An analysis of the performance of Stellenbosch University actuarial science students (2005-2023)

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ABSTRACT
This paper provides a brief overview of the qualification process for actuaries in South Africa, in particular the role played by universities and factors which may contribute to the strength of such programmes. An outline of the Stellenbosch University actuarial science offering is provided and the performance of the Stellenbosch University students over the past 20 years is analysed. Aspects reported on include enrolments and throughput, module pass rates and exemptions from the Actuarial Society of South Africa's examinations. The performance of Stellenbosch University students in the profession's examinations and the time taken by graduates to qualify as Fellow actuaries are also considered.

KEYWORDS
Actuarial students, enrolment, performance, exemptions, qualification, Stellenbosch University

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1. INTRODUCTION

1.1 Qualification as an actuary

1.1.1 To qualify as an actuary it is necessary for one to pass (or be exempted from) a series of examinations set by an actuarial professional association.

1.1.2 Prior to the launch of a local South African qualification by the Actuarial Society of South Africa (ASSA) in 2010, almost all of the practising actuaries in South Africa became Fellows of ASSA by first having qualified as Fellows of the Institute of Actuaries or Faculty of actuaries (UK) (although Fellowship could also have been obtained through qualification via the Society of Actuaries (USA)). The examinations of the UK bodies were hosted in South Africa.

1.1.3 As a first step towards making the actuarial qualification more relevant to actuaries intending to practise in South Africa, and the development of a full local qualification, ASSA (under the auspices of the Institute of Actuaries and Faculty of Actuaries) launched a series of South African examinations at the Specialist Applications level (i.e. the final examinations normally taken in order to qualify as an actuary) from September 2003. Much work was put in from that time, by ASSA and academics at the established South African universities, to facilitate the introduction of a local qualification by ASSA in 2010.

1.1.4 Under the current ASSA curriculum (see details in Appendix A), students can qualify as an Associate of ASSA (AMASSA) if they have a Bachelor's degree (in any field) and have passed (or been exempted from) the following:

– Part A1: Foundation Technical, consisting of three examinations covering Statistics, Business Economics and Business Finance.

- Part A2: Intermediate Technical, consisting of four examinations covering Financial Mathematics, Risk Modelling, Contingencies and Financial Engineering. A fifth subject, covering Data Analytics is to be introduced shortly.
- Part A3: Core Principles, covering the key Actuarial Risk Management course.
- Normative Skills, covering Actuarial Professional Practice, an examination in Communications and some work-based learning.

1.1.5 Associates can progress from the Associateship to becoming a Fellow of ASSA (FASSA) by passing (or being exempted from) the following:

- Part F1: Fellowship Principles, requiring the passing of any two out of the (currently) six subjects encompassing the main actuarial practice areas.
- Part F2: Fellowship Applications, requiring the passing of any one out of the (currently) six advanced subjects encompassing the main actuarial practice areas.
- Normative Skills, covering further Actuarial Professional Practice and work-based learning.

1.1.6 Fellows or Associates of ASSA can also obtain the internationally recognised designation of Chartered Enterprise Risk Actuary (CERA) if they also pass:

- Enterprise Risk Management Principles (from Part F1); and complete the
- Applied Enterprise Risk Management course.

1.1.7 Despite setting its own standards and examinations for most of its qualification, ASSA still makes use of some of the examinations of the Institute and Faculty of Actuaries (IFoA) – the association formed by the merging of the Institute of Actuaries and Faculty of Actuaries in 2015. These are the examinations for the three Part A1 subjects as well as two of the Part A2 subjects (Risk Modelling and Financial Engineering) and one of the Part F1 subjects (Enterprise risk Management). ASSA may soon need to revisit this decision, in particular for the last three of the subjects mentioned.

1.1.8 Many actuarial associations have entered into accreditation agreements with some universities whereby, provided the universities maintain agreed standards, their students may be exempted from writing certain examinations of the professional association.

1.1.9 In South Africa, the most successful Honours graduates could be exempted from over 80% of the ASSA examinations. No exemptions are, however, available for the final (Fellowship Applications) examination.

1.2 Actuarial Science at South African universities

1.2.1 Actuarial Science subjects were first offered at a South African university in 1968 at the University of Cape Town (UCT). In 1973 the first exemption agreements were put in place between UCT and the parent professional bodies responsible for the qualification of most South African actuaries at the time, namely the Institute of Actuaries and Faculty of Actuaries in the UK.

1.2.2 Since that time a number of other South African universities have instituted actuarial science programmes. In 1982, the University of the Witwatersrand (WITS) introduced an actuarial science module (in compound interest) in the second year Mathematics course. This offering was subsequently expanded.

1.2.3 Stellenbosch University (SU) followed suit later in the 1980s with the appointment of Prof. Caspar Greeff, who had been responsible for establishing the Actuarial Science programme at WITS.

1.2.4 Actuarial Science programmes are now also offered at the University of Pretoria (UP), University of the Free State (UFS), North-West University (Potchefstroom campus) (NWU) and the University of Johannesburg (UJ).

1.2.5 Over the years some universities withdrew their Actuarial Science programmes, namely Rand Afrikaans University (now called UJ) and the University of Kwa-Zulu Natal.

1.2.6 Studying towards an Actuarial Science degree is becoming increasingly popular in South Africa. From the early days at UCT in the 1970s, where there averaged fewer than 10 new entrants per year, we are currently at a position where there may be over 800 new entrants per year to the South African university programmes, with the larger programmes accepting over 200 students per year.

1.2.7 Some key characteristics of the South African actuarial education set-up, distinguishing South Africa from most other countries, are:

- Actuarial science is a study direction which attracts many of the top school-leavers.
- The top universities in the country offer an Actuarial Science programme.
- Almost all of the students admitted to ASSA studied at one of the ASSA-accredited universities (over 98% in the years 2020-2023, ASSA Admissions Committee Reports (unpublished), although not all of these may have completed an ASSA-accredited degree.

2. FACTORS CONTRIBUTING TO THE STRENGTH OF AN ACTUARIAL SCIENCE UNIVERSITY PROGRAMME

As students (and their sponsors) place significant trust in a university, it is important that universities consider how to best strengthen their programmes to provide students with not just a generally sound tertiary education but also one which assists students in their endeavours to become actuaries. The sections below will look at various factors which could play a role in this regard.

2.1 Level of accreditation and exemptions offered

2.1.1 The level of accreditation that a university has with the relevant actuarial association, ASSA in the case of South Africa, as well as the number of subjects for which the university can recommend exemptions, are crucial to how well a university can assist students in their journey towards qualification as an actuary. The greater the number of exemptions a student can obtain, the fewer examinations will remain towards qualification as an actuary after university graduation, and the quicker they could qualify.

2.1.2 As stated in ASSA's Accreditation Policy (2018, version 8, section 2.5.1): "Accreditation gives the university, through its nominated Accreditation Actuary, the right to recommend exemptions from subjects to students who satisfy the standards agreed as part of the accreditation process."

2.1.3 Universities can apply for accreditation with ASSA at one of three levels. At level 1, universities may recommend students for exemption from the Part A1 subjects. At level 2, recommendations for exemptions may be made for the Part A2 subjects as well as N111 (Foundation Actuarial Professional Practice) and N211 (Communications). At level 3, recommendations for exemptions can be made for the Part A3 and F1 subjects. ASSA, in its Accreditation Policy (2018), sets out general requirements which a university needs to satisfy for accreditation, as well as specific requirements for each higher level of accreditation. These requirements cover things such as:

- Suitability of curriculum;
- Minimum staff complement required;
- Minimum involvement of qualified actuaries in the programme;
- Minimum qualifications for the Accreditation Actuary;
- Syllabus coverage;
- Exemption assessment structure;

- Appropriateness of facilities on campus;
- Internal quality assurance processes;
- External examiner requirements;
- Research activity;
- Details of the conditions under which exemptions for the agreed subjects can be made.

2.1.4 Meeting the accreditation requirements not only allows the university to make exemption recommendations for the agreed subjects but should also convey to students ASSA's confidence in the ability of the university to deliver a certain minimum quality of programme. It is not clear, however, that the latter condition is included in how ASSA interprets the Accreditation Policy.

2.2 The university's track record in offering exemptions

2.2.1 A university which has offered a particular exemption for a number of years should be well-equipped to have good learning and teaching systems in place to present the material in question to the students in an appropriate way.

2.2.2 Furthermore, it should have the necessary experience to set exemption examinations of an appropriate standard and the ability to source a suitably qualified external examiner to verify the standard.

2.3 Actuarial staff complement, experience and staff turnover

2.3.1 A core theme of ASSA's Accreditation Policy (2018) is around the staffing of the accredited programme. An actuarial programme differs from a standard university programme in that the students are targeting a professional qualification and not just an academic one. To this end it is essential that students are exposed to a number of experienced (both professionally and academically) actuaries.

