COST-BENEFIT ANALYSIS FOR INVESTMENT DECISIONS, CHAPTER 8:

THE ECONOMIC OPPORTUNITY COST OF CAPITAL

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Development Discussion Paper: 2011-8

ABSTRACT

An investment project usually lasts for many years, hence its appraisal requires a comparison of the costs and benefits over its entire life. For acceptance, the present value of the project's expected benefits should exceed the present value of its expected costs. Among a set of mutually exclusive projects, the one with the highest net present value (NPV) should be chosen. This criterion requires the use of a discount rate in order to be able to compare the benefits and costs that are distributed over the life of the investment. The discount rate recommended here for the calculation of the economic NPV of projects is the economic opportunity cost of capital for the country. If the economic NPV of a project is greater than zero, it is potentially worthwhile to implement the project. This implies that the project would generate more net economic benefits than the same resources would have generated if used elsewhere in the economy. On the other hand, if the NPV is less than zero, the project should be rejected on the grounds that the resources invested would have yielded a higher economic return if they had been left for the capital market to allocate them to other uses. This chapter explains how the economic opportunity cost of funds to an economy is derived and how it is used in the appraisal of an investment to calculate its economic present value.

To Be Published As: Jenkins G. P, C. Y. K Kuo and A. C. Harberger, "The Economic Opportunity Cost Of Capital" Chapter 8, Cost-Benefit Analysis for Investment Decisions. (2011 manuscript)

JEL code(s): H43
Keywords: discounting, discount rate, economic cost of capital, rate of time preference, gross of tax rate of return.

Chapter Eight

Economic Opportunity Cost of Capital

8.1 Why Is the Economic Cost of Capital Important?

An investment project usually lasts for many years; hence, its appraisal requires a comparison of the costs and benefits over its entire lifetime. In order for it to be accepted, the present value (PV) of the project's expected benefits should exceed the PV of its expected costs. Among a set of mutually exclusive projects, the one with the highest net present value (NPV) should be chosen.[1] This criterion requires the use of a discount rate so that the benefits and costs that are distributed over the life of the investment can be compared.

The discount rate recommended here for the calculation of the economic NPV of projects is the economic opportunity cost of capital for the country. If on the one hand the economic NPV of a project is greater than zero, it is potentially worthwhile to implement the project. This implies that the project would generate more net economic benefits than the same resources would have generated if used elsewhere in the economy. On the other hand, if the NPV is less than zero, the project should be rejected on the grounds that the resources invested would have yielded a higher economic return if they had been left for the capital market to allocate to other uses.

In the process of project design, the economic cost of capital also plays an important role in the maximization of the potential economic NPV of a project. It is a critical parameter for decision-making on the optimum size of the project and the appropriate timing for the

[1]The benefit–cost ratio is often used as a decision criterion in an economic evaluation. However, the NPV criterion is known to be more reliable than other criteria for both the financial and the economic evaluation. For the financial appraisal, other criteria include the payback period, the debt service ratio, and the internal rate of return. Each of these criteria has its own shortcomings. Detailed discussions are presented in Chapter 4.

implementation of an investment. Both are key factors affecting the project's net benefits and its ultimate feasibility. In addition, the choice of technology for a project is influenced by the opportunity cost of capital. For example, a low cost of capital will encourage the use of capital-intensive technologies as opposed to labour- or fuel-intensive technologies.

8.1.1 Choosing the Scale of a Project

An important decision in project appraisal concerns the size or scale of the facility to be built. It is seldom the case that the scale of a project is constrained by technological factors; hence, economic considerations should be paramount in selecting the appropriate scale. Even if the project is not built to its correct size, it may be a viable project because its NPV may still be positive, albeit less than its potential. The NPV is maximized only when the optimum scale is chosen.

As was discussed in Chapter 5, the appropriate principle for determining the scale of a project is to treat (hypothetically, and on the drawing board, as it were) each incremental change in size as a project in itself. An increase in the scale of a project will require additional expenditures and will generate additional benefits. The PV of the costs and benefits of each incremental change should be calculated using the economic discount rate.

The NPV of each incremental project indicates by how much it increases or decreases the overall NPV of the project. This procedure is repeated (at the planning, drawing-board stage) until a scale is reached at which the NPV of incremental benefits and costs associated with an increment of scale changes from positive to negative. When this occurs, the previous scale (with the last upward step of NPV) is the optimum size of the project. The effect that the economic opportunity cost of capital or economic discount rate has on determining the size of the NPV gives it a central role in determining the optimum scale of a project.

8.1.2 Timing of Investment

Another important decision to be made in project analysis relates to the appropriate time at which a project should start. A project that is built too soon could result in a large amount of idle capacity. In this case, the forgone return from the use of resources elsewhere might be greater than the benefits gained in the first few years of the project's life. In contrast, if a project is delayed too long, shortages may occur, and the forgone benefits of the project will be greater than the alternative yields of the resources.

Whenever a project is undertaken too soon or too late, its NPV will be lower than if it had been developed at the optimum time. The NPV may still be positive, but it will not be at the project's potential maximum.

The key to making a decision on this issue is whether the costs of postponement of the project are greater or smaller than the benefits of postponement. In the most straightforward case, where investment costs K remain the same whether the project is started in either period t or period t+1, the costs of postponement from year t to year t+1 are simply the economic benefits B_{t+1} forgone by delaying the project. On the other hand, the benefit of postponement is the economic return, r_e, that can be earned from the capital invested in the general economy. Thus, the benefit from postponement is equal to the economic opportunity cost of capital multiplied by the capital costs (i.e., $r_e \times K_t$).[2] One can see again that the value of the economic opportunity cost of funds is an essential component in deciding the correct time for starting a project.[3]

8.1.3 Choice of Technology

In order to be a worthwhile undertaking, any investment project must earn enough to cover the economic opportunity cost of capital. If this is not the case, the capital would be better allocated to other uses through the normal workings of the capital market.

Sometimes public sector projects face a financial cost of capital that is artificially low. This is the case not only when they can raise funds at an artificially low rate of interest because of government subsidies or guarantees, but also (typically) when they raise funds at the market-determined rate of yield on government bonds. In either case, the cost of

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[2]There are a number of cases in which the benefits and capital costs are also a function of calendar time. These are discussed in Chapter 5.

[3]This exercise applies when the benefits of the project in period t are the same, regardless of whether the investment was made in t, t+1, t+2, etc., and also when the stream of project benefits over time is increasing with time, i.e., $B_{t+2} > B_{t+1} > B_t$.

capital perceived by the project may be far below its economic opportunity cost.

The use of a lower financial cost of capital instead of its economic opportunity cost would create an incentive for project managers to use production techniques that are too capital-intensive. The choice of an excessively capital-intensive technology would lead to economic inefficiency because the value of the marginal product of capital in this activity is below the economic cost of capital to the country. For example, in electricity generation, using a financial cost of capital that is lower than its economic cost will make capital-intensive options such as distant hydroelectric dams or nuclear power plants more attractive than oil- or coal-fired generation plants (Jenkins, 1985). Hence, it is necessary to have a correct measure of the economic opportunity cost of capital in order to make the right choice of technology.

