Emergency Services Levy
INSURANCE MONITOR

Occasional Paper

Monitoring of insurance premiums in the world of big data

June 2018

Preamble

The way in which insurance is priced is changing. Currently, insurers develop a technical premium price by predicting the probability that an individual (or group of similar individuals) will suffer a loss and the size of that loss; this technical price is then overlaid with marketing considerations.

This conventional approach, however, is giving way to more advanced analytics involving the use of complex machine-driven algorithms, referred to as 'big data' analytics. Insurers can use big data analytics to more finely tune individual risk classification, by finding new or unexpected correlations about individuals and the risk they represent. Greater use of big data analytics therefore has the potential to change the relationship between price and coverage, making it more challenging for insurance consumers to understand the basis upon which their insurance is priced, and possibly raising the market power of insurers. Pricing in this way may even result in insurance being inaccessible to certain individuals or groups because of their risk status, when such individuals are arguably those most in need of the protection that insurance offers.

The use of big data in insurance was briefly discussed in the May 2017 Public Inquiry held by the Emergency Services Levy Insurance Monitor (Insurance Monitor). In this paper, we explore the issues surrounding big data in insurance in more detail, and summarise the main issues that may arise in NSW from general insurance companies' development and use of 'big data' techniques during the emergency services levy (ESL) reforms. We also explore potential implications for companies, consumers, policy makers and regulators.

This paper is based in part on research conducted for the Insurance Monitor by PIRAC Economics.

We invite stakeholder input on any of the matters raised in this paper. Please send input to:

Big Data Project Team
Emergency Services Levy Insurance Monitor
Email: consultation@eslinsurancemonitor.nsw.gov.au

Published by

Emergency Services Levy Insurance Monitor
One Margaret Street, Sydney, NSW 2000.
www.eslinsurancemonitor.nsw.gov.au

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Executive summary

This paper explores the issues surrounding big data in general insurance that may arise in NSW from general insurance companies' access to and use of 'big data' techniques during the emergency services levy (ESL) reforms and some potential implications.

Big data – what is it and why is it important?

'Big data' is a term that describes large volumes of high velocity, complex and variable data that require advanced techniques and technologies to enable the capture, storage, distribution, management, and analysis of the information.[1] When companies use big data, they adopt technology and data processing techniques to collect large datasets from both conventional and unconventional sources, and analyse those data to inform their business decisions and activities. The growing use of big data in many industries is part of a broader uptake in big data use and data analytics and partly enabled by trends towards more interconnected devices (the internet of things).

In financial services, changes in technology and customer expectations are driving innovation in new technology-based services and the take-up of those services by companies is growing rapidly worldwide. Globally, in 2017, it is estimated that twenty four percent of digitally active consumers regularly used insurance products that incorporated financial technology (including big data), a four-fold increase from 8 percent in 2015.[2]

In Australia, implementation of big data techniques has lagged the UK and USA experience[3] but this is changing rapidly. A recent survey of 30 Australian and New Zealand insurers found nearly 30 per cent of respondents expected to implement big data initiatives within 6 months, with 85 per cent having implementation timeframe targets of two years or less[4]. International financial services and FinTech (financial technology) executives consider that the most likely and important areas of technological development in insurance are:

- increased sophistication of data models and analytics to better identify and quantify risk
- increased sophistication in methods to reach, engage and serve customers in a highly targeted manner
- rise of aggregators to compare products and services from different providers.[5]

All these areas rely on big data. Overall, access to big data is likely to have a transformative effect across the insurance lifecycle, affecting how insurance products are designed and marketed, how claims are assessed and paid, and how risk is assessed and managed.

Practical implications

The practical implications and impacts of big data techniques being used by insurance companies can include the following:

- Products and services may become more customised. Big data-based products potentially reduce risk, the likelihood of a claim and costs for the insurer and the customer.
- Simplification and automation of application and renewal processes.
- Data analytics can support tools for insurance comparison and selection.
- Targeted marketing using external data sources to identify customers' needs and circumstances, including their interest in or need for updating or changing their insurance.

