Actuarial Supply and Demand

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Abstract

It seems well accepted and established that there is a need for increased capacity and expertise in the financial services, particularly in developing countries. This is true for both industry and supervisors. In many countries the evolution of a professional supporting infrastructure is embryonic at best, leaving those countries dependent on external suppliers of such expertise – and that presumes such supply is available.

In this paper we estimate the numbers of Actuaries required to meet a measure of demand, both now and in the future. In short, we need a rapid and sustained growth in the profession in order to meet this demand. This is both an opportunity and a threat to the global actuarial profession, depending on whether the challenge is met or not.

Globally, there are about 40,000 Actuaries and the estimated demand is for approximately twice this number. While the analysis made is high level and relatively simple and would benefit from refinement, the messages emerging seem clear. In particular, at a global level, the traditional approaches to Actuarial education do not meet current demand, and are unlikely to be able to do so in the future.

The actuarial demand is almost entirely sourced from the so-called developing world. From an actuarial perspective, the actuarial 'factories' are currently very concentrated – over 80% of Actuaries belong to an association in the United States, United Kingdom, Canada, Germany or Spain.

It is hoped that this paper will serve to promote discussion and debate by providing some indicative results.

1 Background

It seems generally recognised and accepted that there is a shortage, sometimes severe, of Actuaries in many developing countries. To quote from Rod Lester's acceptance speech for the Institute of Actuaries of Australia's 'Actuary of the Year' award in December 2005 (Lester 2005):

> *My team's work covers a huge range of issues but in a nutshell we have three practices –*
> *…*
>
> *and the third is market efficiency, including regulatory and supervisory issues, market liberalization and insurer resolution. This last practice consistently throws up the need to develop the actuarial profession as a core need in most of the* [World] *Bank's client countries.*
>
> *The reasons for this are almost always two fold – the development of motor third party liability insurance and the emergence of nascent life insurance sectors. Pensions systems can also require actuarial intervention – the number of DB social insurance systems that are either completely broken or creating major fiscal headaches around the world is incredible - and there are a number of actuaries making nice livings out of calculating implicit national debts and helping to design transition paths to more sustainable structures.*
>
> *Most of our client countries have few or no actuaries qualified to IAA standards.*

Currently, according to International Actuarial Association (IAA) figures, (IAA 2005), there are 43,000 Fully Qualified Actuaries in Full Member Associations. When reported by Association membership, the total is approximately 54,000. This discrepancy is taken to reflect those individuals who are members of more than one Association. Such multiple memberships are well known, for example between the US Society of Actuaries and the Canadian Institute of Actuaries, between the Institute of Actuaries of Australia and the Faculty of Actuaries or the Institute of Actuaries, and between the Society of Actuaries in Ireland and the Institute of Actuaries, and no doubt there are other examples.

There are relatively few Actuaries in the world. Estimates suggest there may be something like 9.5 million doctors, 5.5 million accountants and 6.5 million engineers. Reflecting on the orders of magnitude involved, for each Actuary there are over 100 accountants and about 200 doctors. Another way of putting the number of Actuaries in the world into context is a comparison with the CFA Institute. Currently, according to CFA 2006, there are about 67,000 Chartered Financial Analyst (CFA) charter holders, representing an over five fold growth from about 10,000 CFA charter holders in 1990. As at December 2005, nearly 85% of CFA charter holders were aged 35 or less.

The word 'Actuary' above has been taken to mean a fully qualified member of a full member association of the IAA. It is acknowledged this count therefore does not include members of other associations or

members of full member associations of the IAA who are not fully qualified (associates or similar).

2 Objective

The objective of this paper is to provide an indication of the numbers of Actuaries required to meet current demand, and to provide some insight into the numbers of Actuaries that will be required in the future to meet future demands.

By the nature of the questions the approach is necessarily approximate. However, the overall implications that emerge are clear.

In order to get a framework to work in, some assumptions are required. It is acknowledged that some of these assumptions may be regarded as having significant elements of 'heroism' in them. The intent here is to get useable results, rather then perfect results.

By implication, the numbers of Actuaries in many developed countries may be adequate – at least in some countries such as Australia the phenomenon of 'actuarial unemployment' has been witnessed and in many of them, including the United States, United Kingdom and Australia there is a longstanding objective of deploying actuaries in new areas (by various names). This provides us with a 'target'.

To get a measure of economic scale and growth, and by implication the need or opportunity for Actuaries, we use GDP. This makes more sense than direct population figures and has the signal advantage of the data being available.

We can then define Actuarial Density, for a region, as

Actuarial Density = Number of Actuaries / GDP (in $US millions)

This definition provides us with a simple tool to assess both the current need for Actuaries, and to estimate whether future growth in the actuarial profession can meet expected future needs.

The use of GDP as a measure of economic scale and growth is consistent with findings that there is an empirical 's-curve' for a relationship between economic development, as measured by GDP per capita, and insurance market development , as measured by insurance penetration. See Swiss Re 2004. This analysis applies to both Life and Non-life insurances. Intuitively this could be expected: if people have the income to be able to purchase insurance or save for their retirement then they are more likely to do so. The 's-curve' also reflects the behaviour that insurance premiums tend to grow faster than the underlying economy as a consequence of increased penetration into the market. The levelling out of the relationship between wealth and increasing insurance penetration is also intuitive as eventually markets become mature and saturated.