8.2 Alternative Methods of Choosing Discount Rates for Public Sector Project Evaluation

The choice of the discount rate to be used in economic cost–benefit analysis has been one of the most contentious and controversial issues in this area of economics. The term "discount rate" refers to the time value of the costs and benefits from the viewpoint of society. It is similar to the concept of the private opportunity cost of capital used to discount a stream of net cash flows of an investment project, but the implications can be more complex. However, after much debate, a consensus, or at least a reasonably good understanding of the issues, has emerged.

In essence, four alternative approaches have been put forward on this issue. First, some authors have suggested that all investment projects, both public and private, should be discounted by a rate equal to the marginal productivity of capital in the private sector (Hirshleifer, DeHaven, and Milliman, 1960). The rationale for this choice is that if the government wants to maximize the country's output, it should always invest in the projects that have the highest return. If private sector projects have a higher expected economic return than the available public sector projects, the government should ensure that funds are invested in the private rather than the public projects.

Second, authors such as Little and Mirrlees (1974) and Squire and van der Tak (1975) have recommended the use of an accounting rate of interest. Their accounting rate of interest is the estimated marginal return from public sector projects given the fixed amount of investment funds available to the government. The accounting rate of interest is essentially a rationing device. If there are more projects that look acceptable than the available investable funds, the accounting rate of interest should be adjusted upwards; and if too few projects look promising, the adjustment should be made in the other direction. Therefore, the accounting rate of interest does not serve to ensure that funds are optimally allocated between the public and the private sectors, but acts only to ensure that the best public sector projects are recommended within the constraint of the amount of funds available to the public sector. This approach does not recognize the fact that if the funds are not spent by the public sector, they can always be used to reduce the public sector's debt. They will then be allocated by the capital market for use by the private sector.

Third, it has been recommended that the benefits and costs of projects should be discounted by the social rate of time preference for consumption, but only after costs have been adjusted by the shadow price of investment to reflect the fact that forgone private investment has a higher social return than present consumption. This method has been proposed by such authors as Dasgupta, Sen, and Marglin (1972), Marglin (1963), and Feldstein (1964).

Fourth, Harberger and other authors have suggested that the discount rate for capital investments should be the economic opportunity cost of funds obtained from the capital market. This rate is a weighted average of the marginal productivity of capital in the private sector and the rate of time preference for consumption (Harberger, 1968; 1987). This proposal has been reinforced by the theoretical work of Sandmo and Dreze (1971) and Dreze (1974), and reconciled to a degree through the alternative approach of using a social rate of time preference in conjunction with a shadow price of investment, a method advocated by Sjaastad and Wisecarver (1977).

Many professionals have chosen to follow this weighted average opportunity cost of funds concept. Furthermore, Burgess (2008) has shown that under a wide range of circumstances, the use of the economic opportunity cost of funds as the discount rate leads to the correct investment choice, while other approaches lead to the selection of inferior projects.

In its simplest form, the economic opportunity cost of public funds, i_e, is a weighted average of the rate of time preference for consumption r and the rate of return on private investment ρ. It can be written as follows:

$$i_e = W_c r + (1 - W_c) \times \rho \qquad (8.1)$$

where W_c is the proportion of the incremental public sector funds obtained at the expense of current consumption and $(1 - W_c)$ is the proportion obtained at the expense of postponed investment.[4]

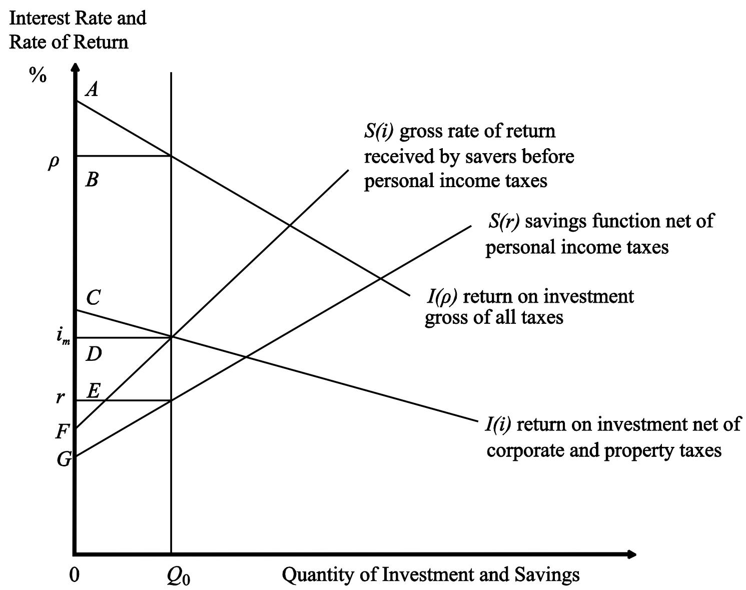
8.3 Derivation of the Economic Opportunity Cost of Capital

The rates of interest observed in the capital markets are fundamentally determined by the willingness of people to save and the opportunities that are available for investment. In an economy characterized by perfect competition with full employment and no distortions, the real market interest rate would reflect the marginal valuation of capital over time and could be used as the economic discount rate. However, in reality there are distortions in the capital markets, such as business and personal taxes, and inflation; hence, market interest rates will reflect neither the saver's time preferences for consumption nor the gross economic returns generated by private sector investment. Both savers and investors must take into consideration taxes and other distortions when entering the capital market to lend or borrow.

The determination of the market interest rate is illustrated by Figure 8.1 for the case in which savers are required to pay personal income taxes on interest income and borrowers pay both business income taxes and property taxes on their investment. For the moment, the effects of inflation will be set aside so that all the rates of return are expressed in real terms. The curve *GS(r)* shows the relationship between the supply of savings and the rate of return r received from savings net of personal income taxes. This function indicates the minimum net return that savers must receive before they are willing to postpone current consumption and save for future consumption. If there is a personal income tax, savers will require a return that is sufficiently larger than r to allow them to pay income taxes on the interest income and still have a return of r left. The savings function, which includes the taxes on interest income, is shown as *FS(i)*.

[4]For a more complete discussion of this derivation, see Harberger (1968; 1972).

Figure 8.1: Determination of Market Interest Rates



At the same time, investors have a ranking of investment projects according to their expected gross-of-tax rates of return, which is shown as the curve *AI(ρ)*. If the owners of the capital have to pay property taxes and business income taxes, they will be willing to pay less for their investment funds than in a no-tax situation. *CI(i)* reflects the rate of return that investors can expect to receive net of all business and property taxes. In this market situation, the interest rate i_m will be determined by the gross-of-personal-income-tax savings function *FS(i)* and the net-of-tax demand for investment curve *CI(i)*.

The basic principle that must be followed to ensure that a project's investment expenditures do not ultimately retard the level of economic output of the country is that such investments must produce a rate of return that is at least equal to the economic return of other investment and consumption that is postponed, plus the true marginal cost of any additional funds borrowed from abroad as a direct or indirect consequence of the project. In order to form a general criterion for the economic opportunity cost of capital for a country, we must assess the sources from which that capital is obtained and attach an appropriate economic cost to each source.