[1] TechAmerica 2012, p.10
[2] EY 2017, p.14
[3] See for example, FCA 2016a; and Willis Towers Watson, 2016
[4] Finity, 2018
[5] PWC 2017, p.10

- Big data can help better equip front line staff with information to improve customer service or can assist in tailoring individual products to meet requirements.[6]
- Claims process improvements, as big data can make claims processes quicker and easier, assist identify legitimate claims and respond in real-time.[7] For example, telematics can improve customer service after a collision.[8]
- Risk management: big data provides new sources of information that create opportunities for a more granular risk assessment, to the individual level; and may improve forward-looking data and deliver better customer information.
- More effective fraud control, which reduces the cost of assessing and paying illegitimate claims leading to reduced premiums, and allows legitimate claims to be processed more quickly.[9] The prospects for improvement are significant. Estimates of insurance fraud place the costs at: in the UK, up to £50 per year per policy holder and the country more than £3 billion",[10] and in the US up to US$34 billion for property and casualty insurance, or as increasing premiums by 3 to 5 percent.[11] A crime syndicate stopped by the NSW Police was responsible for AUD$1 million in fraudulent claims.[12] Big data helped detect organised, premeditated fraud in Canada[13] and the UK[14] by detecting networks between seemingly unrelated people.[15]

Potential challenges

Changes as extensive as those offered by big data, bring both challenges and opportunities. Many of these are positive, as the previous section illustrates. However, there may also be potential risks for consumers. These may include:

- Data protection, privacy and security of consumers personal information. Information about the behaviour of individuals and their personal data is being collected by businesses everyday as people browse the internet, use apps, do online shopping, network through social media and install 'smart' devices in their homes, to name a few. Some businesses analyse this information internally whilst others may collect and sell the data. A major issue for insureds is that it may be difficult to control and understand how data on their social and commercial behaviour is accessed by insurers and used in complex algorithms to assess risk. It is possible that data that is collected for one purpose may end up being used for other purposes without the knowledge of the individual. Insurers may also be unwilling to share data, making it more difficult for customers to switch insurers. Measures suggested by commentators to mitigate concerns include information sharing obligations, such as those being implemented for financial services more broadly ('Open banking').[16] Given the important role of insurance in protecting consumers' most valuable assets, Consumer Data Rights in general insurance may be an area for further inquiry.
- Concerns with more granular risk assessment. As noted by the Actuaries Institute, when each individual's risk is assessed more accurately, fewer people will be treated as average.[17] This has the potential to modify the extent of "risk pooling" across the community, a notion which has traditionally underpinned insurance pricing. Possible consequences include: some people being more accurately identified as being of low risk and being able to access cheaper insurance, whilst others will be assessed as higher risk and charged more for insurance, regardless of the social context in which some of these risks might arise. Where these people are vulnerable or disadvantaged and cannot change their behaviour to reduce their risk, they may find it

[6] MongoDB 2018
[7] WNS DecisionPoint 2016, p.20; Exastax 2017
[8] QBE 2018; EY 2016a, p.4
[9] FCA 2016a, p.33
[10] HM Treasury 2016, p.3
[11] WNS DecisionPoint 2016, p.1, 7
[12] Kidd 2017
[13] CANATICS 2017
[14] HM Treasury 2016, p.43
[15] WNS DecisionPoint 2016, p.17
[16] FCA 2016a, p.18
[17] Actuaries institute 2016, p.4

increasingly difficult to access or afford insurance.[18] There are markets, such as those in Northern Australia, where access to property insurance is of real and continuing concern.

- Discrimination based on factors other than risk and costs. There may be greater challenges for protecting consumers against business practices that rely on unreasonable use of data and adversely impact disadvantaged or vulnerable consumers. Marketing practices may encourage consumers to buy products they do not want or need.
- Competitive implications, as the use of big data could change the competitive dynamics between insurance companies as well as exacerbate the problems associated with information asymmetry between insurers and their customers. This may further constrain consumers from fully participating in the insurance market and ultimately reduce the effectiveness of competition in the market.

The trade-offs associated with data-driven techniques can leave policymakers with a dilemma. Whereas big data has the potential to lower the cost of insurance for many insureds due to individualised risk assessment and could empower consumers by facilitating easier comparison of competing insurance products, it also confers on insurers greater opportunities for 'price discrimination' in product marketing and distribution strategies including individual price discrimination, sometimes referred to as 'price optimisation'. Price discrimination may enable insurers to increase their profitability by extracting more consumer surplus.

