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Combatting debt bias in South African firms

The case for an allowance for corporate equity

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Abstract: The problem of debt bias can be tackled through either disincentivizing the use of debt financing or incentivizing the use of equity financing. Considering the South African context—in which many firms are highly leveraged and the marginal effective tax rates for using debt financing are significantly lower than those for equity financing—this study explores the case for introducing an allowance for corporate equity. We show that while such a reform would significantly neutralize the incentives to invest across debt and equity financing, our static simulations—using the NT-SARS CIT-IRP5 panel—show that it would entail a significant revenue loss to the fiscus.

Keywords: debt bias, investment incentives, corporate tax, tax revenue, South Africa
JEL classification: H21, H25, H32, O23

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1 Introduction

The South African (SA) corporate income tax (CIT) includes a number of elements that distort investment decisions across sectors, asset types, and financing forms. Furthermore, SA firms display a high bias towards debt financing. The issue of bias towards debt financing is obviously not specific to South Africa as most, if not all, tax systems favour debt over equity financing due to the deductibility of interest; the *Economist* (2015), for example, called the problem of debt bias the *Great Distortion*. When considering potential solutions to alleviate debt bias, a number of approaches can be taken: one can think in terms of the *carrot and stick* analogy, whereby either the excessive use of debt financing can be discouraged (*stick*), or an incentive provided to encourage the use of equity financing (*carrot*). A number of countries have put limitations on the deductibility of interest, while others have implemented reforms that incentivize equity financing.

The present paper discusses one option for the latter solution, namely the allowance for corporate equity (ACE),[1] which allows a portion of equity financing to be disallowed from CIT. The introduction of an ACE is expected to significantly improve efficiency by removing the distortion between debt and equity finance and by reducing the cost of capital. Using South Africa as a case study, we calculate the cost of capital and the marginal effective tax rate (METR) for 12 asset types and three financing types. The METR for equity-financed investments are all positive at 4–45 per cent. When we consider debt-financed investments, however, the METRs are strongly negative for all but two asset classes. Thus, there exists a strong incentive for firms to utilize debt financing. This distortion is largely produced by the deductibility of nominal interest payments in an environment of high inflation.

In the presence of an ACE, however, the METR is equalized across financing types and is equal to the statutory corporate tax rate (28 per cent) for inventory investment, and zero otherwise. One major shortcoming with an ACE, however, is that it can entail significant revenue loss. Previous studies have estimated that anywhere up to one-third of CIT revenues might be foregone in the presence of an ACE.[2] In this light, we use the NT-SARS CIT-IRP5 panel to simulate the effects of the presence of an ACE in a static setting during the tax years 2009–14. We find, more or less in line with other studies, that the losses to the fiscus accumulate over a period of time and that after six years these stand at over 7 per cent of CIT revenue. These losses are, in reality, likely to be higher due to the significant incentive offered to investors to use equity financing. In a companion study (McNabb et al. forthcoming), we explore in further detail the revenue implications of the introduction of an ACE, and also simulate a number of other reforms to the CIT code that might (1) also contribute to the mitigation of the debt bias and (2) recoup some of the lost CIT revenues as a result of the ACE.

This paper proceeds as follows. Section 2 outlines the theory underpinning the concepts at hand, namely the METR and ACE. In Section 3, we discuss the SA context, before Section 4 estimates the cost of capital and the METR in South Africa at present. Section 5 introduces the ACE and

[1] We do not consider the comprehensive business income tax (CBIT)—an alternative approach to addressing debt bias that denies the deductibility of interest expenses. This is broadly because CBIT distorts investment decisions and these distortions aggravate in an environment of high inflation such as in South Africa. In the companion paper (McNabb et al. forthcoming), we consider the implications of the introduction of an EBITDA-based partial interest limitation.

[2] See, for example, Zangari (2014), who considered the case of Belgium.

presents (1) static simulations of the potential revenue effects of its introduction and (2) the cost of capital and METR after its introduction. Section 6 concludes.

2 Conceptual context

2.1 Quantifying the effective tax burden of corporate profits

The key objective of this study is to analyse whether the SA corporate tax system distorts the decisions of corporate firms, and the extent to which an ACE would mitigate these distortions.

Two standard measures are applied in our analysis to quantify the distortions caused by corporate taxation. One is the cost of capital or, put differently, the real pre-tax rate of return on marginal investment; the second is the METR.[3]

Both indicators focus on marginal investment, which are projects expected to yield a rate of return just sufficient to persuade investors that the project is worthwhile to implement. They are both capable of taking into account a number of aspects of the tax system relevant for the profitability of investment. These include the corporate tax rate and many types of tax base rules, such as depreciation allowances and the tax treatment of financing costs. The approach is also flexible enough to include the rules on personal-level taxes as well as those concerning cross-border income flows.

There is a related measure, the average effective tax rate (AETR), which calculates the tax burden of investment that yields above-normal profits. This indicator is commonly used in the analysis of location decisions of multinational enterprises. As our focus is on the distortionary effects of corporate taxation in the domestic context, we examine the METR and the cost of capital for the indicators, and exclude both personal-level and international tax rules.

The METR is calculated as follows:

$$\text{METR} = \frac{p-r}{p}, \tag{1}$$

where p is the cost of capital and r is the after-tax rate of return required by the financier—in our case this is the market rate of interest. The numerator, $p-r$, is commonly called the tax wedge. It gives the amount of taxes paid in absolute terms. The METR gives the relative size of the tax wedge.

We calculate the cost of capital, p, using the following formula:[4]

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[3] The approach was developed in a series of studies. King and Fullerton (1984) introduced the methodology and provided a wide application of the METR concept for four industrial countries. The OECD (1991) extended the approach to include cross-border investment and provided calculations of the METR for all OECD countries for both domestic and cross-border investment. Devereux and Griffith (2003) extended the general approach to include the concept of the AETR.

[4] For details, see Appendix A. Our model is in continuous time and follows King and Fullerton (1984) and Sørensen (2008). Note that the OECD (1991), Devereux and Griffith (2003) and Hanappi (2018) use a discrete time approach. There are other smaller differences between the applications as well. Sørensen (2008) is closest to our approach.

$$p = \frac{(1-\tau A)(\rho+\delta-\pi)+d\tau\pi-\beta\tau i}{1-\tau} - \delta, \qquad (2)$$

where τ is the statutory rate of corporate tax, ρ is the nominal cost of equity finance, δ is the real rate of economic depreciation, i is the nominal cost of debt financing, π is the rate of inflation, β is the debt to asset ratio, and d is a dummy variable with $d = 1$ for inventory investment and $d = 0$ for investment in fixed assets. $A = \varphi / (\rho + \varphi)$ is the present value (PV) of fiscal depreciation allowances, where φ denotes the rate of fiscal depreciation.[5] The relationship between the nominal and the real costs of finance is simply $\rho = r + \pi$. We further assume that the cost of debt is equal to the cost of equity, $i = \rho$.

The model considers a small, open economy in which investors can invest in both domestic and foreign shares and bonds. As a result, the company's cost of finance is determined on the international capital market, implying that the real interest rate, r, is independent of domestic decisions. As the after-tax return (real interest, r) is constant, the pre-tax return p has to adjust to changes in corporate taxation.

Next, we provide a short discussion of the effects of different tax parameters. The statutory tax rate affects the cost of capital (and the tax wedge) in multiple ways. First, it reduces the returns on the marginal project. A higher tax rate tends to increase the cost of capital. Second, the tax rate also affects the value of interest deductions and depreciation allowances. Now a higher tax rate implies a lower cost of capital. Combining these two channels implies that an increase in the tax rate tends to increase the cost of capital of an equity-financed project but may increase or decrease that of a project financed by debt.

The latter result depends on the size of fiscal depreciation allowances and whether there is inflation in the economy. Generally, a higher depreciation rate means a higher A and a lower p. The effect of inflation is more complex. In a tax system that taxes nominal profits and allows nominal interest expenses to be deducted, higher inflation generally increases the cost of capital (and METR) of an equity-financed investment but decreases the cost of capital of an investment financed by debt.

As our calculations in Section 4 will illustrate, the combination of accelerated fiscal depreciation and high inflation can yield very low values of the cost of capital of debt-financed investment projects, while the relative tax wedge of equity-financed investment might be close to the statutory tax rate. Hence, under these conditions the tax system may strongly favour debt over equity.