For most countries, it is realistic to assume that there exists a functioning capital market. That is not to say that it is free of distortions, for it is the existence of distortions, such as taxes and subsidies, that prevents us from using the real interest rate in the market as a measure of the economic opportunity cost of funds. In addition, most governments and private investors obtain marginal funds to finance their budgets from the capital market and, during periods of budgetary surplus, typically reduce their debts.

It is true that the financing for a government's budget comes from many sources other than borrowing, such as sales and income taxes, tariffs, fees, and perhaps sales of goods and services. The average economic opportunity cost of all these sources of finance combined may well be lower than the economic opportunity cost of borrowing. However, this fact is irrelevant for the purpose of estimating the marginal opportunity cost of the government's expenditures. As with the estimation of the supply price of any other good or service, the marginal economic opportunity cost must reflect the ways in which an incremental demand will normally be met. Even in the very short run, most governments are either borrowing or, when enjoying a budgetary surplus, paying off some of their debt.[5] Therefore, if fewer public sector projects are undertaken in a given year, more funds will be available in the capital markets for private sector use.

This is not to imply that each year every government uses the capital market as its source or repository of marginal funds. However, the overwhelming evidence from observing developing and developed countries indicates that this is a fair characterization of the behaviour of most governments. As the economic discount rate is a parameter that should be generally applicable across projects and estimated consistently over time, it is prudent for a country to base its estimate of the economic opportunity cost on the cost of extracting the necessary funds from the capital market. The approach has a further advantage in that the capital market is clearly the marginal source of funds for most of the private sector. Hence, it follows that the economic opportunity cost of funds for both the public and the private sectors is based on the costs derived from similar capital market operations.

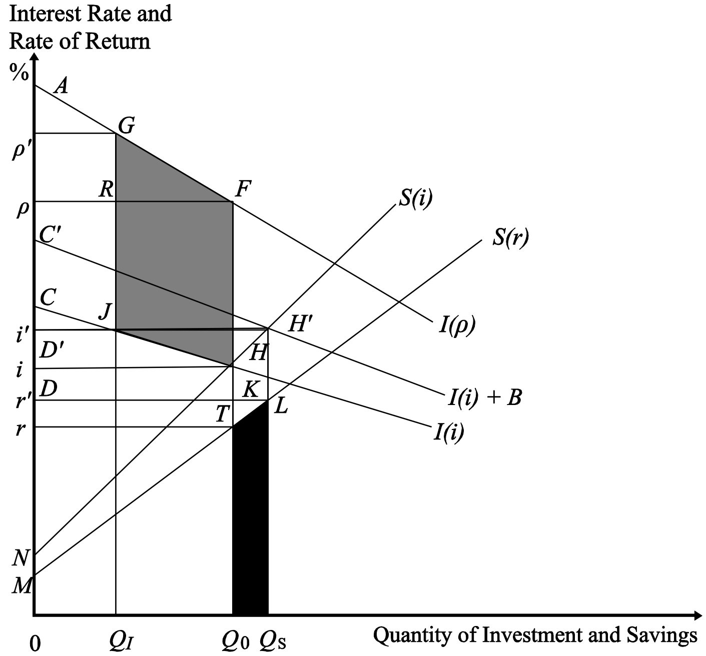
To estimate the economic opportunity cost of funds obtained through the capital market, we will first assume that the country's capital market is closed to foreign borrowing or lending. It is also assumed that taxes

[5]Some of this debt may reflect foreign as well as domestic borrowings.

such as property taxes and business income taxes are levied on the income generated by capital in at least some of the sectors. In addition, we will assume that a personal income tax is applied to the investment income of savers.

In Figure 8.2, we begin with a situation in which the market rate of return is i and the quantity of funds demanded and supplied in the capital market is Q_0. At this point, the marginal economic rate of return on additional investment in the economy is ρ and the rate of time preference, which measures the marginal value of current consumption, is equal to r. Funds of the amount of B are then borrowed from the capital market to finance the project by the amount $(Q_s - Q_I)$. This causes the total demand in the economy for loanable funds to shift from *CI(i)* to *C'I(i)+B*. However, the value of funds for investment elsewhere in the economy, and the net-of-tax returns to them, is measured by the curve *CI(i)*. The gross-of-tax return on the investments is measured by the curve *AI(ρ)*.

Figure 8.2: The Economic Opportunity Cost of Capital



The increase in the demand for funds by the project will cause the market cost of funds to increase from *i* to *i'*, thus inducing people to save more (postpone consumption) by an amount ($Q_s - Q_0$). At the same time, the higher cost of funds will cause people to postpone investments by an amount ($Q_0 - Q_I$).

The economic cost of postponing consumption is equal to the area Q_0TLQ_s, which is the net-of-tax return that savers receive from their increased savings. This is measured by the area under the *MS(r)* curve between Q_0 and Q_s. With a linear supply function, this area is estimated by the average economic cost per unit, $[(r + r')/2]$, multiplied by the number of units, ($Q_s - Q_0$). Postponed investment has a gross-of-tax economic opportunity cost, which is measured by the *AI(ρ)* curve. This includes both the net return given up by the private owners of the investment measured by the curve *CI(i)* and the property and business taxes lost. This opportunity cost is shown by the shaded area Q_IGFQ_0, of which Q_IJHQ_0 is the net return forgone by the would-be owners of the investment, and *JGFH* represents the amount of taxes lost by the government. Again, this can be calculated by the economic opportunity cost per unit $[(\rho + \rho')/2]$ multiplied by the number of units, $(Q_0 - Q_I)$. For marginal changes in government borrowing, we can safely disregard the triangles *RGF* and *KLT*, which arise from the change in interest rates.

The economic opportunity cost of capital i_e can then be defined as:

$$i_e = \frac{r \times (\partial S/\partial i) - \rho \times (\partial I/\partial i)}{(\partial S/\partial i) - (\partial I/\partial i)} \tag{8.2}$$

where $(\partial S/\partial i)$ and $(\partial I/\partial i)$ denote the reaction of savers and other investors, respectively, to a change in market interest rates brought about by the increase in government borrowing.

Expressed in elasticity form, equation (8.2) becomes:

$$i_e = \frac{r \times \varepsilon_s - \rho \times \eta_I \times (I_T/S_T)}{\varepsilon_s - \eta_I \times (I_T/S_T)} \tag{8.3}$$

where ε_s is the elasticity of supply of private sector savings, η_I is the elasticity of demand for private sector investment with respect to changes in the rate of interest, and I_T/S_T is the ratio of total private sector investment to total savings.

Let us suppose that $\rho = 0.16$ and $r = 0.05$. Let us also assume that $\varepsilon_s = 0.3$, $\eta_I = -1.0$, and $I_T/S_T = 0.9$. In this case, the economic opportunity cost of capital can be calculated as:

$$\begin{aligned} i_e &= [0.05\ (0.3) - 0.16\ (-1.0)\ (0.9)]\ /\ [0.3 - (-1.0)(0.9)] \\ &= (0.015 + 0.144)\ /\ (1.20) \\ &= 0.133 \end{aligned}$$

The economic opportunity cost of capital is 13.3 percent. Typically, it will be closer to the gross return from investment than the rate of time preference on consumption because the elasticity of private savings is generally much smaller than the absolute value of the elasticity of demand for private sector investment.

