How Responsive is Capital Formation to its User Cost? An Exploration of Corporate Tax Effects

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How Responsive is Capital Formation to its User Cost? An Exploration of Corporate Tax Effects[#]

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Abstract

The responsiveness of business investment spending to price changes is central in economic analysis. Despite the key role played by the user cost of capital in economic analysis, there is less supporting evidence for the existence of a substantial user cost elasticity.

This study investigates the empirical user cost of capital with specific focus on the contribution that corporate taxes has on the price elasticity of investment in the South African economy. Making use of a disaggregated data set of corporate tax revenues we are able to get better understanding of how firms perceive their tax burden. Using vector auto regression and cointegration techniques we estimate the long run user cost elasticity to be –0.18%. Average total elasticity of companies with respect to effective corporate taxes is estimated at 0.09% implying that taxes plays a very important role in the price determination of capital. We have also shown that additional taxes placed on companies like secondary taxes, are perceived in a different light than normal profit taxes inducing more and bigger changes investment behaviour.

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1. INTRODUCTION

The responsiveness of business investment spending to price changes is central in economic analysis. If capital accumulation is substantially influenced by its user cost it generates possibilities for fiscal policy and the transmission mechanism of monetary policy to influence firm investment behaviour. In particular, user cost of capital, which combines interest, tax and depreciation rates with relative prices, is a key parameter in analysing fiscal policy and assessing the quantitative effects of policy changes.

Despite the key role played by the user cost of capital in economic analysis, there is less supporting evidence for the existence of a substantial user cost elasticity. Blanchard (1986: 153) writes: "…it is well known that to get the user cost to appear at all in the investment equation, one has to display more than the usual amount of econometric ingenuity." The question therefore is why we observe this inconsistency between the theoretical assumption of a high user cost of capital elasticity and empirical findings that have difficulty in verifying its existence? Is the user cost of capital much lower than assumed due to limited substitutability of production factors, or do aggregate investment studies have estimation problems like simultaneity that may be better addressed by micro data? Indeed, many micro data studies have been able to verify the existence of a significant user cost of capital in investment spending.

To show how the user cost of capital and in particular taxes on corporations influence investment decision we use the arguments presented by Hsieh and Parker (2002) and Abel and Bernanke (2001) and adjust it to represent our situation. Although the analysis is very basic it serves the purpose of illustrating the basic theoretical arguments behind the investment tax relationship. We start our discussion with an intuitive approach where after we use more formal measurements to derive our estimation equation in the next section.

2. BASIC THEORY AND BACKGROUND

Without loss of generality, assume that there are two firms in the market. Firm H, has a highly productive investment opportunity while firm L has not. Therefore the marginal product of capital in the future for firm H (MPK^H) will be higher than the marginal product of capital for firm L (MPK^L). This would imply that the MPK curve of firm H will be above that of firm L as depicted in figure 1.

In a world with perfect capital markets a firm will set the marginal product of capital equal to its user cost of capital (UC), and allowing for taxes the user cost of capital will be adjusted to take into consideration the fact that taxes reduce the MPK. Therefore in a first best world the level of capital chosen would be K^{H*} and K^{L*} and gross investment would be equal to $K^{H*} + K^{L*} - 2(1-\delta)$ where δ is the depreciation rate of capital. Adjusting for the effects of taxes the chosen level of capital would be K_a^{H*} and K_a^{L*} with $K_a^{H*} + K_a^{L*} < K^{H*} + K^{L*}$.

To show that taxes have a different impact across firms let us assume that both firms are liquidity constraint to some degree but that firm H still holds its competitive advantage over firm L in that it has more productive opportunities. Since both firms are liquidity constraint they will have to use some of their after tax profits to finance their investments.

Figure 1. Investment decisions by firms

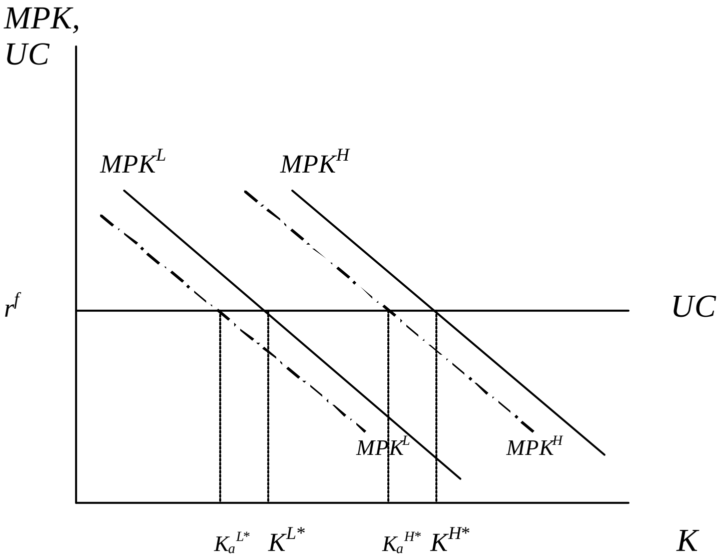
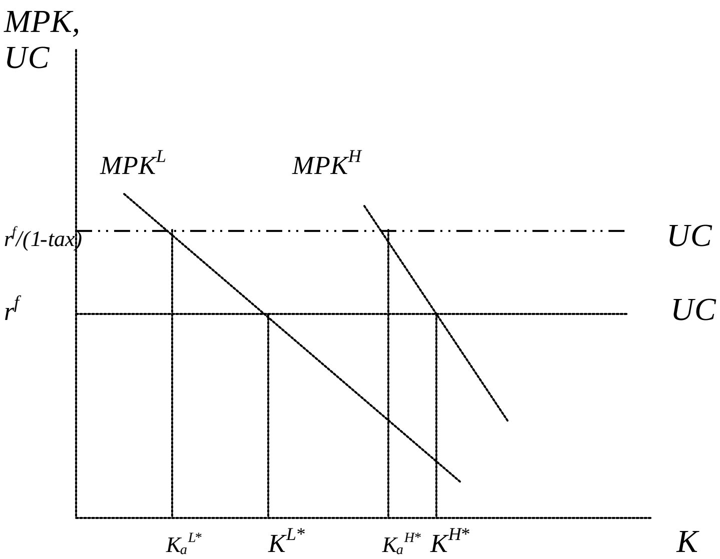