Implications for the Insurance Monitor

Big data will potentially have a significant impact on insurance company operations and pricing. It will impact the Insurance Monitor's price monitoring role, the assessment of the impacts of ESL reforms on the take up of insurance and the analysis of prohibited conduct.

The legislative provision and criteria in the Insurance Monitor's *Guidelines on the prohibition against price exploitation* issued in December 2017 are relevant to any pricing changes affecting regulated contracts of insurance associated with the greater use of big data. Discerning the impact of ESL reform on the take-up of insurance may also become more complex.

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[18] An FCA study of big data in insurance noted that, to date, there is no evidence that big data has resulted an increase in price dispersion across motor and home insurance, or affected the availability of quotes for vulnerable consumers (such as people over 85 or with disabilities). Nevertheless, the Authority noted that it would continue to monitor the potential exclusion of high risk consumers, would look at the pricing practices of a limited number of firms and would engage with the UK government about possible responses if problems were identified.

1. Background

This section of the paper provides background to big data and to this information paper, including the role of the Insurance Monitor, information on major trends in technology adoption by the financial services industry globally and the general insurance industry in NSW, and some concepts illustrating what is meant by 'big data'.

1.1 Role of the Insurance Monitor

The NSW Emergency Services Levy (ESL) Insurance Monitor ("Insurance Monitor") has an important role in over-sighting the conduct and pricing practices of insurance companies who charge ESL on insurance premiums during the period to 30 June 2020.

Insurance companies are required to make contributions to fund the activities of the NSW fire and emergency authorities. Many insurers pass on the cost of these contributions to their policyholders by charging an ESL on certain types of insurance policies covering damage or loss to properties in NSW. The NSW Government had previously proposed to replace this arrangement with a property-based levy to be paid through Council rates. However, this reform was deferred in May 2017. At the time the deferral was announced, insurers had been gradually reducing the ESL they charged on insurance premiums. It has been necessary for insurance companies to re-establish ESL on insurance premiums, which has largely occurred from July to October 2017.

The Insurance Monitor was appointed to provide the public with confidence that insurers will not use the ESL reform as an opportunity to raise premiums without reference to costs. This role was established in a context of widespread distrust of insurers in NSW attempting to profit from the reform at the expense of their customers, and of a need to ensure the overall fairness of the reform. The Insurance Monitor's key functions include:

- providing information, advice and guidance in relation to the ESL reform and prohibited conduct
- ensuring that insurers do not collect more ESL than is necessary to fund their contribution liabilities, through an over-collection assessment for the financial years ended 30 June 2016 and 2017 combined, as well as the financial years ending 30 June 2018 and 2019 combined
- scrutinising price movements in insurance products subject to the ESL regime (price monitoring) in relation to the impact of the reforms on the insurance industry and levels of insurance coverage and in relation to prohibited conduct and compliance with the Act, to ensure that consumers are adequately protected
- taking action in relation to prohibited conduct, being price exploitation or false or misleading conduct in relation to the ESL. Penalties of up to $10 million may be ordered by the Court for breaches of these prohibitions.[19]

These functions have remained largely unchanged despite the deferral of the property-based levy.

Prohibitions against price exploitation and false or misleading conduct have been enacted during times of significant regulatory change in an economy or a market that may provide opportunity (or perceived propensity) for companies to disadvantage consumers. Examples include the implementation of a New Tax System (the GST) in 2000 and the 2013 replacement of the insurance-based fire services levy in Victoria. The economic case for monitoring rests essentially on weaknesses in competition in the industry, which arise because of limited substitutability between suppliers, but also because of information asymmetry and behavioural biases affecting consumers. As a result of these weaknesses, it is considered that the performance of general insurance markets falls short of what would be consistent with workable competition.[20]

The case for monitoring the reimposition of ESL is if as strong as that associated with the removal of ESL. There is a need to address potential consumer confusion or concerns around the fairness of how ESL rates are imposed

[19] ESLIM 2017a
[20] For example, see Senate Economics References Committee, 2017, p.25

between policyholders, as well as changes in premiums for renewals occurring in the 2017-18 financial year. There is concern that base premiums could be increased excessively coincidentally with the reimposition of ESL. There is also a risk that some insurers could try to take advantage of the situation and blame premium increases on the deferral of the emergency services levy reform.

