Actuaries Institute

CONFERENCE PAPER

Big data and the digital economy:

Benefits and pitfalls in the insurance industry

For delivery at the 'Economic implications of the digital economy' joint conference hosted by the Australian Bureau of Statistics and Reserve Bank of Australia, 9-10 March 2022, Sydney

Elayne Grace
CEO Actuaries Institute

Elayne Grace is the Chief Executive of the Actuaries Institute, the professional body representing actuaries in Australia. The Institute oversees education qualification and lifetime learning for the profession, sets professional standards and is a key contributor to public policy across the broad range of sectors in which actuaries have expertise. Elayne's drive has resulted in key research into aged care, big data, climate change, governance, longevity risk and retirement, mental health, and intergenerational equity.

Elayne has 25 years' international experience with leading consulting firms and major insurers, including as a leader of some of the earliest collaborations between business, scientists and NGOs on climate change and risk. She has provided strategic, economic and financial advice on mergers and acquisitions, valuations, product development, strategy development, international governance and emerging risks. She has been an adviser on a Commonwealth Treasury expert panel and to the Indigenous Land Corporation Board on the long-term sustainability of its investments.

She has been recognised in The Australian Financial Review 100 Women of Influence (2019) awards and Voice Project Best Workplace (2021) awards for exceptional levels of employee engagement and satisfaction. Elayne is a graduate of the Australian Institute of Company Directors and a Fellow of the Institute of Actuaries and of the Institute and Faculty of Actuaries (UK).

Contents

Executive summary

In 2022, the transformation of Australia's economy and more businesses into data businesses is introducing a new world order. More businesses are reliant on data, analytics and Artificial Intelligence (AI). This shift reflects the fact that every company is, in many ways, a data and analytics company.

As Forbes magazine stated two years ago when Nike hired a tech executive to head the global sportwear brand: '...this has been widely seen as a signal that Nike … is becoming a tech company, or more specifically, … "a tech company that happens to sell shoes and apparel"'.[1]

Since at least the 18th century[2], actuaries (often referred to as the original data scientists) have used data, statistics, commercial acumen and, more recently, computing power and algorithms to support businesses. But actuaries are also well placed to ask: what are the implications when digitalisation becomes ubiquitous? Our professional standards require us to consider the public interest. In excitement over what is possible, people sometimes forget to ask: 'just because we can, should we?'

Data can help us understand behaviour, predict outcomes, assess risk, manage financial uncertainty and ensure the value chain equitably represents risk, cost and efficiencies. It allows for the frictionless transfer of information, underpinning fully competitive markets. It allows for deeper understanding of the driving forces behind sustainability; it is a catalyst for innovation and the growth of new sectors.

When we talk about AI and machine learning algorithms that are critical to enabling digitalisation, we know that extremely complex patterns in data, which humans might find challenging or impossible to uncover, can transform lives for the better. Data can influence every sector of the economy, from retail, critical infrastructure like energy, telecoms and public transport, to financial services and social structures like superannuation and disability and health insurance, changing lives.

1 Orad (2020).
2 In 1762 the Society for Equitable Assurances on Lives and Survivorship (now Equitable Life) was formed in London and used a scientifically based and mathematically calculated premium rating system for long-term life insurance policies.

But what is acceptable as risks are shifted?

While actuaries work in many of sectors of the economy, this paper focuses on insurance as there are ready case studies to draw upon and make the public policy issues come alive. For example, how do we ensure that an insurance company, using data from a telematic device, prices a higher-risk provisionally licensed (p-plate) driver appropriately?

Should the insurer use premium price signals? Should the insurer tell the contract holder (usually the parent) about risky driving? What is the right mix of signals that results in less risky behaviour, while privacy is maintained? What happens when consumers cannot control all their risks? Should they be priced out of markets? Or subsidised? By whom?

Even within insurance the challenges differ by line of business. The issues in life insurance with data from genetic testing differ from those to using data from social media feeds, and those differ again to the challenges in home buildings insurance and climate change.

The bigger the data, the more safeguards Australians will need. There are important questions around fairness and equity that we must address. The opportunities are vast. We are optimistic.

The velocity at which the market is developing should not be an impediment, but a speed bump along the road. The Institute is exploring how the benefits of digitalisation can be harnessed while minimising the harms. This is not a trivial task.

As actuaries we urge:

- a review of the legal framework around the digital economy. We recommend an expert group be convened to discuss and develop a consensus on what broad principles need to be enshrined in law – and, importantly, what guidance needs to be provided to firms, consumers and professions;
- mechanisms that ensure standards remain broadly aligned with social norms and expectations;
- business cultures that are tailored to the responsible use of data and digital technologies;
- care and consideration for the 'haves' and 'have-nots', or those excluded from the digital economy –

businesses, in terms of their capability to use and access data, and consumers in terms of the quality of their digital identity and their ability to use this in the modern economy; and

- safety nets for vulnerable members of society, including those excluded from the digital economy. Consumers cannot control all risks.

Digital transformation affords Australians unparalleled opportunities. Incumbent upon us is maximising the benefits for society as we embrace those opportunities.

Context 1

Digitalisation is a vast topic, as evidenced by the breadth of the sessions and papers at this conference. As such this paper is necessarily high level. We focus on digitalisation in terms of big data (the input, Section 2), algorithms and data analytic techniques, key new tools for businesses and agencies to optimise their operations (Section 3), the wholesale repricing of risk that big data can cause (a major consequence, Section 4), and the increasing use of the internet and other digital channels as an enabler (for innovation including customer fulfilment, Section 5). This degree of change also necessitates a discussion about consumer expectations and protections and regulatory implications (Section 6). These are the immediate and most prominent manifestations of digitalisation encountered by actuaries with implications for consumers. They raise numerous important public policy issues, some of which we discuss, noting that proper analysis of each issue could be an extensive paper in itself.

Digitalisation is ubiquitous. The digital economy is bringing new business models, new social norms and new partnerships. Although many actuaries are integrally involved in retail, loyalty programs, energy, telcom and government services, this paper focuses largely on the implications in life and general insurance. While it does so mostly with a consumer lens, this necessarily includes implications for businesses in those sectors and for government (as insurance goes to the heart of public resilience).

Actuaries are often referred to as the 'original data scientists'. Since at least the 18th century, the profession has been critical to insurance companies by using data, statistics, commercial acumen and – in more recent decades – modern computing power and algorithms. Actuarial foundations have made us well placed to take advantage of this new era. Actuaries have also played an important risk management role in organisations, including in prudential and regulatory roles in the financial sector.

