

# Slaying the Dragon: improving company and individual returns on investments in actuarial education

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## ABSTRACT

The performance of students in actuarial examinations is correlated with or influenced by a range of factors some of which are controllable and others either inherent or no longer controllable. This paper identifies factors that are correlated to exam performance and seeks to identify factors that may legitimately enhance a student's chances of passing.

The paper also takes an introductory look to the investment required in actuarial education by both the student and employer as well as the returns on this education. By considering some of the factors that influence performance the paper looks at ways to improve the return on this investment.

## KEYWORDS

Education, actuarial, employer, university, interventions

## CONTACT DETAILS

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## 1. INTRODUCTION

... It was a filthy place with long low rough tables at which were seated what appeared to be effigies. I felt I had invaded the devil's banquet, a weird and silent meal. Each table was ruled over by a ... host. For fifty cents he provided the ... necessary for chasing the dragon (Jackie Pullinger)<sup>1</sup>

Every year around 800 of the brightest school leavers enter actuarial programmes at the six universities with programmes accredited by the Actuarial Society of South Africa (ASSA). Each year approximately 80 individuals are admitted as Fellows of the Actuarial Society of South Africa – in effect around 10%<sup>2</sup> of those who set out to achieve the objective they set themselves.

For those who succeed, the journey from entering the university programme to emerging as a Fellow member will take anything from seven years to their full working life. Many of these brightest students will fall at the same hurdle multiple times only to come back for another fix six months later. However, with each success they will renew their hope in ultimately slaying the dragon as they move up to the next challenge, with each step requiring significant investments in time, effort, opportunity cost and money.

The objective of this paper is to examine the evidence and identify strategies that can help both the actuarial students and their employers to improve the return on their investment in actuarial education.

Before focusing on the return in investment the paper describes the landscape of South African actuarial education and the scope of the investigation before summarising the performance of students between 2013 and 2017.

## 2. LANDSCAPE & SCOPE

The path to becoming an actuary is long and comprehensive and can be split into three stages with three categories of education. This is illustrated in Table 1 below.

For those requiring more detail, Appendix 1 sets out the full ASSA current (2018) syllabus as well as the syllabus from 2019.

The scope of this investigation is limited to students who commence writing the ASSA exams. The only relevant factors from their university experience is the number of exemptions that they earn and the university they attended. Students who do not join ASSA are beyond the scope of this investigation regardless of whether they successfully join other actuarial bodies, succeed in other fields or do not complete their studies. Those who complete the Associate level may apply to be admitted as Associate Members of ASSA (AMASSA) and be recognised as generalist actuaries but lack the specialisation offered at the Fellowship level.

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<sup>1</sup> Jackie Pullinger, *Chasing the Dragon*, 1980

<sup>2</sup> This is not a precise statistic as some students from actuarial programmes will qualify through other bodies (typically the Institute and Faculty of Actuaries) and other students join ASSA from non-accredited universities and programmes.

**TABLE 1** Phases of actuarial education

	<b>University</b>	<b>Associate</b>	<b>Fellowship</b>
Academic	Depending on the level of accreditation, exemptions possible from all Associate level subjects and some Fellowship level	A1, A2 and A3 series covering technical subjects and generalist application subjects	Two out of six F1 level exams and one out of six F2 level
Normative	Exemption from foundation phase in accredited programmes	Foundation and core phases consisting of five workshops and three exams	Fellowship professionalism course
Work-based learning	N/A	Two years	Three years (inclusive of the two-year associate level)

For the purpose of this investigation only the academic portion of the syllabus is considered in the statistical analysis and investigation of different strategies. For most of the normative skills programme, attendance and participation in workshops is the key component. The financial and time investment of these sessions is included in the financial projections but the success, failures and interventions for the normative subject exams have been excluded.

### 3. APPROACH & METHODOLOGY

This analysis consists of three components:

- Data analysis
- Employer survey
- Financial and experience modelling

#### 3.1 Data Analysis

The purpose of the data analysis is to identify differentiating factors that impact exam success. Exam success is defined as passing the exam. The study identifies correlations between factors and results. Although the data does not readily reveal causal relationships, where appropriate these are discussed in the paper. The analysis focuses on facilitating practical decision-making and not on achieving academic precision.

The approach taken in analysing the data has been to start by identifying that different subjects and groups of subjects have different underlying pass experience. All analysis thereafter concerns deviation from the mean experience for the subject or group of subjects – effectively looking at the under- or outperformance of the particular subset. There are different approaches to analysing data. The author is grateful to Dave Strugnell who did logarithmic regression analysis on the data. Observations from his analysis are included in the discussion.

### 3.2 Employer Survey

Through the analysis, it was identified that certain employers and types of employers appear to have consistently better exam performance than others. Although these differences were not all statistically significant, they are noticeable and consistent over the period of investigation. A survey was conducted of Actuarial Training Offices (ATOs)<sup>3</sup> to compare the study leave and other benefits as well as the attitude of the employers towards actuarial exam success and failure. All employer-specific information is anonymised in this paper but employers who contributed to the survey will receive individual feedback.

### 3.3 Financial and Experience Modelling

The objective of this section is to identify controllable factors that provide the best return on investment in acquiring an actuarial education. The section looks to value the actual and opportunity costs of study against the benefits to both the individual and employer.

## 4. DATA

Data is drawn from the ASSA database and covers all exam and other education registrations from 2013 to 2017 inclusive. This covers ten full exam sessions and one special supplementary session.<sup>4</sup> While the data accurately reflects the exam performance and demographic factors identifying the candidate (race, gender, date of birth), there are limitations that affect the accuracy of analysis of alma mater and employment.

With regard to educational institutions, member records can include up to ten qualifications and educational institutions. The approach taken is to first identify the first institution listed by the member; if this is one of the six South African universities<sup>5</sup> accredited by ASSA, this is accepted as their alma mater throughout the investigation. For those without an accredited university as their first institution, the second university is considered and accepted as the alma mater if it is accredited. Only if no accredited university is listed is another institution accepted as their primary education institution.

Employment records are not all complete and dates of change in employment are not clear. The current employer is taken as the employer throughout the analysis.

Data on students who passed through the South African Actuarial Development Programme (SAADP)<sup>6</sup> is drawn from separately managed spreadsheets.

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3 Actuarial Training Offices are employers of actuarial students who are accredited by ASSA to provide work-based skills mentoring and support.

4 Due to Fees Must Fall unrest in 2015, there was a delay in the F105 paper for six students. For practical purposes this session is combined with Session 2 for 2015 as students were registered to write in that session but extraneous circumstances prevented this.

5 University of Cape Town, Free State University, North West University, Pretoria University, Stellenbosch University and University of the Witwatersrand.

6 This programme provides funding, educational and other support to selected undergraduate students in actuarial programmes from underprivileged backgrounds.

## 5. EXPERIENCE FROM 2013 TO 2017

During the period of this analysis, 2 594 students presented themselves for 15 311 exams and achieved 6 197 passes (41%). In addition, 1 202 students were awarded 6 505 subject exemptions based on university performance. In the analysis of these results we consider experience across a range of controllable and non-controllable factors. Where differences are identified between different groups, these correlations are noted but do not in themselves reflect a causal relationship.

### 5.1 Overall Results

Other than the localisation of A301 and the introduction of the banking fellowship course (F206) in 2015, there have been no major changes in the structure of the syllabus over this period. There have been significant syllabus changes for some subjects (for example, the Pension and Other Benefit subjects (F104 and F204)) but the exam structure has been unchanged.

This section summarises some key overall results but more detailed summaries of results can be found in Appendix 2.

Table 2 summarises the performance of students over the five years. This does not consider the distribution of subjects but is a snapshot of the overall scale and quality of the candidates.

TABLE 2 Distribution of ASSA exam results by year

Year	Pass	FA <sup>1</sup>	FB <sup>2</sup>	FC <sup>3</sup>	FD <sup>4</sup>	Total
2013	42%	14%	25%	13%	6%	2 658
2014	40%	12%	29%	13%	6%	2 817
2015	40%	13%	28%	13%	6%	3 133
2016	39%	18%	29%	10%	4%	3 123
2017	41%	16%	28%	10%	5%	3 366
<b>Total</b>	<b>41%</b>	<b>14%</b>	<b>28%</b>	<b>12%</b>	<b>5%</b>	<b>15 097</b>

<sup>1</sup>5% or less below the pass mark

<sup>2</sup>Between 15% (included) and 5% (excluded) below the pass mark

<sup>3</sup>Between 25% (included) and 15% (excluded) below the pass mark

<sup>4</sup>More than 25% below the pass mark

Overall the performance has been consistent over the 5-year period with little change in the pass rates but an upscaling of the quality of fails. A simple chi-squared test supports the hypothesis that there is no change in underlying performance over the period.

Aggregate results do not consider the significant differences in expected performance across subjects. Table 3 shows aggregated performance across all subjects over this period. Details of the titles of the different subjects are included in Appendix 1.

However, to aid understanding of the subject codes below – all students write every A1, A2 and A3 series subject. Those working towards the Fellowship designation need to choose two of the six F1 level subjects and one of the six F2 level subjects. The A1 and A2 level subjects are the core technical subjects (accounting, economics, statistics, contingencies, financial maths, etc.). The A3 subjects are applied core subjects (generic risk management including the control cycle and communication). The F1 and F2 are the specialist principles and specialist applications subjects respectively.