Clearly there will be other important factors, such as regulation, structure of pension systems, cultural and religious mores, social and legal infrastructure, and so on, which will impact specific countries in differing ways. The trend toward privatisation, particularly in the Non-life and pension systems, also needs to be recognised and the attendant risks managed. In a globalising and liberalising world there may also be significant supra national influences to consider.

These influences could drive an increasing need for Actuaries, beyond that implied by the simple holistic measure of tracking world GDP used here.

3 Data

The data provided, IAA 2005, reflected only Fully Qualified Actuaries who were members of full member associations of the IAA. In particular:

- Number of members of associations for the 2005, 2004 and 2003 years and totals. Additionally, the totals for the 2002, 2001 and 2000 years were also provided (without split by association). Data from 52 associations (including 5 from the United States of America, 2 from the United Kingdom, 2 from Spain, and 2 from Japan) was provided. Membership data for all these 52 associations for each of the three years was included.
- Numbers of individuals by geographic location for the 2005 year. Members were recorded as being present (presumed to mean having contact addresses) in 95 different countries with final grouping of 'No Country'.

The detail of the data is included in Appendix A.

Some specific notes:

- ***Different Totals by Association and by Country***: The mismatch between the total numbers of Actuaries as members of associations, approximately 54,000 in 2005 compared to the total number of Actuaries by Location, approximately 43,000 in 2005, is assumed to be due to the holding of multiple memberships of full member associations.
- ***Individuals with No Country***: Approximately 4% of individuals were not assigned to a country. Where an allocation was needed, it was assumed they were allocated pro-rata over the given country totals.

The data provided by the IAA was accepted as reasonable without a program of further detailed checking and validation.

Going forward we will use two sub-groupings of countries:

- ***Common Law Group:*** This comprises United States, United Kingdom, Canada, Australia and South Africa

- ***Euro Group:*** This comprises France, Germany, Netherlands, Spain and Switzerland

While there may be some debate about the exact composition of these groups, the intent is to reflect the two broad paths of development of the actuarial profession. To quote Lester 2004:

> ***The actuarial vocation is growing and spreading****, as is its client base. However as a number of papers have pointed out, there are two primary approaches to actuarial education and accreditation currently extant. These are the specialized education plus professional accreditation and reinforcement route followed largely by the English speaking world, and the academic plus regulatory oversight route followed by most Continental countries. … .*

Where relevant we refer to these different approaches as the Common Law and Euro models respectively.

4 Initial Analysis

4.1 Numbers by Association

Some immediate and basic results can be extracted from the data.

Table 4.1: Relative Sizes of Actuarial Profession – by Association

Entity	2005		2004		2003	
	Num	Cum %	Num	Cum %	Num	Cum %
All Full Member Associations	53,800	100	51,700	100	50,400	100
Top 1	28,900	53.5	28,000	54.1	27,500	54.5
Top 3	39,200	72.8	37,800	73.1	37,100	73.6
Top 5	43,300	80.5	41,700	80.5	40,800	80.9
Top 10	48,900	90.9	47,100	91.0	46,000	91.1
Common Law	41,000	76.2	39,600	76.5	38,800	76.9
Euro	6,700	12.5	6,500	12.5	6,200	12.3

The additional groupings are as follows (in decreasing order);

- Top 1: United States
- Top 3: United States, United Kingdom, Canada
- Top 5: United States, United Kingdom, Canada, Germany, Spain
- Top 10: United States, United Kingdom, Canada, Germany, Spain, France, Japan, Australia, Netherlands, Brazil

The numbers given for members have been rounded to the nearest 100.

The percentages suggest a consistent, albeit slow, decline in concentration of the actuarial industry, with the possible exception of the Euro Group. Whether this is significant or not, based on this data, is hard to tell. By any measure the actuarial profession is a very 'concentrated' industry.

The concentration in the traditional established actuarial countries is a little more pronounced if the Common Law and Euro groups are extended to:

- Common Law-2: Common Law group and Ireland
- Euro -2: Euro group plus Belgium, Portugal, Austria, Sweden, Norway, Denmark and Finland

We then get to following augmentation of table 4.1B:

Table 4.1B: Relative Sizes of Actuarial Profession – by Association

Entity	2005		2004		2003	
	Num	Cum %	Num	Cum %	Num	Cum %
All Full Member Associations	53,800	100	51,700	100	50,400	100
Common Law	41,000	76.2	39,600	76.5	38,800	76.9
Euro	6,700	12.5	6,500	12.5	6,200	12.3
Common Law – 2	41,300	76.8	39,900	77.1	39,100	77.5
Euro - 2	8,200	15.3	7,900	15.3	7,600	15.1

The use of these larger groups does not change the conclusions.

We now turn to consider estimating the current position regarding 'Actuarial supply and demand'.