Figure 2. Investment decisions and Taxes for different firms



Therefore, the MPK curve will become the sum of two components, the marginal product of capital of external funds plus the marginal product of capital of internal funds i.e., for firm H, MPK= $\beta MPK_E^H + (1-\beta) MPK_I^H$ where E and I represents external and internal fund marginal product and β is a scale coefficient which shows the weights of internal and external funds. The fact that firm L has less productive resources will result in a different shape of the MPK^L curve. In particular, L will face a flatter MPK curve, indicating that firm L will need to invest more to obtain the same return from capital than firm K. This situation is depicted in figure 2.

When corporate taxes are introduced, the after-tax user cost of capital increases to UC/(1-tax), which shifts the user cost of capital curve upwards. (This is exactly the same as decreasing the MPK curve as above, but adjusting the rate of return simplifies the illustration). The new equilibrium values of capital will be K_{a2}^{H*} and K_{a2}^{L*}. The change in the level of taxes clearly shows that the firms do not respond uniformly to tax policy and that taxes have differential impacts on investment decisions. However, the introduction of taxes will decrease the optimal level of capital and have a negative effect on investment regardless of these differential impacts.

3. LITERATURE REVIEW

Although the literature is very broad on the role that taxes play in corporate investment behaviour we aimed at presenting some findings from studies that is relevant for our focus but comprise as wide as possible range of related arguments. While the majority of the studies on the tax and investment relationship is found in the public economics field these studies are based on micro economic principles and is more often than not seen as an extension of micro economic theory. It is therefore not surprising that the applied economic researcher will be shy to engage in a study, which looks in principle like a mathematical exercise. However, if one is able to look beyond the (very important) mathematical studies of public economic theory you will be surprise how much empirical application possibilities lies within this spectrum. The following findings is from a very mathematical and abstract studies, but is never the less very insightful in giving us some background to the corporate tax-investment field.

Goolsbee (2004) showed that a tax policy toward investment, by changing the relative prices of capital varieties can have a direct effect on the quality and composition of capital goods that a firm purchase. Firms significantly shift investment towards higher quality varieties when they receive investment subsidies. Aggregating data from the American Current Industrial Reports Goolsbee (2004) shows that the entire increase in investment caused by tax subsidies comes from an increase in quality of machinery and not the number of machines. Their work therefore places a question mark on the relevance of investment tax expenditures aimed at increasing the size of the capital stock in a country.

Mintz and Smart (2004) used sub national income taxation data for Canadian provinces and showed that differential corporate income taxation increase the mobility of business investment. When firms may costlessly shift income between jurisdictions through financial transactions, real investment choices of firms and the relationship with the tax policy environment of governments are changed. Income shifting makes the location of real investment less responsive to tax rate differentials, even as taxable income becomes more elastic with respect to tax rates. Their results have some very important implications. Even though income shifting may reduce revenue collections in high tax jurisdictions, it may have positive and offsetting effects on real investment, which in itself may be more attractive to government.

A very important contribution made toward corporate investment and the user cost of capital relationship has been the paper by Chirinko, Fazzari, and Meyer (1999). While most studies use aggregate data their study was based on a micro data set of 4095 firms from all sectors of the economy for a time period of 10 years giving more insight into firm investment behaviour. Their estimated user cost of capital elasticity of –0.25 shows that an increase in the user cost of capital will indeed reduce capital formation. Although their results were based on non-structural analysis this estimate is substantially lower than the value of unity frequently assumed in the applied research literature. This result indicates that price incentives through the effects of taxes have quantitatively smaller impacts on investment than many economists assume. Their concluding remark summarises most of their findings: "There may be good reasons for supporting these (investment incentive) tax policies, and thus for shifting the burden of taxation away from upper-income taxpayers. But a substantial increase in the capital stock is not one of them." (Chirinko, Fazzari, and Meyer (1999): 76).