TABLE 3 Subject level exam performance over five years

Subject	Passes	Attempts	Pass %	Average attempts	Exemptions
A101	410	660	62%	1.4	811
A102	98	210	47%	1.4	1 060
A103	98	282	35%	1.8	1 024
A201	711	1 078	66%	1.4	613
A202	547	1 402	39%	2.0	518
A203	668	1 386	48%	1.8	413
A204	529	1 155	46%	1.9	590
A205	604	1 170	52%	1.8	475
<b>Core technical</b>	<b>3 665</b>	<b>7 343</b>	<b>50%</b>	<b>1.7</b>	<b>5 504</b>
A301	534	1 680	32%	2.1	352
A302	657	1 722	38%	2.1	264
<b>Core application</b>	<b>1 191</b>	<b>3 402</b>	<b>35%</b>	<b>2.1</b>	<b>616</b>
F101	160	490	33%	2.3	61
F102	244	880	28%	2.4	142
F103	100	335	30%	2.3	53
F104	35	108	32%	2.0	26
F105	175	697	25%	2.6	102
F106	160	382	42%	1.6	1
<b>Specialist principles</b>	<b>874</b>	<b>2 892</b>	<b>30%</b>	<b>2.3</b>	<b>385</b>
F201	56	214	26%	2.5	
F202	245	740	33%	2.4	
F203	66	306	22%	2.6	
F204	28	103	27%	2.8	
F205	58	256	23%	2.5	
F206	14	55	25%	1.7 <sup>1</sup>	
<b>Specialist application</b>	<b>467</b>	<b>1 674</b>	<b>28%</b>	<b>2.5</b>	
<b>Total</b>	<b>6 197</b>	<b>15 311</b>	<b>41%</b>	<b>2.0</b>	<b>6 505</b>

<sup>1</sup>Course only been running since second semester of 2015 so not indicative of a 'mature state' for this subject.

Some subject specific factors that stand out:

- The low pass rates for A102 and A103 are primarily due to the higher exemption counts for these subjects. With a greater proportion of the more able students securing exemptions, those writing the subject are drawn from non-accredited programmes and the less able in the accredited programmes.
- Many students have stumbled over A202 as it has a lower pass rate but comparable number of exemptions to the other A2 level courses.
- A301 tests whether students can integrate the skills learnt in the earlier subjects and be able to make generalist judgements. With only those advancing to honours level covering the subject at university, this is clearly a subject that students do not master easily.
- There are some sustained and marked differences in pass performance at F1 and F2 level. An analysis of the performance at A301 (the most significant subject that all Fellowship level candidates must attempt) and the average number of exemptions per student attempting each fellowship subject shows no positive correlation between these measures and performance in the fellowship level subjects. This suggests that there is no direct correlation between the calibre of the students attempting each subject. Possible reasons for the sustained difference in performance over the five-year period include:
  - **Balance between the F1 and F2 subjects.** Subjects with the higher pass rates at F1 level have lower pass rates at F2. The exception being Investments (F105 and F205) that is a low at both levels.
  - **Students' practical experience in the field.** Feedback from counsellors is that certain subjects (particularly those with good experience at F1 level) attract students with no interest or practical experience in the field on the expectation that it is an easy option. At the F2 level, about three years of practical experience is expected as students are expected to show a level of insight and experience that cannot be gleaned from the textbooks.
  - **Different examination standards.** Although there is a rigorous examination governance process in place, it is possible that standards could diverge.
  - **Breadth of the syllabus.** Some practice areas are broader covering a wider range of techniques or nuances in practice than others.
  - **Breadth and depth of student experience.** Some subjects are more integrated meaning that most students with some practical experience will have had direct or indirect experience of all key functions covered by the syllabus. Others are less integrated with many students only having experience in limited aspects of the syllabus. This is sometimes evident by students not passing despite giving excellent answers to one question.
- Despite the vastly divergent pass rates, there are not significant differences in the average number of attempts for different subjects at the same level. Reasons for this include:

- This is not a longitudinal study. It does not follow a cohort through their experience. As the number of students has been increasing over the duration of the period of investigation, this number will understate the number of attempts by the hypothetical average student.
- Gateway subjects. The majority of students who commence their actuarial studies do not qualify as either Fellow or Associate members of ASSA. Persistent failure at certain subjects either discourages students or their employer funding dries up and they drop out of the programme.
- For the F1 and F2 levels, the number of students selecting the particular option. Despite having one of the higher average pass rates, F204 (Pensions and Other Benefits) has a higher average number of attempts due to very few new students selecting it.

## 5.2 Uncontrollable Factors

This paper starts from the assumption that certain attributes are given – specifically race and gender. Although there is an emerging philosophy in universities and elsewhere that individuals have some discretion in how they identify themselves at different stages of their lives, this is beyond the scope of this paper.

In this section correlations between uncontrollable factors and exam performance are shown but this is not assumed to be a causal relationship. It is possible that there is a causal relationship or the uncontrollable factor could be a proxy for a real underlying causal factor such as English proficiency, the quality of primary and secondary education or societal norms and pressures.

For the purpose of comparison, the index value expresses how much more likely a student in the particular group is to pass than the average student over the five years. This is expressed as a percentage of the pass rate for the particular group of students. For example, if the aggregate pass rate for a group of subjects is 50%, an index value of +4 means the group has a pass rate of 52% ( $50\% \times 1.04$ ).

### 5.2.1 GENDER

For most subject groups, female students outperform males – with the difference being most noticeable at A301. A simple chi-squared test suggests that the difference in performance is marginally significant.

One of the reasons for the small but consistent differences in performance appears to be that, depending on your perspective, male students are either more persistent or more obstinate. They either have the resilience to get up and fight on or they are slow in realising they are beaten. On average, male students have taken 2.1 attempts at each subject and female 1.8. The difference is, however, evident in the tail where one female once made a tenth attempt at a subject (FB). Over the same period males have made 47 tenth or higher attempts (nine passes and 38 fails including ten FDs). One student made a 15th attempt (FD) at a subject.

**TABLE 4** Gender differences in exam performance over five years

	<b>Female</b>	<b>Male</b>
Average exemptions	4.2	4.4
Number of attempts	5 029	10 280
A1	-4	+2
A2	+4	-2
A301	+12	-5
A302	+4	-2
F1	+5	-2
F2	-1	+0
<b>Aggregate</b>	<b>+4</b>	<b>-2</b>

### 5.2.2 RACE

Differences by race are clearly highly significant. This, however, only indicates that there is a correlation between race and exam performance and not that there is any causal relationship.

The racial difference is compounded by White students on average emerging from university with 1.6 more exemptions than their Black counterparts. Even without the difference in pass rate, this could reasonably result in an additional year for Black students to qualify than white students. Exemptions are discussed in more detail in section 5.3.3.

**TABLE 5** Racial differences in exam performance over five years

	<b>Black</b>	<b>Coloured</b>	<b>Indian</b>	<b>White</b>	<b>Other</b>
Average exemptions	3.3	4.0	4.7	4.9	4.6
Number of attempts	5 549	430	2 554	6 205	573
A1	-20	+12	+23	+28	-3
A2	-22	+26	+10	+22	+29
A301	-21	+3	+17	+15	-54
A302	-36	+28	+14	+21	+0
F1	-34	-17	-13	+27	-17
F2	-40	-21	-11	+16	-18
<b>Aggregate</b>	<b>-25</b>	<b>+10</b>	<b>+6</b>	<b>+22</b>	<b>-3</b>

### 5.3 Prior Controllable Factors

These refers to factors that are determined before students join ASSA and cannot be changed. These factors impact the state of readiness and the progress made by students before they join ASSA.

### 5.3.1 UNIVERSITY ATTENDED

The ASSA-accredited South African universities are reviewed separately. When analysing these results be aware of the data qualifying comments shown in section 4. The objective of this analysis is not to name and shame particular universities which underperform the mean but to identify whether there are differences between universities in the performance of their students. The universities are, therefore, identified by pseudonyms. In individual feedback to the universities they will be provided with their identity.

TABLE 6 Differences in performance over five years of graduates from different universities

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Other
Average exemptions	5.1	4.5	4.4	4.5	4.6	3.9	3.5 <sup>1</sup>
Number of attempts	2 475	3 796	3 476	1 278	726	755	2 805
A1	+11	+31	-5	+18	-51	-32	-19
A2	+34	-0	-15	+54	-31	-12	-9
A301	+14	+2	-4	-2	+13	+19	-22
A302	-7	-1	-0	+28	+11	+0	-8
F1	+3	-14	+8	+33	+4	+14	-25
F2	+12	-21	+19	+24	-9	-9	-19
<b>Aggregate</b>	<b>+17</b>	<b>-1</b>	<b>-7</b>	<b>+36</b>	<b>-17</b>	<b>-4</b>	<b>-13</b>

<sup>1</sup>Exemptions from non-accredited institutions reflect a combination of exemptions from previously accredited institutions (e.g. UKZN), exemptions from subjects directly written through the IFoA and limitations in the data – refer to section 4 of the paper

Across the aggregate student body, the difference in performance between universities is significant. It appears that some university programmes prepare students better for different parts of the programme. For example, Bravo graduates appear better prepared for the A1 level exams while Charlie's are better prepared for the F1 and F2 exams. These differences may be as a result of the different teaching and assessment methods, broader curricula in the different universities or one or more of the following factors:

- Different numbers of students from non-actuarial programmes in the universities entering the profession.
- Calibre of students entering each university's programme.
- Rigour with which each university weeds out weaker students or discourages them from pursuing the actuarial career after graduation.
- The standards set for exemptions in different universities. Although there is a rigorous external examination process aimed at ensuring consistency, it is possible that exemptions are easier to obtain in certain universities. This would impact the calibre and, hence, performance, of students from those universities

when attempting the A1, A2 and A3 level exams through ASSA. Although Alpha graduates earn on average more exemptions than the other universities, their students perform better than the average for the cohort on all subjects where exemptions are available. Therefore, at a superficial level it appears that their exemption standards are not lighter.

- The racial and/or gender distribution of students graduating from the universities. It is well known that there are significant differences in the racial distribution of both graduates and under-graduates through the different programmes. Given the relatively low differences in performance by gender, this is not considered further. Table 7 shows the performance of Black students out of the different university programmes.

**TABLE 7** Differences in performance over five years of Black graduates from different universities

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Other
Average exemptions	4.1	3.5	3.7	3.0	3.0	1.8	2.8
Number of attempts	1 150	1 566	1 331	33	296	29	1 144
A1	-5	+10	-26	-	-49	-62	-37
A2	+20	-20	-33	+21	-48	-64	-32
A301	+3	-27	-26	-21	-33	-100	-39
A302	-27	-26	-34	+31	-79	-	-64
F1	-26	-37	-33	+10	-3	-	-58
F2	-37	-50	-27	+19	-100	-	-46
Aggregate	-1	-20	-32	+15	-48	-65	-37

With the low student numbers, Delta and Foxtrot’s performance is volatile and should be interpreted with caution. For example, the -100 for Foxtrot for A301 reflects two unsuccessful candidates over five years. When considering differences in the racial mix of students who have graduated from the different universities, Alpha emerges as the best performing university followed by Delta and Bravo.