4.2 Numbers of Individuals

Before assessing Actuarial supply and demand, however, we need to adjust for the impact of individual Actuaries holding multiple association memberships. To do this, the data supplied, IAA 2005, specifying geographical distribution of Actuaries is utilised. This also gives a better indication of Actuarial Demand as it seems not unreasonable to assume that Actuaries are working in the countries in which they are located. This is independent of which association or associations they may be members of.

Table 4.2: Geographical Distribution of Actuaries

Region	Number of Actuaries	Percent of Total
World	42,800	100%
Top 1	17,500	41%

Top 3	26,300	62%
Top 5	30,800	72%
Top 10	36,400	85%
Common Law	28,300	66%
Euro	7,500	18%

The additional groupings are as follows (in decreasing order);

- Top 1: United States
- Top 3: United States, United Kingdom, Germany
- Top 5: United States, United Kingdom, Germany, Canada, France
- Top 10: United States, United Kingdom, Canada, Germany, France, Spain, Japan, Australia, Netherlands, South Africa

Numbers of Actuaries are rounded to the nearest 100 and are after the 'homeless' Actuaries (no geographical location given) have been assigned homes as noted earlier

It is interesting to note that there are some variations to the Top group when the supply countries (by association membership) and the demand countries (by assumed work location) are compared. Germany and Canada reverse positions, France and Spain reverse positions, and South Africa is 10th by demand while Brazil is 10th by supply.

The higher percentages in Table 4.1 compared to Table 4.2 clearly show that the large Actuarial countries are supplying many Actuaries to the rest of the world.

4.3 Actuarial Demand Deficit

Using data from Table 4.2 we now can obtain the results in Table 4.3.

Taking the position that the demand for Actuaries is being met in the Common Law countries, we use GDP as a basis to estimate the number of Actuaries required worldwide. The cells with underlined, bold, and italicised entries are output calculations and represent the number of additional Actuaries required globally bring the global Actuarial Density up to the level given in the preceding row.

Table 4.3: Current Actuarial Supply and Demand

Region	Number Actuaries	GDP ($US m)	Actuarial Density	Additional Actuaries
Common Law	28,200	$15,692,000	0.1804%	NIL
World	42,800	$40,895,000	0.1047%	***31,000***
Euro	7,500	$6,808,000	0.1105%	NIL

World – excluding Common Law	42,700	$40,895,000	0.1047%	***2,400***

The GDP used is the 2004 nominal GDP, in United States dollars, as taken from World Bank data (World Bank 2005).

The above results presume there is no increasing need or opportunity for Actuaries in new fields, such as Social Insurance and Health and other areas, such as Risk Management /ERM that are currently being focussed on by the major Actuarial associations. In this sense the Additional Actuaries numbers in table 4.3 are more likely to be under-estimates than over-estimates. To possibly counterbalance this, if the actuarial model followed in a country is in the vein of the European model in contrast to the Common Law model , then the Actuarial Numbers above may be over-estimated.

On the premise that the Common Law model is more commonly followed, especially in the developing world, and seems acknowledged by the IAIS in terms of the 'Responsible Actuary' role (IAIS 2003) we shall not pursue discussions based on the Euro Group further.

The clear conclusion, on the basis of the Common Law model for Actuarial roles, is that there is currently a major shortage of Actuaries at a global level, and this is before expansions of the profession into 'wider fields' in some form is successfully pursued.

We also note that if the extended Common Law and Euro groups are used, then the actuarial densities obtained above are not materially changed, especially in the context of this analysis which is only intended to be indicative.

5 The Future

It is perhaps of more interest to asses the future Actuarial supply and demand position. The approach taken is simplistic and taken from a 'top down' perspective of using world data. It is recognised this would benefit from a deeper analysis in which variation between countries, from the perspectives of both GDP behaviour and Actuarial needs, is reflected. However, the primary objective of this work is to provide initial and indicative results.

We can also use the data to assess actuarial growth rates. Note these growth rates are net - that is, they reflect the impact of retirements from associations as well as increases due to the entry of new members.

Table 5.1: Actuarial Association Annual Growth Rates

Entity	Period (to 2005)	Result
All Full Member Associations	5 Years	4.3%
	3 Years	3.2%

	2 Years	3.4%
Top 1	2 Years	2.4%
Top 3	2 Years	2.8%
Top 5	2 Years	3.0%
Top 10	2 Years	3.1%
Common Law	2 Years	2.8%
Euro	2 Years	4.1%

From the full member actuarial association perspective, the net growth in aggregate appears to be being driven from the bottom rather than the top, that is, the large associations growth rates are lagging the averages.

In contrast to the growth of the actuarial profession, we use the World GDP data (World Factbook 2005), to estimate a measure to drive the external need for an increasing supply of actuaries.

To provide a driver for growth in numbers we need to use real growth in GDP – that is, growth in GDP after adjustment for inflation.

According to World Factbook 2005 we have the following:

Table 5.2: Real World GDP Growth

Year	Growth Rate
2005	4.3%
2004	4.9%
2003	3.8%
2002	2.2%
2001	2.7%
2000	4.8%
1999	3.0%

Taking the geometric average of these rates of growth gives 3.7%. At a high level this provides a measure of future growth in aggregate Actuarial Demand.