Corporate taxation not only affects the financing decisions but may also distort the choice between different types of investment. The key factor here is how the investment is deducted for taxation purposes, in particular, how the fiscal depreciation allowances relate to economic depreciation. That these two differ may be a result of deliberate policy decisions, but there may well be other reasons as well. The correct depreciation rate is difficult to estimate and even if it were estimated correctly, the true variation across a number of asset types is difficult to take into account in concrete tax legislation. For both reasons the statutory rules commonly deviate from the correct ones. Further, inflation complicates things somewhat: in an inflationary economy there is no easily implementable norm for fiscal depreciation allowances.

The last issue can be illustrated using the following example. Assume that there is no inflation, $\pi = 0$, and that the rate of fiscal depreciation is aligned with economic depreciation,

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[5] δ and φ follow the declining balance method.

$\varphi = \delta \rightarrow A = \dfrac{\delta}{\rho + \delta}$. By inserting these into equation (2) and then p from (2) into (1), we observe that the cost of capital and the METR of investments financed from equity and debt are:

$$p^{equity} = \frac{\left(1-\tau\frac{\delta}{\rho+\delta}\right)(r+\delta)}{1-\tau} - \delta = \frac{r}{1-\tau} \qquad \text{METR}^{equity} = \frac{\frac{r}{1-\tau} - r}{\frac{r}{1-\tau}} = \tau \tag{3}$$

$$p^{debt} = \frac{\left(1-\tau\frac{\delta}{\rho+\delta}\right)(r+\delta) - \tau i}{1-\tau} - \delta = r \qquad \text{METR}^{debt} = \frac{r-r}{r} = 0.$$

The METR of an equity-financed investment equals the statutory tax rate, τ, while this indicator is zero for debt-financed investment. The impact of this difference is clear: the tax allowance for interest expenses just eliminates the tax wedge of marginal investment financed by debt, while there is no corresponding deduction for the cost of equity and therefore the (correctly measured) profit on the marginal investment is taxed at rate τ.

Things change a lot when we allow a positive inflation rate, $\pi > 0$, and accelerated fiscal depreciation $> \delta$. Let us denote the difference between the rates by $\Delta = \varphi - \delta$. We obtain the following formulae for the cost of capital and the METR:

$$p^{equity} = \frac{r}{1-\tau} + \frac{\tau[\pi A - \Delta(1-A)]}{1-\tau}, \;\; \text{METR}^{equity} \begin{Bmatrix} > \\ = \\ < \end{Bmatrix} \tau \tag{4}$$

$$p^{debt} = r - \frac{\tau(1-A)(\pi+\Delta)}{1-\tau}, \text{METR}^{debt} < 0.$$

Let us first focus on inflation ($\pi > 0$, $\Delta = 0$). With a positive inflation rate, METR^{equity} is above the statutory tax rate and METR^{debt} is drawn to negative. The absolute value of these changes is grows with inflation. An implication of this is that the gap between equity and debt increases.

Consider next the case in which both assumptions are relaxed. Now the indicators depend on the difference between the rates of depreciation, Δ. This factor tends to lower the cost of capital. For equity-financed investment, it counteracts the effect of inflation with the result that METR may well be slightly above or around the statutory tax rate. In the case of debt financing, both inflation and accelerated depreciations lower the METR, which now may even become strongly negative, depending, of course, on the sizes of π and Δ. A further implication is that, as A and Δ commonly vary between assets, the tax system tends also to distort the choice between assets.

While the METR approach has proven to be a useful tool in analysing the effects of taxation on corporate source profits, it also has certain limitations. There commonly is only a small number of financing sources and investment types. It can be asked whether an economy-wide picture of incentives can be obtained using just some exemplar cases. There are also particular difficulties in matching correct economic depreciation rates to the representative asset types. One asset class (for example manufacturing machinery) can, in fact, include a wide variety of assets with different useful lives.

A further caveat of the method is that it basically assumes that the representative firm pays taxes at the margin. Hence, tax will be paid on the return on the marginal investment and tax allowances will provide the firm tax savings. Examples of cases in which it is not appropriate are a loss-making firm and a firm that is currently profitable but has a stock of deductible losses or other unutilized tax allowances from previous years.

2.2 An ACE to address the debt bias

In this section we will focus on the question of how to address the debt bias, that is the favourable tax treatment of debt compared to equity. It should be observed that the tax system we focus on, the ACE, has important implications for other dimensions as well, including investment effects and the potential distortions produced by capital allowances.

The ACE tax system

As a number of recent policy papers have concluded, there are various ways to mitigate the debt bias.[6] Broadly speaking, to implement equal tax treatment between debt and equity, either the current allowance for interest expenses should be limited or a new deduction for the costs of equity should be introduced. Thus, simply speaking, the approach of 'carrot' or 'stick' could be followed. One example of the first means, not discussed any further in the present study, is the comprehensive business income tax (CBIT). CBIT forbids the deduction of net interest expenses at the corporate level.[7] An opposite means is the ACE. This system allows corporate firms to deduct an imputed return on the book value of equity in addition to the deduction of actual interest expenses on debt.

The ACE allowance is calculated by multiplying the asset base of the allowance by an imputed rate of return. The former is calculated initially by deducting the sum of the book value of debt and investments in other firms' shares from the value of the firm's assets. The value of shareholdings is deducted to avoid double accounting of equity in ownership chains.

Once the system is already in operation, the current year's ACE base is obtained as follows (Devereux and Freeman 1991; Griffith et al. 2010):

Previous year's ACE base
+ taxable profit in the previous year
+ dividends received
+ net new equity issues
– taxes on previous year's profit
– dividends distributed
– net new acquisitions of shares in other companies
= current year's equity base ('adjusted equity' at the end of the previous year)

Hence, the change in equity base is broadly new equity issues plus retained after-tax profits adjusted by changes in ownership in other companies' shares. The ACE rate is commonly recommended to be the risk-free rate of interest, which can be measured sufficiently well by the government bond rate (see, e.g. Mirrlees et al. 2011).

One common element of most ACE proposals is an inter-temporal smoothing mechanism, which aims to improve the symmetry of the tax system, that is the similarity of the tax treatment of profits

[6] See, for example, de Mooij (2012), IMF (2016), and the European Commission (2016a).

[7] Instead of full denial of interest deduction, many countries have introduced partial limitations to interest deductions. Their particular goal seems to have been addressing the so-called debt-shifting by multinational enterprises (MNEs), but they have also been seen as measures to target the debt bias (see IMF 2016).

and losses. This is implemented by allowing unutilized ACE allowances to be carried forward with interest. If this is done, a firm can be fairly sure that the allowances it deducts later preserve their value (due to interest compounding). Theoretical models imply that if the firm can be certain of being able to deduct full allowances, then the ACE allowance can be calculated using risk-free interest rate; no risk premium is needed on top of the risk-free rate. However, some proposals have stressed the incompleteness of loss-offset and carry-forward rules, particularly in bankruptcy and wind-up situations, and have favoured including a risk premium in the ACE rate (Griffith et al. 2010).

Favourable aspects of the ACE allowance

Theoretical models imply that introducing an ACE allowance roughly eliminates the incentive to use debt instead of equity in financing investment, hence the debt bias disappears. A further effect is that, assuming no other changes, the ACE lowers the cost of capital and therefore improves the incentives for investment. In fact, a well-implemented ACE exempts the marginal return on investment financed from equity. Therefore it ends the distortion of corporate tax to the scale of investment and does this independently of the rate of depreciation allowances. This implies that the ACE also abolishes the potential distortions across assets caused by depreciation allowances. To understand this, assume an all-equity firm that only has depreciable assets in its balance sheet. Now, both the ACE allowance and the depreciation allowances are effectively calculated on the same asset base.[8] This implies that higher depreciation allowances that reduce the book value of assets lead to lower future ACE allowances and vice versa.

We can elaborate this further by using the model introduced in Section 2.1. In that section we mentioned that, in standard corporate taxation, the PV of fiscal depreciation can be written

$$A = \frac{\varphi}{\rho + \varphi} \; (< 1)$$

where φ is the rate of fiscal depreciation. In the ACE system this variable takes the form

$$A = \frac{a + \varphi}{\rho + \varphi}$$

where a is the ACE rate. In a correctly specified ACE system, the ACE rate equals the interest rate, $a = \rho$. Substituting this into the expression for A yields $A = 1$, which implies that the PV of capital allowances over the useful life of the asset is equal to the initial purchasing price of the asset. Inserting this value into the expression of the cost of capital in equation (2) further yields $p = r$ and $\text{METR} = 0$. Hence, the system is neutral with respect to financing and investment,[9] and this holds independent of the rate of fiscal depreciation and the rate of inflation.