Actuaries are heavily involved in digital innovation and very enthusiastic about the changes this can bring to our economy and the significant benefits on offer. Our professional standards require us to consider the public interest and therefore we seek to consider the ethical and public policy implications of this new digital economy. A greater awareness now exists that the potential harms

of digitalisation, and particularly Artificial Intelligence (AI) systems and other forms of automation, need to be managed.

The Institute is exploring how the benefits of digitalisation can be harnessed while minimising the harms. This is not a trivial task.

Understanding harms is particularly complex. It includes understanding if some are unavoidable or affect communities differently. Where these must be traded-off, it requires consideration of how to strike a 'fair' balance. Wide stakeholder input is required to assess what is considered 'fair'.

Understanding benefits is also challenging, especially if the benefits are not foreseeable, as is often the case with technological innovation.

All stakeholders must keep up with the sheer pace of change and diversity of skills required to properly consider these challenges. We must act with pace and work together to ensure there is a strong public policy infrastructure striking the right balance of harnessing benefits and minimising harms.

This paper poses many questions and issues, and some guidance on areas that need to be considered as potential solutions are created. This is deliberate – solutions to many of these issues are challenging and must involve multiple stakeholders of which we are but one. We hope by highlighting some areas we consider important this may help work towards solutions that improve societal outcomes.

Managing data in a 'big' world 2

Popularised as 'Big data', the last decade has seen a massive increase in the volume, velocity and variety of data sets available to be accessed, linked, shared and used. This opens opportunities for new business models, partnerships, social expectations and delivery of data-driven decisioning systems which were hypotheticals only five years ago. It also introduces the risk of 'outages' and cyber attacks with ransom attacks happening every 11 seconds compared to every 40 seconds just a few years ago.[3] A change in mindset about data is becoming essential.

2.1 Can you have too much data?

Perhaps the most significant social change in the big data era has been the ownership and analysis of big data by well-funded organisations and the reduction – in some cases removal – of historical data scarcity. Certainly data, or lack of access to it, has historically been a key commercial differentiator in general and life insurance. The collection of data was difficult, storage expensive, and analysis manual and time consuming. This meant data was scarce and valuable and our attitudes tended to reflect this – more data was usually seen as a good thing, if only one could get it.

This has now fundamentally changed. In the modern era, we are instead faced with the prospect of almost limitless volumes and types of data, readily available, reused and processed at almost zero cost. If the data we need does not exist, we are usually able to collect it. The possibilities are endless.

Since we are no longer in a position of scarcity, this requires a mindset shift from users of data. In an era of abundance, rather than seeking ever more data, we need to instead start asking ourselves which new data should be collected?

In our excitement over what is now possible, we often forget to ask such a 'big' question. It must be asked, not just by the regulators or Chief Data Ethics Officers, but by all practitioners of data. Just because something is technically possible, this does not mean it ought to be created – we must always be asking 'should we', as well as 'can we', particularly when 'can we' is now so often a 'yes'.

3 Morgan (2020).

2.2 Challenges of integrity

Today's digital economy produces vast troves of data which are used in all sorts of ways to understand behaviours, predict outcomes, assess risk and manage financial uncertainty to help ensure the value chain for all types of goods and services is efficient and effective.

Previously untapped sources of data provide new powerful and insightful inputs into decision-making that stakeholders have never had before. Examples include:

- data from telematics devices and smart devices are increasingly used by insurers to better understand the risk of an individual consumer in motor and life insurance[4];
- data gleaned from satellites is informing home insurer assessments of natural disaster risk[5];
- private proprietary financial transaction data is being used to enrich the understanding of the characteristics of a market[6]; and
- discrete data sets are being matched to get a holistic view of customers, sometimes longitudinally, from anywhere in the consumer staples and discretionary sectors through to government services (which by nature are often insurance-like)[7].

Clearly the possibilities for adding further data sources as inputs are almost endless in a digitalised environment. But the age-old issues around accuracy, validity and reliability remain fundamental to ensuring model – and hence decision – integrity. 'Garbage-in-garbage-out' is reinforced, not removed, as the world becomes more data driven.

Data integrity is perhaps one of the largest challenges to the responsible adoption of new data sources in decisions. While some new data sources may be of excellent integrity, some will not, and this may not always be obvious. Take the above telematic example, which shows how easy it is to get inaccurate readings. A phone may be dropped within a car, but this accelerometer reading does not mean the car has crashed. A person may have gaps in their smartwatch data when they forget to wear it at the gym, but the exercise has still occurred. Or alternatively, a person may attempt deliberate fraud – asking another person to wear their smartwatch when on a run. Other examples abound. It is far from clear that new sources of data are always of sufficient integrity to be used for material decisions. Care is needed; lack of integrity is not easily identified, and regularly requires cross-functional teams to collaborate.

As data becomes more readily available, the prospect of accidental incorrect use increases. While this is effectively a problem of integrity, it is also central to the care that data users need to take, and show they are taking, to understand what the data is representing. Definitions of what at face value is the same variable may differ between similar datasets, or alternatively users may ascribe their own incorrect inference on what the data represents.

For example, recording and using as data a sale to a consumer following a direct marketing campaign does not necessarily mean that the sale was caused by the campaign – the person may have been intending the purchase anyway. Using that model to determine the value of future campaigns could lead to value destruction. In this case, the sale data did not represent the information it was purported to represent (positive campaign influence on a consumer).

Data integrity is integral to driving value from big data. Without a conscious effort to validate integrity, increased data may hinder rather than help effective decision-making. At worst, this may lead to incorrect decisions that destroy organisational value and, potentially, cause consumer harm.

4 For example, Youi motor insurer is using telematics to inform its risk assessments and AIA is using data from smartwatches to inform its risk assessment of customer lifestyle.

5 Some insurers use currently available weather data for parametric insurance policies. The final recommendations of the Royal Commission into National Natural Disaster Arrangements included calls for greater provision of more granular weather data. The Government's response included tasking these to a new National Recovery and Resilience Agency. Further details of specific desirable information for insurers is included in Actuaries Institute (2020a).

6 Companies such as Quantium aggregate customer financial transaction data to draw such insights. An application to public policy is provided in Actuaries Institute (2020d) to gaining insights about the gig economy. Further information is in Appendix A.