In equation (8.3), all the different groups of savers have been aggregated into one category, and all groups of investors have also been grouped into one sector. The aggregate elasticity of supply of savings and the aggregate elasticity of demand for investment can be disaggregated into their components as follows:

$$\varepsilon^s = \sum_{i=1}^{m} \varepsilon_i^s \left(S_i / S_T\right) \tag{8.4}$$

$$\eta^I = \sum_{j=1}^{n} \eta_j^I \left(I_j / I_T\right) \tag{8.5}$$

where ε_i^s refers to the elasticity of supply of the *i*th group of savers and (S_i / S_T) is the proportion of total savings supplied by this group; η_j^I refers to the elasticity of demand for the *j*th group of investors, and (I_j / I_T) is the proportion of the total investment demanded by this group.

Substituting equations (8.4) and (8.5) into equation (8.3), we obtain an expression for the economic opportunity cost of capital that allows for consideration of different distortions within the classes of savers and investors:

$$i_e = \frac{\sum_{i=1}^{m} \varepsilon_i^s (S_i / S_T) r_i - \sum_{j=1}^{n} \eta_j^I (I_j / S_T) \rho_j}{\sum_{i=1}^{m} \varepsilon_i^s (S_i / S_T) - \sum_{j=1}^{n} \eta_j^I (I_j / S_T)} \tag{8.6}$$

The classes of savers will usually be differentiated by income groups that face different marginal income tax rates. There will also be savings by domestic businesses. However, it is not clear whether higher interest rates would affect the amount of business savings because the decisions that businesspeople make about whether or not to pay dividends are based more on business investment opportunities. Thus, the amount of business savings is assumed in this study to be independent of interest rates. We can also include in the broad class of savers the foreign savers who supply the funds to a country when it obtains funds from abroad. As the international capital markets become more accessible to domestic investors, we would expect the elasticity of supply of this sector to increase in relation to the other sources of savings. In some circumstances, the cost of foreign borrowing and the elasticity of supply of foreign savings might dominate the entire equation (8.6). It is therefore important to properly assess the economic cost of foreign borrowing; this will be discussed in Section 8.5.

On the demand side, investors are typically divided into the corporate sector, the non-corporate sector, housing, and agriculture, according to the different tax treatment provided to these sectors.

8.4 Determining the Economic Cost of Alternative Sources of Funds

Measuring the real rate of return to reproducible capital in a country is not an easy task. In most cases, the most consistent approach is based on the country's national income accounts. At the very least, the accounts presume to cover the full range of economic activities in the country (including such items as the implicit income from owner-occupied houses and the value added of many informal sector activities).

Employing this method of calculation, one starts from a past base period and the real amount of investment made during each period from the base year until the present. For these purposes, the amounts of real investment should be obtained by deflating nominal investment by the general gross domestic product (GDP) deflator (not the official investment deflator). The purpose of this is to express the capital stock of the country in the same units of account as those used to express the earnings of capital. Our methodology employs the GDP deflator as the general numeraire; it is used to convert all nominal values into real values.

If investment is available by component, it is desirable to carry out the estimates component by component (buildings, machinery, vehicles, inventories) in order to allow for different depreciation rates on these categories. Once an initial capital stock K_{j0} is estimated for each component, and its appropriate depreciation rate δ_j established, the time path of the capital stock is generated by the formula

$$K_{j,t+1} = K_{jt}(1 - \delta_j) + I_{jt}$$

where I_{jt} denotes the amount of new gross investment in each component.

Obviously, it is not possible to speak of a separate rate of return to different pieces of the capital stock of the same entity, so we express the rate of return as Y_{kt}/K_t, where $K_t = \sum K_{jt}$ and Y_{kt} is the income from capital at time t. It consists of the sum of interest, rent, and profit income, as recorded in the national accounts. If these items do not appear explicitly, it is usually possible at least to find a breakdown that includes wages and salaries as one category, corporate profits as a second, and the surplus of non-corporate enterprises as a third. Here the challenge is to separate the surplus of non-corporate enterprises into two components, one representing the value added due to time value of the owners and their family members, the other representing the gross return to capital in these enterprises.

However, this is not the end of the task. Since we are building up a stock of K_t of reproducible capital, its value should necessarily exclude that of land (although improvement to land, such as fences, canals, and even levelling, should be treated as reproducible). So from the income stream accruing to capital, we definitely want to exclude the portion that we estimate as accruing to land. In addition, we should exclude most elements of government capital from the capital base used to calculate its rate of return. Likewise, we should exclude from the relevant "return to capital" any income from these items. In some countries this would give us a rate of return straightforwardly based on the real earnings of reproducible private sector capital (in the numerator) and the real value of this private sector capital stock (in the denominator). However, in most countries these also exist in public sector productive entities such as electricity companies, railroads, airlines, ports, and even manufacturing facilities, which behave sufficiently like other business enterprises to warrant being counted in the same calculation, alongside private business enterprises.

In order to see clearly the rationale for this treatment, readers should focus on the purpose for which we want to calculate the economic opportunity cost of capital in the first place. That purpose is best seen by visualizing the exercise of any organization or person – a private company, one or more individuals, a non-profit institution, the government itself – going into the country's capital market to raise money. This puts added pressure on that market and squeezes out other demanders for funds, while giving some additional stimulus to suppliers of funds in that market. We take the position that the actions of business firms and private savers are governed by natural economic motives, in the sense that we can take seriously the idea that they have reasonably well-defined supply and/or demand functions for funds as a function of interest rates and other variables in that country's capital market. We suggest that government (apart from those public enterprises that in fact behave like business firms) operates mainly with a different type of machinery – legislative acts and authorizations, budgetary decisions, administrative edicts, and the like. In short, we do not see previously authorized public investments being "naturally" squeezed out by a tightening capital market in the same way as we see this same phenomenon for regular business investments.

Our vision of the economic opportunity cost of capital is that as new demands for funds in a country's capital market squeeze out alternative investments, the country loses (or perhaps forgoes) the returns that would have been generated by these investments; at the same time, the country incurs the costs involved in covering the supply prices of the new amounts of saving that are stimulated by the new demand, in addition to whatever incremental costs are entailed in newly generated capital inflows from abroad.

We thus start with a weighted average of the marginal productivity, ρ, of displaced investments, the marginal supply price, r, of newly stimulated savings, and the marginal cost, MC_f, associated with newly stimulated inflows from abroad. This simple vision can be represented as:

$$EOCK = f_1\rho + f_2\, r + f_3\,(MC_f) \qquad (8.7)$$

where f_1, f_2, and f_3 are the sourcing fractions linked, respectively, to sourcing from displaced investment, newly stimulated domestic savings, and newly stimulated capital inflows from abroad. Obviously, $f_1 + f_2 + f_3$ should equal 1.