[8] By the basic accounting identity ACE – equity base, in this simple example, is equal to the assets on the side of the balance sheet.

[9] Recent empirical analysis has provided evidence of some of these effects. Hebous and Ruf (2018) find the effect on financing to be broadly in line with the predictions. The evidence of investment effects is more mixed. While Aus dem Moore (2015) finds a change in investments of small and medium-sized firms, Hebous and Ruf (2018) detect no change in real investment. Both focus on the effects of introducing ACE allowance in Belgium in 2006.

Potential problems of the ACE allowance

Implementing an ACE allowance drops the METR as low as zero and makes the country attractive for both domestic and foreign investors. However, many observers have pointed out that in a budget-neutral tax reform, the introduction of an ACE might require a higher statutory tax rate to finance the allowance. As the argument goes, this would erode the competitiveness of the tax system (see, e.g. Bond 2000; de Mooij and Devereux 2011). While introducing the allowance would affect the scale of investment positively, the increase in the statutory tax rate would have adverse impacts on profit shifting by MNEs and also the AETR. An increase in the latter would make the country a less attractive location for high-profit activities of MNEs.

Some studies have investigated the effects of the ACE reforms on corporate tax revenue. Zangari (2014) reports experiences from the Belgian adoption of ACE in 2006. The study calculates the revenue loss to have been one-third of potential corporate tax revenue. The IMF (2016) provides a static *ex ante* simulation by using a large international dataset and finds that the ACE is likely to reduce revenue by much less—between 5 and 12 per cent, depending on the sector. The study suggests that the straightforward calculations concerning the Belgian revenue loss have overestimated the costs of ACE, partly because they have not taken into account the impacts of ACE on reduced costs following from a reduction in the share of debt. Finke et al. (2014) assessed the impacts on German CIT revenue in a behavioural microsimulation model, finding that revenue losses were in the region of 18 per cent.

How to deal with the revenue loss

The debate concerning a proper design of ACE has pointed out several options to address the revenue loss. One is to implement ACE in an incremental fashion, meaning that it is applied to equity increases starting from some base year. The revenue effect would be small during the first years after the reform. They would, of course, increase over time when the equity base expands, but this 'transition' period would let the dynamic effects of the ACE on firm behaviour occur; these favourable behavioural effects are likely to counteract the negative effects on revenue.

Another initiative to reducing the vulnerability of ACE to tax planning and the revenue loss is a modification proposed by the European Commission in its draft proposal for a common corporate tax base (CCTB) (European Commission 2016b). The novelty of the proposal is that the allowance is calculated on equity increases accumulated over the last 10 years only. This should make the long-run size of the equity base smaller and therefore cap the long-run revenue losses of an ACE implemented in incremental form. Kari et al. (2018) show that this model roughly equals an ACE system in which the allowance is calculated on a standard base but using a rate lower than the standard ACE rate.[10]

Other options to solve the revenue issue are targeting the ACE to specific sectors, such as those in which economic rents are important, and combining other tax changes with the introduction of ACE, in particular changes in personal taxation of equity income, limiting the deductibility of interest expenses in corporate taxation, and reducing the rates of depreciation allowances (see, e.g. Boadway and Tremblay 2016; IMF 2016). The latter means is likely to be able to compensate only for the short-term revenue loss.

[10] However, Kari et al. (2018) also show that the size of the 'effective AGI rate' depends on fiscal depreciation allowances and might, therefore, vary between firms with different asset structures.

3 Institutional setting

In this section we introduce in detail the institutional setting in which our study takes place, namely the corporate tax environment of South Africa.

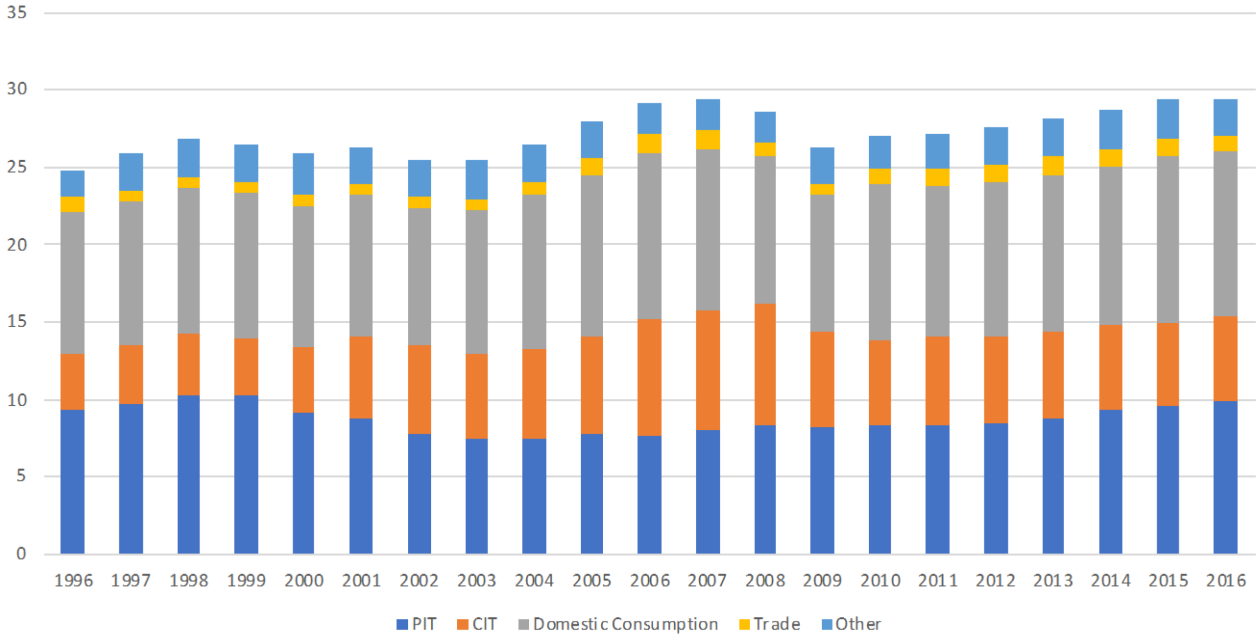
South Africa collected 25.6 per cent of gross domestic product (GDP) in tax revenue for the 2017/18 fiscal year. While this is well above the upper-middle income for sub-Saharan Africa and BRICS averages (Figure 1), the country is still struggling to meet high expenditure needs and the IMF (2018) suggested that revenues were underperforming.

Considering the breakdown of tax revenues, as shown in Figure 2, South Africa collects over 4.6 per cent in GDP from CIT. This is among the highest in the world for which there are data available, and markedly higher than even the OECD average (ICTD–UNU WIDER GRD 2018). Thus, the CIT is clearly an important revenue source. That said, CIT revenues have been declining as a share of total tax revenues since the great recession. Corporate profits in South Africa are taxed at a flat rate of 28 per cent, with a graduated schedule for small businesses, as shown in Table 1.

Figure 1: South Africa tax ratio 1996–2016: comparison with sub-Saharan Africa and BRICS

Source: authors, based on ICTD–UNU WIDER GRD (2018).

Figure 2: Breakdown of total taxes in South Africa, 1996–2016: percentage of GDP



Source: authors, based on ICTD–UNU WIDER GRD (2018).

Table 1: Small business corporate tax schedule, 2013–14

Taxable income	Tax rate
R0–R67,111	0 per cent of taxable income
R67,112–R365,000	7 per cent of taxable income above R67,111
R365,001–R550,000	R20,852 + 21 per cent of taxable income above R365,000
Above R550,000	R59,702 + 28 per cent of taxable income above R550,000

Note: the thresholds and rates payable have changed from year to year; see Appendix C for a breakdown.

Source: authors, based on SARS (2018).

Furthermore, dividends are taxed at 20 per cent upon distribution of profits. As with the majority of countries around the world, the costs associated with equity financing are not tax deductible, while the interest costs of debt financing are. SA source interest paid to non-residents is subject to a withholding tax of 15 per cent.[11] The asymmetric tax treatment of debt and equity is partly taken into account in owner-level taxation of capital income. Interest income is fully included in taxable income subject to a progressive rate schedule (with rates from 18 to 45 per cent), while only one-third of capital gains constitutes taxable income. Owing to the different treatment of debt and equity, measures have been put in place to address schemes intended to disguise equity instruments as debt instruments, especially in cross-border transactions. South Africa's legislation contains specific anti-avoidance measures to tackle potential abuse of the tax base resulting from the differential treatment of debt and equity.