To undertake effective monitoring, the Insurance Monitor needs to understand the context in which the insurance industry operates, how insurance is priced, and how that context is changing. Technology trends in insurance have the potential to materially change the operational and competitive landscape in NSW and affect prices, hence this is an area which the Insurance Monitor maintains an interest.

1.2 Technology trends in insurance

Like other areas of financial services, insurance markets are affected by changing technologies and customer expectations. Commentators point to a range of trends, including more self-directed services, usage-based insurance, combining insurance with risk reduction services, faster claims services, and more individualised products and services.[21] The technologies that are expected to deliver these changes include cloud computing, digitalisation, artificial intelligence and big data analytics.[22]

This paper focusses on big data. In 2017, PWC estimated (based on a DeNovo survey) that the three most important and likely trends in insurance were:

- increased sophistication of data models and analytics to better identify and quantify risk
- increased sophistication in methods to reach, engage and serve customers in a highly-targeted manner
- rise of aggregators to compare products and services from different providers.[23]

All these trends rely on big data.

Internationally and domestically, government policy and regulation are also changing to make it easier for individuals and businesses to access and control their financial services data. Australia, Japan, the EU, and the UK, for example, are passing laws that require banks to cooperate with approved third-parties to, at customers' request, allow access to the banks' systems to draw on customers' data. These initiatives are expected to stimulate innovation in data analysis and use.

These policies, combined with other policies and technology changes, are predicted to have a significant impact on the delivery of financial services (box 1). Data analysis and use in insurance is therefore likely to be affected, as financial technology companies with expertise in financial data analytics and use start to look for new business opportunities.[24]

Box 1: Innovation in financial services

Aggregators or 'Personal Financial Management' services help people manage their money, bringing together payment accounts and other products like mortgages, pensions and investments 'under one roof'. These services could be provided by an array of providers from established banks to charities. Similarly, accounting software companies will operate as aggregators helping businesses in the same way.

[21] PWC 2016, p.14-15; KPMG 2017a, p.31; KPMG 2017b, p.15; Tanguy et al 2017
[22] KPMG 2017b, p.15; Reynolds 2017, p.7
[23] PWC 2017, p.10
[24] IAIS 2017, p.4

Digital comparison tools will enable much easier assessment of complex product pricing, especially as banks are required to provide their data in a more standardised way and provide new information about their quality of service.

Combined, digital comparison tools and personal financial management (PFM) tools will be able to alert customers to business models that require customers to actively switch to get the better rate. They can more effectively help people avoid charges or switch provider.

Payment Initiators will compete with card payments potentially offering cheaper alternatives for online SMEs to collect payments. In due course, they may even develop payment facilities face to face using direct bank transfer.

Taken together consumer experts recognised that these tools had the potential to disrupt the way consumers interact with their finances and financial providers. One outcome could be that traditional banks could give way to new aggregators or payment initiators.

Source: Reynolds, F, 2017, Open Banking: A Consumer Perspective, p.8

This paper reviews international and Australian commentary and describes how the use of big data is expected to affect insurance services, insurance markets and the interaction between insurance providers and customers, and the potential implications of these changes for the Insurance Monitor.