**5.3.2 SAADP SUPPORTED**

The South African Actuaries Development Programme (SAADP) was established by President Cyril Ramaphosa when he was chairman of SASRIA. The objective of the programme has been to increase the number of Black actuaries in particular and others from disadvantaged backgrounds. The programme has three prongs to its activities:

- Create awareness of the profession through visits to disadvantaged schools across the country.
- Provide tuition, living and other funding to selected students attending specific universities.

- Provide academic, social and other support to undergraduate students in their programmes while they study.

The SAADP draws its students from Black, Indian and Coloured students so the most equitable comparison is against non-SAADP students from these groups.

TABLE 8 Impact of SAADP on Black, Coloured and Indian performance

	SAADP	Non-SAADP comparable
Average exemptions	4.5	3.8
Number of attempts	1 053	7 480
A1	+13	-12
A2	+1	-15
A301	+5	-9
A302	-6	-19
F1	-21	-25
F2	-56	-17
Aggregate	-5	-16

Overall the SAADP programme has a significant impact on performance of students after they have left university. What is most apparent is that for the subjects covered through the undergraduate programmes (A1, A2 and A3), the SAADP students outperform not only their peer group but the average of all students. This suggests a resounding success for the programme in its first stage objective and the field where it is most operationally active – that being getting successful black actuarial graduates. With SAADP students earning 0.7 more exemptions than the non-SAADP comparable group this would improve the average qualification period by about six months if there was no difference in pass rates.

However, when students get past the undergraduate level, the situation is less clear. There is less difference in performance at F1 level from the peer group and marked underperformance at the F2 level. Although the relatively small number of attempts (98 attempts over ten sessions) would impact the statistical significance of this difference in performance, SAADP alumni have underperformed their peer group in all exam sessions except one (second session of 2017). Possible reasons include:

- The SAADP support allows marginal candidates, who might otherwise have ceased their studies, to progress through the earlier exams.
- The more rapid progress through the earlier exams results in students attempting the F2 level exams before they have obtained the necessary work experience to face the challenges of the more practically focused F2 level exams.
- The support provided by SAADP is focused on the immediate task at hand of passing particular exams in a supported environment and not on developing the critical thinking skills and resilience required for F2.

- Given their more rapid progress through the earlier exams, SAADP graduates may be promoted more rapidly than their peers. The increased level of responsibility and the associated stress may impact their exam performance at this level.

### 5.3.3 EXEMPTIONS EARNED

Exemptions earned are a combination of how hard students worked at university, how quickly and well they acclimatised and their underlying academic potential. To avoid implicit biases from timing, the analysis includes earned exemptions and not only those that have been formally awarded.<sup>7</sup>

**TABLE 9** Performance in ASSA exams of students with different numbers of exemptions

Exemptions	0	1–2	3–5	6–8	9–10	11+
Number of students <sup>1</sup>	600	300	695	720	232	96
Number of attempts	2 878	1 925	4 124	4 118	1 001	310
A1	+2	–8	+8	+2	+15	+14
A2	–5	–11	+3	+13	+16	+36
A301	–22	–20	+0	+18	+1	+9
A302	–9	–22	+4	+5	+11	+72
F1	–6	–18	+1	–2	+23	+95
F2	+24	–5	–16	–1	+10	+26
<b>Aggregate</b>	<b>–4</b>	<b>–12</b>	<b>+2</b>	<b>+8</b>	<b>+14</b>	<b>+43</b>

<sup>1</sup>More than the number of students presenting themselves for exams (2 643 vs 2 594) as some register but are absent from exams (excluded from analysis) and others only attended normative skills courses during the five-year window.

Exemptions earned are shown to have a significant impact on exam progress when assessed at a per syllabus stage basis. This is particularly evident if the students with zero exemptions are excluded.

Between 15% (Alpha) and 25% (Delta & Foxtrot) of students joining ASSA earn no exemptions during their degrees so need to complete the full ASSA curriculum. This will be an indicator of the number of weaker students emerging from the universities as well as those coming out of non-actuarial programmes.

When analysing performance, the group with zero exemptions is of particular interest. This group includes students through non-accredited universities<sup>8</sup> as well as the least successful candidates through accredited universities and students who

<sup>7</sup> Exemptions are earned based on university performance but only awarded when they are paid for.

<sup>8</sup> A few students who transfer from another actuarial association (typically the IFoA) would receive exemptions from ASSA for IFoA exams passed.

may have achieved exemption level performance but ASSA does not yet have the information to record them. Their poor performance at the A2 and A302 levels leads to the less able students terminating their studies. The improved performance at the Fellowship level exams reflect those who have advanced this far the hard way having the skills and resilience to master the professional exams.

#### 5.4 Active Controllable Factors

Active controllable factors refer to factors that can be changed. Controllable does not mean that the student as an individual has full control over the various elements but that they can be actively managed by the student, their employer or others. Controllable factors relate to:

- Where students live;
- When they write exams;
- For whom they work;
- The order in which they approach exams; and
- What interventions they use to assist them in their exam preparation.

##### 5.4.1 REGION

ASSA students are primarily based in either Gauteng or the Western Cape with less than 5% of exams sat by students based outside these two centres. Table 10 compares the performance of students by region – the region defined as the centre where they wrote the exam.

TABLE 10 Regional differences in exam performance over five years

	Gauteng	Western Cape	Other
Number of attempts	10 510	4 130	671
A1	+1	+2	-19
A2	-9	+24	-10
A301	-1	+2	+2
A302	-2	+1	+31
F1	-3	+8	-11
F2	-5	+10	+8
Aggregate	-5	+15	-6

As can be seen, over the 5-year period, Western Cape students outperformed Gauteng across all subjects. Even allowing for university, race, gender and other differences this difference is apparent but only statistically significant at the A2 level. There is no obvious cause, though some possible explanations include:

- Business culture in different centres impacting study effectiveness;
- Commute time impacting time available for effective study;

- Recreation and entertainment opportunities impacting study; and
- Impact of altitude on learning effectiveness.

#### 5.4.2 SESSION

Exams may be sat in either the first session (April to June) or the second session (September to November) each year. Table 11 shows the impact of the different sessions on performance.

TABLE 11 Differences in exam performance over five years by session

	Session 1	Session 2
Number of attempts	7 612	7 699
A1	+0	-0
A2	+4	-4
A301	+8	-7
A302	+1	-1
F1	-9	+9
F2	+1	-1
Aggregate	+1	-1

A similar number of exams are sat across the sessions with better overall performance in the first session for all subjects except F1 which is stronger in the second half. Allowing for all other factors, this is only significant at the A301 level. The better performance in the first half might be as a result of students who have not obtained an exemption at the end of their final year of university being better prepared when they rewrite the subject in their first session after graduation.

#### 5.4.3 EMPLOYER

Students emerge from the six accredited universities and the large range of other universities to assume employment at a wide range of employers across a range of employment sectors. The following factors may influence the exam performance of students with different employers:

- The perceived value proposition of the employer to graduating students. This will impact the calibre of students accepting positions with the employer.
- The study benefits offered by the employer.
- The culture within the employer concerning success and failure in actuarial exams.

As with universities, the report does not identify specific employers by name. In addition, readers must be aware of the data quality issues outlined in section 4. “Employer” is currently an optional field on the ASSA database which is not populated by all students and some may not have updated changes in employment.

Table 12 shows the overall performance of students at the larger employers and outlier performing medium-sized employers. More detail is provided in Appendix 3.

The table also provides the average number of exemptions per student as, based on the section above, this is a first level proxy for the calibre (with respect to academic exam performance) of the students working for the employer.

TABLE 12 Exemptions and performance by employer

Employer	Exempt / student	Exam attempts	Index
A	4.7	1 159	+7
B	4.9	1 229	+8
C	4.7	1 025	-30
D	4.0	862	-6
E	4.2	975	+2
F	5.7	666	+38
G	4.9	702	+21
H	4.1	752	-7
K	6.5	300	+36
L	6.5	195	+16
M	6.3	160	+52
O	2.3	206	-29
Self-employed	6.0	72	-11
Unemployed <sup>1</sup>	3.0	778	+10
<b>Total</b>	<b>4.3</b>	<b>15 311</b>	<b>0</b>

<sup>1</sup>Unemployed includes pre-employed undergraduate students who perform well at A1 and A2 level

Table 12 shows the eight employers with over 500 exam attempts over the five years (average of at least 50 per exam session), those identifying as unemployed or self-employed as well as four others that stand out for different reasons. Amongst the larger employers, F stands out for having students with more exemptions and significantly outperforming the average student. The others have students with a similar number of exemptions but have the performance index varying between -30 and +21. K, L and M are all medium-size employers that are selective in their recruitment but show marked differences in the performance of their students. O shows similar aggregate performance to C but is less selective in their recruitment (to the extent that university performance is a selection criterion).

Employers are widely classified into different sectors. Considering only the largest 30 employers the sector breakdown is shown in Table 13.

TABLE 13 Exemptions and performance by sector

Sector	Exempt / student	Exam attempts	Index
Audit	5.4	1 350	+27
Banking	3.9	2 029	-6
Consulting	4.1	1 365	-14
L/t insurance	4.3	5 530	+0
Reinsurance	4.3	611	-6
Short term	4.6	351	+12

Audit represents the large consultancies that primarily do audit work – effectively the “Big 4” accounting firms and consulting the remaining range of actuarial and management consultancies. Where groups have a range of activities, the primary sector is applied to the group.

As can be seen there is a wide range in performance by sector. In aggregate the auditors employ more successful students and have a significant performance premium while the others employ students in a narrower range but have different performance. However, a more detailed review is needed to determine the extent that this is due to employer or sector issues or the underlying demographic or other uncontrollable or previously controllable factors.

The superior performance of the audit sector may be explained by the better exemption performance of their students (considered further in section 5.4.3.1). The performance of students in the short-term sector is despite the relatively poor performance of students on the Short-Term Insurance Fellowship course (F203).

Although, overall, employers are not seen to have a statistically significant impact on exam performance, certain outliers stand out on either end of the scale. In addition, there are employers that consistently out- or under-perform their peers.

This section will take a more detailed look at some of these employers. For those who did not participate in the employer survey, empirically available data from the ASSA database are considered. For employers that participated in the survey, qualitative factors from the survey are considered.