7 Under the NSW Government Data Strategy, the State Government has connected data from different sources to assist in its COVID-19 pandemic management. Another example is the investment valuation approach, which relies on longitudinal time series data sets about how individuals have accessed different government services and the outcomes that have followed, and is now embedded in the work of the Department of Social Services at the Commonwealth level and in some State government agencies. Further details are provided in Appendix B.

2.3 Sharing of data

Once data is collected, we must also ask questions such as: Who owns the data? Who can utilise the data, and for what purpose? How should it be collated and shared more widely?

At a minimum, it requires consideration of intellectual property ownership of the data and, potentially, the facts that the data pertain to. Equally, consideration should also be given to whether sharing of it can improve (or detrimentally impact) the wellbeing of particular members of society, or society as a whole.

The Consumer Data Right in Australia is one example of how this might be solved – placing the power in the hands of the consumer as to whether their data is shared and with whom. Similar regimes are emerging around the world, though they are generally still at an early stage of implementation.

While many such regimes focus on the consumer's own data, or products built on that data, they expose important fairness questions. As the open data movement is also being explored in the public sector in many countries, monitoring will be required to balance the benefits and risks and see it emerge as successful. Putting some form of choice and control in the hands of the consumer about their own data and its use is critical. Educating our society to actively manage that is a key part of that choice and control.

As a general principle, the Institute supports enhanced access to public and private data, provided suitable safeguards are in place. There are numerous broad economic advantages that could be fostered by expanding access to data.

In general, competition and innovation are fostered in environments where there is frictionless information, deep understanding of risk and opportunity, and freely available channels for engagement and product or service delivery. The extent of current Fintech and Insurtech activity is illustration of this in action.

Expanding access to data also strengthens policy efficacy. Public policy effectiveness is ultimately tested on evidence and evidence accumulates in data. Where data is not collected or partial, policy impacts can only be hypothesised or approximated. Improving access to data can provide feedback loops to fine-tune policy, faster. Sharing of government data and modelling, in a suitably deidentified manner, also fosters constructive policy debate. It should also deliver a more personalised, relevant and timely experience for the public.

2.4 Regulating the use of data

With the increased availability of data, it is easy to fall in the trap of thinking that data can, and should, be used for any purpose. However, from a consumer perspective, and overall societal fairness, issues around privacy, anti-discrimination and more generally responsible use are crucial to ensure the sustainability and responsible use of data.[8]

Societal norms and expectations and the legal frameworks at any point in time set some of these boundaries. But as evidenced by the conclusions of the Royal Commission into Misconduct in the Banking, Superannuation and Financial Services Industry, the minimum standard is not in itself sufficient because the legal framework can lag societal norms and expectations.

The general use of principles-based regulation in Australia stands us in good stead. This form of regulation will not necessarily need substantial refinement for a digital era, although minor adjustments might be required. The challenge for regulators is to ensure that there is suitable guidance about the interpretation of regulatory principles in novel, untested situations. With the speed of innovation, it will not be sufficient to wait for case law to emerge – proactive and well-considered guidance is a must. Without this, practitioners will be left to resolve challenging questions alone, which raises risks of consumer harm.

These challenges can be illustrated by considering, for example, the data available under the Consumer Data Right, and which is set to be expanded across many other sectors in time. Users of such data should ask: what is fair to assume about the risk profile of those consumers who do not share their data? Adverse selection suggests they will be higher than average risk, but is that accurate? If not, can any benefit be given to those who opt-in? Some consumers may have deep seated privacy concerns for reasons other than their riskiness and the bigger the data, the more safeguards Australians will want and deserve to protect against potential harms. Other consumers may not share their data because they genuinely do not have

8 Local actuaries have been actively considering these questions in recent times. For example, a detailed discussion of discrimination is provided in Actuaries Institute Anti-Discrimination Working Group (2020), and Dolman et al (2020) reflect on when and whether data ought to be used for insurance pricing.

any (for example, all the financial history is in the name of one partner and the other partner becomes penalised for this lack of history due to separation or divorce). These are non-trivial possibilities.

In the absence of clear guidance, current societal expectations and careful consideration of how data is intended to be used should be considered to align with commonly held principles of fairness or other ideals. Common suggestions include:

- testing of concepts with customers prior to launch of a solution, which may involve the use of officially sanctioned 'regulatory sandboxes';
- transparency to the consumer of the data being collected and how it will (and will not) be used, or how it affects a decision;
- an opportunity for redress if the consumer feels aggrieved by a particular use or future use of data;
- allowance for each of the business/agency and customer to correct any errors in the data that they identify; and
- careful consideration of existing regulatory principles and their potential application in the new context.

Algorithms and new data analytic techniques 3

A critical enabler of the recent explosion in digitalisation, particularly personalised digital interactions, has been the use of machine learning and AI. By these terms, we generally mean the programming of software able to automatically generate predictive models, and predictions, using data. At the more sophisticated end of the scale, this involves models that automatically improve over time as new data emerges and may intervene in the environment in specific ways to maximise a stated goal.

Such techniques are different to those traditionally used, which were adapted from (primarily) traditional statistics and econometrics. However, as machine learning and AI techniques have flourished in the last decade, actuaries are leveraging them and leading the way to support their clients and employers with optimised outcomes.

3.1 Potential benefits

There are three general benefits from machine learning and AI techniques.

- The automation of analysis allows unstructured datasets of increasing size and complexity to be used. At a certain level of complexity, traditional techniques may be non-viable in any reasonable time. Related, the automation of analysis can allow automatic updates to systems operating in-market, rather than relying on ad hoc model updates.
- Many machine learning algorithms can discover extremely complex patterns in data, which a human being may find challenging, or impossible, to attempt to specify in traditional analysis.
- These techniques can be used to drive automated decision-making at more granular and faster speeds, as opposed to traditional approaches that would have to apply to a wider cohort of customers and often at a point in time detached from the consumer need being triggered.

The benefits have allowed insurers to leverage data from smart devices, aerial imagery and photographs, and raw text input from claims forms, to create benefits for the

industry and consumers. In a typical insurance company such unstructured data is usually untapped but makes up over 90% of all available internal data.[9]

3.2 Potential harms

There are notable downsides from the use of machine learning and AI systems.[10]

- Opacity and lack of explanation is a common criticism and undermines trust, a foundation of all well-functioning markets. While the field of 'explainable AI' has dramatically expanded in recent years, in many cases AI systems are still regarded as a 'black box' and viewed with suspicion. It may take more time and research effort to solve this problem adequately. In the interim the lack of acceptable explanations may cause challenges for high stakes consumer interactions common in financial services.

