HIGHER EDUCATION IMPACT

universities in the south african economy

a report for HIGHER EDUCATION SOUTH AFRICA September 2007

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FOREWORD

This is the first sectoral study of its kind in the history of South African higher education. This study was by commissioned by Higher Education South Africa (HESA) as part of its project on promoting the value of South African education, which seeks to collect and analyse information relating to the vital contribution made by higher education to South Africa's national developmental goals. The outcomes of the project are meant to promote higher education's achievements among key audiences and stakeholders, including government, business and the general public.

HESA recognises that the discourse on higher education's contributions should not be dominated by economic arguments. The contributions of higher education are indeed much larger and include less tangible aspects such as building better lives, creating informed citizens, deepening democracy and promoting social inclusion and cohesion. Historically, there has existed a degree of tension between the general goals of higher education on the one hand and the aspirations, often articulated by government and business, on the other. This study seeks to find a common language that will enable more fruitful engagement between these parties.

HESA has decided to address the economic contributions of higher education in a process envisaged to produce a series of reports over a spectrum of higher education's contributions to national development. It follows on the publication of *The Spirit of Enquiry* (2006) which examined the achievements in research within higher education institutions. *Higher Education Impact* continues this process of quantifying higher education's achievements, but this time via economic means. This is for two reasons.

- Firstly, the voice from government, policy makers, business and the public, questioning the responsiveness of higher education to national development needs, emphasises the economic usefulness of institutions, epitomised by contributions to skills and economic development. The ASGISA and JIPSA initiatives, for example, have called on higher education to play a greater role in skills development and to contribute toward economic growth.

- Secondly, numerous studies have been done internationally which provide evidence of the importance of higher education for economic growth. The series of studies published by the Universities UK in the period 2002-2007 on the impact of United Kingdom universities on the national economy has provided both the model and benchmark for this HESA study.

The findings of this report clearly indicate the need for public investment in higher education as one of the key long-term strategies for stimulating national economic growth. However, it goes further by showing where investment can best impact on the sector by running simulations on various higher education scenarios. Although the number of simulations is limited in this study for the purposes of brevity, it is possible to run any number of additional simulations from the same data. In different terms, this report offers the possibility of testing where additional funding to higher education would achieve the best knock-on effect for the economy as a whole.

Having analysed one aspect of the economic contribution of higher education, HESA is committed to producing subsequent reports to address some of the "understated" contributions of higher education to national development. It is anticipated that the next study, to be conducted during the early part of 2008, will focus on estimating social rates of return on higher education.

Professor E. Duma Malaza
CEO, Higher Education South Africa

EXECUTIVE SUMMARY

This study was commissioned by Higher Education South Africa (HESA) with the view to determine the impact of the public higher education sector on the national economy.

The study defines the higher education sector as the sum of all higher education institutions (HEIs) in South Africa. Specific data concerning HEIs in South Africa were obtained from a questionnaire that was sent out. The data were used to supplement the information available in public reports and databases for economic modelling purposes. The research team received 16 responses from a possible 23 public institutions.

The first two sections of the study are primarily concerned with introducing the reader to the nature of the study, and briefly reviewing the most important literature.

The middle sections sketch the South African higher education landscape with regard to income, expenditure and employment. The data collected from the various HEIs were based on 2004 figures. The most important findings are highlighted below.

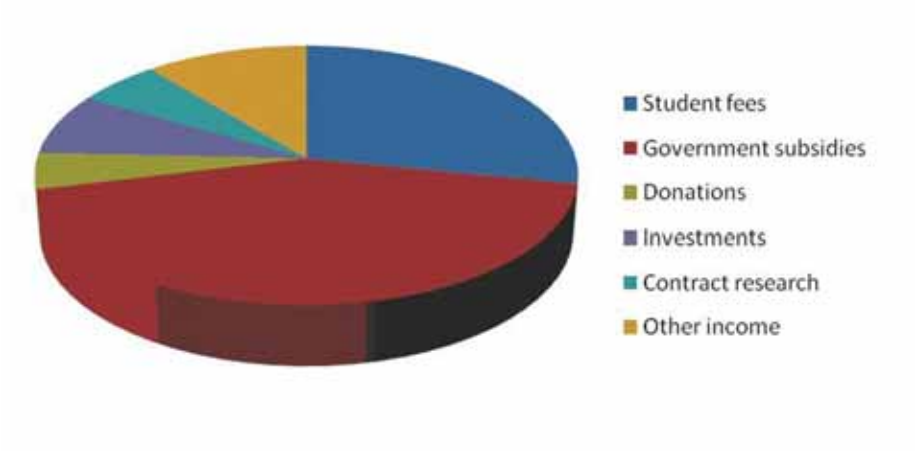
Income

- The size of the South African higher education sector was approximately R20 billion in 2004.
- Government subsidies to HEIs amounted to an average of 43 per cent of their income. The highest figure reported in this regard was 57 per cent.
- Student fees comprised on average 28 per cent of HEI income, and in some cases as much as 38 per cent.
- Investment income of 7.7 per cent on average is of significant importance to HEIs. It is the third largest common source of income, and comprises as much as 27.6 per cent of some institutions' income.
- In terms of income, higher education is significant in size, compared to other industries in South Africa.

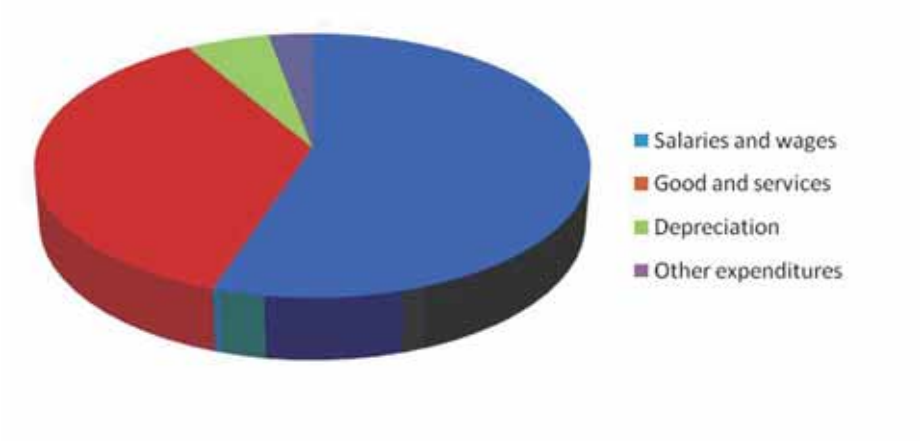
Expenditure

- Staff cost is the largest expenditure component for South African HEIs, with an average of 31.5 per cent of income spent on academic salaries, and 23.7 per cent on non-academic salaries.
- A further 36.5 per cent of income is spent on goods and services.
- A combined 90 per cent of income is therefore spent on labour, and goods and services.

Sources of income



Items of expenditure



Employment

- Top management of HEIs (i.e. deans and higher who comprise only 1 per cent of staff) earn 3.5 per cent of the salary bill of their institutions.
- Even if top and middle management are combined, no institution has more than 10 per cent of their staff employed in these categories. The average for all institutions is 5.3 per cent.
- Average HEI employment includes only 4 per cent engineers, 5.2 per cent natural scientists, and 2.4 per cent education specialists.[1] Some of these numbers appear to be low, especially the latter.
- The various HEIs differ markedly in their personnel compositions.

The main contribution of this study on the impact of higher education in South Africa is contained in the final section. Here three sets of computerised simulations are performed to determine how strong the secondary or "knock-on" effects of the higher education sector on the rest of the economy would be.

Each simulation, either directly or indirectly, involves a scenario concerning the higher education sector. Firstly, government expenditure on higher education is hypothetically increased; secondly, more professionals are trained; and thirdly, the factors of production are assumed to become more productive.

These simulation scenarios reflect realistic possibilities; therefore the results should be of great value to HESA and policy makers.

Although each simulation provided its own set of interesting results, it is perhaps most significant that when these simulations were combined, the results were positive in almost all respects. Scenarios like these are definitely attainable, with the results suggesting that their implementation deserves serious consideration.

Highlights from the modelling scenarios

- Increased government spending on higher education by itself (i.e. without accompanying increases in the professional labour force and factor productivity) has negative effects on GDP and most other economic variables. The money therefore needs to be spent selectively before one could claim that additional spending would benefit the economy.
- Retraining the existing workforce through higher education would yield positive effects for the South African economy, but it is a costly option. For every R1 that the economy would grow, the government would have to spend up to R2 to accomplish the growth.
- Putting high school graduates through the higher education system would have much higher GDP effects; it is estimated that the effects would be four to five times higher than those of the retraining of other workers.
- If government spending were to result in more professionals in the market, as well as higher total factor productivity, government would get up to R1.90 back in revenue for every R1 that they spend

1 The numbers refer to all employees at HEIs, not only academic.

additionally on higher education.

- The economy could grow by up to R11 in real terms for every extra Rand spent on higher education, under the assumption that 1 per cent more professionals would be trained, and total factor productivity in the economy would improve by 0.1 per cent.

It is clear that the role of higher education in developing a country is considerable. Human capital has been central to theories on productivity increases driving economic growth and development for many years. The education sector is one of the building blocks of human capital in any society, and a great source of wealth and prosperity for its citizens. This report supports this well-known result by providing empirically based estimates, based on South African data and relationships, of the potential benefits of investing in higher education, for both individuals and government. At the request of HESA, the researchers used studies undertaken in the United Kingdom as a conceptual starting point for their analysis.

ACKNOWLEDGEMENTS

The authors wish to thank Higher Education South Africa (HESA) for the financial and administrative support provided to conduct this study, as well as the administrators of the various universities who assisted in providing us with correct and up-to-date information. A special word of thanks also to Professor Mark Horridge at the Centre of Policy Studies for help with the modelling database, and Professors Antony Melck, Rolf Stumpf and Martin Hall, as well as Dr Miriam Altman and Alan Hirsch for valuable comments and advice.

The views in this report are our own and do not necessarily reflect those of HESA. Data from individual institutions were not disclosed to anyone except HESA.

chapter one
INTRODUCTION

Overview

We introduce the reader to the nature of this study which uses as its conceptual starting point a similar study commissioned by Universities UK. However, instead of an input-output model, we go a step further by using a computable general equilibrium model to simulate various scenarios in the analysis of the impact of higher education on the South African economy.