From Table 5.1 we can get a high level estimate of the current growth in Actuarial Supply. Note that this is net supply reflecting growth in the profession after replacement of those who retire or leave – not numbers of new Actuaries entering the profession. The most reasonable figure to use is perhaps the Top 10 growth figure over the last 2 years – namely 3.1%.

Thus, at a high level it is clear that the problem of Actuarial Supply risks falling further behind the Actuarial Demand.

It is recognised that this high level approach does not take many factors into account, such as willingness of individuals to relocate, differential GDP growth rates between countries, influences alluded to in section 2 above, and so on. However, the broad picture painted should remain unchanged.

6 Some Projections

To help put the future situation into perspective we have made some high level projections.

To do this we have developed a simple spreadsheet.

6.1 Immediate Increase in Supply

From the preceding section we see that Actuarial Supply is already lagging Actuarial Demand so some increase is required just to maintain the status quo!

See Appendix B.

Commentary:

- Even with an immediate 2% increase in supply (from 3.1% to 5.1%) it takes 40 years before Supply catches up with demand. In a practical business sense this probably not a realistic objective as other solutions, either from the actuarial community or the broader user (of actuarial services) community, will have been found.
- While the required level of new Actuaries to replace existing Actuaries who exit the profession is not known, it may be of the order of 1.5% – 2%. This (g)estimate reflects the historic growth of the profession so the numbers being replaced, on retirement at least, are comparatively small. This suggest the current 'gross' supply of new Actuaries is something like 3.1% +2% or about 5%. A 2% increase on a 5% base is significant
- Note that this requires an immediate 4% increase in Supply to achieve Demand in between 15 and 20 years, and an immediate 5% increase in Supply to achieve demand in between 10 and 15 years. Following on from the prior point, a 5% increase of Supply on 5% base, especially assumed immediately, is unrealistic.
- The assumption that Actuarial supply can be immediately increased is naïve as it takes both time and serious resource commitment to establish the necessary infrastructure to support this, and there is a travel time required before new Actuaries can emerge from the system. Then there remain the issues of further qualifications and/or experience requirements to consider.

6.2 Delay Increase in Supply by 5 Years

See Appendix C. Note that no delay in the increase in Demand is included.

Commentary:

- Now 2% increase in Supply takes 50 Years to match Demand
- A 5% increase in supply (from year 5) still take 20 years to match Demand

6.3 Delay Increase in Supply by 5 Years, and 0.5% Increase in Demand

See Appendix D. At first sight an increase in demand of only 0.5%, at a global level, may be considered disappointing!

Commentary:

- Now a 2% increase in Supply fails to reach Demand in 50 Years
- A 3% increase in Supply requires between 35 and 40 years to match Demand
- A 4% increase in Supply requires between 25 and 30 years to match Demand
- A 5% increase in Supply requires between 20 and 25 years to match Demand
- A 6% increase in Supply requires between 15 and 20 years to match Demand

7 Further Work

The above scenarios serve to give a sense of the scale of the issue, however they are only indicative.

There are many other factors which may influence both the actual outcomes for the profession and projections that may be made.

7.1 Actuarially Skilled, but not Fully Qualified Actuaries

The supply of people with actuarial skills, in contrast to those who are Fully Qualified Actuaries, is significant, at least in relation to the numbers for Actuaries. Those who have attained an 'Associate' actuarial qualification of some type are specifically included in this group.

On the premise that these people have appropriate roles to fulfil in a professional context, a similar pattern of over demand or under supply to that discussed above may be expected. The consequence of this is that the numerical gap between supply and demand will be larger.

There is significant failure rate on the path from Associate to Fully Qualified. While we have no hard data, anecdotally the view seems to be

that perhaps one third to one half of Associates become Fully Qualified. In terms of supply and demand this suggest that at the Associate level the issue is two to three times the numerical size it is at the Fully Qualified level.

To address these demands the numbers quoted above would need to also be multiplied by these factors of two or three. That would imply a shortage currently of up to perhaps a further 100,000 Associates.

We note that in terms of actuarially skilled people, we have only considered the situation in terms of professional qualifications received from professional associations. A further source of actuarially skilled people would be through routes that do not require certification from professional associations. For example, universities could develop degree programs specialising in actuarial areas, but not require or even seek the professional endorsement.

7.2 Actuarial Skill Level Required

The discussion here has implicitly presumed that to be a 'real' actuary a person should be a Fully Qualified Actuary. This view seems well entrenched in many of the established actuarial countries.

It valid to ask whether this is an appropriate position to hold. There is undoubtedly a need for high levels of expertise for some actuarial roles such as the traditional statutory roles in valuation and financial condition assessments etc. However, it does not logically follow from this that all Fully Qualified Actuaries should be trained to a level where they can take on these roles.

The profession may need to consider whether there is a legitimate role for a two (or even multi) tiered approach to the designation of 'Actuary'. In this context it is interesting to note that the United Kingdom profession has recently identified (UK Institute 2006) as one of the seven work streams of a strategic review, that:

> *'re-branding of the two tier actuarial qualification (currently 'Fellow' and 'Associate')* {is} *in order to increase the supply of actuaries'*

There is a potential risk in such reviews that the historic paradigms will remain entrenched with the result that the criteria for 'Actuaries' who are not Fully Qualified are not set with an external view of business need and suffer continual 'scope creep' toward the Fully Qualified level. This would be self defeating for the profession. This may be an issue of particular import in the context of the developing world (in an actuarial sense) in contrast to the developed world.