- AI systems may be more likely to overstep the boundaries of what is acceptable to society. Notable has been the significant recent debate over bias and discrimination resulting from AI systems, though we suggest many of these questions around discrimination were valid questions to ask prior to the emergence of AI, but have been exacerbated by AI.

- AI systems may distort power dynamics in interactions, for example by the use of personalised and optimised 'nudges' to consumers within an interaction. While traditional personalised nudges like advertising (for example targeted mail-outs) are generally accepted, there is likely to be a point at which a highly personalised behavioural nudge becomes socially unacceptable. We suggest this point is not yet well understood.

In general, the emergence of new techniques represents an exciting time. As these tools become increasingly available to non-technical teams, it is critical to understand the risks and ethical considerations associated with out-of-the-box solutions. We encourage considered adoption of them, particularly in areas of potentially significant decisions, such as those found in financial services.

9 CIO (2019).

10 An additional risk to those listed below are Environmental, Social and Governance risks, including the carbon footprint of the computing power required, the mining of the rare earth minerals, and labour practices for those working in data collection, storage and analysis.

The wholesale re-pricing of risk 4

The greater amount and granularity of data is driving a better understanding of a customer's risk profile. This has implications for insurers, their customers, regulators and government. By better understanding a customer's risk profile, insurers will be able to provide more closely tailored, and more accurately priced, products. This means that risks which used to be priced equally – due to a lack of data – may now not be, subject to regulatory pricing constraints.

4.1 Consequences

In an insurance context there are important consequences.[11]

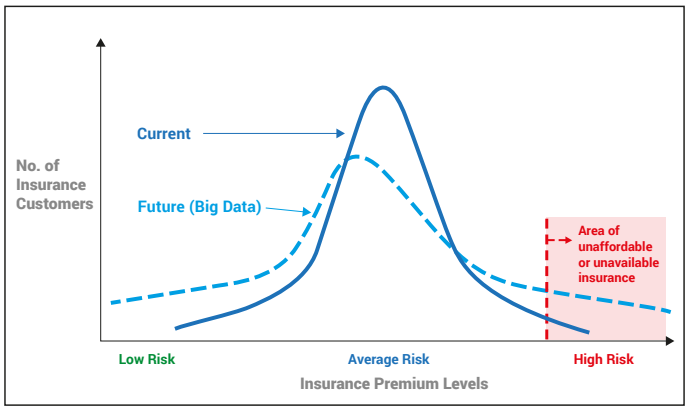
- A greater dispersion of risks and premiums: with no data to estimate risk, all estimates are set at the mean. As more data emerges, a more accurate estimate of risk can be made, and so estimates disperse away from the mean towards their true distribution of values. The emergence of big data will increase this dispersion, which has been occurring for many years already. This is depicted in Figure 1.

- Better risk signaling and potentially lower overall risk: Insurers can feedback the data and the implications of it to customers to allow them to modify their risk (where this is possible and consistent with societal appetite for such nudges). This is depicted as the shifting of the curve to the left in Figure 1.

- Some consumers are excluded from insurance: There will be a growing number of customers for whom insurance becomes less affordable and, as a consequence, they under-insure or do not insure at all. If the risk exceeds the risk appetite for all insurers, insurance will become unavailable. All these circumstances describe customers in the red shaded area in Figure 1. For some of these adversely affected customers, this consequence will be beyond their control because externalities have generated the repricing.

11 A detailed discussion is provided in Actuaries Institute (2016).

Figure 1: Spread of Insurance Premiums



Important public policy questions arise in determining appropriate policy responses for these second and third consequences.

4.2 Risk signaling

More acute analysis of data provides insurers with a lens to more accurately identify the risks that individual customers may be facing and use this to set prices accordingly.

Economic theory suggests that prices of goods or services can be used to influence behaviour. In Insurance we see this through signalling the effect risk mitigating actions will have on premiums. This is the most obvious and long used practice in the insurance industry. For example, customers may be offered a premium discount for having a more bushfire resistant roof or a discount on motor vehicle premiums for car safety features.

There is a balance to be found where the risk cannot be controlled by the customer. While this is not a new problem, greater availability of data raises the prospect of more situations where uncontrollable risks might be identified, priced for in detail and result in what may be perceived as 'unfair' pricing. We discuss this in more depth in Section 4.3.

Given the development in connected devices and the Internet-of-Things (IoT), educating and signaling through early client warning systems by leveraging the insights from real time customer behaviour and connected devices can deliver huge benefit. Some complexities will, however, need to be thought through. For example:

- Telematics in motor insurance: Latest technological advances allow for a driver's every turn, acceleration and braking behaviour to be tracked. This provides an opportunity to educate drivers on safer and potentially less aggressive driving behaviors, and to reward improved behaviour once it is observed. However, questions arise on whether this information should be provided, for example, to the provisional (P-plate) license driver or to the insurance policy holder (potentially the driver's parent) as that is who the insurer has the contractual obligation with? Or should the insurer simply use monthly price signaling adjustments without detailed feedback? What is the right mix of signals that helps yield the risk reduction benefit, without creating new risks and overstepping reasonable expectations around privacy?

- Use of social media in life insurance: Other contentious decisions involve data around personal health and/or use of newer types of data, such as social media posts and financial transaction data. For example, should a life insurer signal suggestions for risk reduction to a policyholder if it observes from these types of data what it assesses as a 'risky' lifestyle? This may be considered an invasion of privacy by some (even though people often reveal their private data voluntarily through social media or by agreeing to accept contractual terms and conditions that allows sharing of their personal information). The availability of new data and its use will test society's willingness to accept the efficiency benefits compared to privacy considerations.

The challenge to all stakeholders is to define more clearly the boundaries of acceptable risk signaling so society can yield the benefits of risk reduction which will come from more knowledge. These benefits are both tangible (lower expenditure on premiums and less physical damage) and intangible (improved health and mental wellbeing from less damage). However, these benefits will not be realised if society rejects these systems wholesale, due to a lack of willingness, safeguards and/or other reasons.

4.3 Policy responses for the under- and un-insureds

As illustrated in Figure 1, the sophisticated analysis of large data sets will create significant issues of insurance access and affordability. However, society is not always comfortable with individuals paying a 'fair price' for insurance if that means affordable access to insurance is not available to many.

Government may have a role to play when competitive insurance markets do not deliver adequate cover at an

affordable price. This is especially so when the underlying risk is beyond the consumer's reasonable control and the insurance is essential.

