table 4.12b: Tax wedges with $\tau = 34\%$, $i = 16\%$, $\pi = 10\%$

	Machinery	Buildings	Inventories	Weighted avg.
Retained earnings	2.8%	2.6%	6.9%	3.6%
New equity	0.6%	0.2%	4.4%	1.3%
Debt	-1.5%	-2.0%	1.9%	-0.9%
Weighted avg.	1.0%	0.7%	4.9%	1.8%

Author´s computation

A rate of inflation of 10% in Brazil would reduce the cost of capital for the tax system. In fact, the major effect of a high rate of inflation would be as if actual rates of interest (i) have

been decreased. Of course, the King-Fullerton model does not compute the pervasive effects of a high inflation to the economy and the conclusion above is very limited.

4.4.5 Changing the Proportion of Inventories Submitted to FIFO

In our fore calculations, we assumed that all inventories were valued using the FIFO method but Brazil also allows valuation by the average cost and by the price minus the marginal profit as well. As the use of FIFO indexes stocks, it is reasonable that companies try to avoid it in order to pay less tax. In the absence of real data, if we suppose that only 20% of stocks are valued with FIFO and 5% of real interest, then we have the following:

Table 4.13a: Pre-tax rates of return with τ = 34%, r = 5% and 20% of stocks with FIFO

	Machinery	Buildings	Inventories	Weighted avg.
Retained earnings	6.3%	6.1%	6.7%	6.3%
New equity	4.1%	3.8%	4.2%	4.0%
Debt	2.0%	1.5%	1.7%	1.8%
Weighted avg.	4.6%	4.3%	4.7%	4.5%

Author´s computation

Table 4.13b: Tax wedges with τ = 34%, r = 5% and 20% of stocks with FIFO

	Machinery	Buildings	Inventories	Weighted avg.
Retained earnings	2.8%	2.6%	3.1%	2.8%
New equity	0.6%	0.2%	0.6%	0.5%
Debt	-1.5%	-2.0%	-1.8%	-1.7%
Weighted avg.	1.0%	0.7%	1.1%	1.0%

Author´s computation

The results show that this policy would favor tax neutrality regarding types of asset. Inventories would improve their rates of return. Future studies should verify the actual proportion of stock valued with FIFO in Brazil and if the adoption of LIFO would have positive effect to asset-type tax neutrality as it is used in many other countries.

4.4.6 Exempting Capital Gains

Many countries do not tax capital gains on retained profits as an increase in the value of shares. Others do but only if the asset is sold after a certain period of time has passed. In Brazil, capital gains are taxed only at the time of realization. Considering that, according to the new view, mature companies prefer to finance their expansions with retained earnings. If this is true, then exempting taxes on capital gains could help encourage investment.

The above tables show that retained earnings would require the higher rates of return. If Brazil eliminates taxes on capital gains, the response would be:

Table 4.14b: Pre-tax rates of return with $\tau = 34\%$, r = 5% 20% of stocks with FIFO and z = 0

	Machinery	Buildings	Inventories	Weighted avg.
Retained earnings	6.0%	5.8%	6.3%	6.0%
New equity	4.9%	4.6%	5.1%	4.9%
Debt	2.0%	1.5%	1.7%	1.8%
Weighted avg.	4.5%	4.2%	4.6%	4.4%

Author´s computation

Table 4.14b: Tax wedges with $\tau = 34\%$, r = 5%, 20% of stocks with FIFO and z = 0

	Machinery	Buildings	Inventories	Weighted avg.
Retained earnings	2.4%	2.2%	2.8%	2.5%
New equity	1.4%	1.1%	1.6%	1.3%
Debt	-1.5%	-2.0%	-1.8%	-1.7%
Weighted avg.	0.9%	0.6%	1.0%	0.9%

Author´s computation

Besides lowering slightly the overall tax wedge, this policy reduces the gap between retaining profits and issuing of new shares. Nevertheless, debt is still the best financial choice.

