ABSTRACTS OF RECENT POSTGRADUATE THESES AND DISSERTATIONS AT SOUTH AFRICAN UNIVERSITIES

Measuring hospital efficiency using DEA: an investigation into the relationship between scale and efficiency within the South African private hospital environment
by A Linden for MBusSc at the University of Cape Town, 2013

This dissertation investigates the relationship between scale and efficiency through the application of data envelopment analysis (DEA) to a set of South African private hospitals over the three-year period from 2007 to 2009. As part of the investigation, it provides a description of the current research into scale and efficiency with a focus on definition and measurement. It also provides an introduction to DEA as a tool for measuring the relationship between hospital scale and efficiency.

Based on the underlying set of private hospitals, this investigation found that scale-efficiency improvements are possible. On average, these improvements could have produced input savings of 6.9% in 2007, 6.8% in 2008, and 6.2% in 2009. Most hospitals were found to operate under non-increasing returns to scale. This, together with relatively low occupancy rates, reinforces the general criticism that excess capacity exists within the South African private hospital industry. However, excess capacity may be appropriate given the operational goals, nature of ownership, and role of private hospitals within the South African healthcare system. There was also evidence that smaller hospitals, when measured in terms of number of beds, are more likely to operate with higher scale efficiency. DEA-model specification was found to have a significant effect on the results of the investigation. In particular, hospital scale efficiency and return-to-scale classification were significantly affected by the selection of different combinations of input and output variables. Additionally, this paper demonstrates how oversimplified approaches to scale analysis can lead to incorrect conclusions.
The evaluation of case-mix-adjusted efficiency scores: the case of the South African private hospital industry
by K Dreyer for MBusSc at the University of Cape Town, 2013

There is little existing South African literature relating to hospital efficiency that allows for differences in case mix across hospitals. One of the primary motivations for this dissertation is to help fill this gap in the literature by examining the impact that adjusting for differences in case mix has on efficiency scores. Data envelopment analysis (DEA) is chosen as the efficiency measurement method because of its flexibility and ease of handling multiple inputs and outputs. A number of DEA models are applied to a sample of South African private hospitals for the years 2008 to 2011. Three different techniques are investigated and their ability to capture differences in case mix assessed. The three techniques investigated are: a case-mix adjustment factor (constructed using diagnosis-related groups (DRGs)) to adjust outputs; including the case-mix-adjustment factor as an additional output; and disaggregating hospital admissions into broad categories, which are used as outputs. A comparison of the unadjusted model with the case-mix-adjusted model reveals that omission of the adjustment can have a considerable impact on efficiency scores. Whilst little difference is noted in average efficiency scores for the group of hospitals—90% for the unadjusted model and 92% for the adjusted model in 2011—there are substantial differences between the adjusted and unadjusted efficiency scores of individual hospitals. On comparison of the three different techniques investigated, it is evident that if there is sufficient data to construct a case-mix-adjustment factor, case-mix-adjusted admissions should be used, rather than using the factor as an additional output variable. In the case where insufficient data are available, the disaggregation of admissions does capture some of the differences in case mix, but a substantial amount of power is lost as a result of increasing the number of output variables. It is noted that a more efficient hospital industry is necessary in order to progress with health-care reform in South Africa and this dissertation is a useful first step to evaluating, managing and improving hospital efficiency in South Africa.

An investigation into the effect of information on decision-making for members of defined contribution pension funds
by R Tagwira for MBusSc at the University of Cape Town, 2012

In recent years there has been increased debate on retirement funding in South Africa and, in particular, what steps can be taken to ensure that the working population retires with adequate savings to meet their needs.

This research considers some of the causes of inadequate retirement provision and the effect of additional information provided to members. The research is limited to defined-contribution pension funds, and considers whether improvements to the quantity and quality of information provided to members could result in better decision-making and ultimately improved provision for retirement. The study considered additional information on peer decisions, projected benefits at retirement, and remedial action
required to meet retirement targets and the effect of these on the contribution-rate decision and increasing preservation.