Firms will also change their investment behaviour in the light of expected tax reform. Alvarez, Kanniainen and Sodersten (1998) established the existence of investment spurts prior to the implementation of tax reform. Making use of a dynamic stochastic adjustment model of firm behaviour they show that the expectation of a future tax cut lead to an acceleration of optimal investment, while the expectation of a reduction in the tax base has the opposite effect. The results supports the views that anticipated reforms, which have significant incentives effects, may give rise to undesirable fluctuations in investment that is unsustainable in the long run. Their results places doubt on the effectiveness of tax policy reforms aimed at sustainable investment growth.

Hasset and Hubbard (1997) concluded that recent studies in the time period indicated that the elasticity of investment to its user cost ranged between -0.5 and –1.0, much higher than previous studies. Although not explicitly estimated they argued that these results would indicate some substantial influence of taxes on investment behaviour. However, they caution that the effect of taxes will depend on the precise specification of the user cost of capital and the relative weight placed on taxes in the user cost specification.

Even in developing countries the elasticity of investment to its user cost and the effectiveness of tax incentives to increase capital and foreign direct investment has been questioned. Focussing on developing countries Zee *et al*. (2002) summarises their tax incentives and investment literature review by stating that: "The main message of this research is that tax incentives can stimulate investment, but that a country's overall economic characteristics may be more important for success or failure….." (Zee *et al*. (2002):1508). Much earlier Tanzi and Shome (1992) and an OECD (1995) study has also shown the relative unimportance of tax incentive compared to the overall economic conditions. After consulting with the private sector it was apparent that tax incentives are unlikely to significantly affect investment decisions and at most may affect the decision of location of investment within a region if other economic factors are satisfactory. Estache and Gaspar (1995) also showed that investment incentives through reducing the marginal effective tax rate of companies has only lead to substantial revenue losses and increase tax distortions compared to the small increase in investment in Brazil.

The review has indicated that various studies have been done in an effort to capture the tax-investment relationship through the effects of corporate taxes. What is noticeable is the fact that there is no consensus on the magnitude of the effect of the price of capital and/or the corporate tax burden. For this reason our study focus on the effects of taxes through the user cost of capital with the objective to give more light on this issue in the South African economy. In the next section we provide a more formal representation of our model specification.

4. THEORETICAL MODEL SPECIFICATION

From the analysis in section 2 it is clear that the formulation of an investment function will fundamentally rest on the relationship between the marginal product of capital and the user cost of capital. When the marginal product of capital (adjusted for taxes) is higher than the user cost of capital (adjusted for taxes) firms will invest.

From a micro economic view the firm would like to maximize its expected present value of profits by choosing the optimal level of output subject to a specific cost level. More formally the profit-maximizing firm maximizes equation 1 with respect to capital (K) and labour (L).

$$Max\ f(K,L) = \int \left[p_t Y(K_t, L_t) - w_t L_t - v_t \left(K_t^{'} + dK_t \right) \right] e^{-rt}.dt \qquad (1)$$

where e^{-rt} is the discount factor, r the rate of discount, v the cost of capital, K' net investment, d the rate of depreciation of capital, w the wage rate and p is the price of output so that pY gives us total revenue. Although intertemporal optimisation through the Euler equations will yield similar results as in the static case, the interpretation requires net present values. For example, in the static case, optimality is achieved where the value marginal product of capital is equal to the marginal cost of capital, i.e., $VMP_K=UC$. However, in the dynamic case, it is the net present value of the value marginal product of capital, which must be equated to the net present cost of capital. The trade-off between investing in capital and investing in labour is given between the relative price ratios (*r/w*) to marginal product (*MPK/MPL*) ratios. If labour were more productive than capital relative to its price, firms would substitute away from capital and into labour.

Following standard Neo-classical investment function specifications and other research (see Frain, *et al*. (1996), Ackerman, and Du Toit (1998) and Moolman and Du Toit (2002)) for an extensive empirical discussion on investment function estimation) the empirical model can be represented as:

$$\ln I_t = d \ln K_t^* = c + b_1 MPK_t - b_2 ucc_t + b_i Z_t \quad i = 1,...,n. \tag{2}$$

In equation (2), *I* represents investment, *MPK* is the marginal product of capital, *ucc* is the user cost of capital, and *Z* is a matrix of short and long run variables influencing investment decisions as described in our estimation section below and proposed by the following literature, Fielding (1999), Fielding (1997), Federke (2003), Mariotti (2002), Kularatne (2002), Ackerman and Du Toit (1998) and Moolman and Du Toit (2002).

From section one it follows that the effects of taxes on investment decisions are generated through the influence taxes have on the user cost of capital. The underlying user costs calculations are based on the seminal work of Hall and Jorgenson (1967) and can be represented as:

$$UCC = \left[\left(\frac{(r - p) - d}{1 - t}\right)\right] * P_{cap} \tag{3}$$

The variables in equation (3) are such that *r* is the nominal 10 year government bond rate, δ is the effective depreciation rate, τ is the effective corporate tax rate, π is the rate of inflation rate P_{cap} represents investment prices.