4.4.7 Raising the Effective Tax Rate on Interest

Currently, Brazil taxes interest income at a rate of 15% which is lower than in most OECD countries.[26] If Brazil changes its rate to 25%, this is what happens:

Table 4.15: Tax wedges with $\tau = 34\%$, $r = 5\%$, 20% of stocks with FIFO, $z = 0$ and $w^i = 25\%$

	Machinery	Buildings	Inventories	Weighted avg.
Retained earnings	2.1%	1.8%	2.1%	2.0%
New equity	2.3%	2.0%	2.2%	2.2%
Debt	0.4%	0.0%	0.1%	0.2%
Weighted avg.	1.5%	1.2%	1.4%	1.4%

Author´s computation

Results show there is almost tax neutrality between new equity and retention as well as asset-type neutrality. There is also an acceptable level of the tax wedge. Debt finance is still the best option for investors with tax wedges close to zero, even with the increase on the tax rate on interest. Hence, a 25% retained at source tax rate on interest income combined with a full exemption on capital gains and dividends would reduce tax distortions among asset type and funds for investment in Brazil. However, we are supposing a low interest rate, which is not true. If the actual nominal interest rate is 16%, then the level of the tax wedge increases to 3.0%, on average, and the cost of capital, represented by the pre-tax rates of return, increases too to 11.0%, on average. Obviously, the values of "p" are higher now but, again, there are no different incentives among the sources of finance, though high values of "p" lowers the stimulus for investment.

[26] Tax rates on interest: US (average) 28%, UK average 22%, Switzerland 30.8%, Sweden 30%, Spain 31.5%, Luxembourg 24%, Greece 25% for residents.

4.4.8 Achieving tax neutrality with low tax wedges

Tax neutrality is not easy to achieve. Calibration is hard because the model parameters are many. Moreover, changes in the real tax system need a lot of political work. Because of this, for the purpose of this study, we look at some alternatives to improve tax neutrality in Brazil, even though such alternatives may not be easily acceptable in the real world. We start by redefining our assumptions.

Let us suppose that the real interest rate is exogenous and close to 5%. We have seen that the lower the interest rate, the lower the tax wedges and for this scenario tax wedges should be around 1.5%, as fore calculations showed. In this case, the tax system would impose a small barrier on real investment.

In previous tables, debt finance always appears as the best financial choice, presenting low tax wedges and sometimes even negative ones. In order to make debt finance tax wedges close to their correspondents of equity and retention, we can raise them a little, while decreasing their correspondents. Then, to move up debt finance tax wedges it is needed to lower the corporate tax rate and/or to raise the tax rate on interest.

On the equity side, we assume dividends are still exempted and INE keeps the same tax treatment as before, that is, INE is deductible from the tax base and is taxed at the same rate as interest. The proportion of dividends and INE distribution is still assumed to be 50% and the inflation rate is still 4.5%. Thus, we are assuming there is no room for equity policies.

For retention, the statutory tax rate on capital gains shall be increased to compensate for the loss in revenues caused by the lower corporate taxation. Note that while the corporate tax decreases, taxation on interest and capital gains increase so as to keep government revenues relatively stable. Though retention appeared in the tables as the worse option for corporate

finance, with lower corporate taxation the trend is for lower tax wedges on retention as well. Thus, the increase on the statutory tax rate on capital gains in this new scenario will not harm retention.

Asset-type neutrality is achieved allowing better conditions for inventories as machineries and buildings seem to have close tax wedges in Brazil. For inventories, a reduction on the stocks valued with FIFO would favor tax neutrality among assets.

After this introduction, we are able to establish the new model parameters:

i. the real interest rate as 5%,
ii. the inflation rate as 4.5%,
iii. the corporate tax rate as 18%,
iv. the statutory the tax rate on dividends as zero,
v. tax rate on capital gains as 30%,
vi. the statutory tax rate on interest and INE as 31%,
vii. the proportion of stocks valued with FIFO as 10%,
viii. the proportion of profits distributed as dividends as 50%,
ix. the statutory depreciation rates as 10% for machinery and 4% for buildings,
x. the economic depreciation rates as 8.2% for machineries and 2.7% for buildings,
xi. the proportion of capital gains realized each year as 10%

The outcome is the following:

Table 4.16: Tax wedges – balanced tax system with low interest rate

	Machinery	**Buildings**	**Inventories**	**Weighted avg.**
Retained earnings	1.4%	1.4%	1.5%	1.4%
New equity	1.4%	1.4%	1.5%	1.4%
Debt	1.3%	1.3%	1.4%	1.3%
Weighted avg.	1.3%	1.4%	1.5%	1.4%

Author´s computation

Note that even if there are high tax rates on capital gains and interest, the level of the tax wedges is still low.