Examples can again illustrate the complexities.

We are seeing this play out in home buildings insurance where premiums in Northern Australia have risen strongly in recent years due to a variety of factors and largely reflecting the deeper understanding of risk at very granular levels of address. After several reviews in recent years, the Government is creating a reinsurance pool to begin from 1 July 2022 with the stated objective of alleviating pressure on premiums.

The consultations on the proposed reinsurance pool have raised some public policy challenges. Essentially, they can all be reduced to the questions of 'what is a 'fair' price for risks in these affected communities?' and 'how should that be paid for?'[12]

Satisfactory answers to these questions require careful consideration of the following:

- what are each of the controllable and uncontrollable risks driving the situation;
- should community members be asked to exercise control where it is found to be possible;
- monitoring of the impact on incentives of all consumers to effectively manage their own controllable risk;
- assessing the suite of potential solutions available for relative effectiveness; and
- assessing core fairness questions of each of the potential solutions: who gains and who suffers detriment, and to what extent is this 'fair'?

In this instance, controllable risk includes responsible property maintenance to mitigate known risks, such as leaks in roofs and damaged window seals, noting though that the uncontrollable externality of climate change is increasing the severity and frequency of natural hazards, which has placed pressure on the insurance market. Other uncontrollable risks (externalities) for individuals include, for example, consequences of land use and planning decisions if those alter the vulnerability of existing properties to natural hazards.

A particularly challenging question is whether the location of a residence is controllable, at either the individual or societal level. While people can sell their home or move home, and homes can be relocated, this is not without very significant cost, especially if the homeowner has been in that location for a long time and well before there is widely available information about the externality.

We must carefully consider what level and what form of control ought to be incentivised, noting that controllability is clearly not binary – there are degrees of ability to control risk, which vary across the population and may be influenced by individual needs and circumstances.

An extreme set of outcomes, a vicious rather than virtuous circle, which all stakeholders must guard against includes:

- the insureds of high-risk properties who become heavily subsidised take few, if any, precautions to reduce their controllable risk;
- the insureds of low-risk properties whose premiums have increased to provide the subsidised funding for high-risk properties no longer take out insurance due to a poor value proposition; and
- as time goes on the insurance pool becomes smaller, less diversified and higher risk, leading to increasingly higher premiums for remaining customers.

All the above may be exacerbated by any incentive for the planning and construction industries to build in high-risk locations and/or to inadequate standards for the expected lifetime of the building structure in that location.

Another example is in life insurance. Genetic testing has improved consumer understanding of their own genetic risk factors and can assist them to take preventative measures to reduce the likelihood of that risk manifesting. In this way, there are elements of risks which are both controllable (avoidance of triggers) and uncontrollable (the genetic disposition). There are huge benefits from such information and action. Insurers, with the permission of regulators, have tried to navigate the trade-off between the risk of adverse selection with the public benefit of genetic testing by agreeing to a moratorium whereby disclosure of test results to insurers is only mandatory for coverage over $500,000. Policy restrictions

12 For background on the consultation see The Treasury (2021) and on the issues see Actuaries Institute (2020c).

introduced have therefore resulted in increased cross-subsidy across customers.

Some other examples to establish protection for consumers with uncontrollable risks in more extreme circumstances include:

- Imposing restrictions on pricing, such as happens with Compulsory Third Party (CTP), or already exists in various laws against direct discrimination;
- Developing new risk sharing mechanisms, akin to the health risk equalisation scheme where health insurers must continue to offer insurance at the same price regardless of age or health status, with mechanisms in place to ensure sharing within industry of claims costs associated with older ages and large claims;
- Emerging Fintech solutions and the re-emergence of mutuals; and
- Confirming government as 'insurer of last resort' as it is for uncertain potentially catastrophic risks such as terrorism events.

As general principles, policy responses to deal with the wholesale repricing of risk should be informed by:

- the degree of controllability a consumer has over the risk;
- the capacity of the consumer and insurer to respond to changing knowledge about the risks (including, in the insurer's case, whether they are writing short- or long-term policies and the degree of repricing allowed within the contract period); and
- the effectiveness and availability of alternative solutions to manage price and risk shocks to both the consumer and insurer, noting that availability is informed by social expectations and legal requirements discussed in Section 2.

Digital fulfilment 5

With exciting innovations in AI, data and cloud computing the days of relying on slow, clunky systems and paper-based methods in insurance companies are increasingly gone. Insurers are building, testing and running product lines using entirely digital means and bringing new lines to market in record times. As technology heavyweights like Google, Apple and Amazon continue to build infinite data stores, and given data goes hand in hand with predicting and pricing risk, insurers continue to question how these data companies will impact the provision of insurance. Will they impact distribution, simply offering resources for a price, provide insurance themselves or, with their extensive reach to customers, create significant disruption to the insurance industry with creative solutions?

The digital economy has re-engineered the connection between consumers and businesses. It has enabled new tools to be developed that enable business operations to be streamlined and often enhance the consumer experience. Fintechs have emerged, attempting to disrupt either part of or the entire value chain of incumbent providers. In many cases it has made it much easier for customers to compare the pricing and features of products from different providers, whether that is by comparing websites or using aggregator or comparator platforms to simplify the task.

5.1 Aggregator and comparator sites for sales fulfilment

Aggregator and comparator sites have, in the main, increased transparency and competition and resulted in many customers receiving better pricing or improved value. However, it does not always lead to good solutions for complex products like some insurance policies.

- For some customers, more in-depth comparisons or tailored advice may be needed to ensure the products cover the relevant risk(s). Features that are important to some, or even all, consumers can be reduced to an asterisk (or similar) or excluded from the comparison.[13]

13 For example, the Australian Taxation Office YourSuper comparison tool excludes the life insurance coverage component of those products and makes no reference to investment risk.

- Products can be simplified or artificially 'stripped down' to get high ratings on a comparison site, particularly if the primary ranking system is based on price. For example, in some markets outside of Australia, travel insurance products sold through aggregators have lower benefit limits or additional policy conditions when compared to products sold directly through a distributor or insurer.

- Many insurers may choose not to advertise through such websites or only advertise a limited range of products. This may lead to only a sub-set of products and prices in the market being displayed, which may not fulfil the individual needs of a customer in terms of price or desired coverage.

- In some situations, more weight can be given to 'bells and whistles' features that make the product more costly in the longer-term. Individual disability income insurance is a contemporary Australian example.