The role of higher education has been well documented in many parts of the world. This study was commissioned by Higher Education South Africa (HESA) and modelled on the 2002 study of the United Kingdom by Kelly, Marsh and McNicoll (hereafter referred to as KMM). Since the start of democracy in South Africa in the early 1990s, there have been very few studies undertaken on the overall impact of the higher education sector in South Africa. This study seeks to redress this gap in the literature through providing HESA with an up-to-date profile of the higher education landscape, an analysis of the impact of higher education, and the potential that this sector holds for the country. We also improve on the KMM study by using a more advanced economic model. A computable general equilibrium model of South Africa is used to simulate the various scenarios described in the final section of this study and to analyse the impacts of higher education on the economy.

Examples[2] of the possible impact that higher education might have on the economy are:

- Providing skilled workers to the economy;
- Economy-wide stimulation, via its own spending;

2 Dr Miriam Altman, Executive Director of the Employment, Growth and Development Initiative at the HSRC, proposed that we add this clarifying paragraph; we are grateful for her valuable comments.

- Local economic development, by virtue of its employment and involvement in surrounding communities;
- The promotion of equity and access to highly paid jobs for the population; and
- Generating and supporting scientific communities that enable innovation and industrial diversification (and therefore economic growth and development).

The importance of higher education and research was recognised by the South African government in its new macroeconomic strategy[3]. The Accelerated and Shared Growth Initiative for South Africa (ASGISA) outlines a number of binding constraints on the country's growth potential, including a shortage of suitably skilled labour. In response to these constraints, ASGISA proposed a number of decisive interventions which can be grouped into six categories, namely (i) infrastructure programmes; (ii) sector investment strategies; (iii) skills and education initiatives; (iv) second economy interventions; (v) macroeconomic issues; and (vi) public administration issues. To help achieve the skills and education initiatives in ASGISA, the Joint Initiative on Priority Skills Acquisition (JIPSA) was established.

The objectives of this high-level initiative, led by Deputy President Phumzile Mlambo-Ngcuka, are to fast-track skills delivery in priority areas and unblock obstacles so as to support ASGISA's core objectives. Higher education clearly has a role to play, and this study aims, amongst others, to provide more evidence in this regard for policy makers concerned with these issues.

The South African economy is experiencing a period of unprecedented growth. However, despite the longest upward phase since the post World War II period, the economy has been unable to eliminate some of its most deeply entrenched problems. Its dual labour market and high levels of poverty and inequality characterise the South African economy. The unemployment rate is much higher than in most other comparable countries in the world, and is predominantly structural in nature.

Structural unemployment is of particular concern for a country such as South Africa. On the one hand, there are large numbers of unskilled labourers who cannot find work, even though job vacancies exist; on the other, there is a relatively small number of skilled and trained workers who earn high salaries. In our view, workers in the one market can only migrate to the other through acquiring further education. We simulate the effects of such migrations with our economic model and clearly highlight the most important results. In addition, we also simulate the potential gains from increased productivity as a result of higher education.

It is appropriate at this stage to elaborate briefly on some of the advantages of the economic model used in the simulations[4]. The KMM study used an input-output model to analyse the economic impacts of higher

3 As part of South Africa's commitment to achieving the Millennium Development Goals, ASGISA was launched in February 2006 with its core objectives to halve poverty and unemployment by 2014.
4 See Appendix 2 for a description of the model.

education in the United Kingdom. One of the major weaknesses of input-output models is that the relationships between sectors are assumed to be constant, which usually results in multipliers that are too large. The computable general equilibrium (CGE) modelling approach allows for more elastic relationships between sectors and factors of production. In this regard, the difference between input-output models and CGE models is similar to the difference between a car with no shock absorbers, and a modern car. The first would transfer all the bumps in the road to the passengers, while the second would "absorb" the shocks through inventive technology. Input-output models have rigid production technologies and fixed recipes. For example, if a loaf of bread requires single units of flour, water, salt and yeast, and one wished to double the output, one would need to double all the inputs. If the demand for bread were to increase, the "knock-on" effects on the flour sector would be large.

Computable general equilibrium models have adjustable recipes of production. They take the relative prices of all commodities into consideration, and allow for substitution between the ingredients of the production process. If the price of flour were to increase, for example, then bakers might decide to change the recipe of their bread by using less flour per unit of bread, and more of some other ingredients. If the demand for bread were to increase in this case, the "knock-on" effects on the flour sector would be smaller than with input-output models. In this study we also report knock-on effects of the higher education sector on other sectors in the economy, but the reader will find that they are smaller, and more realistic, than the numbers reported in the KMM study.

Similar to the majority of CGE models, the model used in these simulations is designed for comparative static simulations of the economy. We use the GEMPACK software package to solve our model. When a specific policy change or shock to the economy is simulated, the model calculates what the change in the equilibrium position of the economy would be from the base level. Although the percentage changes reported in most simulations seem relatively small, they should be viewed in the context of the modelling exercises. CGE modelling often lends itself to very specific and detailed microeconomic simulations. Results of such exercises are bound to be small on a macroeconomic level, but often yield very interesting and important results on an industry or household level. These simulations regarding the higher education sector in South Africa are no exception.

The higher education data used in the model were carefully compiled from available documents and a comprehensive survey conducted specifically for this report. Macroeconomic data from Statistics South Africa and the Council on Higher Education were combined with microeconomic data obtained from the survey. A questionnaire[5] regarding higher education data was sent to all public higher education institutions (HEIs) in South Africa and the majority of them participated by sending us their responses. In total, 16

5 See Appendix 1 for the questionnaire that had to be completed.

responses were received from a possible 23 HEIs, giving a good response rate on the survey of 69.6 per cent. This compares favourably with the response rate of 54 per cent in the KMM (2002) study. The list of participating institutions is given in alphabetical order in Table 1 below.

TABLE 1 List of participating institutions

	Institution
1	Cape Peninsula University of Technology
2	Central University of Technology
3	Durban University of Technology
4	Nelson Mandela Metropolitan University
5	North West University
6	Stellenbosch University
7	Tshwane University of Technology
8	University of Cape Town
9	University of Fort Hare
10	University of the Free State
11	University of Johannesburg
12	University of Pretoria
13	University of the Western Cape
14	University of Zululand
15	Vaal University of Technology
16	University of the Witwatersrand

In the following section we provide a literature review of the impacts of the higher education sector on economies worldwide, and the role of human capital. This is followed by descriptive sections on the income, expenditure and employment profiles of South African HEIs. Model simulations that portray the "knock-on" effects of higher education on the rest of the economy follow. A brief conclusion with some policy recommendations rounds off the report. The appendices to the report contain the questionnaire used in the survey, a more detailed description of the economic model used in the simulations, and information concerning the occupation groups used in the model.

chapter two

LITERATURE REVIEW

Overview

In this chapter we review the most relevant literature related to the impact of higher education on economies elsewhere in the world, and consider the UK study in some detail. Seminal theories on the role of human capital intertwined with economic growth are briefly highlighted as these have made possible robust empirical research on the impact of higher education.

The theories and literature on human capital have contributed to some of the most significant economic research over the past fifty years. Although this report is not of a theoretical nature, we felt it necessary to refer briefly to some of the seminal papers that describe the importance of human capital for economic growth and development. The reason for this is simply that in these papers a clear theoretical relationship between the expansion of human capital and economic growth is established. Since higher education is central to the expansion of a country's human capital, it helps us better to understand its important role in the economy.

An early study by Becker[6] (1962) analyses in considerable detail investment in human capital and finds that most investments raise observed earnings at an older age. An influential paper by Lucas[7] (1988) develops a model of economic development, and clearly stresses the important role that human capital plays through its productivity enhancements of both labour and physical capital. Lucas (1993) explains that the main engine of economic growth is human capital or knowledge accumulation, and that differences in the level of living standards

6 Gary S Becker was awarded the Nobel Memorial Prize in Economics in 1992.
7 Robert E Lucas, Jr was awarded the Nobel Memorial Prize in Economics in 1995.

observed among nations can be traced back to differences in their levels of human capital. Lucas also points out that most of human capital accumulation takes place in schools and research organisations, such as higher education institutions. Perhaps one of the most well-known models in economics – the endogenous growth model developed by Romer (1990)[8] – concludes that the stock of human capital determines the rate of growth in the economy, and that typically too few resources are devoted to increasing human capital through research.

Intertwined by their appreciation for the role of human capital, these papers each made outstanding contributions to economic theory. Today the role of human capital is universally acknowledged. Institutions and governments fund more post-secondary education and research than ever before. The results of these investments have increased economic growth and welfare across the globe, and made higher education institutions one of the leading sources of innovation within society.

However, the reality concerning the role of human capital, and specifically higher education, is of greater importance for the purposes of this report. Following the theoretical work done on these topics, many institutions have started to measure the impact of HEIs on the economy empirically.

As mentioned earlier, this study was based on the Kelly, Marsh and McNicoll (2002) report for Universities UK. The report showed that HEIs play a significant role within the United Kingdom through the economic activity they generate and the intrinsic value placed on the educational services they provide. Using an input-output model to estimate the overall impact of the HE sector for 1999/2000, it was found that the total income of UK HEIs for this period amounted to £12.8 billion. Income of any kind from the UK public sector amounted to 63 per cent of all HEI income, while income from the UK private sector accounted for 27 per cent, and international income 10 per cent.

However, there is considerable evidence that HEIs are rapidly diversifying their sources of income to support their activities, with public sector income having fallen from 73 per cent in 1995/96. The rise in income shares from the private and international sectors shows the increasing importance of higher education as an industry to the United Kingdom. Similar to many South African HEIs, UK institutions were also found to be actively seeking additional income through fund-raising campaigns and undertaking contract work for the private sector. Labour costs constituted the largest single component of expenditure, being 58 per cent of the £12.8 billion spent by UK HEIs in 1999/2000.