An analogy with the medical profession may be appropriate. It is well recognised that there are important and inter-linked roles for paramedics (of various forms and specialities), general practitioners and specialists. It is also accepted that these different roles require different skill sets and individuals may be better suited to particular roles.

7.3 Actuarial Disciplines

The discussion so far has not attempted to delve into the needs of particular actuarial disciplines - life insurance, non-life insurance, health insurance, pensions as the traditional ones, and expansion into investment, banking, risk management, or social security to name some less traditional areas.

While we recognise that this may be of interest and potentially of future value, data is not available (and may be hard to obtain). Also, the objective of this paper is to raise the issue of Actuarial Supply and Demand at the overall profession level.

7.4 Data Refinement and Checking

The analysis made relies on the one hand on an assessment of the numbers of Actuaries, and on the other on an assessment of economic wealth. These are the linked via the simple idea of 'actuarial density'. Like many things, the apparent simplicity of the approach may belie the complexity of obtaining data, especially if the approach is to be extended to more detailed analyses.

As noted earlier the data supplied by the IAA has been relied on without review. This should not be taken as criticism of the data provided, however there is an implicit recognition that if the purpose for which the data is/was requested were more carefully specified, there would then be an opportunity for the data to be reviewed and checked. However, it is unlikely that possible refinements of the IAA data would lead to materially different conclusions at the level of this paper. While growth rates based on three year's worth of data may be considered not to provide a good historical perspective, the real issue in what changes may occur in the future.

In the context of the GDP data used, Table 5.2 is very high data. Refinement to seek to reflect the differing rates of GDP growth in differing countries would be a natural progression. However this would need to be coupled with determining actuarial densities, and so actuarial numbers, and projected growth rates, and a national level as well. This may not be easy.

We also note that the World Bank GDP data converts local currencies into US dollars based on market exchange rates (MER). An alternate approach to conversion is to base it on a Purchasing Power Parity (PPP) approach. It is possible that these different approaches may lead to significantly projected different growth rates for economies (See PwC 2006). The MER approach lead to significantly lower economic growth rates for emerging economies than does the PPP approach. In this context the future Actuarial demand growth and the required increases in future supply to meet demand could be significantly understated.

It is worth noting that a cursory glance at World Factbook 2005 at estimated 2005 growth rates for individual economies shows that the emerging economies are expected to grow significantly faster than the

developed economies – for example the United States projection is 3.5% (and exceeds the rates for all the Common Law and Euro countries except South Africa), but the projections for China and India are 9.3% and 7.6% respectively.

7.5 Sensitivity – Especially Regarding Projections

The sensitivity of the projections made is demonstrated in section 6.3.

Particularly given the high level approach taken, care should be taken in placing too much reliance on specific results obtained. However the underlying message of the current chronic shortage of Actuaries at the global level and the scale of the effort needed to address this remains valid.

7.6 Success and Drop-out Rates

The analysis above has been focussed on outputs of the actuarial education system – Fully Qualified Actuaries in particular. From a solution perspective, it is equally important to focus on the inputs required to achieve these outputs.

Again, 'hard' data is difficult to obtain and so we have relied on 'softer' and more anecdotal data.

It is reasonable to assume that the success rate in achieving Associateships is of the order of one in two to one in three. By 'achieving' we mean reaching the qualification and we do not distinguish between the various causes of leakage which would include more than just the inability to meet the required standards. While increasing the persistence of capable students may be possible, it is unlikely to address the fundamental issues.

Similarly the success rate from moving from Associateship to Fully Qualified seems to also be of the order of one in two to one in three.

Overall this is supported by comments in Stevenson 2006 where it is suggested that, in the Australian context, of about 400 students entering accredited university programs each year, 50 - 60 then may go on to qualify as Fellows of the Institute of Actuaries of Australia (IAAust). This gives a total success rate of the order of one in seven or one in eight. The comments regarding Associateship above are also supported by the author's experience teaching the Actuarial Practice and Control (the basis for exemption for IAAust Part II) subjects at University of Melbourne since 2000.

To increase the output of Actuaries by a factor of 2 means we need to increase the number at the input ends by the same factor. To put this into context, to increase the number of Actuaries by 30,000 this implies there needs to be an increase in the number of entrants into the education process of something like seven or eight time this - say around 225,000. To achieve this in any sensible future time frame may be difficult.

7.7 Lag Times

It is anecdotally acknowledged that the travel time from entry into the education system to emergence as a Fully Qualified Actuary can take on average something like 6 to 8 years. This does not take into consideration the need to develop a significant amount of business experience. The importance of business experience is also generally acknowledged to be critical to the long term success of the profession.

Such long educational travel times imply there must be a significant lag time before the fruits of any initiative to increase Actuarial Supply will be seen (or plucked). The sort of impact this may have is illustrated in Section 6.2.