In a scenario of high interest rates though, these parameters do not satisfy for tax neutrality besides imposing a high cost on capital. Averaged tax wedges rise to 2.4%, 2.8% e 3.4% for

debt, retention and new equity, respectively, when the nominal interest rate is 16% (real interest rate of 11%). In this case, one way to achieve tax neutrality is to raise the corporate tax rate to 20%, eliminate INE, keep dividends exemption, exempt capital gains, forbid FIFO, make the tax rate on interest as 25% and the new results are:

Table 4.17: Tax wedges – balanced tax system with high interest rate

	Machinery	Buildings	Inventories	Average
Retained earnings	1.5%	1.8%	2.0%	1.7%
New equity	1.5%	1.8%	2.0%	1.7%
Debt	1.5%	1.8%	2.0%	1.7%
Average	1.5%	1.8%	2.0%	1.7%

Author´s computation

The tax system is now neutral to the sources of finance but not for assets. Lowering the corporate tax rate could have a positive effect on inventories for equity and retention, but not for debt, which would worsen all its results. Asset-type neutrality could be achieved by changing depreciation rates for machinery and buildings and providing special allowances for inventories. However, a lower interest rate would eliminate the need for complex solutions.

Results suggest that with high interest rates tax policy is less effective to improve tax neutrality in Brazil. The problem is how to reduce new equity tax wedges as dividends are already exempted? Note that eliminating INE favored tax neutrality in the last scenario.

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-Fullerton equations, our model computes the rates

of return to capital before and after taxation, the correspondent tax wedges and effective tax rates. With appropriate settings to approach the real Brazilian economic environment, the model responded to simulations for the study of the status quo as well as of policy alternatives. Our goal was to achieve tax neutrality among different sources of finance and different types of assets, assuming the tax system should not distort investment decisions for the efficiency of the economic system, although the model is consistent for testing biased policies, if necessary. Indeed, policy makers can use (and improve) this tool to test tax policy options before implementation on the real world.

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. Also, the cost of capital and the tax wedges here are higher than usually found in the OECD area. Other important conclusions emerging from our study are:

I. the tax system impact on investment depend heavily on the interest rate, though this is not under control of fiscal authorities. The higher the interest rate, the higher the tax wedges and effective tax rates on capital income, discouraging investment.[27] The influence of the interest rate on the performance of the tax system can be explained by the opportunity costs investors face when deciding among different investment options. In an environment of high real interest rates, tax neutrality becomes hard to achieve and the incentive to debt finance becomes much more intense than to others sources of finance,

[27] The conclusion that a lower interest rate would favor investment is limited to the scope of this study, i.e., the tax system efficiency. For a broader approach, one has to discuss the role of the interest rate on other issues that may affect investment, such as the stabilization policy or the effect of the interest rate on public debt.

such as equity (new shares) and retention of profits for reinvestment. On the other hand, with low interest rates, tax neutrality becomes easier to achieve with tax policy tools.

II. the interest on net equity (INE) have shown poor impact on the cost of capital for new equity. This result seems contrasting with common sense as INE has been well accepted by the business community. Created, perhaps, with the aim of strengthening equity and the formation of capital stock, this policy seems to be impotent to make equity as attractive as debt. If the model is right and the tested hypothesis enough, then INE has to be changed or replaced as it can only be serving to favor tax planning. If not, then we suggest further studies on INE using real data in order to verify its effect on equity finance;

III. 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;

IV. of the three sources of companies funds, debt allows the most effective responses to variable changes to lower the tax wedges on investment while equity has the worst response. Special care has to be taken by legislators when granting tax incentives affecting debt finance because it is easily co-sponsored by taxpayers, as negative tax wedges have come out in our simulations ;

V. in most of our simulations, retention of earnings appeared as the worst financial option. A reduction on the statutory tax rate on capital gains would favor retention while harming new equity;

VI. dividend exemption contributes to lower equity tax wedges, approaching debt. However, this policy alone is not enough to achieve tax neutrality;

VII. the proportion of stocks valued with FIFO have a high impact on the cost of capital regarding inventories. Given that the use of FIFO method tax inflation indexed stocks, an alternative could be the LIFO method. The more the tax on stocks is indexed, the less attractive are inventories in relation to other kinds of assets.

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