A vignette survey was conducted. Three vignettes with three treatments each were designed. The treatments had increasing levels of information. Participants were presented with one treatment per vignette and asked to select the most likely course of action given the information provided. Statistical analysis was then used to determine whether there was a significant difference in the decisions taken for different levels of information presented per vignette.

Examining the presence of anchoring and adjustment in stock market investment decisions
by S Els for MPhil at the University of Cape Town, 2012

With three major stock-market crashes in less than two decades, it is more important than ever before to understand the forces at work in the modern stock market. The anchoring and adjustment heuristic has often been described as one of the psychological forces influencing investment decisions but little research has been done to support this belief. The aim of this dissertation is to study the presence of anchoring and adjustment in stock-market decisions empirically. To do this, a small group of equity analysts from South African investment firms were used for a pilot study before a survey was presented to a sample of 295 fourth-year actuarial and finance students from the University of Cape Town. An experimental research design was used with a salient peak or trough on a share chart (the anchors) as the independent variable and participants’ estimates of a firm’s fundamental value as the dependent variable.

No significant relationship between the anchor and participants’ estimates of fundamental value was found. More specifically, the research results suggested that participants experienced an anchoring effect but were debiased before providing an estimate of fundamental value. This is believed to have occurred because of the inclusion of multiple salient anchors in the research materials consistent with the nature of information available to analysts in real-world contexts of investment decision-making. As these findings contradict those of most studies in anchoring and adjustment, it is suggested that more research needs to be conducted on the relationship between the anchoring bias and stock-market decisions in realistic investment settings. Additional research is also needed to clarify the effect that multiple anchors have on the anchoring bias.
Two investigations into the causal link between child mortality and subsequent fertility using DHS data from Kenya, Lesotho, Malawi, Tanzania and Zimbabwe
by M Bungu for MPhil at the University of Cape Town, 2013

This research performs two investigations into the causal link between childhood mortality and fertility using Demographic and Health Survey data from Kenya, Lesotho, Malawi, Tanzania and Zimbabwe, which are countries at different stages of the demographic transition. The first investigation assesses the effect of the death of a child on the timing of the birth of the next child. Piecewise log-rate models were used to investigate women who had experienced the loss of a child and in all the countries under study these women were found to have shorter birth intervals. The magnitude of the effect was strongest in Lesotho and Zimbabwe. The second investigation assesses the effect of the death of at least one child on insuring against future mortality. Logistic regression models showed that women aged 35 to 49 years who had experienced at least one child death were likely to insure against future child mortality. This effect was most pronounced in Malawi.

Analysis of the projected parity progression ratio method using two successive censuses/surveys
by D Mutakwa for MPhil at the University of Cape Town, 2013

Parity-progression ratios are a useful tool in analysing fertility trends. The projected-parity-progression-ratio method uses the current distribution of age-order-specific fertility rates to estimate the future trends of parity-progression ratios. The major output of this approach is an indication of the future trends in fertility by parity, on the assumption that current age-order-specific fertility rates continue to apply until the end of women’s reproductive life.

The objective of this study is to assess how well the projected-parity-progression-ratio method works when applied to two successive censuses or Demographic Health Surveys. Four countries, namely Malawi, Zimbabwe, Cambodia and Panama, each with two recent censuses which are ten years apart, are used. Each of the censuses and surveys used is taken through a data-quality-assessment process to check for inconsistencies. Using age-order-specific fertility rates derived from births in the past year, parity-progression ratios are projected to the next census. These results are compared with the actual parity-progression ratios obtained in the second census for each country. The application of the projected-parity-progression-ratio method to the Malawian and Panamanian datasets resulted in a relatively good fit, whilst for Zimbabwe and Cambodia the method did not produce a good fit. The results of the comparison show that the method produces a good estimate of parity-progression ratios when the age pattern of fertility remains relatively constant over the intercensal period. The study also reveals that the method is dependent on the quality of the data used. A suggestion for future research is to improve the method assessed through allowing for a gradual shift in the age pattern of fertility for populations with rapidly changing fertility. This can be done by designing a model that allows for a
change in the additional proportion of women expected to attain specific parity by the end of their child-bearing period.