The tax base provisions also include generous depreciation rates and special investment allowances in some sectors (agriculture, mining, and manufacturing). The current law provides generous depreciation rates for assets: for instance, since 2002, the Income Tax Act has allowed accelerated depreciation of new plant and machinery in the manufacturing sector at the rate of 40 per cent, 20 per cent, 20 per cent, and 20 per cent (thus over four years). The mining sector has 100 per cent

[11] Reduced rates are applicable under treaties.

depreciation of new plant and machinery in the year of investment, while the agriculture and renewable energy sectors have a 50 per cent, 30 per cent, 20 per cent accelerated depreciation scheme. The deductibility of interest expense in the presence of accelerated depreciation rates provides a further general investment tax incentive. In calculating the user cost of capital in this paper, we take into account the variations in the above tax parameters.

Considering firms in South Africa, the median debt to equity ratio stands at around 1.3, but this masks a number of outliers, particularly at the higher end of the distribution. For example, the 95th percentile value is over 170. Table 2 illustrates.

Table 2: Debt–equity ratios in South Africa

Percentile	Debt–equity ratio
1 per cent	0.003
5 per cent	0.03
10 per cent	0.08
25 per cent	0.34
Median	1.30
75 per cent	5.25
90 per cent	28.38
95 per cent	170.42
99 per cent	18,865.93
Mean	3,519.91

Source: authors' calculations from SARS-NT CIT-IRP5 panel.

A number of notable studies have been carried out on the SA tax system over the past few years. The first constitutes the findings of the Davis Tax Committee, which was set up in order to 'assess [the] tax policy framework and its role in supporting the objectives of inclusive growth, employment, development and fiscal sustainability' (DTC 2018a), This wide-ranging review of the SA tax system produced a number of reports, and crucially for the present analysis, some of these focused on the CIT and issues of debt bias. While the DTC (2018b) recognized the problems of thin capitalization and the incentives to favour debt over equity financing, recommendations to tackle the issue were largely focused on limiting excessive interest deductions (DTC 2018c).[12] As part of the Davis Tax Committee Review, the IMF produced a report exploring a number of potential reform options to the mining tax code, one of which was the introduction of an allowance for corporate capital (ACC).[13] DTC (2018d) did not, however, support the introduction of such an instrument, despite accepting the fact that it worked towards neutralizing the treatment of debt and equity.

As part of the Davis Tax Committee Review, the World Bank was commissioned to carry out an analysis of the effective tax burden and the effectiveness of investment incentives in South Africa (World Bank 2015a, 2015b). They found that while the METR in South Africa was internationally

[12] One recommendation of the DTC was that, for example, interest limitation rules be brought in line with those suggested in BEPS Action 4 of the OECD.

[13] This extends the ACE to also cover corporate debt.

competitive and that the tax system was not a major deterrent to investment, it was very sensitive to financing structure. With a high debt–asset ratio, the average METR becomes strongly negative in all main industries and using actual financing structures, the METR is negative in some sectors. Indeed, the calculated METRs varied significantly across sectors. The report also provides information on observed debt–asset ratio in South Africa compared to a selection of developed countries. The ratio is 15 percentage points higher than in euro-area countries, implying that on average firms are highly leveraged in SA. The findings of the World Bank are backed up by the OECD (Hanappi 2018), which found that METRs in South Africa showed significant variation across asset types, although this report assumed inflation of 0.73 and 2 per cent—both much lower than the current reality in South Africa, where inflation has fluctuated between around 4 and 7 per cent over recent years—and either full debt or full equity financing.

Carreras et al. (2017) found that the effective tax burden varied across firm size in South Africa, with medium-sized firms facing the lowest and small firms the highest effective tax rates.

4 Analysis of incentives to invest and finance in the current tax system

In this section we calculate the cost of capital and the METR for different types of investment in the current corporate tax system in South Africa. The aim is to unveil whether—and how much—the SA tax system creates distortions in investment and financing in an environment of high inflation. As the focus is on the domestic distortionary effects of corporate taxation, we do not consider personal-level or international tax rules.

Table 3 reports the results for the cost of capital and the METR for 12 asset types and three alternatives financing structures (equity, debt, and 'average' financing). The selection of asset types is determined by information available in two previous studies: one by Hanappi (2018), which presents calculations on METR for 10 asset types in 36 developed and developing countries; and the other by the World Bank (2015a), which focuses on the SA tax system. Information of 9 of our 12 asset types is based on the Hanappi study and three on the World Bank study. For more details, see Appendix B.

The values of economic parameters used in the calculations are organized into three distinct scenarios summarized in Table 4. The real interest rate is 5 per cent in all scenarios. We assume three different inflation levels: 3, 5, and 7 per cent. As the nominal interest rate is the sum of the rates of real interest and inflation, it varies correspondingly between the scenarios. The weight of debt financing (debt–asset ratio) is assumed to be 65 per cent in all scenarios.[14] The rates of economic depreciation of each asset type used in the calculations are given in Appendix B.

[14] This estimate follows that used by the World Bank (2015a: 27) as it reflects the debt–asset ratio of all industries in South Africa in 2013.

Table 3: Cost of capital and METR in South Africa for 12 asset types and three financing structures (real interest rate 5 per cent, inflation 5 per cent)

Asset type	Cost of capital (per cent)			METR (per cent)		
	Equity	Debt	Average	Equity	Debt	Average
A1. Industrial building	5.6	1.7	3.1	10	–195	–123
A2. Office building	6.7	2.8	4.1	25	–80	–43
A3. Manufacturing machinery	6.1	2.2	3.6	18	–126	–75
A4. Power generation plant	5.5	1.6	3.0	9	–209	–132
A5. Mining plant[a]	5.9	2.0	3.4	15	–147	–90
A6. Computers	8.0	4.1	5.5	38	–21	–1
A7. Software	9.0	5.1	6.5	45	2	17
A8. Inventory	8.9	5.0	6.4	44	0	15
A9. Motor vehicles	7.8	3.9	5.3	36	–27	–5
A10. Service sector machinery	7.3	3.4	4.7	31	–48	–21
A11. SME machinery	5.4	2.8	3.6	7	–84	–52
A12. SME buildings	5.2	2.6	3.5	4	–97	–62

Note: [a] METR for mining can also be affected by the royalty regime. South Africa has a mining royalty regime that is triggered by the transfer of mineral resources. This regime was introduced in 2010 by the Mineral and Petroleum Resources Royalty Act No. 28 of 2008 and regulates the imposition and calculation of mining royalties. Calculation of the rate is based on a formula that differs for refined and unrefined minerals

Source: authors' calculations based on data from Hanappi (2018) and the World Bank (2015a).

Table 4: Economic parameters

	Scenario		
	I	II	II
Real interest rate (r)	5	5	5
Inflation (π)	3	5	7
Nominal interest rate (ρ, i)	8	10	12
Debt to equity ratio (β)	65 per cent	65 per cent	65 per cent

Source: authors' calculations based on data from Hanappi (2018) and the World Bank (2015a).

Table 3 reports the results for 5 per cent inflation, which is our main scenario. Calculations for other inflation levels are given in Appendix B. We observe that the METR for investment financed by equity is positive in all asset classes. However, the figures vary widely from 4 per cent for investment in buildings in the SME sector to 45 per cent for investment in computer software.

The METR of investment financed by debt, however, is negative in all but two cases. The variation is particularly large, from +2 per cent for investment in computer software to –209 per cent for investment in plants in power generation. In several cases the METR is strongly negative, reflecting that the cost of capital is much below the real rate of interest. In the case of average financing the pattern of the figures is broadly similar: the average METR is negative in all but two cases and for several asset types the figures are high in absolute terms.

The results concerning the other two inflation assumptions (3 and 7 per cent), reported in Appendix B, show that at the highest inflation assumption the METR of debt-financed investment is even lower (more negative), while the METRs of investment financed by equity are slightly higher (more positive) than under 5 per cent inflation. Hence, the gap between equity and debt financing increases with inflation. For 3 per cent inflation the picture is the opposite.