- The benefits of comparison sites may only accrue to certain customer cohorts (who regularly switch), which may cause detriment to the remainder who may be asked to pay more for their service, to fund the lower premiums for those who switch.

A key solution for these problems has been the requirement for benchmark products (such as the comparison rate for mortgages or legislated product classifications of gold, silver, bronze, basic for private health insurance policies) and 'smart' defaults to be offered (such as for superannuation with MySuper products). These can reduce potential confusion for large cohorts of consumers and enable the benefits of digitalisation to be reaped. For these benefits to be real and maximised, benchmark products and smart defaults must be informed by data about actual consumer behaviour to predict what is likely to be most informative and beneficial for their needs. Machine learning and AI can be particularly useful in this regard.

5.2 Fintech and Insurtech

Other Fintech and Insurtech (aside from comparison sites) have enabled benefits to be yielded by business and consumers through accelerating innovation and wider specialisation. Several examples illustrate the range of benefits which span other or more parts of the value chain.

Embedded insurance (where the insurance is already embedded in the product or service when it is bought) is one of the most straight forward disruptions. This involves offering optional and tailored insurance for online purchases of higher value items or services at the time of check-out because this is the point of need for the customer (to be protected against the risk of loss) and convenient. Purchases of high value electronics and holidays are examples of products and services suited to this type of insurtech. To ensure such innovation harnesses the benefits of digitalisation while minimising the harms, the insurance must be suitable for the customer. The recent Design and Distribution Obligations could be an important protection.[14]

Incidental insurance, which is appropriate to a specific time or location, is other type of insurtech solution emerging. Examples include providing a small amount of insurance that a tradesperson needs when attending a job so they can easily include the appropriate insurance cost in the customer invoice, or for an Uber driver, or a gig economy worker. This transforms a currently relatively large and fixed overhead cost of insurance into multiple micro costs incurred on-demand and which makes invoicing simpler and/or lowers the barriers to performing the work. In these examples, an important consumer protection is that the consumer becomes aware when the larger fixed cost policy is likely to be more suitable.

Other more complex examples involve platforms-as-a-service and connecting of an ecosystem of participants.

Picnic is a platform-as-a-service Fintech that enables customers to join or create insurance mutuals as an alternative solution to having their insurance needs fulfilled. Digital technology enables Picnic's operations to span the complete value chain from product origination through to sales fulfilment. Picnic provides the backend support and ongoing customer service for the specific cohorts of customers who approach it with an insurability problem they want solved.

This is an example of a digital solution to reduce the size of the under- and un-insured population because the mutual nature means profits are reinvested amongst the customers in the pool (often resulting in lower than otherwise premiums). The grouping of like-minded customers may also leverage further benefits of insurance being available that otherwise would not be offered in

14 Noting the Royal Commission identified significant concerns with add-on insurance, which is similar in concept.

more typical for-profit commercial markets. Mutual pools that Picnic has supported include coverage for building insurance in northern Queensland and various covers for early learning centres in NSW. Picnic is also investigating entry to the Directors and Officers and Professional Indemnity markets.

Galileo Platforms is a platform technology company serving the insurance sector. It is an example of using digitalisation as a single source of truth and straight through processing to improve the customer experience. Using blockchain technology, Galileo connects participants in the insurance ecosystem with a single source of truth about an insurance policy; each participant has a window to the central repository of details. At the moment that information is stored in at least four places – the client, insurer, distributor and reinsurer, and possibly more such as suppliers to any of those parties (for example, repairers). The single source of truth enables straight-through, digital client experiences. In this way industry costs, and therefore customer premiums, can be streamlined and overall customer experience improved.

5.3 Internet of Things (IoT), smart sensors and telematics

The ability to harness the data in often near-real time from IoT, smart sensors and telematics could result in significant changes for data-driven sectors like insurance. The number of devices connected to the internet is expected to triple over just a few years from 20 billion in 2017 to 60 billion in 2025 enabled by cloud computing, exponential growth in computational power and even more powerful mobile internet (5G).[15]

The IoT generates vast amounts of data through sensors in networks, cameras, mobile phones, traffic lights, cars, smart home appliances, sea containers and postal packages (and more). Sensors help to reduce failures, incidents and accidents, as noted in Section 4. Privacy concerns will continue to require attention but each year the proportion of customers willing to share data (home, car, health) in return for rewards is increasing as the digital lifestyle becomes more widespread.

Not only do IoT technologies enable insurance companies to determine risks more precisely, but this environment brings opportunities for insurers to develop new products, open new distribution channels and extend their role to include prediction, prevention and assistance.

15 Bloemers, Davids and Witteveen (2022).

Networked devices also allow insurers to interact with their customers more frequently and to offer new services based on the data they have collected.

5.4 Parametric insurance

With customers increasingly demanding speed, convenience and a more personalised service, parametric insurance can use big data and mobile technology to provide innovative solutions to traditional insurance. In the case of travel insurance, a parametric solution would enable the insurer to proactively track a flight and make an immediate payment if a flight was delayed in real time to assist (for example, flight rebooking, cash pay outs or lounge access). The advantages are the insured does not have to provide proof or observe a lengthy claims process and the insurer does need to spend time and resources on assessing claims.

Compensation is provided when an event (defined by specific parameters) occurs rather than on the loss experience. The specifics of the parameters and reimbursement values will be determined before the cover starts. By having a simple yes/no metric such as temperature, it removes the need to have an insurer employee ('adjuster') go into the field to inspect, say crop damage, and offers a path to accelerated digitalisation for insurance. This approach both reduces costs and greatly improves speed of payment offering benefits both to insurers and customers. Other examples of parametric insurance types include:

- Protection against natural disasters; earthquakes, cyclones and hurricanes supported by measured weather data across a specific period.
- Protection for farmers' crops. For example, if drought conditions or particular wind speeds supported by measured weather data across a specific period result in damage to crops.
- Protection against increased energy costs due to an extended cold weather period.

While the products themselves can reduce costs significantly, they do not necessarily offer the comprehensive level of cover available from traditional insurance and may expose a buyer to uncovered loss due to the risk that the metric or index underlying the parametric payment does not exactly correlate with their loss. However, going forward there will be more potential to increasingly adapt these products to better suit the insurance needs of customers.

Regulatory implications 6

The opportunities and challenges from the digital economy are tremendous for all stakeholders. Key elements to ensure the opportunities are maximised and the challenges carefully navigated so we can be confident societal wellbeing is improved include the following.