#### 5.4.3.1 ASCRIBING PERFORMANCE

As can be seen in sections 5.2 and 5.3, there are significant differences in performance as a result of uncontrollable or previously controllable factors. Therefore, in an attempt to isolate the impact of the employer and other controllable factors, a regression analysis is done to remove the impact of the uncontrollable and previously controllable factors.

A regression analysis of the 30 largest employers but excluding the self-employed and unemployed, shows that in aggregate the controllable factors can account for 57% of the performance of their students. Table 14 shows results of isolating the previously controlled and uncontrolled factors from performance.

**TABLE 14** Isolating impact of controllable variables by employer

Employer	Index	Un-/previously controllable	Unattributed	Survey participant
A	+7	+6	+1	Y
B	+8	+1	+7	Y
C	-30	-6	-24	Y
D	-6	+6	-12	Y
E	+2	+6	-4	N
F	+38	+18	+20	Y
G	+21	+5	+16	Y
H	-7	-3	-4	N
K	+36	+28	+8	N
L	+16	+20	-4	Y
M	+52	+15	+37	N
O	-29	-22	-7	N
Self employed	-11	+20	-31	
Unemployed	+10	+3	+7	
<b>Total</b>	<b>0</b>	<b>+3</b>	<b>-3</b>	

Based on this regression, there is a significant portion of the performance due to random fluctuations or controllable factors. Within the largest eight employers the impact ranges from a 24% detraction from performance to a 20% improvement.

The unattributed factors will be formed by a combination of corporate factors, education interventions and individual performance on the day.

#### 5.4.3.2 EMPLOYER SURVEY

A portion of the employer's value proposition to new student employees is the study benefit package. This consists of both the empirical components and the more subtle cultural components. This section looks for points of commonality and difference that may contribute to the performance differential between the seven participants in the survey listed in the table above.

In total, 34 organisations participated in the survey. Table 15 gives a breakdown of these organisations by size, the nature of their study leave programme and their industry. As can be seen, the survey was dominated by insurers and consultancies with no involvement by banks and limited involvement by asset managers and wider field participants. Three of the participants currently have no students.

Looking at the seven large organisations<sup>9</sup> that completed the survey, six have an attempt-based study leave policy while the seventh has a session-based policy. In an

<sup>9</sup> Organisations with more than 500 attempts at exams over the five years

attempt-based policy the hours of study leave are determined by the subject and which attempt it is. In a session-based policy there are a specified number of hours available for the exam session.

TABLE 15 Survey participants

Students	<10	11–25	26–50	51–100	>100	Total
Asset mgt	1	–	–	–	–	1
Audit	–	1	–	1	–	2
Banking	–	–	–	–	–	0
Consulting	8	3	2	0	0	13
Government	1	–	–	–	–	1
L/t insurance	4	1	1	1	4	11
Reinsurance	1	1	1	–	–	3
Short term	1	–	1	–	–	2
Wider fields	–	1	–	–	–	1
<b>Total</b>	<b>16</b>	<b>7</b>	<b>5</b>	<b>2</b>	<b>4</b>	<b>34</b>
<b>What sort of study leave programme do you have for actuarial students?</b>						
Specific actuarial scheme	14	7	5	2	4	32
Generic	2	0	0	0	0	2
<b>Total</b>	<b>16</b>	<b>7</b>	<b>5</b>	<b>2</b>	<b>4</b>	<b>34</b>
<b>How is your study leave structured?</b>						
Attempt based	13	6	5	2	3	29
Session based	2	0	0	0	1	3
Other	1	1	0	0	0	2
<b>Total</b>	<b>16</b>	<b>7</b>	<b>5</b>	<b>2</b>	<b>4</b>	<b>34</b>
<b>Do you provide study leave for second attempts?</b>						
Same as first attempt	1	2	1	0	0	4
50% of first attempt	5	2	0	1	1	9
Only if FA	2	0	0	0	0	2
Other	5	2	4	1	2	14
<b>Total</b>	<b>13</b>	<b>6</b>	<b>5</b>	<b>2</b>	<b>3</b>	<b>29</b>
<b>Do you provide study leave for third attempts?</b>						
Yes	6	1	3	1	2	13
No	6	3	1	0	1	11
Other	1	2	1	1	0	5
<b>Total</b>	<b>13</b>	<b>6</b>	<b>5</b>	<b>2</b>	<b>3</b>	<b>29</b>

The session-based participant provided no further details of their policy.

Study leave is widely provided for first and second attempts with some participants providing a level of study leave for third attempts. The study leave arrangements become increasingly complex and nuanced for third and subsequent attempts.

#### 5.4.3.2.1 STUDY LEAVE HOURS

Study leave offered per subject varies widely between the different companies with little correlation between performance and hours. Table 16 summarises the study leave and the correlation between performance and study leave.

TABLE 16 Relationship between study leave and exam performance

Subject group	Median study leave (hours)	Min study leave	Max study leave	Performance correlation
A1 / A2	80	75	120	-0.13
A301	205	144	256	-0.23
A302	24	8	45	-0.55
F1	122	113	200	-0.03
F2 <sup>1</sup>	200	144	300	-0.40

<sup>1</sup>One record excluded as recorded 23 hours – same as for A302. Assume this is an error as this figure is out of line with the rest of their package and all competitors.

As can be seen there is a wide range of study leave given but negative correlation between the amount of study leave and the exam performance. Given the small sample of employers and the overall range in exam performance due to a wide range of factors, nothing stronger than there is no evidence that increasing the amount of study leave improves exam performance can be read into this position.

#### 5.4.3.2.2 OTHER STUDY LEAVE COMPONENTS

In addition to the standard study leave components some organisations provide additional time for study-related activities. These together with the extent they are offered by the respondents are shown in Table 17.

Although not widely used these benefits allow some differentiation between organisations. Other organisations count time spent in tuition courses as part of the normal study leave allowance.

Of the larger respondents listed in Table 12, none provide the extended study leave near qualification, three allow time to attend tuition courses, four time for academy courses (the same three for tuition plus one more) and one additional time in line with the firm's employment equity policy. On this limited sample, although those providing additional time to attend courses have better results for the courses where tuition is available, this is not significant.

TABLE 17 Other study leave components

Feature	Respondents
Extended leave for those near qualification	5
Additional time to attend ASSA or university tuition courses	9
Additional time to attend ASSA academy courses	9
Special allowance supporting the employment equity policy of the company	1

#### 5.4.3.2.3 FINANCIAL SUPPORT

Respondents were asked what financial support they provided to students as part of the study benefits policy – whether they covered the costs of exams, materials, courses, other tuition support and exam counselling. Table 18 summarises the responses of all respondents to the survey.

TABLE 18 Financial support

Attempt	First	Second	Third	Subsequent
Exam costs	33	28	4	1
Study materials	33	17	1	0
Mock exams	17	8	0	0
Tuition course	20	7	0	0
Online course	17	9	0	0
Counselling <sup>1</sup>	13	6	1	0

<sup>1</sup>Counselling refers to counselling after failing this attempt so any benefit reflected in the results for the next session.

All but one of the respondents provide financial support for the initial exam and tuition material and after the second attempt most students are self-funding their courses, exams and tuition.

The impact of these interventions will be discussed further in section 5.4.5.

#### 5.4.3.2.4 INCENTIVES FOR PASSING

Companies offer a range of incentives for successes in examinations. These range from financial benefits and promotions to less material recognition. Table 19 shows the recognition provided by different employers on passing individual exams as well as on qualifying as an actuary.

There are some nuances where bonuses are paid only on first time passes or where the benefits are conditional on both exam success and job performance. Some also pay a bonus on completion of a series of exams (e.g. the A2 series). Other organisations do not have automatic promotions or financial incentives but passes and qualification are trigger events for a review of their position and earnings which may lead to a salary increase and/or promotion.

**TABLE 19** Employer responses to passes and qualification

Incentive	Pass	Qualify
Salary increase	29	24
Cash bonus	14	10
Promoted	4	7
Acclaimed in the company	16	20
No financial or other recognition	2	2

Of the organisations listed in Table 12, all offer salary increases on passing (though not guaranteed for one), two offer bonuses while a third company promotes people on passing with five of the seven acclaiming the successes in the company. The performance of students in organisations offering bonuses on passing is statistically significantly better than those not offering bonuses. This, however, does not imply there is a casual relationship between bonuses and exam performance. The difference in performance on passing where individuals are acclaimed in the company are not significant.

#### 5.4.3.2.5 CONSEQUENCE OF EXAM FAILURE

The reality is that in every actuarial exam session more students will need to deal with the agony of defeat than will taste the joy of victory. Beyond the core technical exams there are likely to be two or three chasing the elusive dragon for every one that has moved a step closer to ultimately slaying the beast.

Employers also respond to their students' lack of exam success. Table 20 shows employer reactions to exam failure.

**TABLE 20** Employer response to exam failure

Reaction	Respondents
Nothing is said or done	9
They need to refund the company for exam or other costs	4
They forfeit study leave	6
It is treated as a performance issue	3
They are encouraged to take exam counselling (at employer's expense)	6
They are encouraged to take exam counselling (at own expense)	2
The reaction depends on the failure grade	15
Drop off actuarial programme if unsuccessful over two years	1
Mentoring and guidance	3

Failure is more difficult to deal with than success and the responses more nuanced with a lot more clarification in the free text fields than for success. A key component of many responses was that the grade of failure has a significant impact on employer

responses. In addition, mentoring and support was a key theme in many responses. Only one employer mentioned removal from the actuarial programme after a period of sustained failures.

Given the range of responses and the nuances in the response, it is not feasible to calculate whether different corporate approaches to failure has an impact on exam success.

#### 5.4.3.2.6 OVERALL CULTURE TOWARDS EXAMS

Rudyard Kipling described Triumph and Disaster as two imposters.<sup>10</sup> Success and failure are often regarded as two sides of the same coin. As with other aspects of life and risk management, this is true for actuarial exams where the difference between success and failure can be small – being impacted by a calculation error, poor time management, some unlearnt bookwork, a misread question or a lack of confidence.