The pattern of the results can be understood using the insights presented in Section 2.1. The deductibility of nominal interest expenses draws the METR of debt-financed investment to zero or negative, depending on fiscal depreciation allowances and inflation. A high rate of depreciation compared to economic depreciation leads to a low METR, as does high inflation. A combination of both may produce very low METRs, which can be seen in Table 3. The fiscal depreciation rates deviate strongly from the rates of economic depreciation particularly in the case of manufacturing buildings, power generation plants, and mining plants. In those cases we indeed detect the most strongly negative METRs.

Inflation tends to increase the METR of equity-financed investment. High depreciation allowances work to the opposite effect. This is why we observe modest METRs in asset categories that are given generous depreciation allowances (manufacturing buildings, for example) but high in asset types with tight fiscal depreciation rules (software and computers).

Table 3 reports also the cost of capital for the 12 asset types and the three financing scenarios. The message given by these calculations does not differ from that of the METR. However, for debt-financed investment the variation in cost of capital may look more modest. This is a result produced by the definition of the METR. If the cost of capital is much lower than the real interest rate (but still positive), say 2 per cent, the tax wedge is $2 - 5 = -3$ and the METR is $-3/2 = -150$ per cent. Hence, a negative tax wedge divided by a low cost of capital produces a strongly negative METR.

Generally, the results show that, while the incentive to invest generated by SA CIT is quite strong, the corporate tax system distorts the choices of the investment type and the financing form. The tax system favours investment in SME buildings and machinery, assets in mining and power production, as well as in buildings and machinery in manufacturing. Similarly, it strongly favours financing by debt over equity. These aspects are mostly driven by the combination of full deductibility of nominal costs of debt in an environment of high inflation and generous depreciation allowances for some asset types.

The detected distortions may have implications for the performance of the economy. Studies have shown that favouring debt over equity increases the debt–assets ratios of private firms in the economy. This is likely to increase the micro-level bankruptcy risks and macro-level systemic risks (IMF 2016). Further, the observed variation in the METR across asset types suggests that the tax system distorts the allocation of resources to different types of firms and sectors. This may generate losses in production and welfare.

5 ACE tax reform in South Africa

5.1 Content

In this section, we explore the effects from the introduction of an ACE in South Africa. The revenue effects are analysed in Section 5.2 and the effects on investment and financing incentives in Section 5.3.

5.2 Revenue effects

Data

We utilize data from the SARS-NT CIT-IRP5 panel (Pieterse et al. 2018). The dataset contains firm-level data for every firm submitting a CIT return. We confine our analysis to the years 2009–

14 as earlier and later data suffer from missing observations. Table 5 shows the number of firms contained in the CIT-IRP5 panel as of November 2018.

Table 5: Coverage of the CIT-IRP5 panel

Year	# firms
2009	899,395
2010	945,087
2011	925,050
2012	900,131
2013	872,806
2014	770,971
Total	5,313,440

Source: authors' calculations based on the SARS-NT CIT-IRP5 panel.

Approach

In order to simulate the effects of the presence of an ACE, and then the interest limitation rule, we first calculate taxable income and apply the appropriate corporate tax rate—28 per cent for large firms and a graduated schedule for small business corporations, in order to find tax paid in each year.

We calculate the revenue effects of an ACE as follows, in accordance with the approach laid out in Section 2.2:

$$ACE\ base = \Delta\, ret.profits + \Delta\, share\ cap - \Delta\, invest.other\ companies \tag{5}$$

$$ACE\ base_t = ACE\ base_{t-1} + \Delta\, ret.profits + \Delta\, share\ cap - \Delta\, invest.other\ companies \tag{6}$$

$$ACE\ allowance_t = r * ACEBase_t \tag{7}$$

$$ACE\ taxable\ Y_t = original\ taxable\ Y_t - ACE\ allowance_t \tag{8}$$

$$Tax\ paid_t = ACE\ taxable\ Y_t * \tau \tag{9}$$

Equation (5) shows the calculation of the ACE 'base' in general, while equation (6) shows the specific variant estimated here. In this variant of the ACE, the 'ACE base' accumulates each year, building on the previous year. We only have six years of observations, so it is not possible to fully simulate the feature of the ACE proposed by the European Commission (2016b), whereby the ACE base would build up over 10 years, with the increase in equity financing in *t – 11* dropping off.[15]

Subscript *t* is the tax year; τ is the corporate profit tax rate of 28 per cent;[16] *r* is the interest rate, here taken by the return on the R186, the benchmark 10-year government bond. The data cover the period 2009–14, thus we simulate the ACE at the average of the R186 bond in this period.

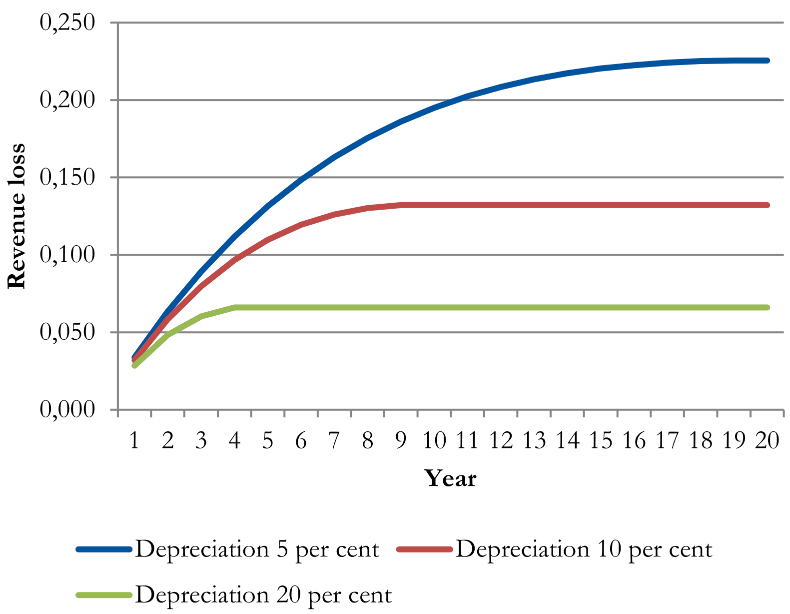
[15] Were the data to run to *t* = 11, we could fully simulate this variant. However given the shorter time frame available, we simulate a more 'general' variant of the ACE, where the base simply accumulates each year.

[16] We also apply the appropriate graduated tax schedule for those firms identifying as small businesses, as per Appendix C.

This corresponds to 8.14 per cent. We also simulate the ACE at 4 per cent, around half of the period average.

As discussed above, the ACE will, naturally, entail a revenue loss compared to the current scenario. But this takes some time to 'build up'. That is, when introduced in year 1, the ACE 'base' is quite small, but this grows over the following years. Figure 3 reports calculations of the ACE's impact on revenue over time in a fictive economy. It shows that, depending on the depreciation rate, the base can take a different number of years to grow. This figure assumes that the stock of capital is 8 in year 1, the rate of return on this capital stock is 25 per cent, and the tax rate is 28 per cent. The annual growth of profits and investment is 8 per cent. Three average straight-line depreciation rates are shown. We observe that at the highest depreciation rate (20 per cent) the steady-state level of the revenue loss is attained within six years. Given that our data cover this time frame, we can expect the results below on the size of the ACE base to be relatively in line with what theory might predict. With the mid-level depreciation rate, 75 per cent of the revenue loss is generated by the end of the sixth year and in the case of the very low average depreciation rate of 5 per cent only 55 per cent of the long-run loss level is attained in the sixth year. Thus, we can expect that most of the long-run level of revenue losses from an ACE will develop within the first 5–10 years.

Figure 3: Revenue loss from ACE as a share of CIT revenue, three scenarios



Source: authors' calculations based on the SARS-NT CIT-IRP5 panel.

Our simulations reported below are carried out on retrospective data in a static setting. Thus, they simulate what CIT revenue *would* have been, *had* the ACE been in place. At this point, no behavioural implications are considered. Obviously, these are important omissions, as the ACE represents an incentive to use equity rather than debt financing. Thus, the results below should be viewed with some caution, and plausibly taken as the lower bound of any actual effects of the presence of an ACE.