From the perspective of addressing the global lack of Actuarial supply these last two practical implementation issues, addressed here and in the prior section, must raise the question of whether there are alternative approaches available which travel through different paradigms than those currently in place.

7.8 Possible Mitigants

The above analyses have relied on data regarding full IAA members associations. Of the 11 nations in the world with populations of more than 100 million (WorldBank 2005) 6 are full member association of the IAA – India (with less than 200 Fully Qualified Actuaries reported in the Actuarial Society of India in 2005), United States, Indonesia (recently admitted and with 125 Fully Qualified Actuaries), Brazil, Japan, and Mexico (in decreasing order). The other five countries with population over 100 million, including one of the top two, are People's Republic of China, Pakistan, Bangladesh, Russia and Nigeria (in decreasing order).

There may be large actuarial education programs in place or planned in some or all of these countries. In particular, the Peoples Republic of China and India appear to be seeking to address their actuarial education issues.

Consequently, there is the potential that the analyses and conclusion drawn above may be mitigated by actuarial education programs in countries that are not (yet?) full members of the IAA.

Also, as noted earlier, there is also the possibility that actuarial training may be provided though other sources than professional bodies and may also be provided without the relevant actuarial association endorsements.

8 Conclusions

Approximately, globally, there are about 40,000 Actuaries and the estimated demand is for approximately twice this number. While the analysis made is high level and relatively simple and would benefit from refinement, the messages emerging seem clear. In particular, at a global

level, the traditional approaches to Actuarial education do not meet current demand, and are unlikely to be able to do so in the future.

The actuarial demand is almost entirely sourced from the so-called developing world, accepting that supply meets demand in the 'established' actuarial countries. From an actuarial perspective, the established actuarial 'factories' are currently very concentrated – over 80% of Actuaries belong to an association in the United States, United Kingdom, Canada Germany or Spain.

From the perspective of a global profession, there is a need for a rapid and sustained growth in the profession in order to meet this demand. This is both an opportunity and a threat to the global actuarial profession, depending on whether the challenge is met or not. From a regulatory and business perspective the need for Actuarial (and actuarial) skills is clear and acknowledged. If the profession does not fill the void, then it should be expected that others will.

Perhaps the size of the mismatch between Actuarial supply and demand suggests a need for some changes in thinking, approach and an increased urgency in developing solutions.

9 Acknowledgements

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Notwithstanding, any errors or omissions in the paper remain the responsibility of the author.

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Appendix A IAA Supplied Membership Data – By Association and by Location

#	Association Totals	FQA - 2005	FQA - 2004	FQA - 2003
1	Argentina	175	160	154
2	Australia	1,332	1,277	1,237
3	Austria	204	191	183
4	Belgique	398	353	353
5	Brazil	601	506	460
6	Canada	2,660	2,590	2,499
8	Cyprus	20	20	20
9	Czech Republic	56	53	50
10	Denmark	302	324	324
11	Egypt	9	9	9
12	Estonia	7	17	17
13	Finland	93	100	100
14	France	1,484	1,523	1,401
15	Germany	2,229	2,050	2,050
16	Greece	83	83	77
17	Hong Kong	233	195	197
18	Hungary	85	80	129
19	Iceland	18	18	18
20	India	194	165	199
21	Republic of Ireland	349	325	303
22	Israel	100	210	86
23	Italy	210	100	193
24	Japan	1,051	1,013	979
25	Japan	386	367	353
26	Latvia	17	17	17
27	Lebanon	10	8	6
28	Malaysia	52	42	42
29	Mexico	357	280	191
30	Netherlands	740	717	736
31	New Zealand	153	159	149
32	Norway	240	240	202
34	Philippines	64	59	59
35	Poland	77	66	66
36	Portugal	104	100	106
37	Puerto Rico	24	24	22
38	Singapore	81	67	65
39	Slovenia	36	35	27
40	South Africa	459	481	444
41	Spain	384	392	330
42	Spain	1,450	1,400	1,300
43	Sweden	192	159	160
44	Switzerland	422	379	379
45	Republic of China (Taiwan)	153	145	138
46	United Kingdom	1,250	1,201	1,185
47	United Kingdom	6,416	6,057	5,915
48	United States	14,959	14,533	14,590
49	United States	56	50	55
50	United States	2,635	2,537	2,354
51	United States	848	830	796
52	United States	10,382	10,033	9,723
	TOTALS	53,840	51,740	50,448

The following totals are by location of individual Fully Qualifies Actuary from the full member associations (in contrast total by association membership)

	COUNTRY	COUNTRY TOTAL
1	NO COUNTRY	1,850
2	Andorra	8
3	Argentina	190
4	Australia	1,237
5	Austria	198
6	Bahamas	5
7	Bahrain	4
8	Bangladesh	2
9	Barbados	10
10	Belgique	465
11	Bermuda	113
12	Botswana	2
13	Brazil	653
14	Cameroon	3
15	Canada	2,429
16	Cayman Islands	1
17	Chile	5
18	China	56
19	Colombia	1
20	Côte D`Ivoire	1
21	Croatia	49
22	Curacao	7
23	Cyprus	19
24	Czech Republic	57
25	Denmark	291
26	Ecuador	1
27	Egypt	8
28	Estonia	17
29	Finland	124
30	France	1,874
31	Germany	2,451
32	Gibraltar	1
33	Greece	76
34	Guyana	2
35	Hong Kong	297
36	Hungary	137
37	Iceland	18
38	India	148
39	Indonesia	7
40	Ireland	392
41	Israel	105
42	Italy	247
43	Jamaica	16
44	Japan	1,058
45	Kenya	5
46	Kuwait	1
47	Latvia	16
48	Lebanon	9
49	Liechtenstein	1