A key element in this story is ρ, since f_1 is typically the largest of the three sourcing fractions. As previously mentioned, we conceive of ρ as representing the typical marginal productivity of the class of investments it is intended to cover. We recommend its estimation, as indicated above, on the basis of the ratio of returns to reproducible capital (net of depreciation but gross of taxes) in the productive sector of the economy to the value of reproducible capital in the productive sector of the economy. If the reproducible capital stock can be conveniently estimated only for the total economy, it would be advisable to reduce this stock by a fraction that is estimated to account for the bulk of public sector capital items, such as government buildings, schools, roads, etc., which are not basically business oriented.

In order to achieve the rate of return that represents the supply price r of newly stimulated domestic savings, we must certainly exclude the taxes on income from capital that are paid directly by business entities plus the property taxes paid by these entities, as well as by homeowners. In addition, we would want to exclude the personal income taxes that are paid on the basis of the income from reproducible capital.

If aggregate national accounts data are being used, we recommend subtracting from the gross-of-tax return to reproducible capital the full amount of corporation income taxes paid and the full amount of property taxes paid, adjusted downward to exclude an estimated portion falling on land. In addition, there is a need to subtract the full amount of personal income taxes paid on the income from capital, also adjusted downward to exclude the income taxes that are paid on the income derived from land.

When this is done, the remaining value covers not only the net-of-tax income received by individual owners of capital but also the costs of intermediation, which is most easily understood (in the case of bank loans) as the difference between the average rate of interest that banks receive on their loans and the average rate they pay to their depositors.

It is also possible to approach the estimation of the economic opportunity cost of capital in a more disaggregated way, distinguishing separate categories of displaced investment (e.g., corporate, non-corporate, and housing) owing to the different tax treatments they receive and distinguishing different categories of savings on a similar basis (e.g., savers with marginal tax rates of 30, 20, 10, and zero percent). For example, in the latter case, the higher an individual's rate of personal income tax, the lower their equilibrium rate of time preference for consumption will be. In a situation in which the market interest rate is equal to 0.08 and the marginal rate of personal income tax is assumed to be 0.1, the value of r is 0.072. Now consider a high-income individual who is faced with a marginal personal income tax rate of 0.4. This individual will have low rates of time preference at 0.048 guiding their decisions on how to spend their consumption over time. Thus, high rates of time preference and high discount rates correspond more closely to the decisions of the poor concerning the distribution of their consumption over time.

Furthermore, consumers who are borrowing in order to finance current consumption will typically have higher rates of time preference than those who only save. If the margin required by finance companies and money lenders over the normal market interest rate is M percentage points, the rate of time preference for borrowers on consumer loans is the sum of the market interest rate and M percentage points. Supposing M is 0.11, the rate of time preference for borrowers on consumer loans becomes 0.19, a rate that is often charged on credit cards, even in advanced countries. From these examples, we can see that as we move from the poor borrowers to the rich groups in society, which are net savers, the time preference rate can quite realistically fall from 0.19 to 0.048.

However, we believe that this approach, which we ourselves have often used in the past,[6] suffers from its de-linking from the aggregate national accounts framework. For example, our preferred framework deducts taxes actually paid, and thus incorporates all the effects of avoidance, evasion, and corruption as they occur in the country in question, while the disaggregated framework tends, perhaps naively, to make the assumption that the statutory marginal rates are rigorously applied.

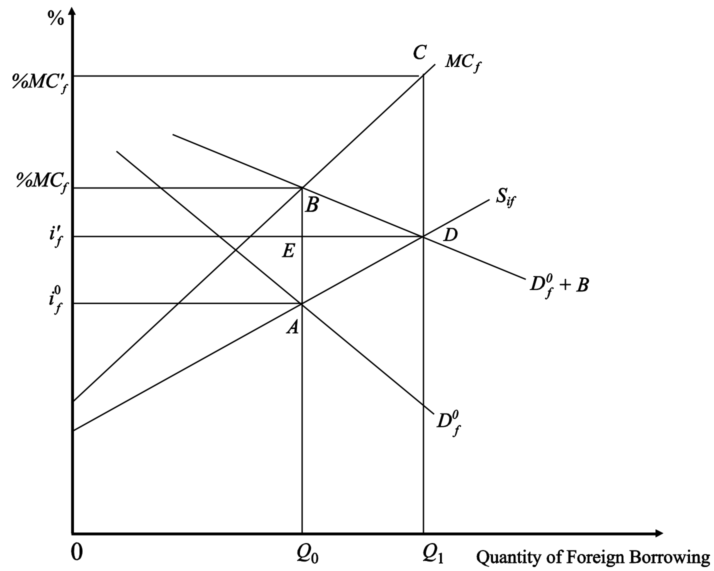
8.5 Marginal Economic Cost of Foreign Financing

In this section we deal with the estimation of marginal economic cost of newly stimulated capital inflows from abroad as a result of project funds raised in capital markets. Foreign capital inflows reflect an inflow of savings from foreigners, which augment the resources available for investment. When the demand for investable funds is increased, this will not only induce domestic residents to consume less and save more, but will also attract foreign savings. When the market interest rate is increased to attract funds, an additional cost is created in the case of foreign borrowing. Not only is this higher interest rate paid on the incremental borrowing, it will also be charged on all the variable interest rate debt, both current and prior, that is made on a variable interest rate basis. Thus, it is the marginal cost of borrowing by the project that is material in this case (Harberger, 1980; Edwards, 1986).

If the interest rate on foreign borrowing by the project is i'_f, it reflects only the average cost of this financing. The marginal cost that is relevant is given by the sum of the cost of foreign financing of the additional unit and the extra financial burden on all other borrowings that are responsive to the market interest rate. This is shown in Figure 8.3.

[6] Jenkins (1973) and Barreix (2003). In the study by Barreix, the analysis was carried out using both aggregate and sector-disaggregated approaches, and demonstrated that both estimates were completely reconcilable.

Figure 8.3: Marginal Economic Cost of Foreign Borrowing



If a country faces an upward-sloping supply curve for foreign financing, the interest rate that borrowers have to pay will increase as the quantity of debt rises relative to the country's capacity to service this foreign debt. With a demand curve for foreign borrowing shown as D^0_f, the interest rate charged on such loans is shown at i^0_f and the quantity of foreign borrowings Q_0. Now suppose that the demand for loanable funds B increases such that its demand for foreign loans shifts to $D^0_f + B$. As a result of the additional funds ($Q_1 - Q_0$) demanded in the capital market, there will be a slightly higher market interest rate, i'_f, paid to foreign savers. This higher interest rate i'_f will be paid not only on the foreign borrowing of this year but on any variable interest rate loans in its stock of foreign financing that are affected by the increased market interest rate for foreign financing. The latter also includes the country risk for the respective country. With the greater stock of foreign financing that must be serviced using foreign exchange, the lender faces a greater exposure to the risk of default from macroeconomic instability. As a consequence, the marginal economic cost of foreign borrowing, MC_f, is not given by the supply curve of foreign savings available to the country but by the marginal economic cost curve, which lies above the supply curve.