Results

Table 6 presents the results. We see that in the presence of an ACE the revenue loss accumulates quite quickly when *r* is set at the market rate of interest in South Africa—which is quite high at an average of 8.14 per cent over the period in question. These results are quite modest in comparison to some of those found in other studies (e.g. Finke et al. 2014; Zangari 2014), but somewhat better in line with those of the IMF (2016). The fairly small relative loss might be a reflection of the high debt bias in South Africa, and the fact that not many firms are using equity financing. Indeed, calculations showed that only around 31,500 firms were benefitting from the presence of an ACE in each year simulated. Again, however, it is highly likely that even with this low number of firms making use of the ACE, incentive effects created by the ACE might mean that, in reality, the losses to CIT revenue would be somewhat higher.

Table 6: Revenue effects of an ACE: percentage change in CIT revenue

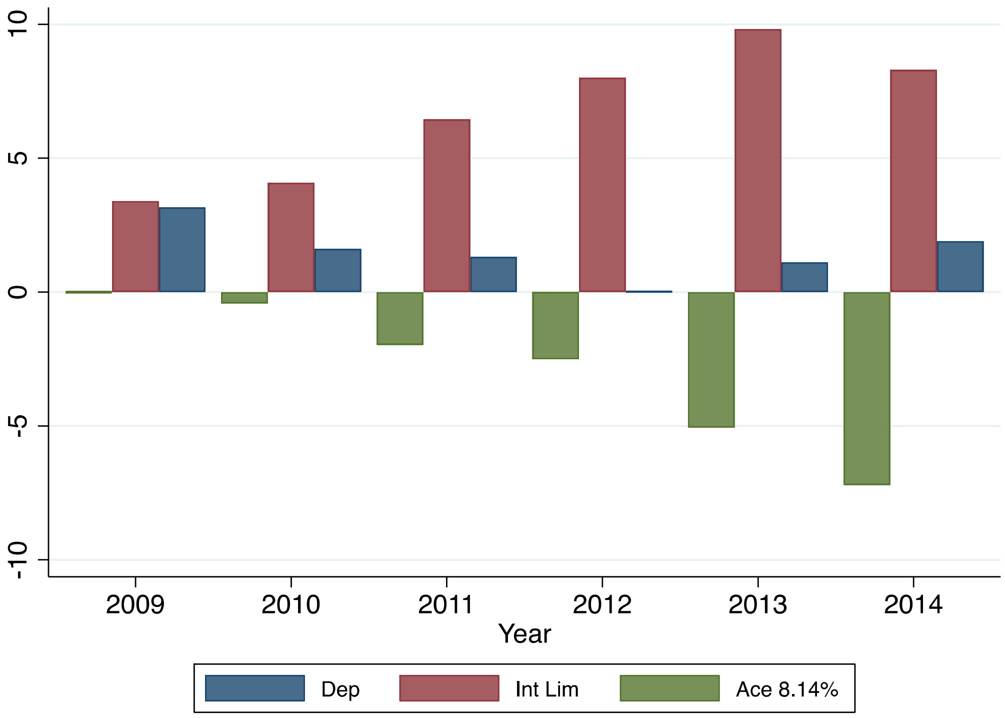
Year	*r* = 8.14 per cent	*r* = 4 per cent
2009	–0.01	–0.00
2010	–0.43	–0.22
2011	–1.98	–1.01
2012	–2.51	–1.30
2013	–5.06	–2.73
2014	–7.21	–3.78

Source: authors' calculations based on the SARS-NT CIT-IRP5 panel.

The potential revenue losses could be offset by the introduction of a BEPS-style interest limitation rule, and an alignment of accelerated depreciation schedules in mining with those in manufacturing.[17] Figure 4 shows the effects on CIT revenue of these 'combined reforms', and, at least in a static setting, it would seem that it might be possible to offset the revenue losses from an ACE by compensating with some other reforms. Our results show that in a static setting, introducing a rule limiting net interest expense to 25 per cent of EBITDA (earnings before interest taxation depreciation and amortization) would raise revenues by 3–8 per cent of CIT. Similarly, an alignment of depreciation rules would raise CIT revenues by around 3 per cent in the first year and around 1 per cent per year thereafter.

[17] A discussion on potential 'solutions' to the revenue loss is captured in the McNabb et al. (forthcoming) paper, which explores in detail implications of a 'package' of reforms to the CIT system that might be implemented in a revenue-neutral way.

Figure 4: Combined effects of an ACE, interest limitation rule and alignment of depreciation schedules: percentage change in CIT revenue



Source: authors' calculations based on the SARS-NT CIT-IRP5 panel.

5.3 Effects of ACE reforms on incentives

This section assesses how the ACE reform would affect the investment incentives in South Africa. The question is to what extent it would reduce the distortionary effects on the form of finance (debt bias) and the investment allocation we detected in Section 4. The analysis focuses on two different reforms: one in which the ACE rate (*a*) corresponds to the market rate of interest, $a = \rho$; and another in which the allowance is calculated at the half rate, $a = 0.5 \times \rho$. An important assumption of the analysis is that the ACE base is the accounting stock of capital after fiscal depreciation minus debt in the company's accounts. The expression for the cost of capital in the presence of an ACE allowance is given in Appendix A.

Table 7 reports the results for the first ACE reform in which the ACE rate equals the interest rate. For all 11 asset types that depreciate gradually over the useful life of the asset, the cost of capital equals the real interest rate (5 per cent) and the METR is zero for both debt and equity. Instead, for inventory investment the cost of capital is 6.9 per cent and the METR is 28 per cent. In Appendix B we report results for the other inflation levels (3 and 7 per cent). They show that for depreciable assets the results do not depend on the level of inflation, while for inventory investment the indicator values increase with inflation.

Table 7: Cost of capital and METR under ACE tax; the ACE rate corresponds to the interest rate (real interest rate 5 per cent, inflation 5 per cent)

Asset type	Cost of capital (per cent)			METR (per cent)		
	Equity	Debt	Average	Equity	Debt	Average
A8. Inventory investment	6.9	6.9	6.9	28	28	28
All other asset types (A1–A7 and A9–A12)	5	5	5	0	0	0

Source: authors' calculations based on the SARS-NT CIT-IRP5 panel.

Hence, the allowance abolishes the distortions of the current system in all but one case. In the following we elaborate on the results. In Section 2.2 we observed that in a correctly specified ACE system, in which the ACE rate equals the rate of interest, the PV of all capital allowances (ACE allowance and depreciation allowances) corresponds to 1 ($A = 1$). Inserting this into equation (2) and assuming the debt share is zero ($\beta = 0$), we see that the cost of capital of an equity-financed investment corresponds to the real rate of interest. This implies a zero METR. The indication is that the capital allowances, the PV of which corresponds to the initial investment outlay, create a tax saving that exactly corresponds to taxes on the marginal return earned on the investment project. Therefore, the equity-financed marginal project is effectively tax exempt.

However, it is not as obvious that introducing an ACE will abolish the distortions when debt is the financing source. After all, the ACE is calculated based on the accounting value of equity. The slightly surprising result can be given as follows.[18] The ACE (tax saving) is calculated as $ACE = a(K - B) = aK - aB$, where K is the book value of assets and B is debt. Consider now implications of an (*ceteris paribus*) increase in debt financing, ΔB. This has two distinct effects on taxable income: an increase in deductible interest costs $i\Delta B$ and a reduction in ACE $a\Delta B$, the net effect on taxable income being:

$$-(i - a)B = 0, \text{ if } a = i.$$

Hence, the ACE exactly eliminates the impact of interest deduction on taxes. At the same time, the problematic effects of interest deduction in an inflationary environment disappear. Hence a properly specified ACE abolishes both key sources of distortions of a standard corporate tax system. The first arises from the deductibility of nominal interest expenses and the other from varying depreciation allowances.

Let us return to the results concerning inventory investment in Table 7. The METR is observed to be positive. This is because South Africa applies a first in–first out (FIFO) system in inventory accounting, implying that the cost of stock that will be deducted when final goods are sold is the historical acquisition cost. In an inflationary environment, this leads to an additional tax of amount $\tau\pi$ each year. The ACE does not abolish this distortionary element.

Table 8 reports results for the alternative ACE reform, where the allowance rate corresponds to half of the real interest rate. The results imply that the distortions generated by SA CIT would become much smaller following such a reform compared to the current tax system, but would not disappear. The reform would diminish both the debt bias and the variation of METR across assets.

[18] A fuller treatment is given in Appendix A.