However, as top achievers in many fields acknowledge, there are ways of legitimately tipping the odds in your favour. The golfer Gary Player is quoted as saying “The more I practise the luckier I get!” while the journalist and freelance commentator, Malcolm Gladwell, wrote that to master something we need to spend 10 000 hours honing our skills.<sup>11</sup> Following extensive research, Jim Collins and his team developed the concept of Return on Luck<sup>12</sup> where he identified some organisations that, due to their leadership and culture, consistently outperform others in a similar position and facing the same challenges. Through a single question where respondents were asked to choose a single phrase that best describes their culture regarding actuarial exams, the survey attempted to identify this trait. Table 21 provides these responses to this question.

TABLE 21 Exam culture summary

In this organisation	Respondents	Large respondents	Unattributed performance
Students are expected to pass every exam they sit	4	1	-24
Passing an exam is an exceptional achievement	18	3	-0
An “honourable failure” is acceptable	12	3	+7
Failure is not an option	0	0	-

Although there appears to be a strong correlation between the employer’s professed attitude towards exam success and the performance of students, this is not evidence of a causal relationship as the harsher standard of expecting students to pass every exam might have evolved from a record of poor performance and not driven it.

10 “If” by Rudyard Kipling from a *Selection of Kipling* (1943)

11 *Outliers* by Malcolm Gladwell (2008)

12 *Great by Choice* by Jim Collins and Morten Hansen (2011)

#### 5.4.4 SCAFFOLDING

Educators define scaffolding as the practice of building from the base and gradually moving to the pinnacle. This is a process that is usually followed automatically without further thought. At school level, no-one questions students entering school in Grade 1 and progressing systematically to Grade 12. Similarly, at university level, no-one questions the need to complete first-year mathematics before progressing to second year.

The actuarial syllabus has been developed from a clear foundation of developing base (A1 level) and core (A2) technical skills before integrating them (A3), applying them in a more specialist environment (F1) and facing challenging practical applications (F2). Intuitively, this provides a logical scaffolded approach to success in the examinations.

However, as goal-driven and lateral-thinking individuals, on leaving university actuarial students have seen their way clear to attempt subjects in a less structured manner. This is sometimes motivated by the need to benefit from the intricacies of their study benefits programme, frustration with certain “bogey” subjects or wanting to study with friends. For the purpose of this investigation, data was not readily available in a form that allowed the measurement of performance of those who have followed a scaffolded approach when compared to a more random approach. Prior analyses of single session results have shown superior performance for students following a more scaffolded approach.

With an absence of appropriate data, this is not considered further for this paper. This will be a useful area of investigation as it may be a significant unattributed factor in assessing exam performance.

#### 5.4.5 EDUCATION INTERVENTIONS

The actuarial qualification process is rigorous and is designed among other things to foster self-development, resilience and perseverance. However, in this context it is still appropriate to have both tuition initiatives and counselling to help students recover from prior poor performance.

In South Africa, interventions began with the universities that have for over 30 years provided tuition in Fellowship level subjects – now specifically the F1 level. Building on these successes and with the development of the South African curriculum, ASSA provides a range of tuition, online courses, mock exams and counselling aimed at supporting able students as they acquire the skills required to be actuaries.

Table 22 looks at the effectiveness of the ASSA education initiatives in supporting students to improve their immediate exam performance. Table 22 only considers performance in 2016 and 2017 when all A301, A302, F1 and F2 exams except F106 were run in South Africa with counselling and other support provided.

Although the numbers for counselling and courses are low, the impact on exam performance over this period is noticeable. Over the two-year period, of the 70 F2 level candidates that had counselling, 31 passed (44%) in the next session compared

with 103 out of 445 (23%) who had no intervention. Put more broadly, the 348 students that had some form of intervention for F2, obtained 124 passes (36% pass rate) vs the 23% pass rate for those with no intervention. Statistically, counselling was shown to be significant at A301 level and the combined impact of tuition and mock exams at F2 level.

TABLE 22 Impact of education initiatives on performance – 2016 & 2017

	Counselling	Course	Online	Mock exam	No intervention
A301	+87				+7
A302	+41				-7
F1	+31		+22		-1
F2	+59	+15	+49	+19	-17

The small number of participants – especially for online courses and counselling – can lead to volatile results but the underlying pattern over this period is clearly that those who take advantage of education interventions perform better than those who do not.

In addition, as part of the ASSA transformation strategy, the ASSA Academy has been established with the primary objective of eliminating the significant racial difference in exam performance as described in section 5.2.2 and illustrated in Table 5. The Academy has been operating for over two years and has been established on the “fail fast, fail often” principle. This principle refers to the Academy’s development, implementation and review cycle for new initiatives and not to the performance of the students. The objective is to help students today based on the best available information and resources today. The programme is under constant review to find solutions that enable targeted students to improve their exam performance within the constraints of available financial resources and the capacity of students and their employers.

### 5.5 Comments and Conclusions based on This Analysis

A literal review of the tables above suggests that to give yourself the best chance of passing exams you need to be a White female student who passed through Alpha university gaining a full set of exemptions then securing a job in the audit sector in the Western Cape. When registering for exams, register for the online course and, should you fail, have exam counselling before the next session. However, race, gender, university attended and exemptions achieved are not factors anyone can change, this conclusion is of no practical value.

This analysis has not sought to determine causal relationships between exam performance and various factors – only to identify factors where there is a correlation.

There are significant differences in exam performance based on race though no evidence of any causal relationship. The work of SAADP shows that Black students can perform better than the average student with the appropriate levels of guidance and

support – thus suggesting that factors including secondary schooling, socio-economic background and language proficiency could be the underlying factors that are being presented as difference in performance based on race.

Study benefit programmes are in some respects similar across companies though there are some differences. However, there appears to be no positive correlation between the amount of study leave given and performance.

There is a strong correlation between exam success and participation in ASSA counselling, tuition and other support. However, the statistics cannot show whether it is the intervention that makes the difference or whether it is the more committed and able students that participate in the interventions. If it is the intervention that makes the difference, then there is a clear argument for study benefit programmes to make increased provision in time and money to participate in these programmes.

There is scope for more investigation onto the impact of corporate culture on student success as there appears to be some correlation.

At any time there are over 2000 ASSA students chasing their own particular dragons. This analysis has shown that there are strong correlations – some of which may be causal – that will help bring the beast to heel and its eventual demise.

## 6. INVESTMENT IN EDUCATION

Investments are made in education by both employers and students – these investments can be measured in terms of transactional cash outlays as well as time. This section reviews these two investments by both students and their employers to estimate the total investment in educating each actuarial student.

The focus of this section is on professional education after the student has graduated from university and joined ASSA.

### 6.1 Direct Costs of Education to Student and/or Employer

Direct costs are defined as money paid to ASSA for exam entries, exemptions and discretionary expenditure including counselling, courses and tuition material.

Tables 23 and 24 show the direct costs of education.

For a student emerging from university with a full set of exemptions the total cost is R88 600 which covers the costs of his/her exemptions, F2 level exam and course material as well as two normative exams and the full workshop programme. For a student with no exemptions who purchases all course notes and passes first time the full cost (ignoring the time value) is R137 204. The hypothetical average student (four exemptions being the median as per Table 9 and the mean number of attempts as per Table 3), the direct costs would be R185 852. This includes the costs of exams, one set of notes and, where appropriate, refresher packs per subject and the full normative skills programme but ignores any tuition or other interventions.

Over and above the cost of an undergraduate or honours degree this is a substantial cost. This cost does not include the indirect and opportunity costs incurred by students or their employers.

**TABLE 23** Direct costs of examination education (2018)

Subject	A1	A2	A301	A302	F1	F2
Exam cost	4 425	4 425	12 650	5 670	5 150 <sup>1</sup>	5 150
Material <sup>2</sup>	1 296	1 296	4 518	864	2 322	1 380 <sup>3</sup>
Exemption	2 770	2 770	3 840	3 840	3 840	–
Tuition						13 820 <sup>4</sup>
Online						5 100
Mock exam						2 160
Counselling			4 260	2 830	2 830	2 830
Number of subjects	3	5	1	1	2	1

<sup>1</sup>F106 is R6 020 as set by IFoA  
<sup>2</sup>For all except F2 this is the Act Ed cost for course notes only applying an exchange rate of R18 to the Pound. More comprehensive support is available at R2 286 for A1 & A2, R8 010 for A301 and R4 140 for F1  
<sup>3</sup>This is the average cost. Costs vary per subject depending on the course length. Range between R1 130 and R1 760. Retaker notes are R910. For hard copy the average cost is R1 608 and retaker notes are R1 040  
<sup>4</sup>Retaker course R6 910

**TABLE 24** Direct costs of normative skills (2018)

Subject	A410	A420	A440	Workshops	F302	WBL
Exam cost	1 530	5 300	1 530			
Exemptions		3 590				
Workshops				26 910 <sup>1</sup>	10 560	
Work based learning						510

<sup>1</sup>Spread over five workshops over two-year period. Sum of current costs. Individual costs vary between R3 680 and R9 660. Those seeking the CERA designation also do C100 at R9 480

**6.2 Indirect and Opportunity Costs of Education**

The most obvious indirect cost is time. Depending on structures, this can be felt by the student or the employer either directly or indirectly. Table 25 shows the number of hours recommended by ASSA for students studying the different levels of the curriculum with the split between the median hours made available by employers and additional hours outside normal work hours.

Although ASSA does not follow Malcolm Gladwell’s 10 000 hours to master a skill benchmark, this remains a substantial amount of time with significant monetary and opportunity cost to both the employer and the student.

**TABLE 25** Study hours required

Subject	A1	A2	A301	A302	F1	F2
Recommended hours <sup>1</sup>	150	200	500	50	300	400
Study leave	80	80	205	24	122	200
Balance	70	120	295	26	178	200
Number of subjects	3	5	1	1	2	1

<sup>1</sup>ASSA Student handbook. [www.actuarialsociety.org.za/download/assa-student-handbook-2/](http://www.actuarialsociety.org.za/download/assa-student-handbook-2/)

The monetary cost or opportunity cost to the employer and the student can be estimated using the following assumptions.

- The cost to the employer of lost productivity is  $3 \times^{13}$  the student's salary rate;
- The cost to the student is his salary rate – the implicit assumption being that leisure time is worth the same to the student as his paid employed time;
- Junior students write the A1 and A2 exams, mid ranking students the A3 exams and senior students the F1 and F2 series exams.