**The impact of HIV on fertility in Malawi**

by E Souza for MPhil at the University of Cape Town, 2012

Fertility decline is influenced by its proximate determinants. The interaction of these proximate determinants, and the socio-economic factors that drive them, has determined the path of fertility transition in sub-Saharan African countries. Studies have shown that human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) also negatively affects fertility in both infected and uninfected women. With the high HIV prevalence rates in these countries, the question of the effect of HIV on fertility has attracted much research recently.

The purpose of this study is to determine the effect of HIV/AIDS on fertility among Malawian women, in particular the difference in the level of fertility between HIV-infected and -uninfected women, and the effect of HIV sero-positive status on fertility. The study is important because, not only could it help demographers and statisticians understand the age-specific-fertility differentials between HIV-infected and -uninfected Malawian women, but it could also assist the general population in understanding the dynamics of HIV/AIDS. It could also be of value to policy makers in informing their decisions regarding the prevention, treatment, care of, and support for, HIV-positive mothers, as well as addressing the reduction of fertility levels amongst Malawian women.

The fertility differentials between HIV-infected and -uninfected women have been assessed by calculating the age-specific-fertility rates for the infected and uninfected women respectively, who constituted the sample, and calculating the corresponding age-specific-fertility-rate ratios. The effect of HIV-sero-positive status on women’s fertility has been determined by performing logistic regression analyses. The dependent variable in the logistic regressions was the dichotomous variable of fertility with a value of 1 if a woman reported having given birth during the 12 or 36 month periods prior to the survey date and 0 if a woman had not given birth during these periods.

The results of the study show that HIV-infected women aged 20 and above have generally lower fertility in comparison to HIV-negative women while for women aged less than 20 years, the opposite is true. HIV-sero-positive status reduces fertility in infected women by between 16 to 40 per cent after controlling for age, education, marital status, place of residence, wealth quintile, history of sexually-transmitted infections, use of contraception, number of living children, and number of sexual partners in the 12 months preceding the survey. These results are consistent with results obtained in the sub-Saharan region by other researchers. However, the study results show a declining difference in fertility levels between infected and uninfected women. As a result of the many initiatives set up to fight against the epidemic by the public and private sectors, one can expect this difference to become insignificant, or to disappear in the near future. Nonetheless, the study results show that HIV/AIDS has partly contributed to the decline in Malawian fertility in the past two decades.
Assessment of the IGME methods of estimating infant mortality rate and neonatal mortality rate from under-five mortality rate in countries affected by HIV/AIDS
by KA Ayalew for MPhil at the University of Cape Town, 2012

This study assesses the UN Interagency Group for Child Mortality Estimation (IGME) methods of estimating the infant and neonatal mortality rates from the under-five mortality rates in countries affected by HIV/AIDS. It uses Botswana, Malawi and South Africa as case studies.

The assessment is made by comparing the IGME results with estimates from projection models and empirical results computed from survey data and vital statistics data corrected for the level of incompleteness for the countries included in the study. In addition, relevant literature is reviewed in order to determine the reasonableness and effect on the results produced of the assumptions made by the method.

The IGME method for estimating the under-five mortality rate appears to produce estimates that are consistent with other empirical results for South Africa over the period of observation and for Botswana, except between 1998 and 2002 when it appears to produce exaggerated results for Botswana. The under-five mortality rates of Malawi are consistent with other results between 1980 and 1991, although the method appears to understate the results of Malawi during the period of high mortality of children due to HIV/AIDS, that is, after 1991. The IGME method of estimating the infant mortality rate from the under-five mortality rate appears to be affected by problems in the under-five mortality rate. For example, the infant mortality rates of Botswana between 1996 and 2003 are inflated and those of Malawi between 1992 and 1998 and after 2006 are underestimated, as are the under-five mortality rates in the corresponding periods. The method for estimating neonatal mortality produces results that exhibit an HIV trend and are exaggerated during the period of high mortality of children due to HIV/AIDS for countries having low background mortality (mortality due to all causes other than AIDS) and affected by HIV/AIDS, as shown in the case of Botswana and South Africa. The method appears to produce results that are consistent with empirical results determined by others for countries having high and rapidly falling background mortality despite being affected by HIV/AIDS, as shown in the case of Malawi.