Table 8: Cost of capital and METR under the ACE tax; the ACE rate corresponds to half of the interest rate (real interest rate 5 per cent, inflation 5 per cent)

Asset type	Cost of capital (per cent)			METR (per cent)		
	Equity	Debt	Average	Equity	Debt	Average
A1. Industrial building	5.3	3.4	4.0	6	–49	–30
A2. Office building	5.8	3.9	4.6	14	–29	–14
A3. Manufacturing machinery	5.6	3.6	4.3	10	–39	–22
A4. Power generation plant	5.3	3.3	4.0	5	–51	–31
A5. Mining plant	5.5	3.5	4.2	8	–42	–25
A6. Computers	6.5	4.6	5.2	23	–10	2
A7. Software	7.0	5.0	5.7	29	1	11
A8. Inventory	7.9	6.0	6.7	37	16	23
A9. Motor vehicles	6.4	4.5	5.2	22	–12	0
A10. Service sector machinery	6.1	4.2	4.9	18	–19	–6
A11. SME machinery	5.2	3.9	4.3	4	–30	–18
A12. SME buildings	5.1	3.8	4.2	2	–33	–21

Source: authors' calculations based on the SARS-NT CIT-IRP5 panel.

The results in Table 8 suggest that the first reform proposal abolishes the distortions on several margins. This result should not, however, be taken too literally. It relies on the assumption that the ACE rate can be set to exactly equal the interest rates on debt and equity faced by the representative company, $a = \rho = i$. However, in practice the relevant interest rates probably vary across companies. Therefore, a single ACE rate cannot abolish distortions for all firms. However, the results still suggest that the first reform proposal is able to improve significantly the neutrality properties of the SA corporate tax system.

6 Conclusions

This study has sought to highlight the issues of debt bias and neutrality in the SA CIT system through calculating the cost of capital and METRs for a number of different assets and financing types. At present, there exist significant incentives to use debt-financed investment, which can cause distortions. We propose the introduction of an ACE in order to mitigate this issue, and show that under such a system, the METR is equalized across different financing types. However, this entails a significant revenue loss: our simulations suggest that CIT revenues would fall by around 7 per cent after approximately six years, and this might well grow larger in future years due to both the cumulative nature of the proposed ACE and incentive effects to utilize equity financing—not modelled in the current study. At the same time, some of this loss might be offset due to relatively lower incentives to use debt financing, resulting in lower costs from interest deductions or potentially from increases in investment outright. Similarly, a share of the revenue loss could possibly be covered by reforms that broaden the base of corporate tax.

Hence, while the ACE goes a long way towards correcting the debt bias and improving the neutrality with respect to investment decisions, it involves the problem of uncertain revenue effects. The latter aspect is probably less of a problem in a surplus situation, but might be accentuated when the government is struggling to meet its spending needs and bolster tax revenues.

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Appendix A: calculating the cost of capital

This appendix presents the model for calculating the cost of capital in a standard corporate tax system and in an ACE system.[19]

Consider an investment project, the initial cost of which is one unit. The project yields a gross return R at the time investment is made. The asset depreciates at the real exponential rate δ. So the real value of the asset at time t is $e^{-\delta t}$. Inflation at rate π increases the return R over time. Combining these two effects, the nominal value of the return at time t can be written as $Re^{\pi t}e^{-\delta t} = Re^{-(\delta-\pi)t}$.

A.1 Standard corporate tax system

Assume that a share β of the project is financed by debt. Assume also that the firm keeps the ratio of debt to nominal value of the asset constant over the life of the asset. Therefore, the project's debt at time t will be $\beta e^{-(\delta-\pi)t}$, where $\delta - \pi$ is the nominal rate of economic depreciation. Now we can write the tax deductible interest expense on debt as follows: $i\beta e^{-(\delta-\pi)t}$.

The firm may also deduct fiscal depreciation at a constant rate φ, which may deviate from the rate of economic depreciation (δ). The book value of the investment (after fiscal depreciation) at time t is $e^{-\varphi t}$, and the amount deducted $\varphi e^{-\varphi t}$.

The firm pays taxes on the gross return minus deductible interest expenses and fiscal depreciation. The firm's tax bill at time t is

$$T = \tau[(R - i\beta)e^{-(\delta-\pi)t} - \varphi e^{-\varphi t}].$$

Now we can write the discounted value of the asset at time zero as follows:

$$V(0) = \int_0^\infty [(1-\tau)R + \tau i\beta)e^{-(\delta-\pi)t} + \tau\varphi e^{-\varphi t}]e^{-\rho t}dt,$$

where ρ is the firm's nominal discount rate.

For a marginal investment it must hold that the value of the project V equals the initial investment cost. Hence the marginal condition is simply $V = 1$.

Solving this to R and denoting the rate of return after economic depreciation by p, yields

$$p = R - \delta = \frac{(1-\tau A)(\rho+\delta-\pi)-\tau\beta i}{1-\tau} - \delta, \qquad \text{(A1.1)}$$

where $A = \dfrac{\varphi}{\rho+\varphi}$ denotes the PV of fiscal depreciation allowances.

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[19] The model follows King and Fullerton (1984) and Sorensen (2008).

A.2 Inventory investment

Consider a one-unit investment in inventory. This investment will be deducted at the time the goods are sold (hence $\delta = \varphi = 0$). During the period the goods are in stock, the investment's value grows at the common rate of inflation, π. At time *t* the value of the investment is $e^{\pi t}$ and the size of the change in value is $\pi e^{\pi t}$. Since the historical cost will be deducted, the firm pays a tax on the inflationary value increase approximated by $\tau\pi e^{\pi t}$. The value of the project at time zero is:

$$V(0) = \int_0^{\infty} [(1-\tau)R + \tau i\beta) - \tau\pi] e^{-(\rho-\pi)t} dt.$$

Solving the marginal condition $V = 1$, we obtain:

$$p = \frac{\rho - \pi - \tau\beta i + \tau\pi}{1-\tau}.$$

A.3 ACE tax system

The ACE base is book equity and it (at time *t*) is calculated by deducting the value of debt, $\beta e^{-(\delta-\pi)t}$, from the book value of the investment (after fiscal depreciation), $e^{-\varphi t}$. Hence the allowance at time *t* is $a(e^{-\varphi t} - \beta e^{-(\delta-\pi)t})$. The value of the project can be written as:

$$V(0) = \int_0^{\infty} [(1-\tau)R + \tau i\beta) e^{-(\delta-\pi)t} + \tau\varphi e^{-\varphi t} + \tau a(e^{-\varphi t} - \beta e^{-(\delta-\pi)t})] e^{-\rho t} dt,$$

$$= \int_0^{\infty} [(1-\tau)R + \tau(i-a)\beta) e^{-(\delta-\pi)t} + \tau(\varphi + a) e^{-\varphi t}] e^{-\rho t} dt.$$

Inserting this into the marginal condition and solving gives:

$$p^{ACE} = R - \delta = \frac{(1-\tau A^{ACE})(\rho+\delta-\pi) - \tau\beta(i-a)}{1-\tau} - \delta,$$

where $A^{ACE} = \dfrac{a+\varphi}{\rho+\varphi}$.

Assume a correctly specified ACE system in which $a = \rho = i$. We obtain $A^{ACE} = 1$ and $\tau\beta(i-a) = 0$, and further that the cost of capital corresponds to the real interest rate (on equity), $p^{ACE} = \rho - \pi$. Hence, this neutrality result is produced by two effects: (1) due to the ACE the capital allowance corresponds to the initial investment outlay (=1)—this is known to produce investment neutrality (Devereux and Freeman 1991); and (2) the definition of the ACE base includes the deduction of book debt—this and the assumption $a = i$ wash out the effect of the deductibility of the nominal cost of debt on the cost of capital.

Appendix B: parameter values and calculation results

B.1 Parameter values

This section reports the assumptions and parameter values used in the calculations. The calculations use tax parameters effective in 2016.

There are three scenarios with different inflation rates, 3, 5, and 7 per cent, and nominal interest rates, 8, 10, and 12 per cent. The real interest rate is 5 per cent in all scenarios.

Table B.1 Economic parameters

	Scenario		
	I	II	II
Real interest rate (*r*)	5	5	5
Inflation (*p*)	3	5	7
Nominal interest rate (*r*, *i*)	8	10	12
Average debt to equity ratio (*b*)	65 per cent	65 per cent	65 per cent

Source: authors' creation.

The rates of economic depreciation are given in Table B.3.