Changes in tax policy would therefore impact on investment by changing the user cost of capital faced by companies. By definition the effective corporate tax rate is given by equation 4.

$$effcit = \left(\frac{Corporate\,Tax\,\mathrm{Re}venue}{Corporate\,\mathrm{Pr}ofits}\right) \tag{4}$$

If we split the corporate tax revenue into direct corporate tax revenue and "secondary" tax revenue (like secondary taxes on companies and skills development levies) we will be able to differentiate between and estimate how these different tax instruments will impact on investment. The benefit of using this approach is that we are able to see how different combinations of tax policies and instruments will impact on investment dynamics. The effective tax rate of equation 4 will therefore become

$$effcit = \left(\frac{\Pr ofit\ taxes + Secondary\ Taxes}{Corporate \Pr ofits} \right) \tag{5}$$

We therefore propose to estimate a Neo-Classical investment function of the South African economy for the time period 1980-2003 with specific focus on corporate taxes and its effects on the user cost of capital and investment. We further aim to show how the effects of secondary taxes on companies is perceived in a different light than taxes on profits and how policy can be improved by adjusting the ratio between the two types of taxes.

5. DATA AND TIME SERIES CHARACTERISTICS OF VARIABLES

To estimate the investment function we employ data obtained from the South African Reserve Bank's Quarterly Bulletin. The variable list and abbreviated names as they are used in this article is shown in table A1 of appendix A. The reason for choosing the relatively short time period of 1980-2003 lies in the fact that our tax revenue data source is limited to this length. The tax revenue data is unpublished data from the Reserve Bank's database and National Treasury data sources. Although unpublished, we are still confident that the data is reliable and is the most representative tax revenue collection data on this disaggregate level. The loss of time series data points is therefore compensated for by the fact that we have more micro level tax revenue data.

When analysing the data some interesting points come to light and are worth noting. Effective company tax rate was on average at 0.34% over our sample period peaking at 49% in 1990. Investment behaviour has also been quite erratic over the last 24 years. Starting off at a high level in the beginning of 1980, investment decreased dramatically in the mid 1980's probably as a result of economic isolation. Investment growth showed a downward trend for most of the decade following 1980 and has only shown signs of strong positive growth since the return to the global economy. Marginal product of capital has also shown similar results as that of investment. Although the decrease in marginal product of capital has not been as dramatic as that of investment it has shown a constant decrease from the beginning of our sample period until the early 1990s where after it has shown some signs of constant increase until 2003. Average marginal product and marginal product growth has been 0.14 and –2% respectively, indicating that capital generated on average 14% profit per unit. The observed systematic movement between investment and the marginal product of capital gives some indication that firms behave in line with economic theory of profit maximizing behaviour.

From an econometric perspective it is important for us to familiarize ourselves with the univariate characteristics of the time series data. In particularly we should determine the order of integration of the time series so that we are able to employ the correct estimation techniques in the econometric modelling section. We do not only make use of the Augmented Dickey Fuller (ADF) test for unit root but in an effort to avoid the low power properties of the standard unit root tests we also employ the Kwaitkowski-Phillips-Schmidt-Schin (KPSS) test as well. We use the test procedure as proposed by Enders (1995: 256-257) when employing the ADF test to avoid test results based on wrong data generating processes assumptions. Our results are shown in table A2 and A3 of appendix A and indicate that all data series are non-stationary in level forms and becomes stationary only after first differences. We therefore conclude that our time series data is I(1) implying that we should employ non-stationary cointegration techniques in our estimation process.

6. ECONOMETRIC RESULTS

In this section we present our empirical estimation results of our investment function. We estimate a vector error correction model (VECM) based on the Engle-Yoo one-step cointegration procedure. Our choice of estimation procedure rests on the fact that this approach allows us to generate fundamental long run elasticities but gives scope to incorporate short run dynamics, which may have important relevance to the decisions taken by firms when they invest.

An important prerequisite to employ this VECM method is to acknowledge the number of cointegration vectors present in our estimation equation. From table 1 we see that both the trace and maximum eigenvalue tests for cointegration shows only one cointegration vector present in the system which allows us to employ the basic VECM specifications with only one error correction model.

Table 2 presents the VECM results of equation 2 with the relevant additional short run variables. The long run elasticities are presented in the top part of the table in the error correction model specification part while the short run dynamics are in the bottom part of the table.

Table 1: Unrestricted Cointegration Rank Test

Sample(adjusted): 1982 2002 Included observations: 21 after adjusting endpoints Series: LOG(INVT) LOG(UCC) LOG(MPK) Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test				
Hypothesized		**Trace**	**5 Percent**	**1 Percent**
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None *	0.661905	34.02148	29.68	35.65
At most 1	0.414174	11.24848	15.41	20.04
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Trace test indicates 1 cointegrating equation(s) at the 5% level				
Hypothesized		**Max-Eigen**	**5 Percent**	**1 Percent**
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None *	0.661905	22.77301	20.97	25.52
At most 1	0.414174	11.22937	14.07	18.63
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level				