Algebraically, the marginal economic cost of foreign borrowing is shown as:

$$MC_f = i_f \times (1 - t_w) + (\partial i_f / \partial L) \times (1 - t_w) \times \phi \times L \tag{8.8}$$

where t_w is the rate of withholding taxes charged on interest payments made abroad; L is the total value of the stock of foreign financing; ϕ is the ratio of the total foreign debt whose interest rate is flexible and will respond to additional foreign financing to the total stock of foreign financing for the country; and ($\partial i_f / \partial L$) is the rate of change in the cost of foreign financing as the current foreign financing increases. Alternatively:

$$MC_f = i_f \times (1 - t_w) \times \{1 + \phi \times (1/\varepsilon_s^f)\} \tag{8.9}$$

where ε_s^f is the supply elasticity of foreign funds to a country with respect to the cost of funds the country pays on its new foreign financing.

Let us consider the case where $i_f = 0.10$, $t_w = 0.20$, $\varepsilon_s^f = 1.5$, and $\phi = 0.60$. Using equation (8.9), MC_f is equal to 0.112. In this case, with a market interest rate of 10 percent for foreign loans, the marginal cost of foreign borrowing would be 11.2 percent.

A final factor that needs to be considered when estimating the marginal economic cost of foreign borrowing is the effect of the expected rate of inflation. If gp_f denotes the expected rate of foreign inflation, then the marginal economic cost of foreign borrowing, MC'_f, after adjustment for inflation, can be derived as follows:

$$MC'_f = \frac{[i_f \times (1 - t_w) - gp_f\ ] \times [1 + \phi \times \frac{1}{\varepsilon_s^f}]}{(1 + gp_f)} \tag{8.10}$$

To estimate the economic opportunity cost of capital in an open economy, we need to combine equation (8.7) with equation (8.10) and the estimate of gross-of-tax return from domestic investment ρ and the cost of newly stimulated domestic savings r. It is these rates of opportunity cost, along with their respective weights, that generate the weighted average rate that should be used as the rate of discount for all government expenditures.

8.6 Intergenerational and Risk-Adjusted Economic Discounting

Questions have been raised as to whether a lower rate should be used for intergenerational discounting because many of the people affected by a particular project or policy may no longer be alive in the distant future (United States Environmental Protection Agency, 2000). However, there is little consensus in the economic literature on economic discounting for intergenerational projects or policies. There are several reasons for not favouring the use of different discount rates over the project impact period unless the opportunity cost of funds is abnormally high or low from one period to another.

Moreover, for projects in which capital expenditures are incurred at the beginning of the project while benefits are spread over the life of the project, applying one discount rate for the streams of costs and another for the streams of benefits can be problematic and empirically difficult for each project. The informational requirements are very demanding for converting all the streams of costs into consumption equivalents in a consistent manner. The problem becomes more complicated when the streams of costs and benefits occur simultaneously and are spread over all years. Using a weighted average of the economic rate of return on alternative sources of funds, the discount rate based on the opportunity cost of forgone investment and consumption can avoid the complicated adjustments.

The use of a risk-adjusted economic discount rate has also been suggested elsewhere to account for the systematic risk of future uncertainty (Brean et al., 2005). However, the discount rates derived above are associated with the average risk in the economy. Since the streams of uncertain future costs and benefits are mainly related to the input variables themselves, they are best dealt with using the Monte Carlo risk analysis, as described in Chapter 6, rather than the adjusted economic discount rates.

8.7 Country Study: Economic Cost of Capital for South Africa

This section illustrates how the economic opportunity cost of capital for South Africa is estimated following the methodology outlined in the previous sections. South Africa is considered a small, open, developing economy. When funds are raised in the capital market to finance any investment projects, those funds are likely to come from three different sources, as described in Section 8.4, namely funds released from displaced or postponed investment, newly stimulated domestic savings, and newly stimulated foreign capital inflows. Following equation (8.7), the economic opportunity cost of capital can be estimated using the sum of the values obtained by multiplying the opportunity cost of each of the three alternative sources of funds by the shares of the funds diverted from each of these sources.

8.7.1 Estimation of the Economic Cost of the Three Diverted Funds

a) Gross-of-Tax Return to Domestic Investment

Using the approach based on the national income and expenditure accounts, the return to domestic investment can be estimated from the GDP net of depreciation and the contributions made by labour, land, resource rents, and the associated sales and excise taxes. The total contribution of labour to the economy is the sum of wages and salaries paid by corporations and by unincorporated businesses. Since owners of unincorporated businesses are also workers, but are often not paid wages, the operating surplus of this sector thus includes the returns to both capital and labour. The labour content of this mixed income was estimated at 35 percent for South Africa during the period between 1995 and 1999.[7] The 35 percent figure is used and assumed throughout the period from 1985 to 2004.

Land is a fixed factor of production that makes a contribution to value added, especially in the agriculture and housing sectors. The contribution of land to the agricultural sector is assumed to be one-third

[7] This figure was obtained from officials of the South African Reserve Bank in Pretoria.

of the total value added in that sector.[8] Regarding the housing sector, information is not available on the amount of value added produced by this sector, nor is it available for the value added of the land component for the sector. Hence, this component is not incorporated into the calculation.

In South Africa, resource rents arise owing to the fact that in the past, the mining of non-renewable resources such as gold, coal, platinum, and diamonds has made a substantial contribution to GDP. These specific resources are non-renewable; when exploited with the help of reproducible capital, they can yield substantial economic resource rents.[9] These resource rents should be subtracted from the income to capital in order to derive the income to reproducible capital.

Moreover, it should be noted that the value-added tax (VAT) implemented in South Africa is a consumption-type tax and allows a full credit for the purchase of capital goods. Hence, the VAT is effectively borne by the value added of labour and not capital; hence, it should be subtracted from GDP in order to derive the return to capital alone.

To arrive at a rate of return, the value of the income attributed to the stock of reproducible capital is divided by the total estimated value of the reproducible capital stock reduced by the value of the reproducible capital stock attributed to production of general government services. Over the past 15 years, the average real rate of return on investment in South Africa is estimated to be approximately 12.73 percent, as shown in Table 8.1.[10] The value of ρ is thus taken to be 13.0 percent for this exercise.

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[8]Data are not available for the agricultural sector alone, but are available on a combined basis for agriculture, forestry, and fishing. Because of the importance of agriculture in South Africa, it is assumed that the value added in the agricultural sector accounts for 95 percent of the total value added in the agricultural, forestry, and fishing sectors combined. Further, the assumption that the contribution of land is equal to one-third of the total value added of the agricultural sector is consistent with what has been estimated in countries of a similar level of development.

[9]Resource rents were estimated by Blignaut and Hassan (2001). However, the resource rents shown here are calculated based on the assumption that the real rate of return to the reproducible capital in mining is 10 percent for the period from 1985 to 1993. From 1994, resource rents are assumed to increase with the inflation rate owing to the absence of data for these years.