KMM further found that UK HEIs directly employed an estimated 345 000 people, equivalent to 1.4 per cent of total UK employment. An employment multiplier of 1.89 was suggested, implying that for every 100 jobs within the HEIs themselves, a

8 Paul M Romer's endogenous growth model is an extension of earlier work done by Robert M Solow on economic growth theory. Solow was awarded the Nobel Memorial Prize in Economics in 1987.

further 89 jobs were generated through "knock-on" effects. Compared to the results of our study, this number is very large. This is most likely due to the input-output model used in the KMM study, which tends to overestimate multipliers of this sort. Similarly, an output multiplier of 1.56 was estimated by KMM.

Another interesting finding was the skills profile of employment generated by the HE sector. Whilst the skills profile of the "knock-on" employment, generated by the expenditure of the HE sector, is lower than that of employment directly within the HEIs, it remains more concentrated in the higher skill bands than the profile of the UK workforce as a whole. Although this is probably due to the particular types of expenditure that the HE sector makes, it suggests that not only does the HE sector generate employment, but it tends to generate more highly skilled employment than other sectors do. Overall, output dependent on the HE sector amounted to £34.8 billion with £13.3 billion paid in wages to UK households.

There exists a fairly extensive literature of the impacts of HEIs on regional economies. Florax (1992) lists more than 40 economic impact studies related to university spending, dating back to 1964. Apart from the KMM study, there have been several quantitative studies on HEIs in recent years. Giesecke (2005) and Giesecke and Madden (2005) both use a similar methodology to that employed in this study, namely Computable General Equilibrium (CGE) modelling, to measure the impacts of universities on regional economies. Both studies took into account demand and supply side effects of HEIs and found the overall effect of these institutions to be positive on most macro and microeconomic variables. The studies also provide excellent explanations of the results and the intricate links between the various industries.

The main focus in these studies was the University of Tasmania, with the Giesecke and Madden (2005) study expanding its impact analysis to include the rest of Australia by using a dynamic multiregional CGE model. Some simulation results worth noting are that productivity increases, generated by universities, cause Tasmanian real GSP to grow strongly, but that the impact on employment is very small. Giesecke and Madden explain that the negligible impact on employment levels is due to offsetting effects created by the improvement in productivity. With labour more productive, firms have a desire to expand production, which, if other factors were to remain constant, would increase their demand for labour, which would in turn increase local employment. However, with workers now more productive, less labour is required to produce the same amount of output as before, which would tend to decrease local employment.

Despite employment not changing much, the simulation results show that local households remain better off, since real consumption and real government revenues are also higher. The rise in real consumption by households reflects increasing real wages and greater profitability of firms, with the expansion in domestic economic activity leading to the increase in real state government revenue.

Universities UK recently commissioned another study on a closely related topic.

PriceWaterhouseCoopers (2007) produced a report to analyse the economic benefits associated with higher education qualification attainment, after taking into consideration both the costs and benefits of HE to individuals and the government. The study defines human capital as the stock of knowledge and skills embodied in an individual as a result of education, training, and experience enhancing his or her productivity. It further describes human capital as one of the core determinants of long-run economic growth in the United Kingdom. HEIs in the UK are found to generate human capital through (i) the provision of education and training to students; (ii) research and development activities; and (iii) the generation and dissemination of knowledge through academic and business networks.

The PWC (2007) study attempts to estimate the value of higher education by assessing the earnings and employment outcomes of individuals in possession of higher education qualifications. The labour market usually places greater value on individuals who have obtained such skills and qualifications, compared to those without them. The study found that there is a large variation in the gross additional lifetime earnings of different degree subjects; for example, the lifetime earnings premium is £340 000 for medicine and dentistry qualifications, compared to approximately £51 000 for the humanities and £35 000 for the arts. Individuals in possession of HE qualifications are also more likely to be employed, compared to those with the next highest level of qualification. Combining income and employment effects, the gross additional lifetime earnings of a representative undergraduate degree over and above two or more A-levels[9] is estimated at £160 000.

It is also interesting to note that despite a large increase in the supply of graduates since the 1980s, there has been no erosion of the graduate premium. This has been due to an equivalent upward shift in the demand for highly trained and skilled individuals over this period. In fact, it seems that the increase in supply of graduates has facilitated the observed increase in demand for their services.

The study also found that the financial benefit of completing a degree is greatest for men from lower socio-economic groups or with smaller family resources, whilst women do relatively well, irrespective of their family backgrounds or circumstances. The findings of the PWC (2007) report were perhaps best summarised by Professor Bone[10] of Universities UK when he stated that "taking a degree remains an attractive personal investment that will produce significant long-term financial gains and many other benefits for the individual graduate" (2007: 1).

Many studies completed in other regions and countries confirm the findings of those discussed here. It seems that the role of higher education as a source of economic growth and a source of individual enrichment through human capital accumulation is very clear. The theoretical work done by

9 A-levels indicate a higher level of education obtained for a subject at school level.
10 Professor Drummond Bone was President of Universities UK when the report was published.

economists since the 1930s has paved the way for the empirical measurements of factors such as higher education today. Lucas (1993: 271) stated that "this inventive model-building process we are engaged in is an essential one, and I cannot imagine how we could possibly organise and make use of the mass of data available to us without it".

As a result of the work of these economists, we are now able to produce reliable empirical research using state-of-the-art economic models. This report hopes to make a significant contribution to higher education literature in South Africa and to give valuable insight to its readers.

chapter three

SOUTH AFRICAN HEIs: INCOME AND EXPENDITURE

Overview

Here we focus on an analysis of income and expenditure patterns of our public HEIs. The bulk of income is derived from three sources: government subsidies (43.1%), student fees (28.1%) and investment income (7.7%). As with the various studies reviewed, the total expenditure is dominated by staff costs, and goods and services. We also compare the income and expenditure profiles of HE with similar sized industries in South Africa and illustrate the relative significance of the sector in the economy.

The Council on Higher Education, as well as Statistics South Africa, regularly publish data regarding higher education in South Africa. However, it was necessary to supplement these data by collecting information directly from higher education institutions through a questionnaire. We asked HEIs to provide data for the year 2004, the latest available complete data set at the time of sending out the questionnaire.

Income

The first question in the survey focused on the sources of income. In this section we report on the responses received from the participating HEIs and summarise all information received regarding the income profile of these institutions in South Africa. Secondly, we analyse how this income was spent.

Table 2 summarises the information received for Question 1a, and lists the most significant income sources. We found large differences between the individual institutions' indicated sources of income, and how they chose to declare the various sources. In the table we present the lowest, highest and average percentages reported among the 16 participating institutions. From this it can be seen that, for example, student fees comprise, on average, 28.1 per cent of total income of

TABLE 2 Sources of income

Source	Lowest %	Highest %	Average %
Student fees	21.0	37.8	28.1
Government subsidy income	32.1	57.0	43.1
Investment income	1.2	27.6	7.7
International donations	0	9.1	1.2
South African donations	0	9.6	3.3
Contract research	0	27.6	5.6
Sales of goods & services	0	14.2	3.9
Research grants	0	6.0	1.9
Other			5.2
TOTAL			100

HEIs, while they comprise at least 21 per cent of all the institutions' income, but nowhere more than 37.8 per cent.

The large differences between the income composition and reporting of the 16 HEIs are noticeable. We requested institutions to summarise their income under the seven headings in Question 1a of the questionnaire, but gave them the option to add other sources of income. The result was that the sixteen institutions gave no less than 28 additional categories of income. From this it can be concluded that the various institutions have different systems of bookkeeping, and do not have the same definitions for certain activities. Also, the financial systems of the former technikons differ from those of the former universities. This fact compromises the quality of the data used in this study. Nonetheless, the results of the survey, as depicted in Table 2, are very insightful.

Firstly, the bulk of HEIs income (78.9%) comes from three sources, namely student fees (28.1%), government subsidies (43.1%) and investment income (7.7%). All the institutions rely heavily on student fees and government subsidies and the variances here are not very large. However, individual institutions differ vastly with respect to the remaining categories of income.

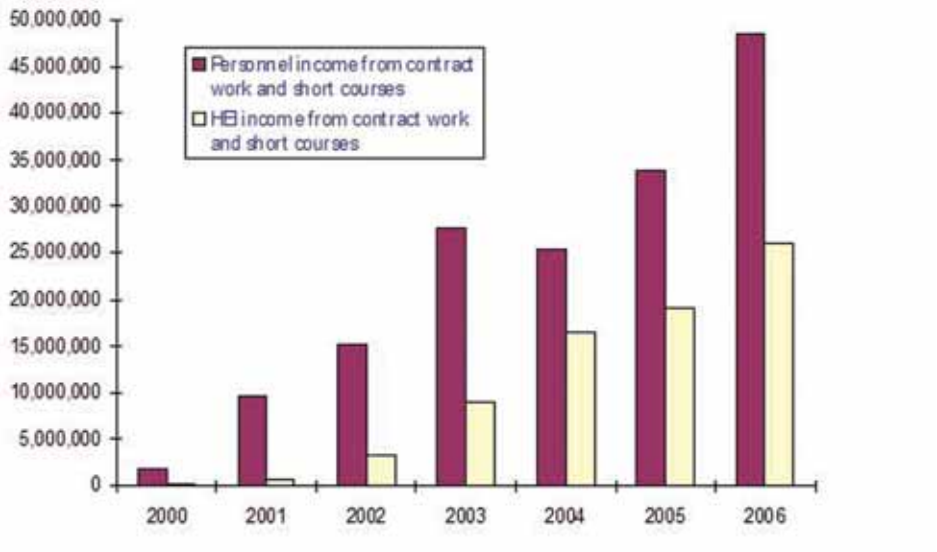
Secondly, investment income is of significant importance to HEIs. It is the third largest common source of income, and comprises as much as 27.6 per cent of some institutions' income. The highest proportion that either international or local donations form of any HEI's income in South Africa is below 10 per cent, with the averages respectively a mere 1.2 per cent for international donations and 3.3 per cent for local donations. Increased donations, regardless of their origin, would allow HEIs to increase investment in crucial areas such

as recruitment and infrastructure. It is a well-known fact that many of the world's top universities have benefited enormously from private donations over the years[11], and perhaps this is a source of income that HEIs in South Africa should explore more vigorously. History has proved alumni to be one of HEIs most valuable assets, and institutions should ensure that they treat them as such.