2.3.2 The ability of the lecturer to provide valid practical examples of the application of the material being studied add to the authenticity of the students' experience and will help provide them with an understanding of how the subject can be applied in practice. Students would thus benefit from being exposed to qualified actuaries as often as possible during their university studies. To this end, a large actuarial staff complement, with a range of practical experience, would be beneficial.

2.3.3 Students will also benefit from having the actuarial team employed on a full-time basis, as opposed to relying on staff appointed on a contract (or sessional) basis, who may only be present on campus for short periods.

2.3.4 In addition, the university would benefit from having low staff turnover. High staff turnover will result in a very inexperienced lecturing team. It takes a few years for an academic staff member to be fully at home with course material, and before that time they may struggle to stay only slightly ahead of the students in terms of subject knowledge. While staff turnover is inevitable, and perhaps desirable at times, it can become very disruptive for a programme and disadvantageous to students.

2.4 Admissions and progression through the programme

2.4.1 There is little doubt that qualifying as an actuary is very demanding, requiring a high degree of mathematical aptitude. Mathematical ability alone, however, is not sufficient to guarantee that someone will be able to qualify as an actuary. Pass rates in the ASSA exams are usually below 40%, which is extremely low bearing in mind that most candidates have already completed a Bachelor's degree in Actuarial Science at a local university and should thus be well-prepared technically.

2.4.2 Taking this into account, it is incumbent on universities to only admit students to an Actuarial Science programme if it believes they are capable of qualifying as

actuaries. It would be disingenuous of a university to do otherwise and could seriously damage the future of such students (also discussed in Slattery (2004)) as well as negatively impacting the reputation of the university. This responsibility is recognised in ASSA's Accreditation Policy (2018, version 8, section 2.3.3) where it states: "The entry requirements [for the accredited university programme] should be such that students entering the programme stand a reasonable chance of qualifying as actuaries."

2.4.3 Difficulties faced by South African universities in selecting appropriate students include the heterogeneity of the South African school system and the fact that final school results are not necessarily great predictors of success at university.

2.4.4 To allow for this and wanting to avoid potentially turning away a talented student who underperformed at school for whatever reason, while bearing in mind the earlier comments around not luring inappropriate students to an actuarial programme, it would seem much better to have relatively high admission requirements but to allow students who demonstrate the necessary ability when at university to transfer in to the programme, than to have overly low admission requirements and to try to cull the numbers later.

2.4.5 The selection and sifting of appropriate students does not stop at the initial admission stage but should continue once students get to university. Performance hurdles could usefully be set along the way in order to discourage and redirect students who don't demonstrate the ability, or willingness to put in the effort required, to continue on the long journey towards qualifying as an actuary.

2.4.6 The better able a university is at selecting appropriate students and redirecting those who do not demonstrate the necessary ability or desire to become actuaries to alternative study paths when required, the better it is for the students concerned. This will assist a university in being able to produce high-calibre graduates who are capable of qualification, which in turn will enhance the university's reputation.

2.5 Maintaining high exemption standards

2.5.1 At the minimum, accredited universities need to adhere to the requirements of the ASSA Accreditation Policy (2018, version 8, sections 4.4.1 and 4.5.2) which state: "The exemption standard …. must, as far as can be determined, ensure that those students granted exemption would have passed the corresponding ASSA examination."

2.5.2 It does nobody any favours in the long run if a university allows its exemption standards to fall and recommends students for exemptions which they may not deserve. Such students would find that they do not have an adequate grasp of that material and are likely to struggle in later examinations as well as in the workplace, where employers would expect them to have the necessary ability. Universities would soon earn themselves a bad reputation in the market and it could threaten their accreditation.

2.5.3 Students who only narrowly miss the exemption standard at university should find themselves well-prepared to succeed in the ASSA examination at their first opportunity. Even the students who were not close to the exemption standard, but at least passed the relevant university course (as they should have done in order to graduate), should have a strong grounding and have a good chance of success in the ASSA examination.

2.5.4 The average performance of a university's students in the ASSA examination must thus provide some indication of how well-prepared students from that university are. It should be borne in mind, however, that it is only a university's weaker students who need to write the ASSA examination as the stronger students would have reached the exemption standard (for subjects where an exemption is offered).

2.6 Provision of a programme which has sufficient breadth and depth

2.6.1 In addition to covering the ASSA curriculum it is important that a university provides its students with a rounded education, covering other material which will be useful to the graduates in their future careers.

2.6.2 Commonly, accredited universities will offer their students some level of computer programming, an introduction to Business Management, the ability to take some second year Economics or Financial Risk Management, at least two full years of Mathematics and a full major in Mathematical Statistics.

2.7 Research activity

2.7.1 Research is critical to grow the body of knowledge in, and understanding of, a discipline. Research can assist in the continuing advancement of a field such as actuarial science as well as contributing to addressing societal challenges. Research can enrich the academic environment with researchers being at the forefront of their field and provides students with the opportunity to apply critical thinking to various problems.

2.7.2 In South Africa, students are often only exposed to research at the Honours level, where the emphasis is generally on teaching students about the research process as opposed to conducting cutting-edge research.

2.7.3 ASSA recognises the relevance of research at the accredited universities (Accreditation Policy (2018, version 8, section 4.3.7)) by requiring that each accredited university must "have, or be prepared to demonstrate its commitment to having, an active research programme in issues of relevance to the actuarial profession".

2.7.4 The publication of research papers in reputable academic journals and the presentation of research at conferences can enhance a university's reputation. This is particularly the case these days, where a university's research output is compared globally.

2.7.5 Challenges face most South African actuarial departments, however, compared to many other university departments, due to factors such as:

- Few actuarial graduates remain at university to undertake Master's or Doctoral studies, as they place much higher priority on completing their actuarial qualification and entering industry.
- Few actuarial academics have Doctoral degrees themselves.
- Unlike in most disciplines, postgraduate courses in actuarial science are constrained by needing to align with the profession's syllabuses. Academics thus find themselves teaching to those syllabuses, as opposed to their teaching being aligned to their research interests which would build research capacity in those fields.

3. THE STELLENBOSCH UNIVERSITY ACTUARIAL PROGRAMME

3.1 Actuarial Science qualifications offered by Stellenbosch University

3.1.1 Stellenbosch University currently offers the following qualifications in actuarial science:

- Bachelor of Commerce in Actuarial Science: BCom (Actuarial Science)
- Bachelor of Commerce Honours in Actuarial Science: BComHons (Actuarial Science)
- Postgraduate Diploma in Actuarial Science: PGDip (Actuarial Science)
- Master's in Actuarial Science: MCom (Actuarial Science)
- Doctorate: PhD

3.1.2 The University previously also offered a Bachelor of Science degree in Actuarial Science, but this did not attract many students and was withdrawn from the University's offering in the mid-2000s. The degree will not be included in the remainder of this study.

3.1.3 The degree curriculum has regularly changed to keep pace with changes in the actuarial profession's curriculum (initially that of the Institute and Faculty of Actuaries and, since 2010, the Actuarial Society of South Africa). The current Bachelor's, Honours, Master's and Diploma curriculums are provided in Appendix B.

3.2 Minimum admission requirements

3.2.1 The minimum requirements for admission (based on final school results) into the Bachelor's degree have been strengthened over time, to take account of the higher demand for the programme as well as potential grade inflation of school results, broadly as follows:

- From 2004: 80% for Mathematics; 60% for English/Afrikaans First Language; 70% average.
- From 2017: The minimum average was increased from 70% to 80%, (excluding Life Orientation), the language requirement was extended to other Home Languages (but retaining a minimum performance in English) and the programme was also categorised as a "Selection Programme", whereby final admission was not guaranteed for those meeting the minimum requirements.

3.2.2 The minimum admission requirements for the Honours degree are:

- A BCom (Actuarial Science) or equivalent degree with Actuarial Science and Mathematical Statistics as majors;
- Passes in university modules equivalent to at least six of the seven foundation and intermediate technical subjects of the Actuarial Society of South Africa (or core principles subjects of the Institute and Faculty of Actuaries); and
- Exemptions from (or passes in the profession's examinations for) at least five of the foundation technical and intermediate technical examinations of the Actuarial Society of South Africa (or core principles examinations of the Institute and Faculty of Actuaries). The five subjects must include at least A211 or A213.
  If the bachelor's degree was not completed in the minimum time of three years, an additional exemption is required for each additional year taken.
- An average mark for both third year Actuarial Science and third year Mathematical Statistics of at least 60% is expected.

3.2.3 For several years, the Grade 12 Mathematics mark and Grade 12 average mark of the students admitted to the BCom (Actuarial Science) programme have averaged around 90%.

3.2.4 These relatively high admission requirements ensure that Stellenbosch University continually attracts high-calibre students.