1. The law must be clear. Where necessary, changes to the law to accommodate considerations resulting from the digital economy may be required. But in any event, the law must give clear instruction to practitioners about the conduct required of them. Notably, the various uncertainties and trade-offs observed in the sections above must be made clear. This may involve general economy wide principles, as many of these issues are about whole of society risk appetite, backed up by regulatory guides and similar material that are sector specific. Principles based legal standards without regulatory guidance is always insufficient but is particularly problematic in an era of rapid change, and in an area of some subjectivity and debate. The intersection of ethics, economics, commerce, technology and human behaviour is complex and there is no single right answer, yet we must express an answer, or at least allow practitioners to confidently assess the correctness of their answer to a question. We suggest that having a broad range of experts debate the perspectives and arrive at a consensus – to then be tested with the public if possible – would be a potential way to resolve such questions effectively.

2. There need to be mechanisms in place to ensure those standards remain broadly in line with social norms and expectations (noting these change over time) and that help ensure business cultures are tailored to the responsible use of data and digital technologies.

3. Mechanisms need to be in place to monitor and guard against a world of 'haves' and 'have-nots', both amongst businesses in terms of their capability to use and access data and amongst consumers in terms of the quality of their digital identity, and their ability to utilise this in the modern economy. This means keeping barriers to entry low for business and the barriers to participation low for consumers. It may also mean an active decision to not pursue certain forms of data or interaction, where the trade-offs become too severe, which would need to be enforced by regulation.

4. Safety nets for vulnerable members of society need to be in place and are best considered proactively. In the insurance examples in this paper, this is especially those who become under- and un-insured, and who cannot act to mitigate their risks. The experience with the reinsurance pool for home buildings, re-emergence of mutuals and any other solutions on the horizon should be informative for all sectors; safety nets must be in place.

Appendix A – Non-traditional data and analytics to investigate the gig economy

In 2020, the Institute released the Green Paper The Rise of the Gig Economy and its Impact on the Australian Workforce. The paper is illuminating in at least two regards: it uses private data sources and new analytic techniques to provide quantitative and qualitative insights into the gig economy and its workers.

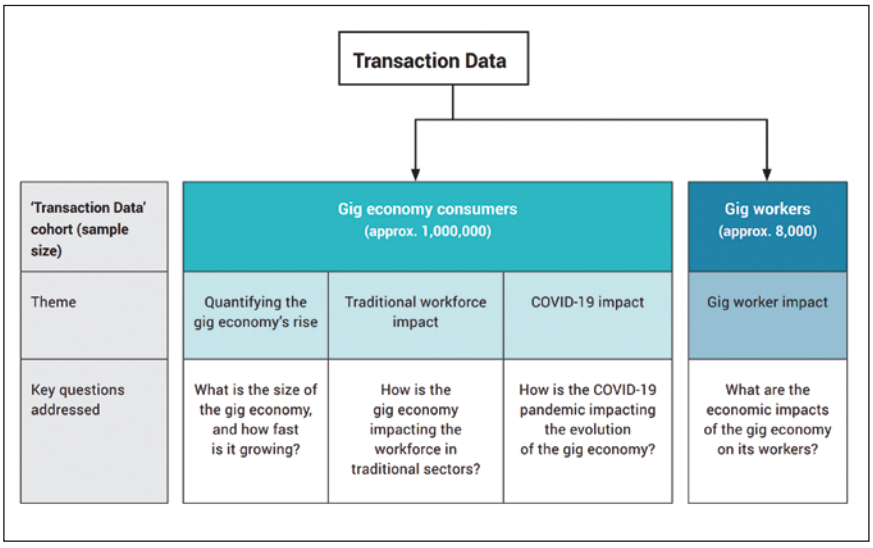
The paper defined the gig economy as on-demand services mediated by digital platforms where workers are classified as independent contractors. The analysis examined de-identified and privacy compliant electronic banking transactions over five years from one million gig economy consumers and more than 8,000 gig workers from five digital platforms. The three gig economy sectors examined were private transport, meal delivery and task-based services. The first two were explored in greater detail.

Key findings include:

- The gig economy grew over nine times between 2015 and 2019 to capture more than $6.3 billion in consumer spend in 2019. Consumer spend in private transport sector rose 39% and the (online) meal delivery sector increased six-fold between 2015-2019.
- Gig worker profile over-represents more vulnerable segments of Australian workforce – young workers, students and the formerly unemployed.
- Benefits include greater autonomy, flexibility and increase in short-term levels of discretionary expenditure.
- But most gig workers do not receive entitlements such as minimum wage, employer paid superannuation, sick leave, annual paid leave, paid parental leave, long service leave and workers compensation insurance because they are deemed independent contractors.
- Less than 1.5% of gig economy workers make personal superannuation contributions, and where they do, the payments are minimal compared to the employer-paid contributions of minimum wage workers. A simulation of superannuation outcomes showed that "workers who spend five to 10 years of their productive labour years participating in the gig economy may be between $48,000 or $92,000 worse-off in superannuation savings at retirement" relative to a minimum wage employee, increasing the prospect of greater reliance on public safety nets, including the Age Pension.
- The surge in consumer spending has gathered pace with COVID-19. Gig workers have provided valuable transport for restaurants and retail stores, softening the impact that government mandated closures had on the economy and while gig workers have benefited from the boom, the longer-term implications are less certain.

As the gig economy continues to evolve, it is important that further research and inclusion of this cohort is understood so that policy changes reflect adequate support for these workers without reducing the benefits to the economy from the gig workforce.

Figure A.1: Using 'Transaction Data' analysis to uncover gig economy insights



Appendix B – The data and analytics rich investment valuation approach to improve government services

Actuaries helped pioneer the development and use of an investment valuation approach in welfare systems.[16] This approach looks at the likely pathways different people can take through their lives, along with the associated services they will need from government agencies, such as health, education, child protection, justice and welfare.

It draws on historical longitudinal and time series data to understand the actual paths taken by previous and current consumers of government services and the associated costs. It uses machine learning to identify the most reliable and strongest predictive factors of the demand for any given service. These factors are then built into long-term microsimulation models to predict outcomes for current consumers of government services with and without different targeted interventions.