Thirdly, the role that contract research plays has been relatively small to date, with an average of only 5.6 per cent of income generated through this avenue. However, evidence suggests that this is rapidly increasing. We obtained up-to-date statistics about the growth of income from contract research and short courses[12] at one of the sixteen institutions, and report the trend of growth in this component from 2000–2006 in Figure 1 below. It is interesting to note how the ratio between HEI and personnel (staff) income from these sources has changed over this period.

Given the nature of the South African economy, and government's commitment to capacity building within the public sector, this source of income seems likely to become increasingly important to both institutions and personnel.

FIGURE 1 Personnel and income (Rands) in one HEI



11 John D Rockefeller's donations at the turn of the 19th century went a considerable way to establishing the University of Chicago as one of the premier HEIs in the world. More recent examples include Sidney E Frank's donation of $100 million towards undergraduate scholarships at Brown University in 2004, and John W Kluge's extraordinary gift of $400 million to Columbia University in 2007.

12 Short courses presented by HEIs generally refer to tertiary level courses for non-degree purposes.

In order to consider how South African HEI income data match up, we compare in Table 3 the average composition of income sources from this study to those in the KMM study. Although some of the definitions differ slightly, we used the categories and proportions from KMM (2002: 11) and listed them in the table below. The South African proportions are adapted from Table 2 (see page 12).

Again, the comparison is very insightful. Firstly, the subsidy income plus donations in South Africa comprises a larger percentage than in the UK, at the respective times of the studies. This implies that higher education in South Africa is more dependent on government subsidies and other grants for its operations than the UK sector is, which is not a surprising result. South Africa is still a developing country whose HE system should be a specific strategic priority of the government of the day.

Secondly, student fees in South Africa form a higher proportion of total HE income than in the UK. This is rather surprising, and contradictory in some sense, because most South Africans are poor, and few are able to afford higher education. However, government subsidies have steadily decreased. At the same time, the national government has improved the accessibility of higher education to the poor through its allocations to the National Student Financial Aid Scheme. The latter is particularly important because of the level of income inequality that exists in South Africa.

Thirdly, the table shows that research grants form a much higher part of total income in the UK. However, the South African number for government subsidies includes a significant research proportion, so that the large difference shown in the table is an over estimate of the actual difference between the two countries. Nonetheless, as previously shown, the income from contract research in South Africa is rapidly increasing, and should become a major source of income for HEIs in the near future.

TABLE 3 Comparison between UK and South African HEI income sources

Source	UK	South Africa
Funding council grants (UK) Subsidy plus donations[13] (SA)	40.3	47.6
Student fees	22.2	28.1
Research grants and contracts	16.1	7.5
Other services rendered	5.3	12.4
Other general operating income	13.9	
Endowment income and interest receivable	2.2	4.4[14]

13 Sum of government subsidy income and all donations in Table 2.
14 Only the interest/dividend portion of investment income.

Fourthly, even though we do not know what the "other" two sources of income in Table 3 are for the UK, they comprise almost one fifth of total income, while the number for South Africa is 12.4 per cent. It seems reasonable to suggest that South African HEIs should try to emulate UK institutions by finding "other" sources of income in order to reduce reliance on subsidies. In this regard, the fact that South Africa's income from endowments is a higher percentage of total income than that of the UK institutions is a positive sign.

In fact, South African universities compare well with some other internationally renowned universities. We found data for three more universities on this component of income, and report the results in Table 4. The numbers in the table confirm that the 4.4 per cent of all HEI income that is made up by investment income compares well with the universities listed. However, many of the HEIs in South Africa have no or very little such income.

TABLE 4 Further comparisons between income sources[15]

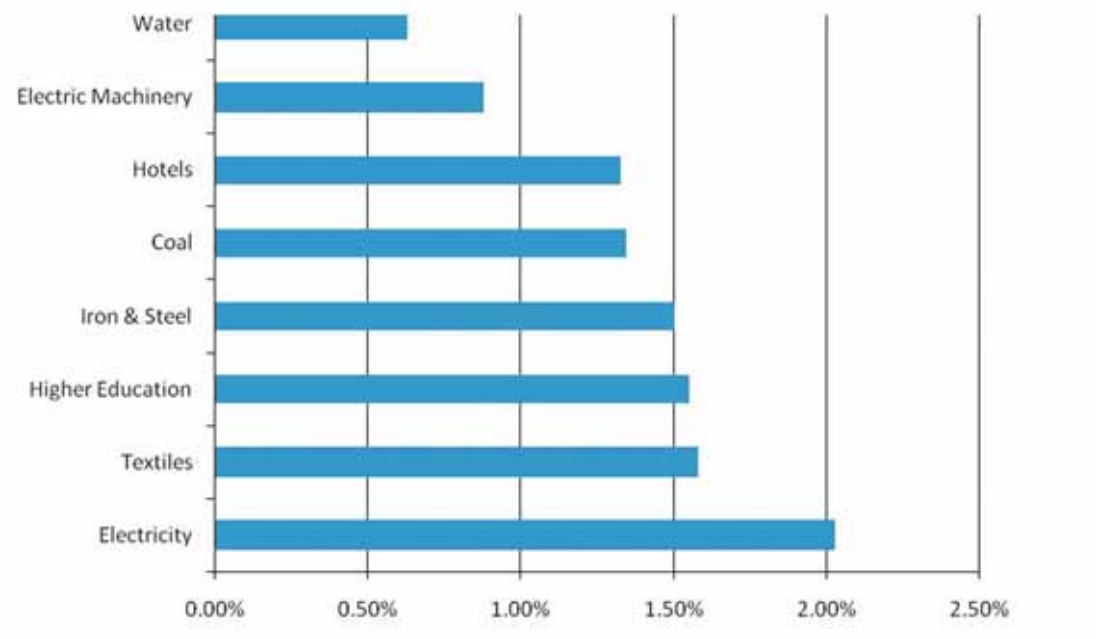
University	Type of income	% of total income	
		2005	2006
University of Exeter	Endowment and investment	1.35	0.79
		2004	2005
University of Illinois	Gifts and endowment income	3.32	3.25
		2005	2006
University of Oxford	Endowment income and interest receivable	4.51	4.63

The overall size of higher education as an individual sector, compared to other sectors in the economy, is also worth noting. In this section we combined the income and expenditure profile of HEIs in South Africa because they should be equal in the long term.

Judging by the income and expenditure profiles of the various industries in South Africa, the overall size of HE seems to be quite significant. Total income and expenditure directly generated by the HE sector in South Africa was estimated to be around R20 billion in 2004, or approximately 1.5 per cent of GDP. This compares favourably with other industries in South Africa, such as electricity and textiles. Figure 2 shows the relative size of the HE sector, compared to other selected industries from the model database.

15 Information obtained from the respective websites of the universities listed.

FIGURE 2 Relative sizes of selected South African industries (% of GDP)



Industries such as agriculture and gold are larger than the electricity industry and are therefore excluded from the diagram, as are "other general government services". Nonetheless, the diagram still gives a good indication of the relative size of the higher education sector in South Africa. One often hears about the importance of our iron and steel industry, or coal mining, yet higher education is larger.

Expenditure

The second question in the survey was on the items of expenditure. Table 5 gives a summary of the information received from the HEIs in response to Question 1b.

Virtually all studies reviewed earlier found that HEIs spent almost all of their income, and that the largest expenditure component was labour cost. Our survey confirms that this also holds true for South Africa.

Expenditure patterns were fairly similar for all institutions and do not justify a detailed exposition here. Stated differently, the lowest and highest percentages that individual HEIs spent on the listed items were very close to the average numbers.

TABLE 5 Items of expenditure in South African HEIs

Item	Lowest %	Highest %	Average %
Academic salaries	25.9	43.2	31.49
Non-academic salaries	17.6	32.2	23.69
Goods and services	28.3	42.6	36.50
Depreciation of capital	3.03	8.95	5.46
Finance cost	0.13	3.11	1.50
Other			1.36
TOTAL			100

As the table shows, two items dominate total expenditure:

- academic and non-academic salaries form 55 per cent of total expenditure; and
- goods and services form an additional 36.5 per cent.

More than 90 per cent of expenditures therefore is comprised of these two items. In general, the income and expenditure patterns of South African HEIs are very similar to those found in the KMM (2002) study, especially the breakdown of expenditure items.

In the next section we profile employment by HEIs, and shed more light on the largest expenditure component, namely labour cost.

chapter four

SOUTH AFRICAN HEIs: EMPLOYMENT

Overview

This chapter focuses on employment and remuneration patterns in our public HEIs. An interesting finding is that top management comprises only 1 per cent of staff of HEIs and, on average, earns 3.5 per cent of the salary bill. Even though HEIs differ markedly in their personnel composition, a shared challenge to the sector is to align staff profiles with South Africa's needs to build capacity for growth and development and, in so doing, to achieve healthier staff ratios.

The remuneration and employment profiles of South African HEIs are given in Tables 6 and 7, as presented to us by the HEIs in response to the survey. While the sixteen institutions gave us very good data regarding income and expenditure patterns, the question about employment and remuneration proved to be a bit harder to elicit appropriate responses.[16] Only ten institutions were able to complete the entire Question 1c on their respective employment profiles.

Table 6 shows percentages of the total salary bill of HEIs in South Africa. The first row shows for example that, on average, top management salaries comprise of 3.5 per cent of the total salary bill. The lowest percentage of the total salary bill that any of the institutions pay their top management is 1.9 per cent, while one institution pays as much as 7.3 per cent. The outliers in the data are mostly due to the nature of the specific HEI, or differences in the reporting and classification of employment information.

16 One of the institutions responded that the data "could unfortunately not be supplied because of the fact that this would involve a manual action to collect".

TABLE 6 Remuneration bills by category

Category	Lowest %	Highest %	Average %
Top management (deans and higher)	1.9	7.3	3.48
Middle management (HOD's and equivalent)	2.3	14.5	7.87
All engineers (academic and other)	0	46.8	6.43
All accountants (academic and other)	0	4.4	2.11
IT specialists (academic and other)	1.1	6.4	3.01
Natural scientists	0	13.4	6.74
Faculty of Education	0.5	6.5	2.5
Other academics	5.6	43.5	24.92
Administrative personnel	19.0	40.8	30.13
Security	0.2	3.9	1.08
All other blue collar workers	2.3	22.7	5.84
Other			5.89
TOTAL			100

We also asked the institutions to give numbers of full time equivalent persons working in the different employment categories. Only ten institutions were able to provide suitable data, the results of which are presented in Table 7 below. Institutions are listed in random order and show the percentages of staff members that fall in each category. The reason for giving all the institutions' results is that important (and interesting) information would be lost if we were only to list the lowest, highest and averages.