Maternal mortality in high-HIV-prevalence countries: a critical analysis of the MMEIG methodology for estimating maternal mortality
by T Gotora for MPhil at the University of Cape Town, 2012

The main objective of this research was to analyse critically the methodology used by the Maternal Mortality Estimation Interagency Group (MMEIG) to estimate maternal mortality in countries with high HIV/AIDS prevalence. This study interrogates each of the assumptions (implicit and explicit) in the MMEIG method by reviewing literature and studies that investigated each assumption.

This research clearly demonstrated that there are differences in the effect that HIV/AIDS has on maternal mortality between regions and among countries. It showed that
for southern African countries, the mortality rate of pregnant women infected with HIV/AIDS is lower than the mortality rate of non-pregnant women infected with HIV/AIDS, but appears to be significantly higher than the 40% assumed by the MMEIG. Consequently, the proportion of HIV/AIDS deaths in women aged 15 to 49 years last birthday occurring during the pregnancy-related period is higher than that estimated from the MMEIG’s method for estimating $v$. The research also showed that the estimated number HIV/AIDS deaths due to indirect maternal causes is more than the 50% assumed by the MMEIG, and consequently, HIV/AIDS deaths due to maternal causes estimated by the MMEIG are lower than expected. In spite of interventions to reduce mortality among women infected with HIV/AIDS (and hence lower estimates of death rates than estimated by the WHO life tables), HIV/AIDS is shown to increase the number of AIDS deaths due to maternal causes collectively through higher levels of $v$, $k$, and $u$, than is assumed by the MMEIG.

Through increases in GDP and SAB, and decreases in GFR, the covariates used by the MMEIG in its model of non-AIDS maternal mortality are associated with maternal mortality in a way that tends to predict lower levels of maternal mortality. Underlying observations of maternal mortality data and corollary adjustments to these data, on the other hand, suggest increasing levels of maternal mortality. On the assumption that countries with complete vital registration require a 50% adjustment for misclassification of maternal deaths, southern African countries with vital registration less complete than South Africa are likely to require an adjustment higher than the additional 50% assumed by the MMEIG. This research also clearly showed that the 10% adjustment made by the MMEIG to account for the proportion of pregnancy-related deaths due to unnatural causes underestimates the expected proportion of pregnancy-related deaths due to unnatural causes for South Africa, and possibly for the southern African region. Even though there is much uncertainty about maternal mortality estimates, based on the findings of this research, it is evident that the MMEIG approach to estimating maternal mortality underestimates the level and trend of maternal mortality estimates for countries with high HIV prevalence.

_A framework of the regulation of long-term insurers: solvency assessment and the role of the statutory actuary_

by DJ Viljoen for MSc at the University of the Witwatersrand, 2012

In this dissertation, the theory of solvency assessment and its evolution for long-term insurers is reviewed. Key international bodies and standards are identified and selected jurisdictions’ solvency frameworks are reviewed. The South African framework required by legislation introduced in 1998 is compared with these standards. Solvency capital requirements, valuation methods and risk-management standards are the key areas considered. The financial results of a model office according to the South African requirements are compared with the financial results modelled stochastically according to the identified international standards. It is shown that the South African framework
does not meet international standards. The key problem areas are the prescribed nature of the solvency capital requirement, the onerous treatment of policy cancellations and the treatment of new business.

The role of actuaries in solvency assessment is also investigated. The role of the statutory actuary in South Africa is compared with similar international roles. It is concluded that, although similar international roles, notably the appointed actuary of the UK, have evolved, the role of the statutory actuary has remained the same.