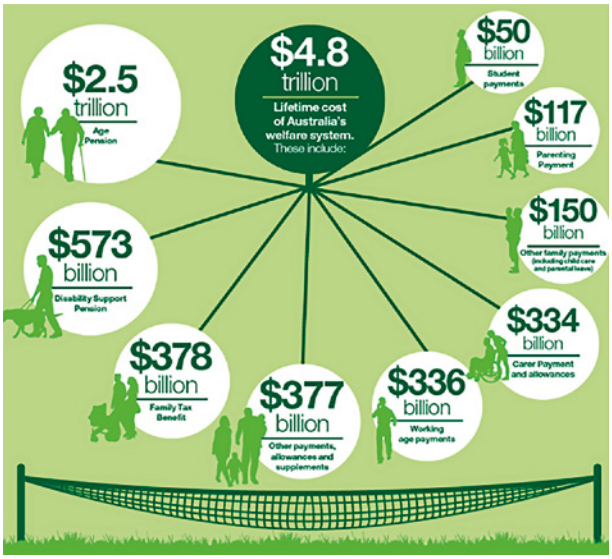
It therefore provides an evidenced-based and financial quantified approach to considering potential social outcomes to assist prioritisation of government service delivery and the expected expenditure.

Such an approach highlights the value of early intervention and careful targeting of programs. For example, in New Zealand where this approach was first adopted, 75% of the long-term cost is estimated to be concentrated amongst those who first enter the social welfare system before age 20. In NSW, it was found that 7% of the population under 25 will account for 50% of the future cost of government services spanning welfare, justice, health and child protection.[17]

The 2015 Federal Budget introduced an investment approach for the Australian social security system as recommended by the McClure welfare review, directly inspired by the original approach taken in New Zealand. Some State governments have also adopted the investment valuation approach to some of their services.[18]

Across all levels of government, up to one fifth of annual GDP is spent each year on welfare, housing, health care, justice and child protection making the potential financial savings significant. The potential social improvements of opening pathways for individuals that lead to active employment, stable housing and reduced criminal activity, amongst other outcomes, are transformational.

Figure B.1: Lifetime cost of Australia's welfare system (2016)



Source: Department of Social Services (2016).

Significant improvements have been made in linking State, Territory and Commonwealth data sets, data collection on outcomes, and tackling fragmented services. The Institute encourages these efforts to continue. This must continue to be done in a manner that respects individual's privacy and builds trust with the community.[19]

16 A further discussion is provided in Miller (2018).

17 NSW Department of Communities & Justice (2018).

18 A discussion of how the NSW Government has applied this approach to support children in foster care is outlined in Actuaries Institute (2020b).

19 A further discussion is provided in Miller (2018).

References

Actuaries Institute. (2016). *The Impact of Big Data on the Future of Insurance*. Green Paper. https://actuaries.asn.au/Library/Miscellaneous/2016/BIGDATAGPWEB.pdf

Actuaries Institute. (2020a). *Notice to Give Information (Witness Statement) to Royal Commission into National Natural Disaster Arrangements*. https://www.actuaries.asn.au/Library/Submissions/2020/RCWitnessStatement.pdf

Actuaries Institute. (2020b). Children of the Data Revolution at the 20/20 All-Actuaries Summit. *Actuaries Digital*. https://www.actuaries.digital/2020/08/27/children-of-the-data-revolution-at-the-20-20-all-actuaries-summit/

Actuaries Institute. (2020c). *Property Insurance Affordability: Challenges and Potential Solutions*. Research Paper. https://actuaries.asn.au/Library/Miscellaneous/2020/GIRESEARCHPAPER.pdf

Actuaries Institute. (2020d). *The Rise of the Gig Economy and its Impact on the Australian Workforce*. Green Paper. https://www.actuaries.asn.au/public-policy-and-media/thought-leadership/green-papers/the-rise-of-the-gig-economy-and-its-impact-on-the-australian-workforce

Actuaries Institute Anti-Discrimination Working Group. (2020). *The Australian Anti-Discrimination Acts: Information and Practical Suggestions for Actuaries*. https://actuaries.logicaldoc.cloud/download-ticket?ticketId=0d5870d6-2acc-4c74-8bce-d01afd0eba8f

Bloemers, O., Davids, J., and Witteveen, R. (2022). *Insurtech Trends for 2022*. https://www.insurancethoughtleadership.com/going-digital/insurtech-trends-2022

CIO. (2019). *AI Unleashes the Power of Unstructured Data*. https://www.cio.com/article/220347/ai-unleashes-the-power-of-unstructured-data.html

Department of Social Services. (2016). *Australian Priority Investment Approach to Welfare – Infographic*. https://www.dss.gov.au/review-of-australias-welfare-system/australian-priority-investment-approach-to-welfare/australian-priority-investment-approach-to-welfare-infographic

Dolman, C., Lazar, S., Caetano, T., and Semenovich, D. (2020.) *Should I Use That Rating Factor? A Philosophical Approach to an Old Problem*. https://actuaries.logicaldoc.cloud/download-ticket?ticketId=dec35c10-44b0-4345-844c-4772da856dba

Miller, H. (2018). *People, Projections and Payments: A Look at Modern Government Service Delivery*. Dialogue Paper. https://actuaries.asn.au/public-policy-and-media/thought-leadership/the-dialogue/people-projections-and-payments-a-look-at-modern-government-service-delivery

Morgan, S. (2020). Cybercrime To Cost The World $10.5 Trillion Annually By 2025. *Cybercrime Magazine*. https://cybersecurityventures.com/cybercrime-damages-6-trillion-by-2021/#:~:text=We%20predict%20there%20will%20be%20a%20ransomware%20attack,hitting%20healthcare%20providers%2C%20hospitals%2C%20911%20and%20first%20responders.

NSW Department of Communities & Justice. (2018). *Investment Modelling*. Available at: https://www.theirfuturesmatter.nsw.gov.au/investment-approach/investment-modelling

Orad, A. (2020). Why Every Company Is A Data Company. *Forbes*. https://www.forbes.com/sites/forbestechcouncil/2020/02/14/why-every-company-is-a-data-company/?sh=3dc024e017a4

The Treasury. (2021). *Cyclone Reinsurance Pool Taskforce*. https://treasury.gov.au/review/cyclone-reinsurance-pool-taskforce

The Institute of Actuaries of Australia
Level 2, 50 Carrington Street
Sydney NSW 2000 Australia
t +61 (0) 2 9239 6100
e actuaries@actuaries.asn.au
w www.actuaries.asn.au

Published February 2022.

Acknowledgement

The Actuaries Institute acknowledges the traditional custodians of the lands and waters where we live and work, travel and trade. We pay our respect to the members of those communities, Elders past and present, and recognise and celebrate their continuing custodianship and culture.