Even though one institution pays its top management more than 7 per cent of the total salary bill, the average of all institutions is only 3.5 per cent, while the largest number of full time equivalent persons serving in the top management is 2.1 per cent of the same institution's total workforce.

These numbers sound quite healthy and we could conclude with confidence that our HEIs are not top heavy, and that senior managers do not consume much of the total salary bill of their institutions. Even if top and middle management are combined, no institution has more than 10 per cent of their staff in these categories, while the average of all the institutions is 5.3 per cent.[17]

17 Perhaps all the institutions err in this regard, because there is a general sense amongst HE management that individuals are working extremely hard to get the job done.

TABLE 7 Percentage employment by category

Category	I	II	III	IV	V	VI	VII	VIII	IX	X	AVE
Top management (deans and higher)	2.1	1.3	1.0	1.3	0.4	1.0	1.1	1.0	1.9	1.0	1.06
Middle management (HOD's and equivalent)	7.0	2.8	8.2	8.0	0.9	8.5	4.7	3.2	3.4	3.5	4.20
All engineers	5.9	5.2	5.7	2.5	4.8	0.1	1.3	3.8	0	8.8	4.01
Accountants	1.3	1.2	2.5	1.8	2.4	4.0	1.2	1.5	1.2	3.6	2.01
IT specialists	1.5	2.0	5.7	4.5	3.1	4.5	1.0	1.3	1.0	3.8	2.66
Natural scientists	1.6	3.5	0	6.2	7.7	11.8	4.3	2.8	9.0	6.5	5.17
Faculty of education	0.5	1.1	0.8	5.1	0.5	6.5	4.5	2.7	3.0	1.0	2.35
Other academics	30.1	16.6	9.6	22.6	27.1	17.4	20.4	30.8	26.5	22.5	24.5
Admin personnel	42.3	36.5	34.6	37.1	40.3	34.2	55.8	41.4	40.3	29.9	40.5
Security	1.0	4.8	1.8	0.4	0.2	0.9	5.7	0.8	1.6	0	1.39
Other blue collar workers	0	25.0	30.1	10.7	11.3	11.2	0	10.7	12.2	15.1	11.0
Other	6.7	0	0	0	1.2	0	0	0	0	4.5	1.18
TOTAL	100	100	100	100	100	100	100	100	100	100	100

However, the percentage of top and middle management is greater than any one of the following four key groups where South Africa needs to build capacity for growth and development. On average, HE employment comprises only 4 per cent engineers, 2 per cent accountants, 5.2 per cent natural scientists, and 2.4 per cent education specialists.

Some of these numbers seem very small, especially the number of education specialists, given that institutions surveyed now include the former colleges of education. The difficulties experienced by our primary and secondary schools are not surprising when we spend so little money on training educators.

Individual HEIs could compare themselves to the average distribution of staff in the HE sector, and address their own personnel ratios. Further insights could be gained from studying the employment structures of institutions that are successful in research or teaching. However, given differences in context as well as in definitions and reporting standards, care should be taken when evaluating individual results.

For example:

- The employment profile of Institution III in Table 7 could raise serious doubt about the structure of this institution with a disproportionate number of employees classified under administration and blue-collar labour.

- On the other hand, Institution VI appears to be a model institution, with remarkable statistics. It has the largest proportions of staff in the four categories of management, accountants, natural scientists and education specialists, and the second largest in IT specialists. The institution may be able to obtain these results by employing a small number of administrators and few "other academics", presumably by focussing on a manageable number of academic programmes and by outsourcing key services.

However, as has been pointed out,[18] HEIs located in poor regions may be one of the few employers and therefore be compelled to draw in lower skilled employees, as opposed to outsourcing key services. This, in turn, would be reflected in the employment profiles of such HEIs.

18 Dr Miriam Altman provided this critical input in response to an earlier draft of this report.

chapter five
MODELLING SIMULATIONS

Overview

The crux of the study is presented in this chapter. Three sets of simulations show the potential secondary or "knock-on" effects of the HE sector on the economy. Notable is that increased government spending on its own will not have the desired impact, whereas the impact of school graduates participating in higher education would have much higher GDP effects than retraining workers. Combining the three simulations illustrates that the economy would grow by up to R11 in real terms for every extra rand spent on higher education, assuming that 1 per cent more professionals would be trained, and total factor productivity would improve by 0.1 per cent.

In this section we report the results of three modelling scenarios. It is important that these results be interpreted within the context of the theoretical structure of the economic model, as well as each simulation's design and resolution. The model closure contains assumptions about the exogenous and endogenous variables in the model, and should best reflect the economic environment in which the simulations are conducted. An abbreviated description of the model structure and closure used in these simulations is included in Appendix 2.[19]

Firstly, we hypothetically allow government to spend 1 per cent more on higher education, assuming that private spending by households will decrease as a result. That is, we assume that personal taxes will be used to finance the increase in government spending on higher education. The size of the increase is not important from a modelling perspective, but it is convenient to work with unitary numbers when different simulations are combined, as is done below.

Secondly, we calculate the effect on the economy of 1 per cent more professionals being trained by the higher education sector, as a result of the increased spending

19 For a more detailed discussion of the ORANI-G model on which our model is based, see Horridge (2000).

by the government. This scenario includes three different simulations.

Thirdly, we calculate the effect of the entire workforce and other factors of production becoming more productive as a result of the increase in the higher education sector, and the presence of more professionals in the workplace.

Unless otherwise stated, the results of the various simulations shown in the tables below indicate the percentage change in the economy if such a policy change were to be made.

SCENARIO 1

Simulation 1: Increase in government expenditure on higher education

The increase in spending on higher education by the government, viewed in isolation (i.e. without taking the resulting effects on the labour force and other factors of production into consideration), has a negative effect on the economy. The funds for more spending have to come from somewhere, and it is unlikely that government would decrease other expenditure to fund higher education. For example, it would be difficult for the South African government to decrease spending on public health or social services in order to finance higher education. In this scenario we study the effects of the increased spending on higher education when financed by increased taxes on individuals.[20]

Table 8 shows that total government spending increases while private household consumption expenditure decreases as a result of increased taxes. Real GDP also decreases which shows an overall contraction in the economy. Note that the numbers are the net results of increased government spending on higher education, after a new equilibrium has been reached in the economy.

Spending by the government puts upward pressure on prices, as seen in the GDP price index, export price index and nominal wages. These price changes have effects throughout the economy and drive the CGE model. Total spending on labour is kept constant in this simulation.

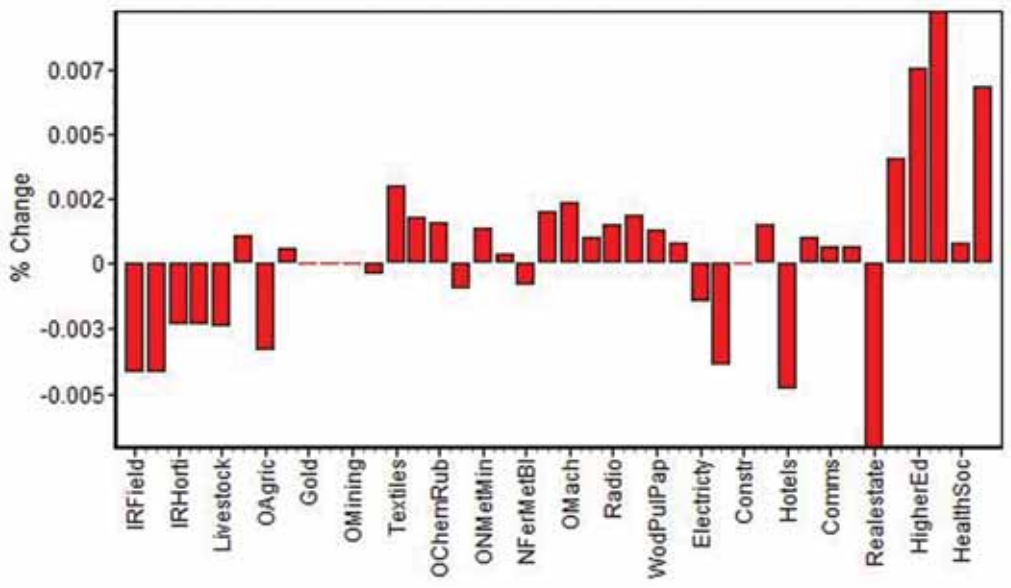
Figure 3 shows the percentage changes in commodity prices as a result of the increase in government expenditures. Although the magnitudes of the price changes are small, the reader should note that some commodity prices increase and others decrease. This diagram implicitly shows how the model works. We start with an economy in equilibrium – supply equals demand in all markets – and then change one or more of the variables exogenously. In this case, we manipulate government spending on higher education, and then let the model "find" a new equilibrium. Hundreds of prices need to be adjusted up or downward in a long series of chain effects throughout the entire economy, until all markets return to equilibrium. Prices increase if demand for commodities increase relative to supply, and vice versa.

20 Dr Miriam Altman proposes that further research be done to compare the impacts of alternative uses of funding in order, for example, to determine the opportunity costs of funding more HEIs.

TABLE 8 Selected results from scenario 1

Economic variable	Change
Change in real GDP (R millions)	-R10.85m
Aggregate real government spending	0.083 %
Real household consumption	-0.026 %
Real GDP from expenditure side	-0.0015 %
GDP price index, expenditure side	0.0037 %
Exports price index, local currency	0.0012 %
Average nominal wage	0.021 %
Import volume index, duty-paid weights	-0.0101 %
Export volume index	-0.0114 %
Skilled employment	0.0046 %
Unskilled employment	-0.014 %

FIGURE 3 Percentage change in selected commodity prices



Final consumers consume less of all commodities in this simulation, but to different degrees, depending on the relative change in a commodity's price. For example, on the left hand side of Figure 3 the percentage changes in prices of agricultural commodities are shown to be negative, while most manufacturing commodities prices have increased (middle of figure). The results suggest that consumers would decrease their demand for agricultural commodities less than the decrease in demand for manufacturing commodities.