[10]This estimate is lower than the one shown in Kuo, Jenkins, and Mphahlele (2003) for the following reasons. First, the amount of return to capital in the

b) Cost of Newly Stimulated Domestic Savings

When project funds are raised in the capital markets, domestic savings in banks or other financial institutions are stimulated. The net-of-tax return to the newly stimulated domestic savings can be measured by the gross-of-tax return to reproducible capital minus the amount of income and property taxes paid by corporations and the personal income taxes paid by individuals on their income from investments. It is further reduced by the cost of the financial intermediation services provided by banks and other financial institutions. These costs of financial intermediation are an economic resource cost that increases the spread between the time preference rate for consumption and the interest rate charged to borrowers. Owing to a lack of detailed data in this sector, it is estimated by assuming that the value added produced by financial institutions accounts for one-half of the value added created by the total of all financial institutions and real estate. Furthermore, the intermediation services are estimated to be a further half of the value added in the financial institutions.[11] Hence, the amount of return divided by reproducible capital stock represents the net rate of return to households on newly stimulated savings. It also reflects the rate of time preference for forgone consumption.

Using national accounts data over the past 20 years, the cost of newly stimulated domestic savings, *r*, for South Africa is estimated at about 4.50 percent, as shown in Table 8.2.

Kuo–Jenkins–Mphahlele study was measured gross of depreciation, and the reproducible capital stock was assumed to be the total stock in the economy, including that of general government services. Second, the national accounts data appear to have been revised substantially in some areas, especially since 1995.

[11]See Statistics South Africa, Final Supply and Use Tables, 1998. The fraction of value added in the financial institutions was about 48 percent of those in the financial institutions, real estate, and business activities combined. The share of operating surplus in the total value added in financial institutions was 53 percent.

c) Marginal Economic Cost of Foreign Financing

The real marginal cost of foreign financing, MC_f, can be estimated using equation (8.10). In South Africa, long-term debts currently account for more than 70 percent of total foreign debt. These long-term debts are mostly denominated in US dollars. The coupon rate charged by the US institutions ranges from 8.375 percent to 9.125 percent for US dollar bonds (South African Reserve Bank, 2006). For this exercise, it is assumed that the average borrowing rate from abroad is about 8.5 percent per annum, with the GDP deflator of 2.5 percent in the United States.

The fraction of long-term loans outstanding with variable interest rates, ϕ, is about one-third.[12] If we include both long- and short-term debts with variable interest rates, they would amount to 53 percent of the total stock of South Africa's foreign debt. For the purpose of this exercise, we assume the amount to be about 50 percent. Thus, the following information is given: $i_f = 8.5$ percent, $t_w = 0$, $gp_f = 2.50$ percent, and $\phi = 0.50$. Assuming that ε_s^f is 1.5, one can obtain the value of MC'_f, which is approximately 7.80 percent.

8.7.2 Weights of the Three Diverted Funds

The weights of the three diverted funds depend upon the initial shares of the sources of these funds and their price responsiveness to changes in the market interest rates. We estimate that the average ratio of the total private sector investment to savings (I_T/S_T) for the past 20 years is about 73 percent. The average shares of total private sector savings are assumed to be approximately 20 percent for households, 65 percent for businesses, and 15 percent for foreigners.[13] Assuming the supply elasticity of household savings to be 0.5, the supply elasticity of business saving to be zero,[14] the supply elasticity of foreign funds to be 1.5, and

[12]The percentage of long-term debts with variable interest rate declined from 69.9 percent in 1994 to 33.8 percent in 1999 (World Bank, 2001).

[13]These shares fluctuate from year to year in South Africa. This is also a parameter for sensitivity analysis.

[14]It is not clear whether higher interest rates would affect the amount of business savings. This is because businesses are more concerned with investment opportunities.

the demand elasticity for private sector capital in response to changes in the cost of funds to be −1.0, one can estimate the proportions of each of the diverted funds. They are 9.48 percent from newly stimulated domestic savings, 21.33 percent from newly stimulated foreign capital, and 69.19 percent from displaced or postponed domestic investment.

8.7.3 Estimates of the Economic Cost of Capital

The economic opportunity cost of capital can be estimated as a weighted average of the rate of return on displaced private sector investment and the rate of return to domestic and foreign savings. Substituting the above data in equation (8.7), one can obtain an estimate of the economic cost of capital for South Africa of 11.08 percent.

The empirical results depend on the values of several key parameters, such as the supply elasticity of foreign capital, the initial share of each sector in total private sector savings, the average rate of return on domestic investment, resource rents, the labour content of mixed capital and labour income for unincorporated businesses, foreign inflation rate, etc. A sensitivity analysis is performed to determine how robust the estimate of the economic cost of capital is. The results indicate that the value would range from 10.74 percent to 11.49 percent.[15] Thus, a conservative estimate of the economic cost of capital in South Africa would be a real rate of 11 percent.

8.8 Conclusion

The discount rate used in the economic analysis of investments is a key variable in applying the NPV or benefit–cost criteria for investment decision-making. Such a discount rate is equally applicable to the economic evaluation, as distinct from a financial analysis, of both private

[15]For example, if the supply elasticity of foreign capital is 1.0 instead of 1.5, the share of financing from foreign funds becomes smaller, but the marginal cost of foreign funds is increased. As a consequence, the economic opportunity cost of capital increases to 11.49 percent. On the other hand, if the supply elasticity of foreign capital is increased to 2.0, the economic cost of capital would be 10.74 percent. Perhaps the most important element in determining the economic cost of capital is the gross-of-tax return on domestic investment. If the average rate of return is 1.0 percentage point higher than 13.0 percent of the base case, the economic opportunity cost of capital would become 11.77 percent.

and public investments. If the NPV of either type of project is negative when discounted by the economic cost of capital, the country would be better off if the project were not implemented. Estimates of the value of this variable for a country should be derived from the empirical realities of the country in question. Of course, the results of such a discounting effort are only as good as the underlying data and projection made of the benefits and costs for the project.

This chapter began with the presentation of alternative approaches to choosing discount rates for investment projects and a review of their strengths and weaknesses. An approach that captures the essential economic features uses a weighted average of the economic rate of return on private investment and the cost of newly stimulated domestic and foreign savings. Most practitioners have chosen to use a discount rate that follows this weighted average opportunity cost of funds concept. This chapter has described a practical framework for estimating the economic opportunity cost of capital in a small, open economy. The model considers the economic cost of raising funds from the capital market. It takes into account not only the opportunity cost of funds diverted from private domestic investment and private consumption, but also the marginal cost of foreign borrowing. For illustrative purposes, this methodology is applied to the case of South Africa.