Based on these assumptions the total costs of study leave are shown in Table 26.

**TABLE 26** Costs of study leave

Subject	A1	A2	A301	A302	F1	F2
Annual salary (R'000)	300	300	408	408	516	516
Hourly rate (R)	167	167	227	227	287	287
Employer cost (R'000)	40	40	139	16	105	172
Student cost (R'000)	12	20	67	6	51	57
Total cost	52	60	206	22	156	229
Number of subjects	3	5	1	1	2	1

In addition to these hours, there is also the preparation for and attendance of the normative skills programme. Here typically there is no study leave so all preparation is done on the student's time and all workshops attended on the employer's time. On this basis, the employer will be liable for an additional nine days spent in workshops and normative assessments and the student for an additional 124 hours of preparation time. With the exception of the final two days of the employer's time, this time can be assumed to be evenly split between junior and senior students. On this basis, the additional cost to the employer is R44 000 and to the student R24 000.

<sup>13</sup> Feedback from the big four auditing companies and from a smaller independent consultancy suggests that the ratio on their standard costs is higher. But as clients are often charged less than the standard rate or not all hours are billed, this is a reasonable pragmatic starting point.

Returning to our three hypothetical students (one with all exemptions, another with no exemptions but passing everything first time and the “average student”), Table 27 aggregates the total time cost.

TABLE 27 Aggregated time costs

Costs R'000	All exemptions	No exemptions	Average student <sup>1</sup>
Exam employer time cost	172	858	1 046
Normative employer time cost	44	44	44
<b>Total employer time cost</b>	<b>216</b>	<b>902</b>	<b>1 090</b>
Exam student time cost	57	367	862
Normative student time cost	24	24	24
<b>Total student time cost</b>	<b>81</b>	<b>391</b>	<b>886</b>

<sup>1</sup>See text in section 6.1. Beyond the first attempt it is assumed that the employer allows half the study leave and covers half the direct costs for the second attempt and none thereafter. The student studies for the same total number of hours so balance seen as student costs

On this basis, the total opportunity and time costs significantly dwarf the direct costs of exams and materials.

It is possible to take a more pragmatic view and argue that students tend to be more productive when they are in the office or make up some of the time outside the exam season through extra time and or effort. This is not allowed for in this analysis.

Table 28 aggregates the time and financial costs for the employer and student in these two extreme cases and for the “average” student.

TABLE 28 Aggregated total costs

Costs R'000	All exemptions	No exemptions	Average student
Direct costs to employer	89	137	152
Time cost to employer	216	902	1 090
<b>Total employer cost</b>	<b>305</b>	<b>1 039</b>	<b>1 242</b>
Direct cost to student	–	–	34
Time cost to student	81	391	886
<b>Total student cost</b>	<b>81</b>	<b>391</b>	<b>920</b>

As can be seen in Table 28, the total direct costs of education represent a relatively small proportion of total costs. However, the opportunity cost measured as the cost of time, increases significantly for students who do not earn exemptions and particularly for students who do not pass everything at the first attempt. As seen in Table 18 most study leave programmes provide a rapidly diminishing level of direct support after the

first attempt resulting in the direct and opportunity costs being rapidly transferred from the employer to the student. From this it is clear that slaying the dragon not only brings about a sense of achievement but is also expensive. The bottom line remains – is it worth it.

### 6.3 Benefits of Actuarial Education

The benefit of an actuarial education can be viewed from a range of different lenses:

- The Sir Edmund Hillary and JF Kennedy lens. When asked why he climbed Everest, Hillary’s response was because it was there. In a 1962 speech, President JF Kennedy stated “We choose to go to the moon in this decade and do other things, not because they are easy, but because they are hard ...”<sup>14</sup>
- Growth in skills and knowledge leading to job satisfaction and challenges lens.
- Improved earnings potential from a scarce skill that has proven value adding potential lens.
- Capacity for hard work lens. Successfully completing the actuarial exam programme requires students to acquire a capacity for hard work, persistence and resilience as well as a willingness to devote considerable hours to working.

For the purpose of this paper, we shall focus primarily on the earnings potential for both the employer and the actuary. Although, for many actuaries the first two benefits hold a stronger appeal, they are more subjective and less easy to quantify.

As can be seen in Table 29, the majority of employers who responded provide immediate salary increases on passing exams and many also pay bonuses. This is the immediate but lasting first benefit of interim success on the road to qualifying as an actuary.

The measure used for the purpose of this exercise is to estimate the value of life-time earnings for those who achieve success in their exams against those who make less progress. Given the current low level of involuntary unemployment amongst actuaries, unemployment is ignored in this investigation. Table 29 estimates the present value of life-time earnings for actuarial students starting work and making various levels of progress through their exams.

For the successful student it is clear there is a substantial bounty on the dragon’s head even if qualification is a slow process.

For the employer, there is less sense in projecting life-time earnings as staff would not be expected to spend their full careers with a single employer and other than student debt obligations, departing actuaries generally have no further obligations to their former employers. Here the short-term benefit can best be determined by a combination of increased billable hours (no study leave) at a higher rate and with the unquantifiable measure of increased focus without the distraction of pending examinations.

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14 John Kennedy, 12 September 1962, Rice University football stadium.

From a more macro-economic perspective it is possible to construct an argument that employers benefit from actuaries who qualified while working for other employers. This is not considered for the purpose of this paper.

**TABLE 29** Estimated gross life time earnings

PV of earnings over 40-year career (R'm) <sup>1</sup>	PV	Premium
No exam progress	8.6	–
15 years to become a TASSA <sup>2</sup> with no further progress	12.8	4.2
Achieve Associate level exam success after 15 years with no further progress	17.4	8.6
Fellow after 15 years	22.8	14.2
Fellow after 10 years	27.0	18.4
Fellow after 7 years	30.3	21.7
Fellow after 3 years	34.0	25.4

<sup>1</sup>Salary data from payscale.com; Assume standard salary increases 6% p.a. and 8% discount rate.  
<sup>2</sup>Technical Member of Actuarial Society of South Africa. Achieved on passing or being exempted from Core technical (A1 and A2 series exams) and Foundation Normative Skills programme.

Table 30 shows the model calculation of the value of qualification to the employer. This compares the final year of study where the student takes first attempt study leave for one F1 level and one F2 level course.

**TABLE 30** Estimated 1-year change in value to employer on qualification

1-year value to employer of qualification	Prequalification	Qualified	% change
Billable rate per hour (R)	860	1 160	35%
Salary per hour (R)	287	387	35%
Total hours per work year	1 800	1 800	0%
Less leave 20 days	(150)	(150)	0%
Less study leave	(322)	–	–100%
Net hours	1 328	1 650	24%
Billable portion	75%	75%	–
Net billable hours	996	1 238	24%
Total billings (R'000)	857	1 436	68%
Less salary	(516)	(696)	35%
<b>Net revenue</b>	<b>341</b>	<b>740</b>	<b>117%</b>

The increase in total hours available to the employer together with the wider scope of work the actuary can take on allows the employer to immediately increase the value

generated by the newly qualified actuary. Although this example uses consulting where value added is more easily monetised, the same principle flows into other employment relationships.

## 7. OPTIMISING THE RETURN

As seen above, the investment in actuarial education is significant for individuals and employers when allowing for the direct and time costs. The time value of either forfeited earnings or the opportunity cost of time spent studying significantly outstrips the direct costs of examinations and different interventions. However, as seen in section 5.4.5, the probability of passing increases noticeably with some interventions. Taking a deterministic view using experience statistics for the last five years, Table 31 shows the return for students, attempting an F2 level course.

TABLE 31 Estimated value to student and employer of different interventions for F2 exams

Attempt	1	2	3
Value to student calculated as net increase in life earnings (R'000 with % increase from no intervention in brackets)			
No intervention	1 031	976	822
Online tuition course (Cost R5 100)	1 887 (83%)	1 890 (94%)	1 655 (101%)
Counselling after each fail (Cost R2 830)	1 031 —	1 780 (82%)	1 557 (89%)
Value to employer calculated as increase in net consulting income over two years (R'000 with % increase from no intervention in brackets)			
No intervention	223	223	202
Online tuition course (Cost R5 100)	398 (79%)	409 (84%)	370 (83%)
Counselling after each fail (Cost R2 830)	223 —	388 (74%)	351 (73%)

These scenarios are calculated on the following assumptions:

- Study leave for first attempt as per median in Table 16. Second attempt at 50% this level and none for third attempt.
- Student studies for the difference between ASSA recommended study hours (Table 25) and first year study leave in their own time but takes unpaid leave for the shortfall between first attempt study leave and what is offered at future attempts.
- Similarly, the employer covers full costs of tuition, exams, counselling and materials for the first attempt reducing to 50% for the second attempt and zero thereafter. The student covers the balance of the costs.

- 75% of hours are deemed billable and employer revenue is three times salary.

Should the correlation in pass rates of different ASSA interventions reflect a causal relationship, it is clear there is a significant potential return to both the student and the employer on these interventions. With the immediate downside risk of counselling being the cost of the session if the subsequent attempt is unsuccessful, there is a compelling argument for students to enhance their performance by having exam counselling.

For the online or physical courses there may be some need to modify study schedules to maximise the benefit of the course that may have revenue implications that are not modelled here. However, even with these, the online course and more expensive face-to-face course both give a strong argument for improving student performance and the returns to both the students and the employer.

This case is easy to make for the F2 level exams where often the exam is the last obstacle before a student qualifies as a Fellow member and is universally recognised as an actuary. Table 32 shows a similar analysis for A301 where counselling is available but not widely used.

TABLE 32 Estimated value to student and employer of counselling for A301 exams

Attempt	1	2	3
Value to student calculated as net increase in life earnings (R'000)			
No intervention	221	202	158
Counselling after each fail (Cost R4 260)	221	442	405
	–	(119%)	(156%)
Value to employer calculated as increase in net consulting income over two years (R'000)			
No intervention	286	325	338
Counselling after each fail (Cost R4 260)	286	573	591
	–	(76%)	(75%)

Although the amount of value that appears to be added by counselling is less than for the F2 level, there remains a substantial return on an investment in exam counselling for both the employer and the student if the correlation in performance reflects a causal relationship.