GDP consists of a number of components that are added up to a total, namely private consumption expenditure, government consumption expenditure, investment expenditure and net exports. Export prices are closely related to domestic prices and a graphical representation would look very similar to Figure 3. The export market is extremely competitive and an increase in the price of an export commodity would lead to an immediate decline in foreign demand.

Most manufacturing prices increase in Simulation 1, while only the prices of agricultural commodities and a few other prices decrease. The cumulative effect is such that the increases in prices dominate and that total exports decrease, with a resulting negative impact on GDP.

Investment expenditure does not change because the total capital stock is kept constant by modelling design and therefore does not have an influence on GDP. The two GDP components – private consumption expenditure and exports – are large and offset the increased government expenditures on higher education.

Although this simulation contributes very little to the higher education debate in isolation, it is important to understand the separate impact of each scenario in order to understand the more complex scenarios in which multiple variables change simultaneously.

SCENARIO 2
Increase in the supply of professionals[21] in the labour market

Simulation 2: Retraining a pool of workers from all occupations

In this simulation we calculate how many workers from different industries and occupations would have to be retrained if the total number of professionals needs to grow by 1 per cent, while keeping the total number of employed persons constant.[22] Spontaneous changes in wage rates and prices of commodities drive the model; if more professionals are trained, they become less scarce and their "price" (wage) decreases. All other occupation groups that are retrained become scarcer, and their wages therefore increase. Industries try to

21 See Appendix 3 for details on the different occupation groups.

22 Dr Miriam Altman had a word of caution to all readers, and we quote: "The authors underestimate the impact on GDP of simulations 2 and 3 (retraining workers) due to the limitations of a static CGE model with no provision for unemployment. [Readers should not] draw the conclusion that investing in working HEI graduates might have less economic impact on the basis of this analysis." She agrees that Simulation 4 is more realistic.

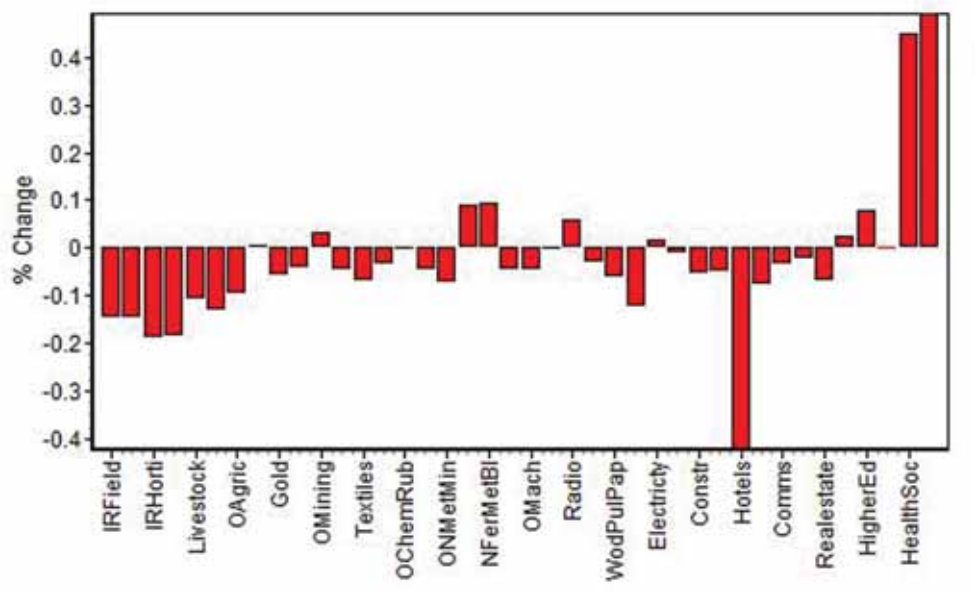
minimise cost when making their hiring decisions, and they would then hire more professionals and fewer other workers.

The results of the simulation are given in row one of Table 9, while Figure 4 shows the net result of the percentage changes in numbers of workers employed by all industries. For example, the agricultural industries (on the very left of the diagram) employ fewer workers, while the services industries (on the far right of the diagram) employ more. Agriculture has the feature that it does not employ many professionals. Should some of this sector's workers be retrained, more workers would be lost through this than would be gained from employing newly trained professionals. The total number of workers remains the same in the economy in this simulation, so there is no increase in unemployment. In reality the agricultural sector would employ more elementary and other workers from the pool of the unemployed.

The services sectors are known to have many professionals in their employ, and if more of them were trained, they would have a net increase in employment, as the diagram shows. Higher education also employs more workers, but not to the same extent as health and social services on the far right.

The economic benefits of the simulated education (training) could be depicted in terms of increases in real GDP.[23] Table 9 shows that if the number of professionals

FIGURE 4 Percentage change in numbers of workers per sector



23 That is, not including increases in GDP due to inflation.

increased by 1 per cent (while all other occupations decreased by 1 per cent), then the economy would show a net growth of 0.023 per cent. What does an increase of 1 per cent mean in terms of the number of professionals? As an occupation group, professionals currently make up 10 per cent of the labour force, and a 1 per cent increase would mean that this group grows to become 10.1 per cent of the labour force. It is therefore a realistic scenario to model increases in any of the occupational groups by 1 per cent through education[24].

The increase in real GDP looks very small, and it is. However, as previously pointed out, we usually find small numbers like this in CGE modelling results tables. Note the relative sizes of the numbers: in Simulation 1 above where we increased government spending on higher education, GDP contracted by 0.001 per cent. If more professionals are trained through this spending, GDP increases by 0.023 per cent. The net result is an increase of 0.022. In Scenario 3 below the net effects increase further.

Simulation 3: Retraining a pool of workers from specific occupations

In the previous simulation more professionals are trained from all other occupational groups. Since all of them are pooled together, we lose much information on the individual effects that each of their training would have on the economy. Running the simulations again, but training professionals

TABLE 9 Selected results from scenario 2

		GDP	Cons	Exports	Skilled	Unskilled	Weights
1	Proportional	0.0229	0.019	0.039	0.093	-0.113	
2	Grade 12	0.0765	0.069	0.121	0.186	0.001	
3	Weighted average	0.0146	0.004	0.052	0.045	-0.027	
4	Clerks	0.0261	0.018	0.059	0.064	0.001	0.4
5	Craftsmen	0.0216	0.042	-0.049	0.051	-0.001	0.05
6	Domestics	0.0361	0.025	0.083	0.186	-0.299	0
7	Elementary	0.0381	0.031	0.071	0.186	-0.285	0
8	Legislators	-0.0176	-0.019	-0.028	-0.039	0.001	0.05
9	Operators	0.0399	0.037	0.058	0.186	-0.274	0.1
10	Skilled Agric	0.0042	-0.039	0.157	0.016	0.001	0.1
11	Service	0.0078	-0.014	0.072	0.021	0.002	0.15
12	Technicians	-0.0109	-0.015	-0.004	-0.026	0.001	0.15

24 The absolute size of the shock is not important. Even though our model is non-linear, half of the current shock would more or less give half of the size of the results.

from each one of the other occupational groups separately, allows us to "decompose" the increase in GDP found above.

Table 9 shows the results of the respective simulations. The first line shows the said simulation where the same proportion of all other occupations is retrained. The first column shows the GDP results. We also tabulate private consumption expenditure (Cons), exports, spending on skilled employment (Skilled), and spending on unskilled employment (Unskilled).

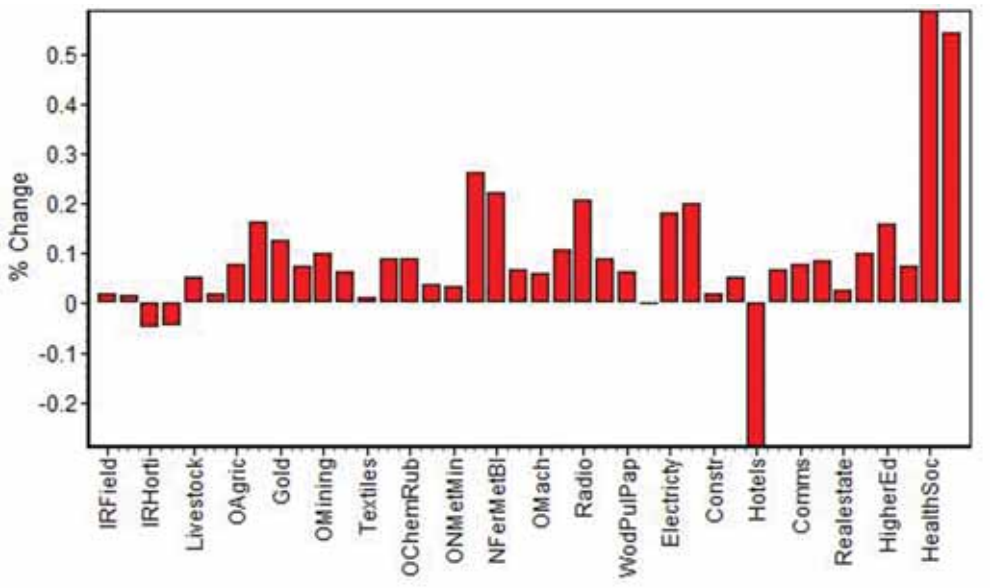
Retraining certain occupational groups would have a negative effect on GDP, for example, legislators and technicians. However, if it were possible to train other occupation groups, GDP could be positively affected. Rows 9 – 11 in Table 9 show that the retraining of operators, elementary workers and domestic workers would render the highest dividends in terms of GDP.

A more feasible option might be the retraining of clerks, as retraining them would have the same GDP effect as the average effect of training some of all occupational groups. In reality this does happen – many people work as administrative staff and study further through night classes or correspondence, and subsequently move into the professional group.