3.3 Progression requirements

3.3.1 In addition to the normal scaffolding that takes place within a discipline, i.e. students being required to pass the first year of a given subject before taking the follow-on subject the next year, the University places additional performance requirements on students to take account of the difficulty of actuarial science studies and to try to ensure that students have the necessary skills to cope with the more advanced material.

3.3.2 The most noteworthy of these are:

- A minimum final mark of 60% for the first semester of Mathematics in first year in order to take the Introduction to Actuarial Science module in the second semester.
- A minimum average final mark of 60% across the two first year Mathematics modules, plus a final mark of at least 65% for Probability Theory and Statistics to be admitted to any of the second year Actuarial Science modules.

- Passes in the first semester for Actuarial Science, Mathematics and Mathematical Statistics in the second year to be admitted to the second semester Actuarial Science module.
- Students must pass all modules making up the second year of Mathematics and Mathematical Statistics to be admitted to any third year Actuarial Science module.

3.3.3 Emphasis is placed on trying to detect the students that are in an inappropriate degree as soon as possible for the student's benefit. It is not doing the students any favours by falsely encouraging them to stay in a programme they are not suited for. An early change to a more appropriate course of study invariably results in a successful outcome for the student.

3.4 Academic staff

3.4.1 The actuarial staff form part of the larger Department of Statistics and Actuarial Science, in the Economic and Management Sciences Faculty.

3.4.2 From having as few as one permanent actuarial staff member for a short period in the early 2000s, the University can now boast eight qualified actuaries (six Fellows and two Associates) on its permanent staff, six of whom are appointed on a full-time basis and the other two on a five-eights basis.

3.4.3 The actuarial staff members come from a range of backgrounds and so can offer students a wide range of perspectives.

3.4.4 Furthermore, the extremely low staff turnover experience by the University is worth noting. In the last fifteen years there has only been one resignation of a full-time staff member, with the vacancy being filled as soon as the post was re-advertised. Many South African universities are not as fortunate and have had to deal with regular staff resignations.

3.4.5 The size and stability of the actuarial staff complement allows the University to allocate the staff to the course they are best suited to run and has given staff the opportunity and time to develop expertise in these courses, to the benefit of students and the maintenance of standards.

3.4.6 In addition to the permanent staff members mentioned above, the University appoints several contract staff members (all Fellow members of ASSA), due to their specific topic knowledge and practical experience, to assist on the lecturing of its Part F1 (Fellowship Principles) courses at postgraduate level.

3.5 Teaching methods

3.5.1 Stellenbosch University is a traditional contact university. Other than in extra-ordinary circumstances (such as during the COVID-19 pandemic) students are required to attend lectures and participate in tutorials. Summative assessments are primarily closed-book in nature.

3.5.2 Lecturers have significant freedom to present their courses in the way they feel is best. Students are expected to come to class having pre-read the material for that day's lecture. This affords the opportunity for a greater degree of class participation than is often the case.

3.5.3 From as early as first year, and running through to Honours, students are required to complete some components of their actuarial studies in groups. While this is not always popular amongst students, it provides them with the necessary exposure to working as part of a team which will be required in practice.

4. STELLENBOSCH UNIVERSITY ENROLMENTS AND THROUGHPUT

4.1 BCom (Actuarial Science) enrolments and throughput

4.1.1 In the analysis following for the BCom (Actuarial Science) degree data have been grouped into three-year cohorts. This was done in order to obtain larger groups to analyse and hence remove some of the fluctuations which took place on a yearly basis.

4.1.2 The table below shows the average number of new enrolments in the BCom (Actuarial Science) degree by year, along with the percentage which graduated with a BCom (Actuarial Science) degree in 3, 4 or 5 or more years, the percentage which completed a different degree, the percentage who are still registered at the University and the percentage which left the University without completing any Bachelor's degree.

TABLE 1. BCom (Actuarial Science) enrolment numbers and throughput

Year of enrolment	2005-07	2008-10	2011-13	2014-6	2017-19	Overall (2005-19)
Average enrolment per year	48.0	49.7	75.3	110.7	115.0	79.7
Graduating in 3 years	36.1%	34.2%	30.1%	31.9%	34.8%	33.2%
Graduating in 4 years	6.3%	10.7%	18.1%	10.8%	17.1%	13.5%
Graduating in 5+ years	2.8%	10.1%	5.8%	3.6%	4.9%	5.1%
Graduated with a BCom (Actuarial Sc)	45.1%	55.0%	54.0%	46.4%	56.8%	51.8%
Graduating with a different degree	46.5%	39.6%	33.2%	42.5%	29.9%	37.2%
Still registered	0.0%	0.0%	0.0%	0.0%	4.9%	1.4%
Leaving university without graduating	8.3%	5.4%	12.8%	11.1%	8.4%	9.6%
Aver. duration to graduate BCom (Act Sc)	3.28	3.62	3.56	3.40	3.49	3.47

4.1.3 The figure below displays this graphically, with each column representing a different cohort showing the number of students falling in the various categories.

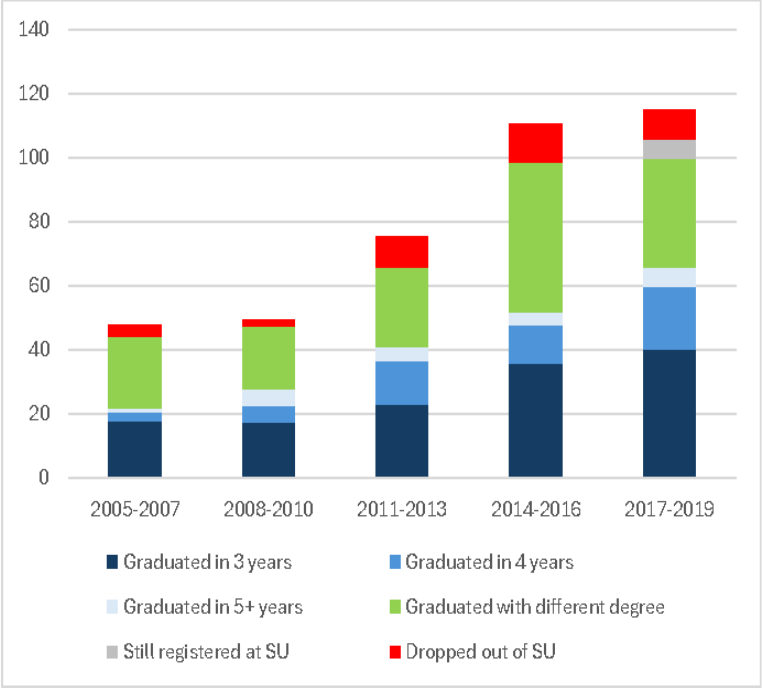

FIGURE 1. BCom (Actuarial Science) enrolment numbers and throughput

4.1.4 Some observations:

(a) There has been substantial growth in enrolments over the past twenty years, with annual enrolments more than doubling over the period of investigation.

(b) A more in-depth look at enrolments by years shows that much of the later increase was due to very high enrolments in 2016 and 2017, with over 140 enrolments in each of the years (which were around 50% above the norm at the time). Much of this spike may have been related to perceptions that student protests (which were happening from late 2015 related to the Fees Must Fall movement) were less disruptive at Stellenbosch University than at many other universities. Furthermore, significant changes in Stellenbosch University's Language Policy from 2016 would have contributed to making the University potentially more attractive to many students, owing to the reduced emphasis on Afrikaans as the language of instruction and administration, affording students the opportunity to complete their studies in English at the University.

(The stated essence of the Stellenbosch University Language Policy (Stellenbosch University (2021)) "in relation to language usage in the University's academic, administrative, professional and social contexts aims to increase equitable access to SU for all students and staff, promote multilingualism and the appreciation thereof, and facilitate pedagogically sound learning and teaching. Without losing sight of the fact that SU also serves continental and global communities, we commit ourselves to multilingualism by using the three official languages of the Western Cape, namely Afrikaans, English and isiXhosa.")

(c) The years 2020-2023 produced an average enrolment of 98.8, but with an increase of some 30% in 2024 Stellenbosch University appears to be moving to a period of higher enrolments. Applications for 2025 appear to be continuing on this upward trend.

(d) It should be noted that Stellenbosch University also offers degrees whose curriculums are very similar to the BCom (Actuarial Science) degree in the first year. Many students who do not meet the admission requirements for entry to the BCom (Actuarial Science) degree register for one of those other degrees (the most popular being BCom (Mathematical Sciences)) with a view to performing well enough in their first year and being allowed to transfer into the BCom (Actuarial Science) programme the following year.

(e) It is encouraging to see that, despite the large increase in enrolments, the proportion of students completing the BCom (Actuarial Science) degree is increasing over time. The 2017-2019 group, despite not being fully run-off (with around 5% of the initial enrolments still enrolled), exhibit over a third completing the BCom (Actuarial Science) degree in the minimum time of three years, and a little over half completing in three or four years.