## 8. CONCLUSIONS

Through this paper I have taken a deliberate and meandering wander through the dark alleys of the actuarial student world where each year hundreds start the quest after their dragon but only a fraction of them emerge victorious at the other end having slayed the dragon and claimed the elusive designation as a Fellow of the Actuarial Society of South Africa.

Hard data shows strong correlations in performance when the group is segmented by race. This, however, is no indication of a causal relationship between these factors but does give a sound starting point to identify factors that may be impacting performance.

Similarly, within the data quality constraints raised in the paper, the analysis suggests that students emerge from different universities equipped with different skills that result in there being a noticeable correlation between performance of students at different stages of the quest and the universities they attended.

Using regression to estimate the impact of the historical and uncontrollable factors showed that there remain marked differences in exam performance between different employers. A qualitative survey that was well supported in certain employer groups found limited differences in many of the easily quantifiable components of the benefit package between companies with vastly different levels of student performance. This left the unanswered question of whether there are underlying corporate culture and DNA factors that engender exam success or failure. This is an area for future work that could be enhanced with a targeted survey of working students as well as the use of appropriate corporate culture experts.

There is a clear correlation between the level of education and other support initiative and the performance of students. Although intuitively there appears to be a causal relationship here, it is neither proven nor obvious. Performance of SAADP students and some university performance suggests a negative correlation between support at the early stages and performance towards the Fellowship level. However, where specific tuition or counselling is provided for a subject there is a strong performance correlation. However, the burning question remains, is this a causal relationship or is it a case of the more able and dedicated students making use of opportunities that are available.

Through all these analyses of pass rates and exam performance generally, it remains clear that there is no substitute for hard work and personal study. However, tuition and counselling should serve to counter the equally true statement that the first sign of insanity is doing the same thing and expecting different results. These interventions should lead to changed actions that could lead to changed outcomes.

Underlying all this remains the question whether it is all worth it – why chase this dragon. Although for many members of the actuarial community this may begin as an intriguing challenge to beat something that has a reputation for being difficult and satisfy a hunger for problem solving, ultimately the measure of success for the purpose of this meander is the possible financial impact on both students and employers.

For the purpose of this paper enhanced life-time earnings against the short-term cost is considered for students and increased revenue on a consulting model over a two-year period for employers.

The analysis here is no more than a tentative first step in what can become a thorough and challenging career growth model. This has shown that, at current remuneration and employment levels, actuarial students and actuaries add significant value to both

themselves and their employers. This value can be enhanced through interventions that have been shown to be closely correlated with exam success.

In closing, the dragon may be fierce, powerful and elusive but successfully slaying it brings not only deep satisfaction but also lucrative opportunities in what appears to be a still growing market for successful dragon-slayers.

#### ACKNOWLEDGEMENTS

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## APPENDIX 1

### ASSA Education Structure

The ASSA education curriculum consists of three exam-based tiers as well as practical experience and the development of broader professional work and life skills. All examinations can be completed through ASSA with exemptions available for sufficiently good experience at university.

Table A1.1 sets out the 2018 curriculum structure for the exam-based part of the curriculum.

TABLE A1.1 ASSA technical and specialist exam syllabus

	2018	2019
Technical specialist (TASSA)	<b>Foundation skills</b> A101 Probability & Mathematical Statistics A102 Economics A103 Finance & Financial Reporting  <b>Intermediate technical skills</b> A201 Financial Mathematics A202 Models A203 Contingencies A204 Statistical Methods A205 Financial Economics	<b>Foundation skills</b> A111 Actuarial Statistics I A112 Business Economics A113 Business Finance  <b>Intermediate technical skills</b> A211 Financial Mathematics A212 Actuarial Statistics II A213 Contingencies  A214 Financial Economics
Associate level (AMASSA)	Complete the TASSA level plus: A301 Actuarial Risk Management A302 Communications	Complete the TASSA level plus: A301 Actuarial Risk Management NA211 Communications
Fellowship level (FASSA)	<b>Complete AMASSA plus two of six Fellowship Principles subjects:</b> F101 Health & Care F102 Life Insurance F103 General Insurance F104 Retirement & Related Benefits F105 Finance & Investments F106 Enterprise Risk Management	
	<b>One of six Fellowship Applications:</b> F201 Health & Care F202 Life Insurance F203 General Insurance F204 Retirement & Related Benefits F205 Finance & Investments F206 Banking	

These subjects need to be successfully passed together with the normative skills programme and work-based learning. Depending on their programme and the results they achieve during their university studies, students can be exempted from writing all the exams except the Fellowship Applications level through ASSA.

## APPENDIX 2

## Detailed exam results

TABLE A2.1 Overall ASSA Exam Results 2013–2017

Subject	Pass	FA	FB	FC	FD	Total	Pass %	Exempt
A101	410	42	100	59	49	660	62%	811
A102	98	24	44	32	12	210	47%	1 060
A103	98	21	76	49	38	282	35%	1 024
A201	711	40	139	87	101	1 078	66%	613
A202	547	129	370	225	131	1 402	39%	518
A203	668	100	300	210	108	1 386	48%	413
A204	529	73	263	193	97	1 155	46%	590
A205	604	94	251	143	78	1 170	52%	475
<b>Core technical</b>	<b>3 665</b>	<b>523</b>	<b>1 543</b>	<b>998</b>	<b>614</b>	<b>7 343</b>	<b>50%</b>	<b>5 504</b>
A301	534	251	619	210	66	1 680	32%	352
A302	657	412	487	140	26	1 722	38%	264
<b>Core application</b>	<b>1 191</b>	<b>663</b>	<b>1 106</b>	<b>350</b>	<b>92</b>	<b>3 402</b>	<b>35%</b>	<b>616</b>
F101	160	117	145	59	9	490	33%	61
F102	244	202	300	109	25	880	28%	142
F103	100	63	122	42	8	335	30%	53
F104	35	18	31	17	7	108	32%	26
F105	175	138	255	95	34	697	25%	102
F106	160	60	107	45	10	382	42%	1
<b>Specialist principles</b>	<b>714</b>	<b>481</b>	<b>815</b>	<b>308</b>	<b>84</b>	<b>2 402</b>	<b>30%</b>	<b>385</b>
F201	56	54	93	11	–	214	26%	
F202	245	237	238	19	1	740	33%	
F203	66	78	143	17	2	306	22%	
F204	28	14	48	13	–	103	27%	
F205	58	62	112	24	–	256	23%	
F206	14	19	20	2	–	55	25%	
<b>Specialist application</b>	<b>411</b>	<b>410</b>	<b>561</b>	<b>75</b>	<b>3</b>	<b>1 460</b>	<b>28%</b>	
<b>Total</b>	<b>5 981</b>	<b>2 077</b>	<b>4 025</b>	<b>1 731</b>	<b>793</b>	<b>14 607</b>	<b>41%</b>	

Table A2.1 shows that even within a group of subjects there is a wide range of pass performances. For some subjects this is due to a higher number of students getting exemptions (A101 & A103). There are other subjects where more students battle to achieve the required standard (A202) where there is both a low pass rate and low number of exemptions.

While there are relatively few poor attempts (FC and FD grade) for the Fellowship level exams, students find these subjects more difficult to pass. These subjects are dominated by Life (F102 and F202) as this remains the dominant practice area.

Table A2.2 shows the pass rates for each of the ten exam periods during this five-year period. This table shows wide fluctuations in the pass rates for subjects from session to session. As the examiner's primary assessment criterion is "Does this student demonstrate the level of skill and knowledge required at this stage of their professional development?" In making their determination they are guided by what students have presented and the difficulty of the paper and not by any marks distribution curve or target pass rates.

The two key uncontrollable factors discussed in the analysis are race and gender. Table A2.3 gives the pass rates per subject by race and gender (separately).

When examiners mark scripts they have no information other than the candidate number and the script presented. With this there is no race or gender bias built into the marking. By gender it can be seen that females have tended to have a better grasp of the Pensions and Other Benefits practice area (F104 and F204) though with only 50 exam entries between the two subjects over the ten exam sessions, little weight should be given to this. Their better performance over A301 is more significant.

Where and when students sit exams can have an impact on their performance. Table A2.4 gives per subject results for each session and major centre.

Session 1 candidates out-perform session 2 for most subjects covered in university undergraduate level programmes and A301 (honours level) possibly as a result of recent graduates writing exams in subjects where they narrowly missed the exemptions. At the fellowship principles level, the second semester has outperformed the first for all subjects except short-term (F103) and risk management.

Table A2.5 shows the per subject performance for the different universities as well as the SAADP student performance.

Caution needs to be exercised when looking at the figures especially for Echo and Foxtrot. For example, Foxtrot's 100% pass rate for F201 represents one candidate who passed in five years. Although, with the exception of Delta at one end of the spectrum and Echo at the other, overall university performance is in a narrow band but with significant differences at a subject and subject group level.