Simulation 4: Training high school graduates

Row 2 in Table 9 shows the results of an increase of 1 per cent in the number of professionals, without decreasing any of the other occupational groups. This simulates the training of high school graduates into the professional arena. The GDP effect is much stronger than in any of the other simulations, since there is no decrease in the labour supply of any occupational group. It assumes that all other occupational

FIGURE 5 Percentage change in number of professionals by industry



groups remain constant, while the professionals increase. The percentage changes of professionals hired by the various industries in this case are given in Figure 5, and clearly show that most industries would employ more professionals.

The results discussed in Scenario 2 show the importance of education for the economy. If the manufacturing industries resemble the engine of the economy, then the labourers working there could probably be seen as the fuel without which the engine would not run. From an economic point of view, the primary function of higher education, and education more generally, is to train persons to become ready for specific occupations. Some industries are more productive than others in terms of the generation of GDP, and if labourers could be transformed by the education system to produce more than before, then the system is useful (from an economic point of view).

To conclude this section, we would like to comment on employment multipliers. The KMM study reports a multiplier of 1.88, which means that for each person that higher education employs additionally, the rest of the economy would employ a further 0.88. In the rigid input-output model used in that study, everything is assumed to exist in fixed proportions, so that no sector could grow without all other sectors growing in similar proportions. In our CGE model one sector could grow at the expense of another, as portrayed in the diagrams above. Put differently, higher education could not just employ more people without finding those people somewhere. Neither of the two models allows for unemployment (disequilibrium in some markets), but the KMM model allows the economy to grow without having to explain where the extra resources come from.

SCENARIO 3

Simulation 5: An increase in total factor productivity

Some of the studies on the effect of higher education on the economy of a country simulate an increase in labour productivity, as a result of workers obtaining HE qualifications (Giesecke & Madden, 2005). We did not find a study that estimated what the exact effect of the labour force is on the productivity in South Africa, and it would be difficult to estimate such an effect. However, it is generally accepted that higher education would increase a worker's productivity, and this may have contagious effects on other factors of production. Trained professionals are considered to be human capital, and an improvement in the capital stock is generally accepted as improving the labour productivity as well. We comment on the knock-on effects of such increases here.

Table 10 shows the modelling results of a 1 per cent[25] increase in total factor productivity in the economy. As said earlier, by modelling a unitary change in a model variable, the results become easily readable as per a "percent increase in labour productivity". For example, for each percentage increase in the labour productivity, real GDP would

25 We show the results of a 1 per cent increase here, but when we combine all the effects, we work with only a 0.1 per cent improvement in productivity.

TABLE 10 Selected results from scenario 3

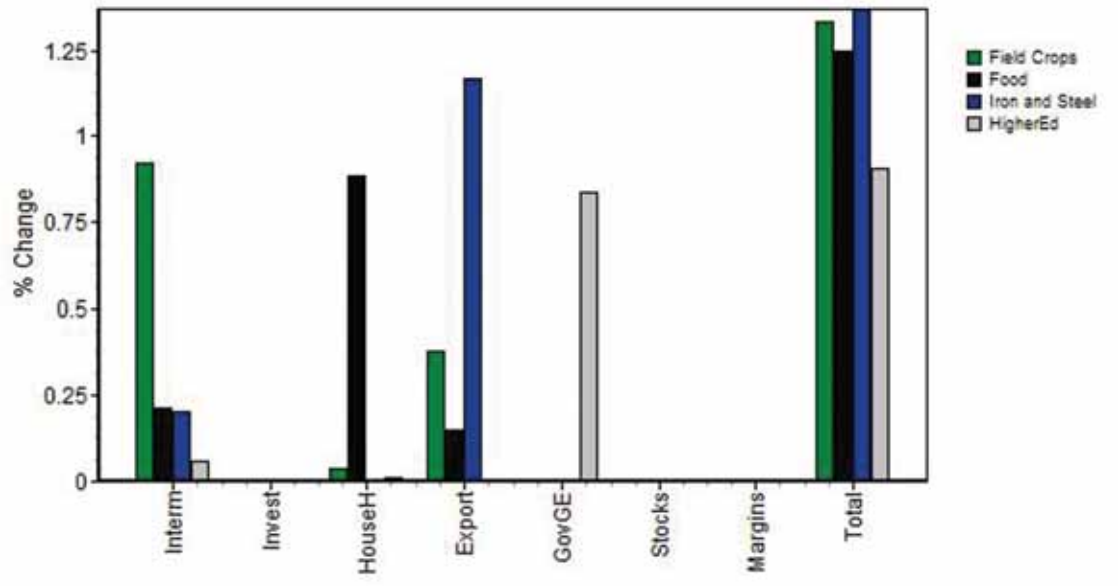
Economic variable	Change
Change in real GDP (R millions)	7364.75
Change in real government income (R millions)	1826.62
GDP price index, expenditure side	-0.079 %
Duty-paid imports price index, local currency	0.314 %
Real devaluation	0.393 %
Terms of trade	-0.301 %
Average capital rental	0.973 %
Average nominal wage	0.843 %
Exports price index, local currency	0.012 %
Exchange rate, Rand/US$	0.314 %
Average real wage	0.843 %
Aggregate employment (persons weights average)	0.001 %
Real GDP from expenditure side	0.996 %
Import volume index, duty-paid weights	0.627 %
Real household consumption	0.941 %
Export volume index	1.515 %
Aggregate real government demands	0.941 %
Skilled employment	-0.019 %
Unskilled employment	0.057 %

increase by 0.996 per cent, export volumes would increase by 1.52 per cent, and real government revenue would increase by 1.02 per cent. One could make extremely insightful conclusions from the model results without having to know exactly what the influence of higher education is on factor productivity for South Africa.

The simulation is done for the long run, which usually means that total employment remains constant, while the capital stock is adjustable, by (modelling) assumption. However, to isolate the productivity effect, we also fix the capital stock. Productivity of factors of production is in principle a long run phenomenon, i.e. factors do not become more productive overnight.

All the results of the simulation are driven by changes in relative prices. The same labour force becomes more productive, so that firms are able to produce much more, given the same inputs into the production

FIGURE 6 Breakdown of the sources of growth



process. Per unit cost of production decreases and hence most prices of commodities decrease.[26] The modelling results show that consumers effectively pay 0.3 per cent less for a basket of consumption goods. The same mechanism causing a decrease in the cost of production also causes export prices to decrease. Since the international market for goods and services is extremely competitive, such a decrease in one country's prices improves that country's competitiveness and would have large effects on the foreign demand for its products. Table 10 shows that export volumes would increase by 1.5 per cent for each percent that the productivity of all factors improves.

If the productivity improves in a country, all industries will benefit. However, the sources of growth in the respective industries usually differ, depending on their sales structure. A few examples are shown in Figure 6 above. The yellow bars show that growth in iron and steel mostly comes from increased exports, with a small contribution from intermediate sales. However, producers in the category, irrigated field crops, who sell much of their output to other South African industries, obtain their growth from significant increases in intermediate sales, and a bit from exports. As would be expected, the food industry gets the largest component of their boost from households, who experience a decrease in food prices relative

26 A fundamental assumption of the model is that firms do not make abnormal profits; in other words, they pass all cost savings through to the consumers.

TABLE 11 Modelling results[27]

Economic variables	SIM 1[28]	SIM 3[29]	SIM 4[30]	SIM 5[31]	TOTAL 1 (1+3+5)	TOTAL 2 (1+4+5)
Change in real GDP (R millions)	-10.85	108.0	566.0	732.1	829.19	1287.25
Change in real government renue (R millions)	-23.6	-208.5	63.15	181.6	-50.58	221.12
Aggregate real government spending	0	0.028	0.140	0.000	0.028	0.140
Real household consumption	0.0037	0.010	-0.012	-0.008	0.006	-0.017
Real GDP from expenditure side	-0.001	0.025	0.048	0.031	0.056	0.078
GDP price index, expenditure side	-0.0048	0.016	0.060	0.039	0.050	0.095
Duty-paid imports price index, Rand	0.0023	-0.010	-0.024	-0.030	-0.038	-0.052
Real devaluation	-0.016	0.016	0.125	0.097	0.097	0.206
Terms of trade	0.0208	0.002	-0.130	0.084	0.107	-0.026
Average capital rental	0.0012	0.015	0.024	0.001	0.017	0.026
Average nominal wage	-0.001	0.025	0.048	0.031	0.056	0.078
Exports price index, local currency	0.0208	0.002	-0.130	0.084	0.107	-0.026
Exchange rate, Rand/US$	-0.0015	0.015	0.077	0.099	0.112	0.174
Average real wage	-0.0101	0.006	0.044	0.062	0.058	0.097
Import volume index, duty-paid weights	-0.0263	0.004	0.070	0.094	0.071	0.137
Export volume index	-0.0114	0.052	0.121	0.151	0.191	0.260
Aggregate real government demands	0.083	0.004	0.070	0.094	0.181	0.246
Skilled employment	0.0046	0.045	0.186	-0.002	0.048	0.189
Unskilled employment	-0.014	-0.027	0.001	0.006	-0.035	-0.008

27 All results in percentage changes, unless otherwise stated.
28 Simulation 1 refers to the increase of government expenditure on higher education.
29 Simulation 3 refers to the retraining of a pool of workers from specific occupations as professionals.
30 Simulation 4 refers to the training of high school graduates as professionals.
31 Simulation 5 refers to the increase in total factor productivity.

to other commodities, while higher education's largest source of growth remains the subsidies from government. Interestingly, since export prices decrease significantly, one could expect a substantial growth in foreign student demand, and not only from local households.

Combined scenario – The overall impact

In Table 11 we show the total impact that additional government expenditures on higher education would have on the economy. We combine the effects of the three scenarios previously simulated to find this result. The scenarios were (i) increased spending by government on higher education; (ii) more professionals being trained; and (iii) improved productivity in the economy.

We show two sets of combinations. The first set combines scenario (i) and (iii) above with simulation 3 where more professionals are trained from a weighted average of other occupations, whilst the other combines (i) and (iii) with simulation 4 where more professionals are trained from high school graduates. The separate results of the various simulations are summarised again, with the combined effects given in the final two columns of Table 11. The individual simulations are the same as those described in the previous section.