Table 2: VECM estimation results

Vector Error Correction Estimates				
Sample(adjusted): 1980 2002				
Included observations: 23 after adjusting endpoints				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Cointegration equation				
LOG(INVT(-1))	1.000			
LOG(UCC(-1))	-0.181	0.084	-2.139	0.046
LOG(MPK(-1))	0.437	0.227	1.921	0.069
c	11.487	0.521	22.049	0.000
Error correction: D(LOG(INVT))				
CointEq1/error correction	-0.508114	0.045800	-17.56642	0.0000
D(LOG(INFL(-1)))	-1.053220	0.128947	-8.167832	0.0000
D(LOG(GDP(-1)))	3.525464	0.642736	5.485085	0.0002
D(LOG(GDP(-2)))	6.843902	0.834928	8.196995	0.0000
D(LOG(RDEXRATE))	0.365531	0.102872	3.553279	0.0045
D(LOG(NWPRIV(-1))	-1.550375	0.176023	-8.807806	0.0000
D(R10YRATE(-1)))	-4.950485	1.050995	-4.710284	0.0006
DUM90	0.109614	0.032236	3.400351	0.0059
R-squared	0.958804	Mean dependent var		-0.039149
Adjusted R-squared	0.928843	S.D. dependent var		0.158291
S.E. of regression	0.042225	Akaike info criterion		-3.189467
Sum squared resid	0.019612	Schwarz criterion		-2.741388
Log likelihood	40.89467	Durbin-Watson stat		2.091702
Diagnostic Test	**Test Statistic [Probability]**			
Normality	JB=0.922 [0.631]			
Heteroscedasticity	LM=16.799 [0.468]			
Serial correlation	LM[2]=0.721[0.697]			
Specification	RESET[2]=2.275 [0.321]			

Our regression analysis presents dramatic results for the user cost of capital (UCC). Our adjusted empirical estimate of the UCC is shown to be -0.18, which is significantly different from the UCC of unity normally assumed in theoretical model specifications. Although this result is different from theoretical assumptions it is similar to the findings of Ackerman and Du Toit (1998) and Chirinko, Fazzari, and Meyer (1999) proposing a UCC of -0.15 and -0.25 respectively. With respect to the impact of tax policy on investment our results confirms the findings of previous studies that taxes on companies influence investment behaviour. However, the magnitude of the tax effect is not that apparent. If tax policy were able to impact on the UCC, investment would decrease by 0.18% for every 1% increase in the level of UCC. Similar to the results found by Chirinko, Fazzari, and Meyer, (1999), our results also indicate that a shift in the tax burden from the upper class would not have the huge impact on investment that is frequently assumed and advocated in the literature. Since the UCC has both a short and long run effect the total elasticity would only be seen through simulation results in the next section.

As expected the elasticity on the marginal product of capital is positive indicating that increases in the productivity of capital would yield higher investment. MPK was calculated as the ratio of net operating surplus of companies to the capital stock i.e. MPK shows the amount of profit generated by each unit of capital. The inclusion and significance of this variable makes an important contribution to the literature on investment function estimation in the South African economy. The normal procedure to estimate an investment function is to proxy the productivity of capital by making use of gross domestic product (see Ackerman and Du Toit (1998) and Moolman and Du Toit (2002)). However, our explicit formulation of the marginal product of capital encompasses these specifications, as the effect of gross domestic product is captured in the short run function. Moreover, by using the marginal product of capital in the long run cointegrating equation our specification is theoretically sounder. The elasticity of 0.44 shows that the subsequent increase in investment due to increased marginal product is only half as much is the increased productivity. Combining with the UCC elasticity estimate this result implies that the firms have some form of substitution constraint since they cannot take full advantage of the increases in productivity or they cannot fully substitute away from capital if the user cost increase. One reason for this observation is the fact that the South African labour market is very inefficient and that the many labour laws and the pressure from labour unions distorts optimal firm behaviour in that they cannot substitute labour freely, subsequently constraining investment choices.

The coefficient for the error correction term indicates that imbalances from the equilibrium level of investment is corrected after only half (0.5) a time period, showing that firms quickly adjust to market conditions. In the short run the dynamics can be divided into four main categories. Firstly, the firm are influenced by the costs it faces (changes in the UCC through the real interest rate), secondly it looks at income variables (changes in gross domestic product (GDP)), thirdly it would look at the cost and productivity of labour in order to discount the cost of substitution (changes in the wage rate (wrate) and labour productivity (labprodind)) and lastly is the effect of changes in the Rand-Dollar exchange rate. Our results also show the inclusion of a dummy variable to capture the effects of isolation years through. Although the aim was to generate the most parsimonious specification the relatively rich short run dynamic structure confirms our initial arguments that the dynamics around investment decisions is very complex. When running some simulation results and making tax policy suggestions in our next section the use of the VECM procedure would give us more representative results than normal OLS regression studies.