**TABLE A2.2 Pass rates by session**

<b>% Pass</b>	<b>13-1</b>	<b>13-2</b>	<b>14-1</b>	<b>14-2</b>	<b>15-1</b>	<b>15-2</b>	<b>16-1</b>	<b>16-2</b>	<b>17-1</b>	<b>17-2</b>
A101	54	65	70	50	76	61	56	66	60	58
A102	60	18	38	56	56	52	64	36	42	45
A103	27	36	23	40	21	52	16	30	47	48
A201	73	73	67	75	75	55	59	62	52	75
A202	55	35	47	38	44	36	31	31	39	36
A203	58	36	53	44	57	38	49	56	53	32
A204	65	54	44	53	39	41	42	44	38	46
A205	41	51	48	53	56	47	57	43	53	64
<b>Core technical</b>	<b>53</b>	<b>49</b>	<b>52</b>	<b>50</b>	<b>54</b>	<b>45</b>	<b>47</b>	<b>48</b>	<b>48</b>	<b>50</b>
A301	24	37	31	35	29	26	40	29	43	27
A302	44	40	44	35	39	35	29	33	36	44
<b>Core application</b>	<b>36</b>	<b>39</b>	<b>38</b>	<b>35</b>	<b>35</b>	<b>29</b>	<b>35</b>	<b>31</b>	<b>40</b>	<b>36</b>
F101	20	28	25	32	31	35	31	43	52	33
F102	14	30	19	31	35	38	19	34	28	28
F103	22	19	29	29	32	36	36	29	37	24
F104	47	58	8	41	0	44	0	27	56	14
F105	20	21	24	21	29	40	16	36	17	30
F106	25	46	40	44	41	62	54	32	44	30
<b>Specialist principles</b>	<b>20</b>	<b>29</b>	<b>25</b>	<b>31</b>	<b>32</b>	<b>40</b>	<b>26</b>	<b>35</b>	<b>34</b>	<b>29</b>
F201	33	33	36	22	33	16	28	26	14	24
F202	30	29	32	35	34	31	31	31	37	39
F203	15	36	10	17	17	19	18	30	23	25
F204	38	18	27	22	30	29	29	45	29	0
F205	21	28	35	8	24	29	9	32	24	15
F206						0	33	18	38	31
<b>Specialist application</b>	<b>26</b>	<b>30</b>	<b>30</b>	<b>24</b>	<b>30</b>	<b>25</b>	<b>25</b>	<b>30</b>	<b>30</b>	<b>29</b>
<b>Total</b>	<b>43</b>	<b>40</b>	<b>41</b>	<b>40</b>	<b>44</b>	<b>37</b>	<b>38</b>	<b>40</b>	<b>42</b>	<b>41</b>

TABLE A2.3 Pass rates by gender and race

Subject	Male	Female	Black	Coloured	Indian	White	Other
A101	64	59	51	78	73	76	58
A102	48	44	34	75	53	65	50
A103	35	33	27	33	52	46	33
A201	66	66	54	68	71	80	89
A202	37	43	25	53	52	53	50
A203	47	51	38	59	53	59	57
A204	46	45	35	64	47	58	78
A205	51	53	47	71	51	55	59
<b>Core technical</b>	<b>49</b>	<b>51</b>	<b>39</b>	<b>62</b>	<b>56</b>	<b>61</b>	<b>61</b>
A301	30	36	25	33	37	36	15
A302	37	40	24	49	44	46	38
<b>Core application</b>	<b>34</b>	<b>38</b>	<b>25</b>	<b>39</b>	<b>40</b>	<b>42</b>	<b>25</b>
F101	32	33	20	26	28	41	63
F102	28	27	19	26	22	36	18
F103	26	37	16	28	25	40	15
F104	29	46	15	33	40	46	0
F105	25	27	17	15	27	31	17
F106	42	43	37	36	38	46	33
<b>Specialist principles</b>	<b>30</b>	<b>32</b>	<b>20</b>	<b>25</b>	<b>26</b>	<b>38</b>	<b>22</b>
F201	26	26	14	0	9	35	100
F202	34	32	26	29	30	36	40
F203	21	22	9	0	18	26	14
F204	25	35	4	50	29	35	
F205	24	20	12	25	30	25	0
F206	25	25	9		17	34	33
<b>Specialist application</b>	<b>28</b>	<b>28</b>	<b>17</b>	<b>22</b>	<b>25</b>	<b>32</b>	<b>23</b>
<b>Total</b>	<b>39</b>	<b>43</b>	<b>33</b>	<b>43</b>	<b>42</b>	<b>47</b>	<b>38</b>

**TABLE A2.4** Pass rates by Region and Session

<b>Subject</b>	<b>First session</b>	<b>Second session</b>	<b>Gauteng</b>	<b>Western Cape</b>	<b>Other</b>
A101	64	60	62	67	55
A102	51	43	44	54	63
A103	28	41	38	32	11
A201	64	68	61	81	55
A202	43	35	36	50	30
A203	54	41	45	55	47
A204	45	47	44	53	42
A205	51	52	42	70	49
<b>Core technical</b>	<b>51</b>	<b>48</b>	<b>46</b>	<b>61</b>	<b>44</b>
A301	34	30	31	32	33
A302	39	38	38	39	50
<b>Core application</b>	<b>37</b>	<b>34</b>	<b>35</b>	<b>35</b>	<b>38</b>
F101	31	34	34	31	27
F102	23	32	25	34	26
F103	32	28	29	34	50
F104	25	39	31	33	44
F105	21	29	25	27	19
F106	42	42	41	48	22
<b>Specialist principles</b>	<b>27</b>	<b>33</b>	<b>29</b>	<b>33</b>	<b>27</b>
F201	29	23	25	29	25
F202	33	33	33	33	36
F203	17	25	22	19	22
F204	30	25	25	25	50
F205	23	22	23	24	16
F206	35	20	24	40	
<b>Specialist application</b>	<b>28</b>	<b>28</b>	<b>26</b>	<b>31</b>	<b>30</b>
<b>Total</b>	<b>41</b>	<b>40</b>	<b>39</b>	<b>46</b>	<b>39</b>

TABLE A2.5 Pass rates by university and for SAADP

Subject	SAADP	Alpha	Bravo	Charl	Delta	Echo	Fox	Other
A101	80	66	81	59	88	32	46	44
A102	29	67	59	38	70	25	40	46
A103	29	29	39	36	37	18	20	36
A201	71	88	77	58	96	64	63	56
A202	36	55	36	35	60	18	41	37
A203	47	60	50	42	80	30	41	43
A204	49	53	51	36	77	34	47	43
A205	54	77	47	42	74	35	28	43
<b>Core technical</b>	<b>51</b>	<b>65</b>	<b>52</b>	<b>44</b>	<b>75</b>	<b>33</b>	<b>43</b>	<b>45</b>
A301	33	36	33	31	31	36	38	25
A302	36	36	38	38	49	43	38	35
<b>Core application</b>	<b>35</b>	<b>36</b>	<b>35</b>	<b>35</b>	<b>39</b>	<b>39</b>	<b>38</b>	<b>29</b>
F101	27	32	26	40	36	36	46	29
F102	20	28	25	24	42	33	39	21
F103	33	29	23	42	45	22	27	26
F104	8	29	25	55		42	20	22
F105	24	29	25	22	34	24	26	16
F106	38	46	36	51	47	37	38	33
<b>Specialist principles</b>	<b>24</b>	<b>31</b>	<b>26</b>	<b>33</b>	<b>40</b>	<b>32</b>	<b>35</b>	<b>23</b>
F201	7	25	15	54	37	67	100	6
F202	9	33	28	35	34	38	40	35
F203	17	23	19	25	32	40	14	19
F204	8	29	19	29	57	38	50	20
F205	30	30	24	32	31	3	14	13
F206	13	40	15	22	33	40	0	0
<b>Specialist application</b>	<b>12</b>	<b>31</b>	<b>22</b>	<b>33</b>	<b>35</b>	<b>25</b>	<b>25</b>	<b>23</b>
<b>Total</b>	<b>39</b>	<b>44</b>	<b>40</b>	<b>39</b>	<b>51</b>	<b>33</b>	<b>38</b>	<b>38</b>

## APPENDIX 3

### Employer Performance

Table A3.1 summarises the overall performance of the 30 largest employers (by number of actuarial staff) as well as the self-employed and unemployed. The figures represent the over- or underperformance of students for each of the subject groups relative to the average student. For example, a +5 for F1 means that for the F1 (Fellowship principles) subjects these students performed 5% better than the average student – if the overall pass rate is 30% the +5 means these students achieved 31.5%.

The index numbers for some of the smaller employers need to be interpreted with caution as they may reflect the results of fewer than five students in the subject group over the five years.

Based on this model, with a few exceptions, students have a better chance of success with larger employers and those placing a high premium on intellectual capital. It appears most difficult for self-employed students to succeed in exams despite the self-employed being one of the stronger groups with regards to average exemptions.

The unemployed students include students not yet in the job market attempting to pass subjects where they failed to secure their exemptions.

“I” represents the total over- or underperformance for the employer.

“X” represents the portion of the index explained by uncontrollable and previously controllable factors according to the regression model.

“Y” represents the balance due to controllable factors and “luck”.

TABLE A3.1 Employer performance

ER	Nr	A1	A2	A301	A302	F1	F2	I	X	Y
A	1 159	-11	+11	+25	+13	+5	-9	+7	+6	+1
B	1 229	+16	+15	+6	+5	-1	-5	+8	+1	+7
C	1 025	-17	-32	-23	-27	-41	-30	-30	-6	-24
D	862	+4	-4	-7	-15	-5	-19	-6	+6	-12
E	975	+17	+2	+5	-11	+2	-21	+2	+6	-4
F	666	+39	+24	+54	+33	+56	+38	+38	+18	+20
G	702	+68	+33	+10	+15	+8	-15	+21	+5	+16
H	752	-23	-8	+19	-21	+3	+2	-7	-3	-4
I	485	+2	-14	+2	+10	-22	+5	-9	-7	-2
J	319	+30	+2	-37	+5	-1	-2	+0	+5	-5
K	300	+33	+64	+51	+34	+26	-0	+36	+28	+8
L	195		+61	+1	+34	-3	-28	+16	+20	-4
M	160	-5	+61	+43	+51	+57	+45	+52	+15	+37
N	234	-19	+4	+0	+5	+23	-16	+3	-13	+16
O	206	-26	-34	-13	-25	-17	-23	-29	-22	-7
P	185	-21	-39	-80	-16	-24	-40	-38	-16	-22
Q	188	+36	+33	+8	+5	-26	+43	+18	+16	+2
R	135	+17	-34	-16	+19	-76	-28	-26	+4	-30
S	156	-19	+45	+18	+18	-38	+105	+6	+15	-9
T	104	-14	-16	-21	-60	-17	+19	-18	+5	-23
U	156	+90	+3	+32	+10	-22	-28	+8	+6	+2
V	75	+90	+84	+18	+23	-62	+79	+18	+18	0
W	95	-11	-13	+40	+46	+50	+19	+3	+5	-2
X	96	-29	-15	-48	+31	-26	-10	-18	-18	0
Y	150	-45	-17	+10	-13	-65	-100	-25	-11	-14
Z	127	-52	-13	-14	+5	-9	+2	-12	+14	-26
AA	70	-24	-21	-21	-100	-59		-32	-28	-4
BB	87	+90	-34	-37	+9	-40	+43	-20	+6	-26
CC	50		-8	+57	+5	+27	+2	+7	+28	-21
DD	63	+90	+1	+5	+31	-45	-40	-9	+13	-22
Self	72	-100	-49	+57	+1	+22	+37	-11	+20	-31
Une	778	+8	+18	-46	-33	-56	-40	+10	+3	+7