The marginal excess burden (MEB) is defined as the ratio between the change in real government expenditure and the change in real GDP, and the final two columns show remarkably high MEBs. One per cent more spent by government on higher education amounts to R116m in our model database. In the Total1 and Total2 columns, real GDP increases by more than R800 million and R1.2 billion respectively, which amounts to MEBs of 7.15 and 11.09. This means that for each rand that the government spends on higher education, the GDP will increase by R7.15, or R11.09, respectively.

These are high numbers and could only become true if the said improvements in total factor productivity were to occur together with the increase in government spending on higher education.

chapter six
CONCLUSION

Overview

Human capital has been central to theories on productivity increases driving economic growth and development. This study supports this well-known result by providing empirically based estimates, based on South African data and relationships, of the potential benefits of investing in higher education. Based on the findings of this study, we conclude with four recommendations.

Our great leader, Nelson Mandela, once said "Education is the most powerful weapon which you can use to change the world". As the authors of this report, we could not agree more. This study has shown the value of higher education in South Africa to be of immense importance. Many government officials and economists in South Africa believe that we could obtain the macroeconomic objectives outlined in ASGISA by growing at continuous levels of 6 per cent or higher. These statements have already been countered to some extent by researchers who believe that achieving 6 per cent growth is not sustainable given the current socio-economic environment in South Africa (Focus 55, 2007).

In order to achieve our national goals, we need more than just economic growth. The manner in which this growth is achieved is of great importance to a country such as South Africa. We believe that to attain sustainable economic growth would require a strong education system that could deliver productive workers to the market, on all levels.

At first glance, the higher education industry in South Africa looks very similar to that of the United Kingdom and other developed countries. The average ratios of income and expenditure are very similar, as

are the employment profiles. However, there is a significant number of HEIs in South Africa that show unhealthy income and expenditure patterns, as well as employment profiles. Our conclusion is that enough information is available in this report and elsewhere for any institution to change its profiles over time by adopting better policies and striving to achieve healthier ratios.

From our modelling exercises we conclude that merely increasing government spending on higher education would not improve the education system, or the economy.[32] On the contrary, we find that extra spending by itself would actually harm the economy. Households and firms would probably have to pay higher taxes to finance this expenditure, which would decrease their disposable income and cause a chain reaction of events further down the line. The net result would be a contraction of aggregate expenditure, and subsequent decline of the economy.

Rather than an increase in spending, we would like to recommend a system of differentiated spending based on mission differentiation. The spending instrument in the hands of the government could be used to reach various goals, such as improved equity, or increased numbers of engineers, IT-specialists, accountants or educators. What is important is not the quantity of expenditures on HEIs, but the efficiency of the expenditures.

Alternatively, if the increased spending results in more professionals serving in the labour force, as well as higher overall factor productivity, then the impacts on the economy could be very favourable. Our modelling results show that each extra Rand that is spent productively on higher education could result in up to R11 extra real GDP for the country. The conditions for the spending are that the number of extra professionals that enter the market should grow at the same rate as the marginal spending on higher education, and that the productivity of all factors of production should simultaneously also improve at a specific rate.

To conclude this section, we would like to make the following recommendations, based on the findings of this report:

- Firstly, we would recommend that government should increase its spending on higher education, but more importantly, should do so as proposed in this study. This would require additional government spending to improve the total factor productivity of the country. Additional spending should be differentiated based on mission differentiation, while taking the efficiency of income, expenditure and employment profiles into consideration.

32 Dr Miriam Altman confirms this conclusion by saying "the case for more spending would [only] be made if: it were shown that the efficiency of current spending could not be improved; and that an expansion in spending on HEIs had more impact on the economy than other types of spending such as that on primary or secondary education, or on nutrition, etc."

- Secondly, we recommend that the authorities utilise the subsidies on HEIs to achieve specific goals, such as numbers of trained engineers, IT-specialists, education specialists, etc., and also to achieve certain equity targets in the South African labour force.

- Thirdly, the tax system should be adjusted to allow for bequests to be made to HEIs, to strengthen this source of income to them.

- Lastly, when evaluating and comparing HEIs in South Africa, it would be advisable for HESA to promote a more uniform reporting structure for income, expenditure and employment between institutions. This would greatly facilitate future research on the HE sector.

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APPENDIX 1

Survey Questionnaire

Survey Question 1a

Please give a summary of all income and expenditure of your institution for the year 2004.

Income		Expenditures	
Student fees		Goods and services	
Minus bursaries given		Construction of buildings or roads	
Subsidy income from the State		Salaries	
Interest on investments or endowments		Depreciation of capital	
International donations			
South African donations			
Consultation income coming to institution			
Other (please specify)		Other (please specify)	
Total income		Total expenditure	
		Surplus or deficit	

Survey Question 1b

Please give a more detailed breakdown of the goods and services bought in 2004.

Expenditures on goods and services	Amount
Water	
Electricity	
Post, courier services and telecommunication	
Publishing, printing, binding and duplication costs	
Paper and paper products; Stationery	
Food and beverages, including dormatories and functions on campus;	
Office machinery, including computers	
Professional & scientific equipment, optical instruments, medical and surgical	
Electrical machinery, machine tools, food machinery, household appliances	
Motor vehicles and parts	
Petrol and diesel	
All travel costs, local and abroad, excluding petrol	
Basic chemicals, fertilizers, pesticides paint and printing ink, soap products	
Textiles, carpets, rugs	
Conferences, membership fees, per diems	
Rent of office space and buildings	
Financial and insurance services	
All repairs of equipment	
Other (please specify)	
Total expenditure on goods and services	

Survey Question 1c

Please give a more detailed breakdown of salaries paid to employees in 2004.

Salaries paid	Amount	Number of persons (full time equivalent)
Top management (deans and higher)		
Middle management (HOD's and equivalent)		
Rest of all engineers (academic and other)		
All accountants (academic and other)		
IT specialists (academic and other)		
Natural scientists		
Faculty of Education		
Other academics		
Administrative personnel		
Security		
All other blue collar workers		
Other (please specify)		
Total salaries		

APPENDIX 2

The Economic Model[33]

The model used in this study is based on the structure of the ORANI-G general equilibrium model of the Australian economy (Horridge, 2000), and is written and solved using GEMPACK[34] (Harrison and Pearson, 1996). The model allows for limited substitution on the production side while it focuses on substitution in consumption. It is a comparative-static model with an overall Leontief production structure and CES sub-structures for (i) the choice between labour, capital and land; (ii) the choice between the different labour types in the model; and (iii) the choice between imported and domestic inputs into the production process. Household demand is modelled as a linear expenditure system that differentiates between necessities and luxury goods, while households' choices between imported and domestic goods are modelled using the CES structure.

The model is based on the official 1998 social accounting matrix (SAM) of South Africa, published by Statistics South Africa (2002). The database was appropriately updated and modified to allow for the necessary simulations. The model divides households into 12 income and four ethnic groups, and distinguishes 40 sectors on the production side. For the purpose of this study, we split the general government sector into "higher education" and "other general government services". The elasticities used for the CES functions in the model have been taken from De Wet (2003).

The model's closure rules reflect a long-run time horizon, with the exception that the capital stock is assumed fixed, while the rate of return on capital is allowed to change. Labour supply is also taken to be exogenous, while real wages can change. The model differentiates between 11 different labour groups, namely legislators, professional workers, technicians, clerks, service industry workers, skilled agricultural workers, craftsman, elementary workers, domestic workers, and operators.

33 This general description of the model was adapted from Van Heerden et al (2006) in which a similar model was used.

34 GEMPACK, an acronym for General Equilibrium Modelling Package, is a suite of software applications created to ease the task of solving GE models.

With reference to the macroeconomic variables, it is assumed that (i) aggregate real consumption is a constant proportion of GDP, with the implication that if government consumption increases, private consumption must fall if GDP remains constant; (ii) government consumption on specific commodities "follows"[35] private consumption; (iii) aggregate investment remains constant since the total capital stock is fixed; and (iv) the trade balance is endogenous. This specification allows us insight into the effect of the suggested policies on South Africa's consumption and competitiveness. All technological change variables and all tax rates are exogenous to the model. Finally, the consumer price index is set to be the numeraire in each of the simulations.

35 If a certain commodity becomes more expensive, consumers will demand less of it, whether private or public consumers.

APPENDIX 3

Corresponding SASCO groups for occupations

Professionals

Physicists, chemist and related professionals; mathematicians, statisticians and related professionals; computing professionals; architects, engineers and related professionals; physical sciences technologists; physical, mathematical and engineering science professionals not elsewhere classified; life science professionals; health professionals; nursing and midwifery professionals; life science and health professionals not elsewhere classified; college, university and higher education institutions teaching professionals; secondary education institutions teaching professionals; primary and pre-primary education teaching professionals; special education institutions teaching professionals; other teaching institutions teaching professionals; other education professionals not elsewhere classified; business professionals; legal professionals; archivists, librarians and related information professionals; social science and related professionals; writers and creative or performing artists; religious professionals; other professionals not elsewhere classified.

Other occupations

In their 1998 SAM Statistics South Africa (2002) classifies all occupations into eleven groups according to the South African Standard Classification of Occupations (SASCO). The main occupation groups are legislators, professionals, technicians, clerks, service workers, skilled agricultural workers, craft workers, plant and machine operators, elementary occupations, domestic workers, and all unspecified occupations. For a description of all occupations used in the 1998 SAM and the corresponding SASCO groups, see Statistics South Africa (2002).

LIST OF TABLES AND FIGURES

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LIST OF ACRONYMS AND ABBREVIATIONS

ASGISA	Accelerated and Shared Growth Initiative – South Africa
CGE	Computable General Equilibrium
CoPS	Centre of Policy Studies
GDP	Gross Domestic Product
GEMPACK	General Equilibrium Modelling Package
GSP	Gross State Product
HE	Higher Education
HEI	Higher Education Institution
HESA	Higher Education South Africa
HSRC	Human Sciences Research Council
JIPSA	Joint Initiative on Priority Skills Acquisition
KMM	Kelly, Marsh and McNicoll
MEB	Marginal Excess Burden
PWC	PriceWaterhouseCoopers
SAM	Social Accounting Matrix
SASCO	South African Standard Classification of Occupations
UK	United Kingdom
UUK	Universities United Kingdom

NOTES

HESA

HIGHER EDUCATION
SOUTH AFRICA