Figure 1 Actual and fitted values of the change in investment

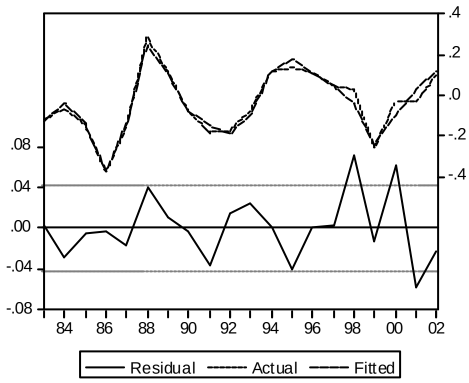


Figure 1 shows a graphical representation of our estimation results (in differences). The results confirms the high R^2 value of 0.96 and shows that our estimation is able to capture dynamics of investment behaviour in South Africa over the last two decades. By capturing the effects of MPK in our long run specification with a more representative proxy variable we are of the opinion that our structural model is theoretically sound and also gives us the confidence that our results are free of specification bias and misspecification problems.

7. IMPLICATIONS FOR TAX POLICY

The empirical UCC elasticity is of great importance to policy analysis. It represents the long run effects on the desired capital stock of policy changes that affects the user cost of capital. In this section we consider and evaluate the implications of several tax policy proposals. The fact that we use structural analysis to estimate the investment function helps us to avoid problems associated with policy simulations due to the *Lucas Critique*[1] and give us the confidence that our results represent true economic responses. To keep all simulations within the boundaries of our model we only initialise changes from 1988 onwards.

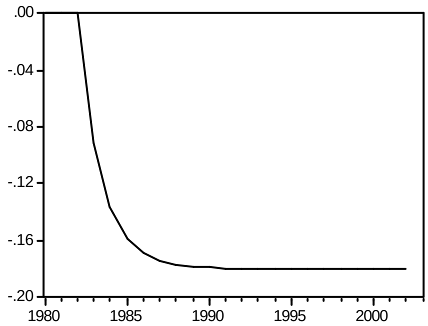
Our first policy scenario is to confirm the total long run elasticity of investment to the UCC by calculating the response of investment to a 1% increase of UCC. Simulation results, as depicted in figure 2, confirm the estimation results. Investment adjusts to a level 0.18% lower than initially due to the increase in the UCC. On average this amounts to a decrease of R 6 561 million in the level of real investment.

The next policy scenario is a natural extension of the first and aims to establish how much a change in corporate taxes contributes toward changing UCC and investment behaviour. This is achieved by increasing the effective tax rate by 1%. Expectation is

[1] The *Lucas Critique* cautions that because of the fact that new policies change the economic "rules" and thus affect economic behaviour, no one can safely assume that historical relationships between variables will hold when policy changes.

for investment to decrease due to the positive effect that increased taxes would have on UCC. However, since taxes represents only a part of the total UCC we cannot explicitly see its effect on investment from the estimation results.

Figure 2 Investment response to a percentage increase in UCC



The next policy scenario is a natural extension of the first and aims to establish how much a change in corporate taxes contributes toward changing UCC and investment behaviour. This is achieved by increasing the effective tax rate by 1%. Expectation is for investment to decrease due to the positive effect that increased taxes would have on UCC. However, since taxes represents only a part of the total UCC we cannot explicitly see its effect on investment from the estimation results.

Results indicate that the average change in investment due to the 1% increase in effective corporate tax rates is –0.09%. On average this implies a decrease in investment of R 3 500 million per annum. This supports previous studies indicating that tax incentive to stimulate investment growth through decreasing corporate taxes would only have marginal effects on the actual level of investment. However, with respect to the total change in the UCC a change in the tax rate explains a huge proportion of the change in investment due to changes in the UCC. Therefore, in this specific context taxes might be the most effective tool South Africa has to stimulate investment. An interesting study would be to see whether South African firms also use a tax incentive to substitute old capital with new advanced capital as proposed by Goolsbee (2004), or whether as our results indicates, the effectiveness of taxes to change investment behaviour is in actual fact very low.

The final scenario is aimed at establishing some estimate of the trade-off between "direct" and "indirect" corporate taxes. In the data section we have already noted that our data source enables us to differentiate between corporate taxes on profits (direct) and other taxes on companies (indirect) like secondary taxes, companies' contribution to skills development levies and taxes on companies' contribution of retirement funds. To our knowledge this is the first time that a differentiation is made between the different taxes levied on companies. Since these indirect taxes are seen as an additional burden on the firm they may have differential impacts on firm investment behaviour.

A secondary tax on companies in South Africa was introduced in 1995. Since then a total of R28 839 billion was collected from companies at an average of R2883.9 billion per year. The introduction of the skills development levy in 2000 was aimed at raising funds to increase the productivity of production factors. The actual contribution of firms towards this fund is 0.7 of the mandatory 2% of payroll. A total amount of R7 328 billion at an average of R2 443 billion per year has been collected since the introduction of skills development levies in 2000. The last variable contributing to indirect taxes is revenue collected on the contribution made by companies towards retirement funds. Once again, since its introduction in 1998 an average amount of R4 947 billion per annum contributed towards the total amount of R34 626 billion collected on retirement funds. In total the additional burden faced by the companies due to these indirect taxes amounted to R685 95 billion at an average of around R7 billion a year. The effective indirect tax rate faced by the companies started at 1.4% in 1995 increasing steadily and settling down to around 7.9% in 2002 and 2003. On average, this indirect tax has increased the effective corporate tax rate by 5.7%.