(f) The average length of time taken to complete a BCom (Actuarial Science) degree is close to 3.5 years.

(g) It should be noted that while many students do not complete a BCom (Actuarial Science) degree, it is only a little under 10% of the original intake who leave the university without completing any Bachelor's degree.

4.1.5 In all the studies on SU student performance in which it was considered, students' past academic performance in Grade 12 (in terms of Grade 12 Mathematics mark as well as students' average Grade 12 mark) was found to have a statistically significant impact on success or failure in the BCom (Actuarial Science) programme (for example, Louw (2013), Jacobs and Wenhold (2015), Basson and Kockott (2017), Botha (2018)). There are, however,

many other factors which may potentially influence student performance at university, some of which will be discussed below.

4.1.6 Strugnell and Ranchod (2016) in a study of the performance of UCT actuarial science students found that significant factors included: Grade 12 mathematics, national benchmark test results for mathematical literacy (and academic literacy), race and the impact of academic support programmes.

4.2 BCom (Actuarial Science) enrolments and throughput by gender, race and home language

4.2.1 The table below records enrolments by gender.

TABLE 2. BCom (Actuarial Science) enrolments and throughput – Gender

Year of enrolment	2005-07	2008-10	2011-13	2014-6	2017-19	Overall (2005-19)
Average enrolment per year – Female	17.3	16.0	29.3	48.3	53.3	32.9
Percentage enrolment – Female	36.1%	32.2%	38.9%	43.7%	46.4%	41.2%
Average enrolment per year – Male	30.7	33.7	46.0	62.3	61.7	46.9
Percentage enrolment – Male	63.9%	67.8%	61.1%	56.3%	53.6%	58.8%
Ppn. graduating BCom (Act Sc) – Female	44.2%	41.7%	54.5%	42.8%	58.1%	49.9%
Ppn. graduating BCom (Act Sc) – Male	45.7%	61.4%	53.6%	49.2%	55.7%	53.1%
Aver. dur'n to grad. BCom (Act Sc) – Fem	3.17	3.55	3.50	3.45	3.51	3.46
Aver. dur'n to grad. BCom (Act Sc) – Male	3.33	3.65	3.59	3.36	3.48	3.48

4.2.2 Some observations:

(a) In the early period of investigation male enrolments were almost double female enrolments. The numbers of enrolments of both males and females increased substantially over the period, with the relative difference in proportions narrowing.

(b) Female enrolments in the years 2022-2023 (not shown in the above table) were higher than male enrolments, at 54% compared to 46%.

(c) No discernible difference in performance between males and females was detected overall. 50% of females completed a BCom (Actuarial Science) degree (32% in the minimum time of three years) compared to 53% of the males (34% in the minimum time). On average females took 3.46 years to complete the degree compared to 3.48 for their male counterparts.

4.2.3 The SU throughput analysis will next consider race. Race has traditionally been included as a factor to investigate in such studies as it provides an indicator against which to measure the transformation of the actuarial programme and profession. Race may be capturing elements of schooling, finances, psycho-social challenges, the added challenges faced by first-generation students (whereby a student is the first from their family to attend a university), etc., which can influence a student's likelihood of success.

4.2.4 The table below analyses the enrolments and throughput of Black, Coloured and Indian (BCI) students, using the same metrics as in Table 1 above.

TABLE 3. BCom (Actuarial Science) enrolment numbers and throughput – BCI students

Year of enrolment	2005-07	2008-10	2011-13	2014-6	2017-19	Overall (2005-19)
Average enrolment per year	3.7	4.0	10.3	24.7	23.3	13.2
BCI as a percentage of total enrolments	7.6%	8.1%	13.7%	22.3%	20.3%	16.6%

Graduating in 3 years	36.4%	16.7%	19.4%	20.3%	15.7%	19.2%
Graduating in 4 years	9.1%	16.7%	12.9%	9.5%	18.6%	13.6%
Graduating in 5+ years	0.0%	0.0%	9.7%	5.4%	10.0%	7.1%
Graduated with a BCom (Actuarial Sc)	45.5%	33.3%	41.9%	35.1%	44.3%	39.9%
Graduating with a different degree	36.4%	33.3%	25.8%	40.5%	32.9%	34.8%
Still registered	0.0%	0.0%	0.0%	0.0%	7.1%	2.5%
Leaving university without graduating	18.2%	33.3%	32.3%	24.3%	15.7%	22.7%
Aver. duration to graduate BCom (Act Sc)	3.20	3.50	3.85	3.58	3.90	3.72

4.2.5 Some observations:

(a) There has been substantial growth in enrolments of BCI students over the past twenty years, admittedly from a very low base in the early period of investigation.

(b) The proportion of BCI students almost tripled from the 2005-2007 cohort to the 2017-2019 cohort. This trend has continued, with BCI enrolments in the period 2022-2023 accounting for 23.7% of total BCom (Actuarial Science) enrolments.

(c) BCI students, however, have underperformed their counterparts, with marginally under 40% completing a BCom (Actuarial Science) degree and taking on average 3.72 years to do so. The recent completion rate will move up a little if some of the students from the last cohort who are still registered, complete their degree.

4.2.6 The table below analyses the enrolments in the BCom (Actuarial Science) programme by home language.

TABLE 4. BCom (Actuarial Science) enrolment proportions – Home language as a percentage of total enrolments

Home language	2005-07	2008-10	2011-13	2014-6	2017-19	Overall (2005-19)
Afrikaans	72.9%	73.2%	66.4%	54.8%	47.2%	59.3%
English	25.7%	24.8%	29.2%	38.6%	43.8%	35.0%
Other (South African)	0.7%	2.0%	3.1%	5.1%	4.6%	3.7%
Other (non-South African)	0.7%	0.0%	1.3%	1.5%	4.3%	2.0%

4.2.7 Some observations/comments:

(a) There has been a substantial reduction in the proportion of students whose home language is Afrikaans over the period, with substantial growth in the English and Other groups. This trend has continued to the 2020-2023 intake, where English is the most common home language (45%) and the Other (South African) group has increased to 7%.

(b) Prior to 2017 students needed to have taken Afrikaans or English at Home Language level in Grade 12 (and met the performance requirement) to be admitted to the programme. From 2017, if English was not taken as a Home Language, a mark of at least 75% was required for English as First Additional Language in Grade 12. Thus, all of the admitted students have demonstrated competence in Afrikaans or English.

(c) While there is little difference in performance between the Afrikaans and English groups, those with a different SA official language as their home language performed much worse than the others, with only about 10% completing a BCom (Actuarial Science) degree (although the few that did complete the degree, did so quickly). With a total enrolment of fewer than 50 students, however, this is a very small group to be

drawing conclusions from about home language per se, bearing in mind the comment in (b) above.

4.3 Student perceptions on factors leading to success in, or withdrawal from, the actuarial programme

4.3.1 Bezuidenhout and McConney (2015) conducted a survey of just under 300 students at SU taking Actuarial Science modules (comprising around 75% of students taking these modules), investigating students' perceptions regarding the factors which contribute to success in, or withdrawal from, the Actuarial Science programme. Some of the key findings were:

(a) The top five factors perceived as contributing to success in the programme were: ability to deal with exam stress; conducive study environment; friends and family; tutorials and fellow classmates.

(b) The top five factors perceived as contributing to withdrawal from the programme were: not performing well academically; poor stress- and time-management; having a poor work ethic; lack of interest in actuarial programme/career; and inability to deal with failure.

(c) Several of the factors showed significantly different responses based on the demographics of the students, in particular lectures in your preferred language and financial reasons.

(d) It should be noted that the survey was conducted amongst active students taking Actuarial Science modules and not those who had actually withdrawn from the programme.

4.4 Degrees taken by the students leaving the BCom (Actuarial Science) programme

4.4.1 Over the period of investigation, almost 500 students who registered for a BCom (Actuarial Science) degree graduated with a different Bachelor's degree. With such a high proportion of enrolments to the BCom (Actuarial Science) degree ending up graduating with a different degree, it is important to investigate which degrees they ultimately obtained. The table below shows the proportional breakdown of the non-actuarial degrees obtained by these students.

TABLE 5. Degrees obtain by students leaving BCom (Actuarial Science)

Degree	Percentage
BCom (Mathematical Sciences)	44.6%
BCom (General/Other)	23.7%
BAccounting	11.6%
BCom (Economic Sciences)	11.0%
BCom (Management Sciences)	4.4%
BEng (All types)	2.3%
BSc (All types)	1.7%
Other (MBChB, BA)	0.6%

4.4.2 It is hardly surprising that the majority of students who graduate with a different degree opt to change to a BCom (Mathematical Sciences) degree as its curriculum is very close to that of the BCom (Actuarial Science) degree (with a core of mathematics, mathematical statistics and financial risk management) and offers students the opportunity to pursue a Chartered Financial Analyst (CFA) qualification.