Table B.2: Tax parameters (2016)

Corporate tax rate (*t*)	28 per cent
SME corporate tax rate (t^{SME})	21 per cent
Inventory accounting	FIFO

Source: authors' creation.

Fiscal depreciation rates are given in Table B.3.

Table B.3: Rates of economic depreciation and fiscal depreciation

Asset type		Economic depreciation (DB) (per cent)	Fiscal depreciation (SL), current rules (per cent)
A1	Industrial building	3.1	40/20*
A2	Office building	2.3	5
A3	Manufacturing machine	10.4	40/20*
A4	Power generation plant	2.0	20
A5	Mining plant	20.9	100
A6	Computers	40.1	33,3
A7	Software	55.0	33,3
A8	Inventory	0	0
A9	Motor vehicles (services)	25.0	20
A10	Machinery (services)	19.0	20
A11	SME machinery and equipment	10.4	100
A12	SME buildings	3.1	100

Note: * The rate of first-year depreciation is 40 per cent, and the rates for the following three years are 20 per cent.

Source: authors' creation.

For asset types A1–A4 and A6–A7 we use the economic depreciation rates presented by Hanappi (2018). For A5, A9, and A10 we use the values given by the World Bank (2015a; table 15 for mining and table 20 for services). For A11 and A12 we use the same rates as for manufacturing.

The rates of both economic and fiscal depreciation of inventory investment are zero because the acquisition cost of inventory does not generally depreciate.

We calculate the cost of capital separately for equity-financed and debt-financed investments. The debt case is obtained by setting $b = 1$ and equity case $b = 0$. The average cost of capital and METR of an asset type is calculated by using the weight 0.65 for debt and the weight 0.35 for equity (World Bank 2015a: 27).

B.2 Calculation results

Table B.4 Cost of capital by asset type, current tax system (real interest rate 5 per cent, inflation 3, 5, or 7 per cent)

Asset type	Inflation 3 per cent			Inflation 5 per cent			Inflation 7 per cent		
	Equity	Debt	Average	Equity	Debt	Average	Equity	Debt	Average
A1. Industrial building	0.055	0.024	0.035	0.056	0.017	0.031	0.057	0.010	0.026
A2. Office building	0.065	0.034	0.045	0.067	0.028	0.041	0.068	0.022	0.038
A3. Manufacturing machinery	0.059	0.028	0.039	0.061	0.022	0.036	0.063	0.016	0.033
A4. Power generation plant	0.054	0.023	0.034	0.055	0.016	0.030	0.056	0.009	0.026
A5. Mining plant	0.057	0.026	0.037	0.059	0.020	0.034	0.061	0.022	0.035
A6. Computers	0.075	0.044	0.055	0.080	0.041	0.055	0.085	0.038	0.055
A7. Software	0.083	0.052	0.063	0.090	0.051	0.065	0.097	0.050	0.066
A8. Inventory	0.081	0.050	0.061	0.089	0.050	0.064	0.097	0.050	0.066
A9. Motor vehicles	0.074	0.042	0.053	0.078	0.039	0.053	0.083	0.036	0.052
A10. Service machinery	0.069	0.038	0.049	0.073	0.034	0.047	0.076	0.029	0.046
A11. SME machinery	0.053	0.032	0.039	0.054	0.027	0.036	0.054	0.028	0.037
A12. SME buildings	0.052	0.030	0.038	0.052	0.025	0.035	0.052	0.026	0.035

Source: authors' creation.

Table B.5: METR by asset type, current tax system, per cent (real interest rate 5 per cent, inflation 3, 5, or 7 per cent)

Asset type	Inflation 3 per cent			Inflation 5 per cent			Inflation 7 per cent		
	Equity	Debt	Average	Equity	Debt	Average	Equity	Debt	Average
A1. Industrial building	9	–111	–69	10	–195	–123	12	–395	–252
A2. Office building	23	–48	–24	25	–80	–43	27	–132	–77
A3. Manufacturing machinery	15	–78	–46	18	–126	–75	20	–209	–129
A4. Power generation plant	8	–116	–73	9	–209	–132	11	–441	–283
A5. Mining plant	13	–90	–54	15	–147	–90	18	–128	–77
A6. Computers	33	–14	2	38	–21	–1	41	–30	–5
A7. Software	40	4	16	45	2	17	48	0	17
A8. Inventory	38	0	13	44	0	15	48	0	17
A9. Motor vehicles	32	–18	0	36	–27	–5	39	–39	–12
A10. Service machinery	27	–33	–12	31	–48	–21	34	–70	–34
A11. SME machinery	6	–57	–35	7	–84	–52	8	–80	–49
A12. SME buildings	3	–65	–41	4	–97	–62	4	–94	–60

Source: authors' creation.

Table B.6: METR by asset type, ACE reform, $a = \rho$, per cent (real interest rate 5 per cent, inflation 3, 5, or 7 per cent)

Asset type	Inflation 3 per cent			Inflation 5 per cent			Inflation 7 per cent		
	Equity	Debt	Average	Equity	Debt	Average	Equity	Debt	Average
A1. Industrial building	0	0	0	0	0	0	0	0	0
A2. Office building	0	0	0	0	0	0	0	0	0
A3. Manufacturing machinery	0	0	0	0	0	0	0	0	0
A4. Power generation plant	0	0	0	0	0	0	0	0	0
A5. Mining plant	0	0	0	0	0	0	0	0	0
A6. Computers	0	0	0	0	0	0	0	0	0
A7. Software	0	0	0	0	0	0	0	0	0
A8. Inventory	19	19	19	28	28	28	35	35	35
A9. Motor vehicles	0	0	0	0	0	0	0	0	0
A10. Service machinery	0	0	0	0	0	0	0	0	0
A11. SME machinery	0	0	0	0	0	0	0	0	0
A12. SME buildings	0	0	0	0	0	0	0	0	0

Source: authors' creation.

Table B.7: METR by asset type, ACE reform, $\boldsymbol{a} = 0.5 * \boldsymbol{\rho}$, per cent (real interest rate 5 per cent, inflation 3, 5, or 7 per cent)

Asset type	Inflation 3 per cent			Inflation 5 per cent			Inflation 7 per cent		
	Equity	Debt	Average	Equity	Debt	Average	Equity	Debt	Average
A1. Industrial building	9	–111	–69	10	–195	–123	12	–395	–252
A2. Office building	23	–48	–24	25	–80	–43	27	–132	–77
A3. Manufacturing machinery	15	–78	–46	18	–126	–75	20	–209	–129
A4. Power generation plant	8	–116	–73	9	–209	–132	11	–441	–283
A5. Mining plant	13	–90	–54	15	–147	–90	18	–128	–77
A6. Computers	33	–14	2	38	–21	–1	41	–30	–5
A7. Software	40	4	16	45	2	17	48	0	17
A8. Inventory	38	0	13	44	0	15	48	0	17
A9. Motor vehicles	32	–18	0	36	–27	–5	39	–39	–12
A10. Service machinery	27	–33	–12	31	–48	–21	34	–70	–34
A11. SME machinery	6	–57	–35	7	–84	–52	8	–80	–49
A12. SME buildings	3	–65	–41	4	–97	–62	4	–94	–60

Source: authors' creation.

Appendix C: **small business tax schedules, 2009–14**

Taxable income	Tax rate
2013–14	
R0–R67,111	No income tax payable
R67,112–R365,000	7 per cent of taxable income above R67,111
R365,001–R550,000	R20,852 + 21 per cent of taxable income above R365,000
Above R550,000	R59,702 + 28 per cent of taxable income above R550,000
2012–13	
R0–R63,556	No income tax payable
R63,557–R350,000	7 per cent of taxable income above R63,557
Above R350,000	R20,051 + 28 per cent of taxable income above R350,000
2011–12	
R0–R59,750	No income tax payable
R59,751–R300,000	10 per cent of taxable income above R59,750
Above R300,000	R24,025 + 28 per cent of taxable income above R300,000
2010–11	
R0–R57,000	No income tax payable
R57,001–R300,000	10 per cent of taxable income above R57,000
Above R300,000	R24,300 + 28 per cent of taxable income above R300,000
2009–10	
R0–R54,200	No income tax payable
R54,201–R300,000	10 per cent of taxable income above R54,200
Above R300,000	R24,580 + 28 per cent of taxable income above R300,000
2008–09	
R0–R46,000	No income tax payable
R46,001–R300,000	10 per cent of taxable income above R46,000
Above R300,000	28 per cent of taxable income above R300,000