The "tax trade-off" scenario is generated in an attempt to see how investment would have performed if these indirect taxes was never introduced at all i.e. how big was the influence of these indirect taxes on investment. In order for us to generate meaningful simulations we alter the effective tax rate with the respective contributions made to this rate by the different indirect taxes. Our results of the 6 different policy simulations are summarised in Table 3 showing the average change in investment.

Table 3 The effects of indirect taxes on companies

Excluded for indirect taxes on companies	**Average percentage increase in effective tax rate due to inclusion**	**Average percentage increase in investment (1995-2003)**
STC, SDL, Retfund	5.7	0.48
STC, SDL	2.5	0.22
STC, Retfund	5.4	0.46
SDL, Retfund	3.0	0.10
STC	2.4	0.17
Retfund	3.6	0.31
SDL	1.0	0.001

Our results make for some interesting reading. If none of the indirect taxes was introduced investment would have been on average 0.48% higher than it was for the last decade, confirming our expectation that these additional taxes have a more negative impact on investment behaviour than normal profit taxes. Not surprising is the fact that secondary tax on companies together with taxes on retirement fund have the biggest effect on investment, with an increase of about 0.17% and 0.31% in investment if STC and taxes on retirement funds was excluded completely. The absence of SDL would on average increase investment by 0.001%, confirming the fact that skills development levies is in essence an extra cost on employment and not so much on investment. Since STC and taxes on retirement funds comprises the biggest part of indirect taxes it is also reasonable that a combination that effectively takes away both these taxes will yield the highest increase in taxes of any combination.

8. CONCLUSION

This study investigates the empirical user cost of capital with specific focus on the contribution that corporate taxes has on the price elasticity of investment. Making use of a disaggregated data set of corporate tax revenues we are able to get better understanding of how firms perceive their tax burden. Using vector auto regression and cointegration techniques we estimate the long run user cost elasticity be –0.18. Including short run dynamics we are able to generate policy scenarios that is consistent to firm investment behaviour in South Africa.

Our results support evidence from Chirinko, Fazzari and Meyer (1999) which places doubt on the theoretical user cost elasticity of unity. Furthermore, the lower elasticity implies that policy aimed at influencing investment through the user cost of capital will not have the effective impact proposed by theory. Average total elasticity of companies with respect to effective corporate taxes is estimated at 0.09% implying that taxes plays a very important role in the price determination of capital with half of the user cost elasticity being contributed towards the tax effect. We have also shown that additional taxes placed on companies like secondary taxes, are perceived in a different light than normal profit taxes inducing more and bigger changes investment behaviour. Our results support the existing literature that taxes only play an important part in investment behaviour *after* other variables, like macro economic stability, have been discounted.

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APPENDIX A DATA DESCRIPTION AND UNIVARIATE CHARACTERISTICS

Table A1. Variable list

Abbreviation	**Series Name**	**Calculation**
Cap	Total fixed capital stock	-
Cit	Total corporate tax revenue	-
Deprate	Effective depreciation rate	Actual depreciation/ fixed capital stock
Dirtaxn	Direct corporate tax revenue	Dirtaxn=Cit
Dum3	Binary variable for the effects of economic isolation	Dum3=0 for 1980-1994 Dum3=1 for 1995-2003
Dum4	Binary variable for the effects of the Asian financial crisis	Dum4=0 for 1980-1997 Dum4=1 for 1998-2003
Effcomp	Effective corporate tax rate	(Dirtaxn+Indirtaxn)/Noscn
GDP	Gross domestic product	-
Indirtaxn	Indirect corporate tax revenue	(0.7 * sdl + stc + retfun)
Infl	Inflation rate	-
Invdefl	Investment deflator	-
Invt	Total fixed investment	-
Labprodind	Labour productivity index	-
MPK	Marginal product of capital	Nosc/Cap
N10yrate	Nominal 10 year government bond yield	-
Noscn	Nett operating surplus of companies	-
PPI	Production price index	-
Retfund	Taxes on retirement fund contributions	-
SDL	Skills development levy	-
STC	Secondary Taxes on Companies	-
UCC	User cost of capital	(((N10yrate-infl)+deprate)/(1-effomp)))* Invdefl
Wrate	Real wage rate	-

*natural logarithms are indicated by a "log" before the abbreviation, e.g. the natural logarithm of Y is indicated by logY.
**All values are used in real terms in the estimation equations if not indicated otherwise.

Table A2. Augmented Dickey-Fuller and Kwaitkowski-Phillips-Schmidt-Schin tests for the univariate time series characteristics of the data, Levels, 1980-2003.