4.5 Postgraduate enrolments and throughput

4.5.1 The table below shows the average number of new enrolments in the BComHons (Actuarial Science) degree by year, along with the percentage which graduated with a BComHons (Actuarial Science) degree in 1, 2 or 3 or more years, the percentage which completed a different degree, the percentage who are still registered at the University and the percentage which left the University without completing an Honours degree.

TABLE 6. BComHons (Actuarial Science) enrolment numbers and throughput

Year of enrolment	2008-10	2011-13	2014-6	2017-19	2020-22	Overall (2008-22)
Average enrolment per year	21.0	22.7	28.0	38.7	45.0	31.1
Graduating in 1 year	71.4%	69.1%	56.0%	53.4%	65.2%	62.0%
Graduating in 2 years	20.6%	22.1%	38.1%	31.0%	27.4%	28.5%
Graduating in 3+ years	1.6%	4.4%	2.4%	10.3%	0.7%	4.1%
Graduated with a BComHons (Act Sc)	93.7%	95.6%	96.4%	94.8%	93.3%	94.6%
Graduating with a different Hons degree	1.6%	0.0%	0.0%	1.7%	0.0%	0.6%
Still registered	0.0%	0.0%	0.0%	0.0%	2.2%	0.6%
Leaving university without an Hons degree	4.8%	4.4%	3.6%	3.4%	4.4%	4.1%

4.5.2 Some observations:

(a) As was the case with the Bachelor's degree, there has been substantial growth in enrolments over the past twenty years, with annual enrolments more than doubling over the period of investigation.

(b) The completion rate in the BComHons (Actuarial Science) degree has remained fairly constant at around 95% throughout the period of investigation.

(c) A slight strengthening of the admission requirements over the last two years has resulted in a larger proportion of students completing their degree within one year, viz. 85% for the 2023 cohort.

4.5.3 As the Bachelor's and Honours degrees are stand-alone degrees, with many students not wishing to continue from Bachelor's to Honours and with many not meeting the Honours admission requirements, it is less useful to analyse throughput since initial enrolment for the Bachelor's degree (this analysis would be much more relevant had SU been offering a 4-year Bachelor's degree such as the Bachelor of Business Science degree offered at UCT). Nevertheless, the approximate throughput rates over the period of Bachelor's enrolment from 2005-2018 were: 20% completing an actuarial Honours in four years, 30% completing in 5 years, 35% ultimately completing, with close to a further 25% completing a non-actuarial Honours degree (usually in Financial Risk Management or Mathematical Statistics).

4.5.4 Registrations for the SU Postgraduate Diploma in Actuarial Science have rarely reached double figures since 2018. For several years before then, registrations were as high as 20. This drop-off in registrations may be related to students electing to take the less comprehensive ASSA tuition offering at the Fellowship Principles (F1) level. Few students graduate with a PGDip (Act Sc), as many do not complete enough modules and others convert to a Master's degree.

4.5.5 MCom (Actuarial Science) enrolments at SU have remained low over the period of investigation, ranging from zero to five in a year.

4.6 Pass rates in key SU courses

4.6.1 At Stellenbosch University, a course (or module) runs over a period of one semester or a full academic year. Course credits, multiplied by ten, give an indication of the number of notional hours a student is expected to devote to the course.

4.6.2 The average pass rates in the key Actuarial Science modules over the period 2019-2023 are shown in the table below (for modules denoted by * the pass rates are for the period 2020-2023, as these modules first commenced in 2020). Also shown are the module credits and the ASSA subject with which they are associated. (Pass rates are calculated as the number of passes divided by the number of enrolments less the number of students who discontinued the module.)

TABLE 7. Pass rates in the key Actuarial Science modules

Module	Credits	ASSA Subject	Pass Rate
Actuarial Science 142	16	A113	67.1%
Actuarial Science 211	18	A211	78.3%
Actuarial Science 241	22	A212	73.5%
Actuarial Science 311 *	24	A212	92.0%
Actuarial Science 341 *	24	A213	87.4%
Actuarial Science 371 *	32	A214	84.5%

4.6.3 Some observations:

(a) Pass rates improve from year to year. This appears sensible, as the weaker students move out of the programme.

(b) The pass rate for Actuarial Science 142 is understandably low. The content of this module is largely non-mathematical and introduces students to many new concepts, as well as the key practice areas actuaries tend to work in. SU believes this is an important module, as it not only shows students what lies ahead in terms of actuarial studies, but it also gives them their first indication of the standards expected of actuarial students.

4.6.4 The Actuarial Science students perform much better than other students in mathematically-based modules which they both take. Comparative pass rates for the period 2019-2023 are shown for some of these modules in the table below.

TABLE 8. Pass rates for some modules taken by both actuarial and non-actuarial students

Module	Credits	Actuarial Pass rate	Non-actuarial Pass Rate
Actuarial Science 112 (Intro. to Financial mathematics)	8	94.0%	59.5%
Mathematics 114	16	96.4%	76.9%
Mathematics 144	16	93.3%	70.8%
Probability Theory & Statistics 144	16	93.2%	58.3%
Actuarial Science 211 (Financial Mathematics)	18	83.6%	57.8%
Mathematical Statistics 214	16	80.0%	50.6%

4.6.5 These results align with earlier studies covering this aspect of performance, such as Basson and Kockott (2017).

4.7 Some comparative results relating to the University of Cape Town

4.7.1 UCT is one of the few universities in South Africa which has published results on analyses caried out on the performance of its actuarial science students. It is interesting to see how some of these results compare to those given above for SU.

4.7.2 The main actuarial science degree offered at UCT is the Bachelor of Business Science (BBusSc) degree. In addition to the mainstream four-year degree, an augmented stream has been offered since 2016 (where first year Statistics is taken over the full first year instead of only one semester) as well as an extended degree programme, offered over five years targeting previously disadvantaged students which commenced in 2010. A three-year BCom degree in actuarial science was also introduced from 2010 when the BSc degree in actuarial science was withdrawn.

4.7.3 Research carried out by Mulaudzi (2024) relating to the UCT BBusSc (Actuarial Science) degree indicated the following (for enrolments from 2010-2017):

- For the mainstream and augmented programmes: 42% of the Whites students completed the degree, 27% of Coloured students, 25% of Indian students and 23% of Black students.
- For the mainstream programme: 19% of students completed the degree in four years, 42% ultimately completed the BBusSc (Act Sc) or the three-year BCom (Act Sc) degree, with 14% dropping out without a degree (although some may have completed a degree at a different university).
- The results for the five-year extended degree programme were much worse, with only 6% of students completing the degree in the minimum period of five years and 21% dropping out.

4.7.4 Strugnell and Ranchod (2016) investigated students who were enrolled for an actuarial science degree in the Commerce Faculty at UCT in the period 2002-2015. They estimated the chance of completing any of UCT's actuarial science degrees (i.e. either the three-year BCom or four-year BBusSc degree, including the completing of the Quantitative Finance stream) to be 40.5%. (The Quantitative Finance stream, introduced in 2000, is a four-year BBusSc degree, which offers students most of the exemptions available to the BBusSc (Act Sc) graduates.)

4.7.5 Earlier research on the UCT BBusSc (Act Sc) degree by Slattery et al (2000) found that 34% of students enrolled in the period 1993-1996 completed the degree, 36% of those enrolled in the period 1988-1992 and 39% of those enrolled in the period 1977-1987.

4.7.6 Regarding gender, Ramjee et al (2013) reported significant differences between the female and male completion rates for the BBusSc (Actuarial Science) degree, with 31.8% of females compared to 43.1% of males completing the degree (for enrolments in the period 2005-2006), 36.6% of females compared to 48.3% of males (for enrolments in the period 2000-2004), and 34.1% of females compared to 40.8% of males (for enrolments in the period 1995-1999). Experience at SU has been quite different to this.

4.7.7 Comparing to UCT, it is also interesting to note that SU has attracted a much higher proportion of female students to its actuarial science programme than has been the case at UCT. Strugnell and Ranchod (2016) reported that the proportion of female students in UCT's actuarial science programmes had increased from approximately 30% in 2002 to 35% in 2015. From a similar base at the start, the SU programme had approximately 45% of its new enrolments being female by the mid-2010s.

5. STELLENBOSCH UNIVERSITY EXEMPTIONS FROM THE ASSA EXAMINATIONS

5.1 Exemption principles

5.1.1 As mentioned in 2.5.1 above, the ASSA Accreditation Policy requires, as a minimum, that the exemption standard must, as far as can be determined, ensure that those students granted exemption would have passed the corresponding ASSA examination.