50	Luxembourg	22
51	Malaysia	40
52	Malta	2
53	Mauritania	1
54	Mauritius	10
55	Mexico	404
56	Moldova	1
57	Monaco	2
58	Morocco	5
59	Namibia	3
60	Netherlands	863
61	New Zealand	127
62	Niger	1
63	Nigeria	4
64	Norway	257
65	Oman	1
66	Pakistan	22
67	Philippines	76
68	Poland	11
69	Portugal	122
70	Puerto Rico	31
71	Russian Federation	1
72	Saudi Arabia	1
73	Singapore	113
74	Slovakia	1
75	Slovenia	36
76	South Africa	690
77	South Korea	21
78	Spain	1,495
79	Sri Lanka	1
80	St Vincent and Grenadines	1
81	Suriname	5
82	Sweden	307
83	Switzerland	526
84	Taiwan	199
85	Tanzania	1
86	Thailand	15
87	Trinidad and Tobago	18
88	Tunisia	1
89	Turkey	3
90	United Arab Emirates	2
91	United Kingdom	6,029
92	United States	16,672
93	Uruguay	1
94	Venezuela	1
95	Vietnam	8
96	Zimbabwe	4
	Grand Total:	**42,824**

Appendix B Printouts From Projection Spreadsheet – Section 5.1

Blue items are inputs, black items are either labelling or computed.

	Actuarial Supply						Actuarial Demand	
Current		42,700						73,700
		3.10%						3.70%
Add%		0.00%	0.50%	1.00%	1.50%	2.00%		0.00%
Years	**Apply Add%**	3.10%	3.60%	4.10%	4.60%	5.10%	**Apply Add%**	3.70%
0								
5	1	49,742	50,960	52,201	53,467	54,757	1	88,381
10	1	57,945	60,817	63,817	66,949	70,219	1	105,988
15	1	67,501	72,581	78,017	83,831	90,047	1	127,101
20	1	78,632	86,621	95,377	104,969	115,473	1	152,420
25	1	91,600	103,376	116,599	131,438	148,080	1	182,783
30	1	106,706	123,373	142,544	164,581	189,893	1	219,195
35	1	124,303	147,238	174,262	206,080	243,513	1	262,860
40	1	144,802	175,719	213,038	258,045	312,274	1	315,223
45	1	168,682	209,709	260,442	323,112	400,452	1	378,017
50	1	196,499	250,274	318,394	404,587	513,527	1	453,320

	Actuarial Problem = Difference = Demand - Supply				
Current	31,000				
	0.00%	0.50%	1.00%	1.50%	2.00%
Years					
5	38,640	37,422	36,180	34,914	33,624
10	48,043	45,171	42,171	39,039	35,769
15	59,600	54,520	49,084	43,270	37,054
20	73,788	65,799	57,043	47,451	36,947
25	91,183	79,407	66,184	51,346	34,703
30	112,489	95,822	76,650	54,614	29,302
35	138,557	115,622	88,597	56,779	19,346
40	170,421	139,504	102,185	57,178	2,948
45	209,336	168,308	117,575	54,905	-22,434
50	256,821	203,046	134,927	48,733	-60,207

Years	**Diff as % Demand**	**Diff as % Demand**	**Diff as % Demand**	**Diff as % Demand**	**Diff as % Demand**
0	42.1%				
5	43.7%	42.3%	40.9%	39.5%	38.0%
10	45.3%	42.6%	39.8%	36.8%	33.7%
15	46.9%	42.9%	38.6%	34.0%	29.2%
20	48.4%	43.2%	37.4%	31.1%	24.2%
25	49.9%	43.4%	36.2%	28.1%	19.0%
30	51.3%	43.7%	35.0%	24.9%	13.4%
35	52.7%	44.0%	33.7%	21.6%	7.4%
40	54.1%	44.3%	32.4%	18.1%	0.9%
45	55.4%	44.5%	31.1%	14.5%	-5.9%
50	56.7%	44.8%	29.8%	10.8%	-13.3%

Appendix C Printouts From Projection Spreadsheets – Section 5.2

Blue items are inputs, black items are either labelling or computed.