Variable	**H_0:Non-stationary (ADF)**				**H_0:Staionary(KPSS)**
	Model	**Adf lags**	t_t , t_m , t	F_3, F_1	*KPPS LM-stat*
Cap	Trend Intercept None	3 0 0	-4.452*** -0.724 7.577	5.82 0.524 -	0.059 0.739*** -
Cit	Trend Intercept None	4 4 0	2.986 3.839 3.791	3.564 3.737 -	0.169** 0.602** -
Deprate	Trend Intercept None	4 0 0	-3.030 -0.604 -1354*	2.529 0.364 -	0.099* 0.575** -
Effcomp	Trend Intercept None	0 0 0	-1.980 -2.019 0.132	2.126 4.079 -	0.117 0.115 -
GDP	Trend Intercept None	1 0 1	-1.282 1.249 2.343	2.527 1.561 -	0.157** 0.655** -
Indirtaxn+	Trend Intercept None	-	-	-	-
Infl	Trend Intercept None	0 0 0	-2.430 -1.226 -0.819	2.965 1.503 -	0.145** 0.542* -
Invdefl	Trend Intercept None	0 0 2	-1.550 4.483 1.085	14.000 20.090 -	0.172** 0.706** -
Invt	Trend Intercept None	1 2 2	-3.126* -2.459* -1.719*	6.086 6.356 -	0.148** 0.491** -
Labprodind	Trend Intercept None	1 3 0	-2.498 -2.737 1.466	2.324 3.120 -	0.170** 0.569** -
MPK	Trend Intercept None	0 0 0	-2.954 -5.273*** -2.763***	13.592 27.811 -	0.215** 0.49** -
N10yrate	Trend Intercept None	0 0 0	-2.954 -5.273*** -2.763**	13.592 27.811 -	0.178** 0.207* -
Noscn	Trend Intercept None	4 3 3	-0.082 3.904 4.362	17.143 8.573 -	0.189** 0.670** -
PPI	Trend Intercept None	5 5 5	-0.837 1.136 0.134	2.952 3.320 -	0.178** 0.704** -
Retfund+	Trend Intercept None	-	-	-	-

SDL+	Trend Intercept None	-	-	-	-
STC+	Trend Intercept None	-	-	-	
UCC	Trend Intercept None	0 0 0	-2.134 0.195 2.315	2.660 0.038 -	0.123* 0.661** -
Wrate	Trend Intercept None	0 0 0	-1.579 -0.641 1.587	1.257 0.411 -	0.153** 0.582** -

*(**)[***] indicates rejection of H_0 on a 10(5)[1]% level of significance.

+Time series length is too short to perform reliable unit root tests. Correlogram of auto and partial auto corrolation and graphical representation shows data series to have I(1) properties.

Table A3. Augmented Dickey-Fuller and Kwaitkowski-Phillips-Schmidt-Schin tests for the univariate time series characteristics of the data, First differences, 1980-2003.

Variable	**H_0:Non-stationary (ADF)**				**H_0:Staionary(KPSS)**
	Model	**Adf lags**	t_t , t_m , t	F_3, F_1	*KPPS LM-stat*
Cap	Trend Intercept None	5 5 2	-4.566*** -4.496*** -0.829	12.210 13.459 -	0.500 0.500* -
Cit	Trend Intercept None	0 0 4	-3.890** -3.082** 1.790	7.550 9.499 -	0.113 0.451* -
Deprate	Trend Intercept None	0 0 0	-3.435** -3.552** -3.347***	6.195 12.619 -	0.19* 0.19 -
Effcomp	Trend Intercept None	0 0 0	-4.967*** -5.000*** -5.070***	12.341 25.000 -	0.153* 0.176 -
GDP	Trend Intercept None	1 0 0	-3.54399 -2.906* -2.613**	4.741 4.450 -	0.094 0.330 -
Indirtaxn+	Trend Intercept None	-	-	-	-
Infl	Trend Intercept None	0 0 0	-3.745*** -3.990*** -4.016***	7.596 15.915 -	0.541* 0.145* -
Invdefl	Trend Intercept None	0 0 2	-4.215** -2.853* 1.427	9.118 8.137 -	0.107 0.628* -
Invt	Trend Intercept None	4 1 1	-4.479*** -3.646** -3.484***	5.205 6.753 -	0.055 0.171 -
Labprodind	Trend	1	-1.733	2.289	0.108

	Intercept None	1 1	-2.361* -2.296**	3.057 -	0.211 -
MPK	Trend Intercept None	0 0 0	-4.396*** -3.435** -3.581***	9.758 11.801 -	0.084 0.645* -
N10yrate	Trend Intercept None	1 0 0	-6.080*** -4.274*** -4.375***	13.548 18.264 -	0.330* 0.640* -
Noscn	Trend Intercept None	4 0 0	-3.484** -2.349* -1.683*	6.868 5.516 -	0.088 0.514* -
PPI	Trend Intercept None	5 4 4	-1.794* -1.053* 1.765	6.776 8.651 -	0.057 0.535* -
Retfund+	Trend Intercept None	-	-	-	-
SDL+	Trend Intercept None	-	-	-	-
STC+	Trend Intercept None	-	-	-	-
UCC	Trend Intercept None	0 0 0	-5.414*** -5.347*** -4.062***	14.657 28.589 -	0.113 0.196 -
Wrate	Trend Intercept None	0 0 0	-3.977** -4.039*** -3.812***	7.974 16.314 -	0.093 0.104 -

*(**)[***] indicates rejection of H_0 on a 10(5)[1]% level of significance.

+Time series length is too short to perform reliable unit root tests. Correlogram of auto and partial auto corrolation and graphical representation shows data series to have I(1) properties.