5.1.2 To date this requirement has been left largely in the hands of each accredited university together with their ASSA-approved external examiners. It should inevitably, however, become ASSA's responsibility to ensure that it is satisfied that each accredited university is meeting this standard.

5.2 Undergraduate exemptions

5.2.1 Over the period 2005-2024, students completing an accredited Bachelor's degree at Stellenbosch University have been eligible to be recommended for up to seven exemptions from the examinations of the Actuarial Society of South Africa or the Faculty/Institute of Actuaries (prior to the introduction of the ASSA qualification). The subjects for which exemptions could have been recommended were:

- From 2005-2009: Faculty/Institute of Actuaries Core Technical subjects CT1-CT7.
- From 2010-2018: ASSA Foundation Technical subjects A101-103 and Intermediate Technical subjects A201-204. These seven subjects continued to follow the Faculty/Institute of Actuaries subjects CT1-CT7, and ASSA made use of the Faculty/Institute's examinations for these subjects.
- In 2019: ASSSA Foundation Technical subjects A111-113 and Intermediate Technical subjects A211 and A212. A202-204 were offered for the last time.
- From 2020-2023: ASSSA Foundation Technical subjects A111-113 and Intermediate Technical subjects A211-214.

5.2.2 The following should be noted:

(a) From 2019, the ASSA subjects were updated as follows: A211 replaced A201, A212 replaced both A202 and A204, A213 replaced A203 and A214 replaced A205. Exemptions were translated from the old to the new curriculum on that basis.

(b) In 2018/2019 a transitional arrangement allowed some students to be recommended for the A212 exemption, despite only having met the requirements for one of the A202 and A204 exemptions (based on their only narrowly having missed the other exemption).

(c) From 2020 Stellenbosch University introduced subject A214 into the third year of the BCom (Actuarial Science) degree. Prior to that time, the subject (under the old code A205) was offered in the Honours (4^{th}) year only. During 2020, as part of this transition, the subject was offered to both third year and Honours students. As a result of this change, BCom (Actuarial Science) graduates would effectively get one step closer to qualifying as actuaries from that time, despite them nominally only being eligible for the same number of exemptions as had been the case before that time.

(d) Computer-based assessments became part of the exemption requirements for the new subjects A212, A213 and A214.

5.2.3 The table below shows the exemption rates obtained for each of the Part A2 subjects over the period. It should be noted that in respect of A212, an additional hurdle needs to be met by students provisionally recommended for the exemption, based on performance in third year Actuarial Science and Mathematical Statistics modules (so the final exemption rate may have been lower than indicated below).

TABLE 9. BCom (Actuarial Science) exemptions from Part A1&A2 subjects

Year in which exemption was obtained	Subject A211/ A201/CT1	Subject A212/ A202/CT4	Subject A212/ A204/CT6	Subject A213/ A203/CT5	Subject A214/ A205/CT8
2019/2020 - 2024(Sem 1)	47.1%	39.0%		55.7%	41.9% (43.5%)
2010 - 2018/2019	42.1%	51.9%	56.8%	45.1%	(39.9%)
2005 - 2009	46.7%	55.4%	63.6%	42.0%	(64.6%)

(Figures in brackets relate to the performance of Honours students)

5.2.4 Some observations:

(a) The most noticeable increase in exemption rates in recent years has been for A213. This is perhaps not too surprising, as the syllabus for that subject has reduced in size since 2019. Similarly, there appears to have been an increase in the A211 exemption rates.

(b) The most noticeable decline in exemption rates is in respect of A212, where the exemptions are well down on the levels for the earlier A202 and A204 subjects. With a larger syllabus, and some assessment taking place earlier in the degree, this is not too surprising.

(c) While the A214 exemption rate may have declined a little, the exemption rate is still encouraging bearing in mind that prior to 2020 it was offered in the Honours year rather than in third year. In 2020 it was offered to both third year and Honours students, who obtained exemption rates of 30.9% and 43.5% respectively.

(d) It is perhaps most encouraging to see that exemption rates are still at reasonable levels despite the large increases in student numbers experienced over the investigation period.

(e) As a comparison against the first row of the above table, the ASSA pass rates for subjects A211-A214 in the period 2019 (Semester 1) to 2024 (Semester 1) were: 48.7%; 17.2%; 49.3% and 31.6% respectively. (Data extracted from the ASSA website (2024), Exam Results page.)

5.2.5 The table below summarises the total number of exemptions obtained by graduates (out of the maximum of seven available throughout). The grouping is done by year of graduation.

TABLE 10. No. of Part A1&A2 exemptions obtained by BCom (Actuarial Science) graduates

Year of graduation	2007-09	2010-12	2013-15	2016-8	2019-21	Overall (207-21)
Average number of exemptions	4.89	4.93	4.84	4.91	5.02	4.93
Proportion obtaining all 7 exemptions	24.1%	23.0%	25.0%	27.6%	27.1%	26.0%
Proportion obtaining 6 exemptions	21.5%	24.3%	11.7%	14.7%	14.6%	16.1%
Proportion obtaining 5 exemptions	17.7%	9.5%	21.7%	14.7%	16.6%	16.4%
Proportion obtaining 4 exemptions	10.1%	21.6%	15.8%	16.0%	19.6%	17.0%
Proportion obtaining 3 exemptions	15.2%	12.2%	20.0%	20.2%	19.1%	18.3%
Proportion obtaining 2 exemptions	5.1%	6.8%	2.5%	4.9%	3.0%	4.1%
Proportion obtaining 1 exemption	6.3%	2.7%	2.5%	1.8%	0.0%	2.0%
Proportion obtaining no exemptions	0.0%	0.0%	0.8%	0.0%	0.0%	0.2%

5.2.6 From the above it can be seen that the average number of exemptions obtained by graduates has remained close to five (out of the seven available) across most cohorts of students. Just over one-quarter obtained all seven exemptions, one-sixth obtained

six and a further one-sixth obtained five. Thus almost 60% of graduates over the period obtained at least five of the available seven exemptions.

5.2.7 The question should be asked as to whether such levels of exemptions are reasonable. It could be argued, for example based on the performance of SU students in the ASSA examinations (see Table 13 below) that SU may be overly cautious with its exemption recommendations.

5.3 Postgraduate

5.3.1 In the BComHons (Actuarial Science) programme students can obtain exemptions from the ASSA subjects N211 (Communications) and a311 (Actuarial Risk Management).

5.3.2 The N211 exemption has been offered since 2009 (including its forerunner A302/CA3). From 2009-2023 the exemption rate averaged at 49.8%. For the past number of years, the Honours students have written the same exam as the ASSA students, with the exemption mark being set at the same level as the ASSA pass mark.

5.3.3 For subject A311/A301/CA1, Stellenbosch University (SU) set its own independent exemption examinations from 2005-2012. From then onwards Stellenbosch collaborated with the University of Cape Town (UCT) to set joint exams (other than in 2017 when disruptions at UCT meant their examinations had to be deferred). From 2019 the University of the Free State (UFS) and North-West University (NWU) joined the collaborative process. UCT have always had the largest number of students in the joint examinations (at a little over 50%), followed by Stellenbosch (a little over 30%), with NWU and UFS together accounting for less than 20% of the students.

5.3.4 The table below sets out the exemption rates for subject A311, split into three time periods relating to when other universities joined the collaborative examination process.

TABLE 11. Subject A311 exemptions

Years	Exemption rates for Stellenbosch University	Exemption rates for other collaborating universities
2019 - 2023	68.3%	36.8% (UCT, NWU & UFS)
2013 - 2018	59.4%	42.5% (UCT, excluding 2017)
2005 - 2012	49.1%	No collaborating universities

5.3.5 In each of the joint A311/A201 examinations written since 2013, SU students comfortably achieved a higher exemption rate than the students from any other university. While the experienced staff members who lecture this course at SU no doubt played a role in this, a significant factor must be that SU selects students for admission to its Honours programme whereas at UCT all students who pass the third year of the BBusSc degree can continue to subject A311 in their fourth year (and are thus a less select group). The NWU and UFS Honours programmes are less well established and appear to have lower admission requirements, which will almost certainly contribute to their students' under-performance.

5.3.6 It is noticeable that the SU exemption rate has increased dramatically over the last decade. A contributing factor must be that as other universities join the collaboration the external examiner feels more comfortable recognising the relative performance of the SU students. This comparison is lost when a university writes its own examinations.

5.3.7 Another interesting statistic related to the relative performance of students during 2020, the year most impacted by COVID-19 restrictions on students' university attendance. At SU, the Honours students were allowed to return to campus for the full second semester. This was not the case at most other universities, in particular UCT. At 35 percentage

points, the exemption rate difference between SU and UCT was its largest over the 10-year period of collaboration. This provides fairly clear evidence of the merits of face-to-face tuition on subjects at this level in the actuarial qualification.