		Actuarial Supply					Actuarial Demand	
Current		42,700						73,700
		3.10%						3.70%
Add%		0.00%	2.00%	2.50%	3.00%	5.00%		0.00%
Years	**Apply Add%**	3.10%	5.10%	5.60%	6.10%	8.10%	**Apply Add%**	3.70%
0								
5	0	49,742	49,742	49,742	49,742	49,742	1	88,381
10	1	57,945	63,787	65,319	66,880	73,426	1	105,988
15	1	67,501	81,799	85,775	89,924	108,387	1	127,101
20	1	78,632	104,897	112,637	120,907	159,995	1	152,420
25	1	91,600	134,516	147,911	162,566	236,176	1	182,783
30	1	106,706	172,500	194,231	218,578	348,629	1	219,195
35	1	124,303	221,209	255,058	293,889	514,626	1	262,860
40	1	144,802	283,672	334,933	395,148	759,662	1	315,223
45	1	168,682	363,772	439,823	531,296	1,121,370	1	378,017
50	1	196,499	466,491	577,561	714,354	1,655,303	1	453,320

	Actuarial Problem = Difference = Demand - Supply				
Current	31,000				
	0.00%	2.00%	2.50%	3.00%	5.00%
Years					
5	38,640	38,640	38,640	38,640	38,640
10	48,043	42,200	40,668	39,107	32,562
15	59,600	45,302	41,326	37,177	18,714
20	73,788	47,524	39,784	31,513	-7,575
25	91,183	48,267	34,873	20,218	-53,392
30	112,489	46,695	24,963	617	-129,434
35	138,557	41,651	7,802	-31,029	-251,767
40	170,421	31,551	-19,710	-79,925	-444,439
45	209,336	14,245	-61,806	-153,279	-743,353
50	256,821	-13,171	-124,240	-261,034	-1,201,982

Years	**Diff as % Demand**	**Diff as % Demand**	**Diff as % Demand**	**Diff as % Demand**	**Diff as % Demand**
0	42.1%				
5	43.7%	43.7%	43.7%	43.7%	43.7%
10	45.3%	39.8%	38.4%	36.9%	30.7%
15	46.9%	35.6%	32.5%	29.3%	14.7%
20	48.4%	31.2%	26.1%	20.7%	-5.0%
25	49.9%	26.4%	19.1%	11.1%	-29.2%
30	51.3%	21.3%	11.4%	0.3%	-59.0%
35	52.7%	15.8%	3.0%	-11.8%	-95.8%
40	54.1%	10.0%	-6.3%	-25.4%	-141.0%
45	55.4%	3.8%	-16.4%	-40.5%	-196.6%
50	56.7%	-2.9%	-27.4%	-57.6%	-265.2%

Appendix D Printouts from Projection Spreadsheets – Section 5.3

Blue items are inputs, black items are either labelling or computed.

		Actuarial Supply					Actuarial Demand	
Current		42,700						73,700
		3.10%						3.70%
Add%		2.00%	3.00%	4.00%	5.00%	6.00%		0.50%
Years	**Apply Add%**	5.10%	6.10%	7.10%	8.10%	9.10%	**Apply Add%**	4.20%
0								
5	0	49,742	49,742	49,742	49,742	49,742	1	90,533
10	1	63,787	66,880	70,092	73,426	76,886	1	111,210
15	1	81,799	89,924	98,768	108,387	118,842	1	136,610
20	1	104,897	120,907	139,176	159,995	183,693	1	167,812
25	1	134,516	162,566	196,115	236,176	283,933	1	206,139
30	1	172,500	218,578	276,349	348,629	438,874	1	253,221
35	1	221,209	293,889	389,408	514,626	678,365	1	311,055
40	1	283,672	395,148	548,722	759,662	1,048,546	1	382,099
45	1	363,772	531,296	773,215	1,121,370	1,620,732	1	469,369
50	1	466,491	714,354	1,089,551	1,655,303	2,505,157	1	576,572

	Actuarial Problem = Difference = Demand - Supply				
Current	31,000				
	2.00%	3.00%	4.00%	5.00%	6.00%
Years					
5	40,791	40,791	40,791	40,791	40,791
10	47,423	44,330	41,118	37,784	34,325
15	54,811	46,686	37,842	28,223	17,769
20	62,915	46,904	28,636	7,816	-15,881
25	71,623	43,573	10,024	-30,036	-77,794
30	80,721	34,643	-23,128	-95,408	-185,654
35	89,846	17,167	-78,353	-203,571	-367,310
40	98,427	-13,049	-166,623	-377,563	-666,447
45	105,597	-61,927	-303,845	-652,001	-1,151,363
50	110,081	-137,782	-512,979	-1,078,731	-1,928,585

Years	**Diff as % Demand**	**Diff as % Demand**	**Diff as % Demand**	**Diff as % Demand**	**Diff as % Demand**
0	42.1%				
5	45.1%	45.1%	45.1%	45.1%	45.1%
10	42.6%	39.9%	37.0%	34.0%	30.9%
15	40.1%	34.2%	27.7%	20.7%	13.0%
20	37.5%	28.0%	17.1%	4.7%	-9.5%
25	34.7%	21.1%	4.9%	-14.6%	-37.7%
30	31.9%	13.7%	-9.1%	-37.7%	-73.3%
35	28.9%	5.5%	-25.2%	-65.4%	-118.1%
40	25.8%	-3.4%	-43.6%	-98.8%	-174.4%
45	22.5%	-13.2%	-64.7%	-138.9%	-245.3%
50	19.1%	-23.9%	-89.0%	-187.1%	-334.5%