Table 8.1: Return to Domestic Investment in South Africa, 1985–2004 (million rand)

	Expressed in Current Prices										*Expressed in 2000 Prices*		*Percentage*
Year	*GDP*	*Total Labour Income*	*Taxes on Products*	*Value Added Tax*	*Subsidies*	*GVA in Agriculture*	*Resource Rents*	*Depreciation*	*Return to Capital*	*GDP Deflator Index*	*Real Return to Capital*	*Capital Stock (Mid-Year)*	*Rate of Return*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1985	127,598	69,115	11,791	-	1,536	6,091	6,323	21,003	22,283	18.00	123,801	1,358,877	9.11
1986	149,395	80,969	13,946	-	1,814	6,831	8,994	26,348	22,725	21.07	107,850	1,377,945	7.83
1987	174,647	95,102	16,141	-	2,146	8,994	11,605	29,823	25,713	24.13	106,583	1,383,741	7.70
1988	209,613	111,556	20,936	-	2,241	11,149	12,269	34,521	35,504	27.79	127,766	1,391,734	9.18
1989	251,676	134,204	26,505	-	2,375	12,332	12,933	40,978	44,023	32.58	135,107	1,407,786	9.60
1990	289,816	158,557	29,153	-	2,488	12,184	13,596	45,990	50,249	37.64	133,494	1,425,970	9.36
1991	331,980	182,514	31,096	18,792	2,523	13,825	12,411	50,251	56,232	43.56	129,088	1,440,425	8.96
1992	372,227	209,129	33,190	17,506	4,519	13,056	11,227	54,227	66,457	49.91	133,156	1,448,246	9.19
1993	426,133	234,347	41,611	25,449	6,320	16,284	10,042	58,575	82,873	56.44	146,833	1,452,144	10.11
1994	482,120	260,776	48,373	29,288	6,400	20,252	11,005	64,500	98,830	61.86	159,775	1,458,980	10.95
1995	548,100	295,467	53,644	32,768	5,898	19,317	12,134	71,827	117,460	68.20	172,239	1,472,298	11.70
1996	617,954	332,191	58,119	35,903	5,635	23,720	13,115	78,817	137,366	73.71	186,353	1,492,361	12.49
1997	685,730	366,463	63,419	40,096	4,856	25,140	14,178	87,188	156,216	79.69	196,034	1,517,125	12.92
1998	742,424	401,632	74,473	43,677	6,923	25,434	15,271	96,615	158,848	85.83	185,067	1,544,460	11.98
1999	813,683	436,124	80,528	48,330	5,718	26,179	16,350	107,966	177,618	91.89	193,288	1,565,853	12.34
2000	922,148	478,812	87,816	48,377	3,886	27,451	17,792	119,237	226,708	100.00	226,708	1,580,321	14.35
2001	1,020,007	514,603	96,363	54,455	4,571	32,588	19,156	130,848	267,391	107.67	248,350	1,595,909	15.56
2002	1,164,945	564,357	109,820	61,057	4,664	44,179	21,126	149,329	329,119	118.74	277,180	1,612,489	17.19
2003	1,251,468	618,498	120,219	70,150	3,336	42,007	22,075	161,635	338,513	124.07	272,833	1,630,963	16.73
2004	1,374,476	676,231	146,738	80,682	2,671	41,323	23,377	172,394	372,402	131.39	283,428	1,656,231	17.11

Source: For the period 1985–2004, South African Reserve Bank, *South Africa's National Income Accounts 1946–2005* (June 2005).

Notes: GDP: gross domestic product; GVA: gross value added.

Column (2) is obtained from the sum of wages and salaries paid by corporations and 35 percent of net operating surplus generated by incorporated businesses.

Column (9) = (1) − (2) − (4) – 0.95*(⅓)*(6) – {(2)/[(1) − (3) + (5)]}*[(3) − (4)] − (7) – (8).

Column (12) is obtained from the total capital stock net of general government services.

Table 8.2: Cost of Newly Stimulated Domestic Savings in South Africa, 1985–2004 (million rand)

Year	*Expressed in Current Prices*												*Expressed in 2000 Prices*	*Percentage*
Year	*GDP*	*Total Labour Income*	*Taxes on Products*	*GVA in Agriculture*	*Resource Rents*	*Depreciation*	*Income and Wealth Taxes Paid by Corporations*	*Income and Wealth Taxes Paid by Households*	*Wages and Salaries Received by Households*	*Property Income Received by Households*	*Value Added in FIs, Real Estates*	*Return to Domestic Savings*	*Real Return to Domestic Savings*	*Rate of Return to Domestic Savings*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1985	127,598	69,115	11,791	6,091	6,332	21,003	7,434	9,038	65,078	16,861	15,849	4,181	23,230	1.71
1986	149,395	80,969	13,946	6,831	8,994	26,348	8,486	10,512	75,444	18,772	17,312	2,096	9,949	0.72
1987	174,647	95,102	16,141	8,994	11,605	29,823	8,736	12,354	88,577	25,107	20,688	2,491	10,326	0.75
1988	209,613	111,556	20,936	11,149	12,269	34,521	10,194	14,468	103,565	34,228	25,069	6,746	24,276	1.74
1989	251,676	134,204	26,505	12,332	12,933	40,978	11,249	19,723	124,050	42,485	30,265	9,304	28,553	2.03
1990	289,816	158,557	29,153	12,184	13,596	45,990	15,284	23,831	146,240	49,541	36,039	8,338	22,151	1.55
1991	331,980	182,514	31,096	13,825	12,411	50,251	13,547	28,961	169,516	59,380	44,945	19,033	43,694	3.03
1992	372,227	209,129	33,190	13,056	11,227	54,227	10,963	35,050	193,250	73,942	53,265	26,341	52,778	3.64
1993	426,133	234,347	41,611	16,284	10,042	58,575	12,579	37,599	216,368	82,383	62,861	37,739	66,866	4.60
1994	482,120	260,776	48,373	20,252	11,005	64,500	14,565	45,280	240,416	94,052	76,491	46,132	74,580	5.11
1995	548,100	295,467	53,644	19,317	12,134	71,827	14,115	51,623	272,916	110,378	82,162	59,390	87,087	5.92
1996	617,954	332,191	58,119	23,720	13,115	78,817	21,408	59,496	306,225	121,807	94,122	66,332	89,987	6.03
1997	685,730	366,463	63,419	25,140	14,178	87,188	24,134	68,048	338,204	142,844	110,488	74,558	93,562	6.17
1998	742,424	401,632	74,473	25,434	15,721	96,615	29,935	75,422	370,589	155,866	122,227	63,557	74,048	4.79
1999	813,683	436,124	80,528	26,179	16,350	107,966	30,220	84,335	402,375	176,116	140,673	73,362	79,834	5.10
2000	922,148	478,812	87,816	27,451	17,792	119,237	33,248	87,848	440,299	206,496	156,252	109,440	109,440	6.93
2001	1,020,007	514,603	96,363	32,588	19,156	130,848	58,701	89,700	471,816	231,010	177,531	116,150	107,879	6.76
2002	1,164,945	564,357	109,820	44,179	21,126	149,329	68,807	95,801	515,053	271,925	204,590	153,266	129,079	8.00
2003	1,251,468	618,498	120,219	42,007	22,075	161,635	70,356	99,451	567,024	280,899	228,075	155,418	125,263	7.68
2004	1,374,476	676,231	146,738	41,323	23,377	172,394	75,343	108,628	618,215	305,088	247,514	169,534	129,029	7.79

Source: For the period 1985–2004, South African Reserve Bank, *South Africa's National Income Accounts 1946–2005* (June 2005).
Statistics South Africa. Final Supply and Use Tables 1998.

Notes: GDP: gross domestic product; GVA: gross value added; FIs: financial institutions.
Column (12) = (1) − (2) − (3) – 0.95*(⅓)*(4) – (5) – (6) – (7) – (8)*{(10)/[(9) + (10)]} − (11)*0.5*0.5.
Column (14) is obtained by dividing Column (13) of this table by Column (12) of Table 8.1.

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