5.3.8 Finally the analysis looks at exemptions from the Part F1 (Fellowship Principles) subjects. For the past twenty years, SU and UCT have collaborated at this level. Due to the resources needed to offer these courses by universities which are so geographically close together, subjects have been offered as follows:

– Hosted at SU: F102 & F103; and
– Hosted at UCT: F101, F104 (although last offered in 2014 due to a lack of demand) and F105. (F108 will replace F101 and F104 from 2025.)

5.3.9 Students write the same examinations as the ASSA students, papers are marked together with the ASSA papers and the exemption mark is set equal to the ASSA pass mark. Unlike with the other exemptions available from ASSA examinations, it is not necessary to complete a full degree or diploma in order to qualify for an exemption at the Part F1 level. Thus, a number of students taking the joint SU/UCT courses are part-time students who are already working.

5.3.10 The table below shows the exemption rate on the joint SU/UCT courses compared to the ASSA pass rates in the period 2010-2023 (all sessions).

TABLE 12. Part F1 exemptions compared to ASSA pass rates

Subject	F101	F102	F103	F104	F105	F107	Overall
SU/UCT exemption rate	58.1%	61.5%	86.8%	70.0%	48.8%	-	61.7%
ASSA pass rate	37.4%	27.5%	30.9%	35.0%	26.5%	44.6	29.9%

5.3.11 Clearly the SU/UCT students perform much better than the students not taking a university course. The same general picture was true for earlier versions of exemption courses at an equivalent level prior to the introduction of the ASSA examinations in 2010.

5.3.12 It should also be noted that the above table is also measuring the performance of the SU/UCT students in the relevant Part F1 examinations, as opposed to an independent exemption assessment, as students write the same paper as the ASSA candidates.

6. STUDENT PERFORMANCE IN THE PROFESSION'S EXAMINATIONS

6.1 ASSA examinations in the period 2010-2019

6.1.1 In this section the results of analysis carried out by Malan and Thackwray (2020) are discussed. The analysis covers all the Part A1 and A2 subjects (referred to as technical subjects) and the N2, A3, F1 and F2 subjects (referred to as non-technical subjects) written in the period 2010-2019. The (anonymised) data used for this research was provided by ASSA.

6.1.2 Analysis considered the impact of the following factors: on student pass rates (Accredited) University attended (Cape Town, Free State, North-West, Pretoria, Stellenbosch and Witwatersrand); home language (English/Afrikaans/Other); gender; examination centre (the four used in SA) and examination session (first/second semester).

6.1.3 The table below shows the overall pass rates achieved by university attended, split into the technical and non-technical subjects (with the number of examination attempts for each shown in brackets). Universities other than SU have been called Universities A-E in the table below (not corresponding to the order given above).

TABLE 13. Pass rates by university attended for the ASSA technical and non-technical examinations in the period 2010-2019

University attended	Technical subjects	Non-technical subjects
Stellenbosch University	72% (860)	40% (1613)
University A	65% (1615)	35% (3037)
University B	52% (3531)	28% (3802)
University C	42% (3306)	32% (3158)
University D	31% (624)	32% (804)
University E	39% (591)	35% (695)

6.1.4 Some results which emerged from this analysis:

(a) Based on Pearson's chi-squared test, Malan and Thackwray (2020) found that university attended was a statistically significant factor (at the 5% level of significance) influencing an individual's likelihood of passing the technical examinations.

(b) For the key subjects A211 (Financial Mathematics) and A213 (Contingencies) it is noteworthy that the pass rates for SU students over the period were:

– For A211: 93% (with the other universities falling in the range 52%-88%).

– For A213: 88% (with the other universities falling in the range 35%-65%).

(c) It should be noted that a student allocated to a particular university in the ASSA database may not have completed the accredited actuarial science programme at that university. While such numbers are not expected to be large, it does mean that the pass rates above may understate the performance of the students who completed the accredited programmes (on the assumption that those who complete an actuarial programme, without exemption for the relevant subject, are still stronger students than those who did not complete an actuarial programme).

6.1.5 While university attended clearly plays a role in students' success in the profession's examinations, other factors have also been identified as statistically significant (although such relationships are not claimed as being causal) in various studies, such as:

– Malan and Thackwray (2020) found that examination centre was significant, and that home language was also likely significant (more so with the non-technical subjects).

– Brogden and Giddings (2018) found that race (which they included as a factor in place of home language) was significant.

– McDougall (2018) found that the students' employer was significant.

6.2 Faculty/Institute of Actuaries' examinations in the period 1999-2009

6.2.1 As 2010 saw the introduction of the ASSA qualification, it is worthwhile considering the period immediately before this for the purposes of comparison. During the period considered, there were different curriculums in place for the Faculty/Institute of Actuaries (1999-2004 and 2005-2009). As much of the curriculum was simply repackaged, results for the full period 1999-2009 will be presented (although the initial research carried out did look at the two sub-periods separately). Research carried out by Diedericks (2009) (covering the period 1999-2008) was extended to include the year 2009.

6.2.2 Data collection was significantly more time-consuming for this research than for the later research conducted using the ASSA examinations data. The data set was constructed using the following:

– List of candidates attempting each exam, obtained from ASSA.

– ASSA membership application information.

- Graduate information from various universities (some more detailed than others).
- Feedback from universities to help identify some of the unidentified candidates.
- Pass lists as published by the Faculty/Institute of Actuaries following each examination session.

TABLE 14. Pass rates by university attended for the Faculty/Institute technical and non-technical examinations in the period 1999-2009

University attended	Technical subjects	Non-technical subjects
Stellenbosch University	63% (729)	36% (1898)
University A	51% (927)	38% (2666)
University B	48% (1398)	34% (2400)
University C	42% (1511)	34% (2233)
Other universities	32% (1115)	27% (1371)
Unidentified	43% (1013)	28% (1150)

6.2.3 Some results which emerged from this analysis:

(a) As shown in Table 13, SU students performed the best in the profession's examination for the technical subjects. Results on the non-technical subjects were much closer by university, with SU students finishing second.

(b) SU students showed better performance in the more recent period (2010-2019) than in the period shown in the table above (1999-2009).

6.3 Combining exemptions and passes in the profession's examinations

6.3.1 When considering pass rates in the profession's examinations it should be borne in mind that it is only a university's weaker students who write the profession's examinations (at least the technical ones), as the stronger students will have been recommended for exemptions. If exemptions are too easy to obtain at a university, that university's students might be expected to do less well in the profession's examination (for that subject).

6.3.2 If one assumes that all students recommended for a particular exemption would pass the equivalent ASSA examination at the first attempt in the event that exemptions were not available (which is quite reasonable, as that is the underlying criterion on which exemptions are recommended), than an overall measure of a university's student performance in a particular subject might be obtained by combining the exemptions registered by ASSA in a particular year for that university's students with the pass rate for the university's students in that subject for that year (both sessions combined).

6.3.3 As an illustration of what this would mean for SU:

TABLE 15. Combined Pass Rates by subject for 2019

	A211	A213	A214
Number of exam sitters during the year from Stellenbosch University	15	24	59
Number of passes	11	24	28
Raw pass rate: (passes/sitters)	73.3%	100.0%	47.5%
Number of exemptions recorded by ASSA during the year	26	17	15
Combined pass rate: (passes + exemptions) / (sitters + exemptions)	90.2%	100.0%	58.1%

6.4 Time taken to qualify as an actuary after university graduation

6.4.1 An important metric to consider is the time taken by students to qualify as a Fellow actuary after they leave university. This is something needing more investigation, with the last in-depth study relating to SU graduates having taken place in 2013.

6.4.2 Van Tonder (2013) investigated SU graduates (1997-2011) who completed a Bachelor's degree with a major in Actuarial Science or an Honours degree in Actuarial Science and, by comparing with the list of qualified Fellows from ASSA and the Faculty/Institute of Actuaries found 105 graduates had qualified as Fellows. (For this purpose, a Fellow was regarded as someone who had completed all of the necessary examinations, but who may not yet have fulfilled any work-based experience requirements).

6.4.3 This analysis was further sub-divided into those who graduated before 2005 and those who graduated from 2005 onwards. This was done for the following reasons:

- SU exemptions data was not obtainable prior to 2003 (when the 2005 graduates may have commenced their studies).
- SU implemented higher admission requirements for BCom (Act Sc) from 2004.
- The Faculty/Institute of Actuaries implemented a curriculum change in 2005.

6.3.4 The table below shows the median time taken to qualify as a Fellow actuary, split by year of graduation and whether the student left with a Bachelors or Honours degree. The time taken to qualify was measured from the last graduation for each student.

TABLE 16. Median time taken to qualify as an actuary since graduation

Year of graduation	No. of graduates who qualified	Median time to qualification for Bachelor's graduates	Median time to qualification for Honours graduates
2005 - 2011	51	5.45 years	3.80 years
Before 2005	54	6.64 years	5.03 years
Combined	105	6.05 years	4.43 years

6.4.4 From the above it can be seen that:

(a) Students who complete an Honours degree generally take less time to qualify as a Fellow than those who leave university with only a Bachelor's degree. This is not at all surprising, since it should be expected that if one spent more time in full-time study, one would qualify quicker. Furthermore, the students staying at university to complete an Honours degree tend to be the stronger students, plus they will cover more of the material needed to qualify in that degree (currently, in particular, the large and challenging Actuarial Risk Management (A311) course).

(b) The median time to qualification reduced by over a year for those graduating from 2005 onwards, compared to the earlier graduates. This could be an indication that the 2005 curriculum change by the Faculty/Institute of Actuaries made it easier to qualify, or it could be an indication that that more recent SU graduates were stronger (possibly due to SU's increased admission requirements) or were better prepared to proceed to qualification.

(c) The study also found that the number of exemptions from the profession's examinations a student obtained the quicker they were likely to qualify. It is possible that this could have contributed to the reduction in qualification time referred to above. However, there was insufficient data on exemptions in the earlier group to test this.

6.4.5 Slattery et al (2000), in a study of graduates from the University of Cape Town's BBusSc (Actuarial Science) programme, also found that median times to qualification had been reducing at that time, down to 5 years for the 1993-1997 cohort of graduates from a figure of 10.5 years for the pre-1983 cohort.

7. CONCLUDING COMMENTS

7.1 Almost 40% of Stellenbosch University students in the recent cohorts completed a BCom (Actuarial Science) degree in the minimum time of three years. For some time, a little over 50% of students ultimately completed the degree. Around 90% of the intake graduate with some Bachelor's degree. While there is always room for improvement of throughput, bearing in mind the difficulty of actuarial studies and the heterogeneity of the South African schooling system, such results are perhaps not unexpected.

7.2 The Stellenbosch University programme has grown substantially in size over the past 20 years and is making positive strides in terms of transformation. In the light of these increases in size, it is encouraging to see that throughput has remained fairly steady (with an average time to graduation of around 3.5 years) as well as the average number of exemptions per Bachelor's graduate (at close to 5 of the Part A1 and A2 exemptions available), and that student performance in the profession's examinations) appears, if anything, to be improving over time.

7.3 The Stellenbosch University students perform well in the ASSA examinations compared to graduates from other universities. This could be attributed to a combination of many factors, some of which include the SU actuarial programme's admission and progression requirements, the high standards demanded of students as well as the expertise of the actuarial staff members and the low staff turnover experience by SU.

7.4 Stellenbosch University adopts the philosophy that its actuarial graduates should be capable of qualifying as Fellow or Associate members of ASSA. To this end, SU sets relatively high admission, progression and exemption requirements for students. It would be disingenuous to attract students to the programme, or encourage students to remain in the programme, if it is not likely that they have the ability to qualify as an actuary. It is much better for such students to be redirected to a more suitable course of study at an early stage.

7.5 Not all South African universities have taken the same approach as taken by Stellenbosch University in terms of their philosophy towards the production of actuarial science graduates. This is evident from several aspects, but at first inspection can be seen through the admission requirements at different universities. It would be of benefit to the profession in South Africa if other universities also provided insight into their approaches and performance statistics.

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APPENDIX A
ASSA Curriculum

A1. To qualify as an Associate of the Actuarial Society of South Africa (AMASSA), students must have a Bachelor's degree (in any field) and must complete the following:

- Part A1: Foundation Technical
  - A111: Actuarial Statistics *
  - A112: Business Economics
  - A113: Business Finance

  (* indicates that there is both a written and a computer-based exam)
- Part A2: Intermediate Technical
  - A211: Financial Mathematics
  - A212: Risk Modelling and Survival Analysis *
  - A213: Contingencies *
  - A214: Actuarial Economic Modelling *

  (* indicates that there is both a written and a computer-based exam)
- Part A3: Core Principles
  - A311: Actuarial Risk Management (two examinations)
- Normative Skills
  - N111: Foundation Actuarial Professional Practice
    This comprises online courses and assessments.
  - N211: Communications (typed examination)
  - N311: Core Actuarial Professional Practice
    This is a two-year component comprising a number of workshops.

A2. To qualify as a Fellow of the Actuarial Society of South Africa (FASSA), students must, in addition to completing all of the subjects in Parts A1-A3 and Normative Skills listed above, have a Bachelor's degree (in any field) and must complete the following:

- Part F1: Fellowship Principles

  Two subjects must be passed from the following:
  - F102: Life Insurance Principles
  - F103: General Insurance Principles
  - F105: Finance and Investment Principles
  - F106: Enterprise Risk Management Principles
  - F107: Banking Principles
  - F108: Health, Social and Employee Benefits Principles
- Part F2: Fellowship Applications

  One subject must be passed from the following:
  - F201: Health and Care Applications
  - F202: Life Insurance Applications
  - F203: General Insurance Applications
  - F204: Retirement and Related Benefits Applications
  - F205: Finance and Investment Applications
  - F206: Banking Applications
- Normative Skills
  - N411: Fellowship Actuarial Professional Practice
    This is a one-year component comprising a workshop and work-based learning.

A3. Fellows or Associates of ASSA can also obtain the internationally recognised designation of Chartered Enterprise Risk Actuary (CERA) if they also pass:

– F106: Enterprise Risk Management Principles; and
– C100: Applied Enterprise Risk Management Course

This is a two-day attendance course, including pre-course work.

APPENDIX B
Stellenbosch University qualification

B1. BCom (Actuarial Science)

The table below shows the 2024 curriculum for the BCom (Actuarial Science) degree (by year of study), the module credits, the semester in which the module is offered and the ASSA subject to which the module is related for exemption purposes.

TABLE B1. BCom (Actuarial Science) curriculum (and credits)

Year of study	University course	Credits	Semester	ASSA Subject
1	Actuarial Science 112	8	1	
	Actuarial Science 142	16	2	A113
	Business Management 113	12	1	
	Business Management 142	6	2	A113
	Computer Science 113	16	1	
	Economics 114	12	1	A112
	Economics 144	12	2	A112
	Financial Accounting 188	24	1 & 2	A113
	Mathematics 114	16	1	
	Mathematics 144	16	2	
	Probability Theory & Statistics 144	16	2	
2	Actuarial Science 211	18	1	A211
	Actuarial Science 241	22	2	A212
	Economics 214	16	1	A112
	Financial Risk Management 212	8	1	A113
	Mathematical Statistics 214	16	1	A111
	Mathematical Statistics 245	8	2	A111
	Mathematical Statistics 246	8	2	A111
	Mathematics 214	16	1	
	Mathematics 244	16	2	
	Plus at least one of:			
	- Economics 244; or	16	2	
	- Financial Risk Manageme3nt 242	8	2	
3	Actuarial Science 311	24	1	A111 & A212
	Actuarial Science 341	24	2	A213
	Actuarial Science 371	32	1 & 2	A214
	Mathematical Statistics 312	16	1	
	Mathematical Statistics 316	16	1	
	Mathematical Statistics 344	16	2	A212
	Mathematical Statistics 365	16	2	A212

B2. BComHons (Actuarial Science)

TABLE B2. BComHons (Actuarial Science) curriculum (and credits)

University course (totalling at least 120 credits)	Credits	Semester
Actuarial Risk Management (A311)	60	1 & 2
Actuarial Science Research Assignment	30	1 & 2
Introduction to R programming	6	1
At least 6 credits from:		
- Communications (N211)	6	2
- Actuarial Science Capita Selecta	6	1 & 2
At least 18 credits from approved modules in:		
- Mathematical Statistics Honours; or		1 & 2
- Financial Risk Management Honours		1 & 2

B3. PGDip (Actuarial Science)

TABLE B3. PGDip (Actuarial Science) curriculum (and credits)

University course (totalling at least 120 credits)	Credits	Semester
Actuarial Risk Management (A311)	60	1 & 2
Life Insurance Technical (F102)	45	1
General Insurance Technical (F103)	45	2
Finance and Investment Technical (F105)	45	2
Other approved modules totalling at most 30 credits		

B4. MCom (Actuarial Science)

TABLE B4. MCom (Actuarial Science) curriculum (and credits)

University course (totalling at least 180 credits)	Credits	Semester
One of the following research modules:		
- Actuarial Science Research Project	60	1 & 2
- Actuarial Science Thesis	120	1 & 2
Coursework modules making up the required credits, from:		
Life Insurance Technical (F102)	45	1
General Insurance Technical (F103)	45	2
Finance and Investment Technical (F105)	45	2
Health, Social and Employee Benefits Technical (F108)	45	1
Other approved modules totalling at most 30 credits		