1.3 What is big data?

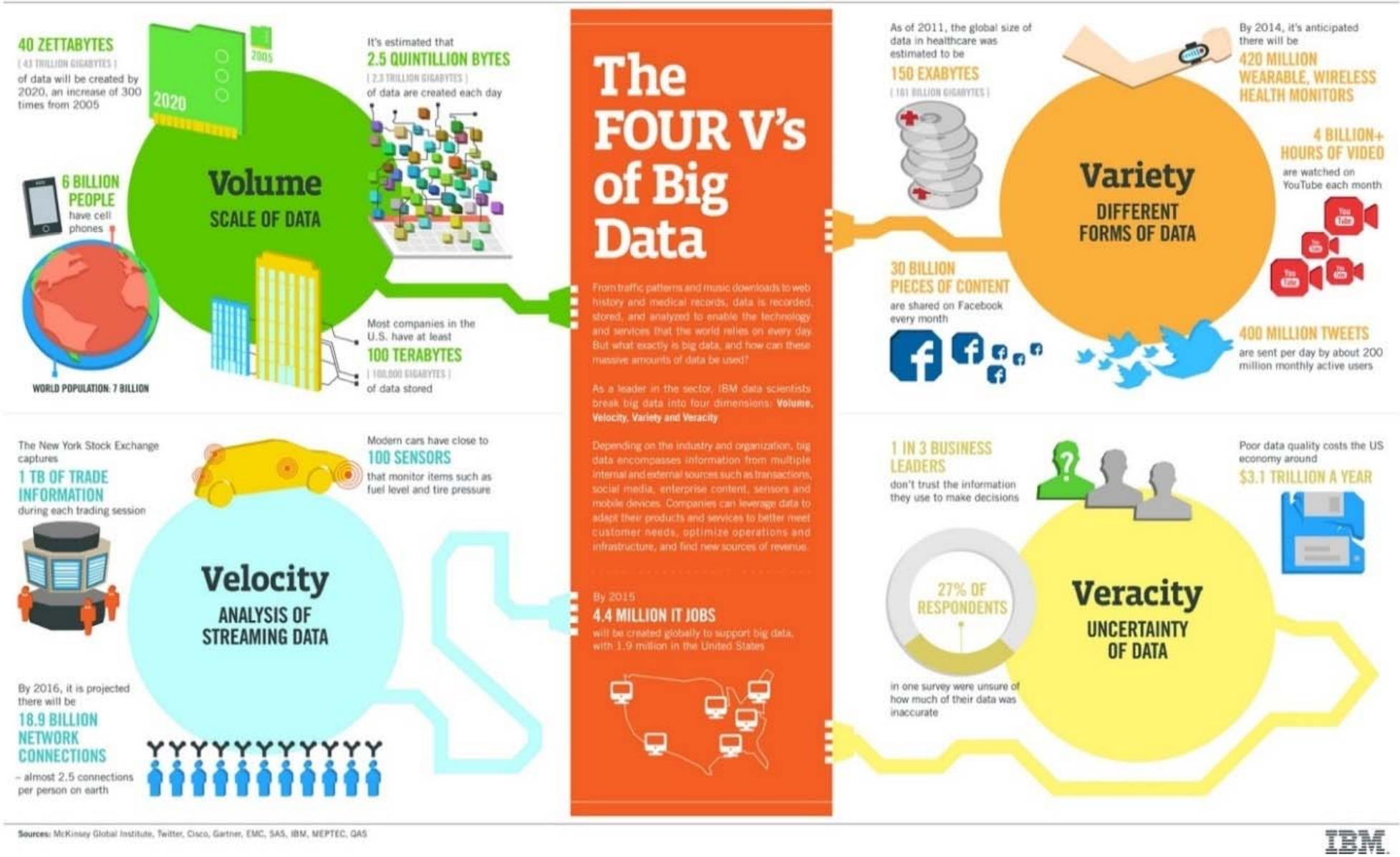
Big data is more than just large data sets of information. In isolation, mountains of data are valueless. Data must be effectively collected, stored and analysed. Growth in big data is only useful to businesses because of the concurrent growth in affordable big data management, analytics and storage capacity.

The rise of related FinTech (financial technology) innovations has led to the development of an array of data applications capable of handling the volume of data required for big data analysis. This analysis can look at representative cross-sections of consumers and reveal trends and patterns that otherwise would not be visible. However, it is likely to be an incremental and evolutionary process[25].

The three "V"s of big data - volume, velocity and variety - are commonly used as a starting point from which to understand big data. IBM adds a fourth "V", veracity, as illustrated in figure 1. Others have argued that value is also important.[26]

[25] FCA 2015, p.5
[26] Marr 2015

Figure 1-1: IBM's Four Vs of Big Data



Source: http://www.ibmbigdatahub.com/infographic/four-vs-big-data

Volume – the most obvious characteristic of big data is very large data sets. International Data Corporation forecasts that by 2025, global data will have risen from 16.1 zettabytes (ZB, trillion gigabytes) to 163 ZB, of which a quarter will be generated and accessible in real time.[27] The social media company, Facebook, for example, increased data storage size three-fold in 2013-2014, and it estimated that rate of growth has continued.[28] Facebook users increased from 100 million in 2008 to 2.07 billion in the second quarter of 2017.[29]

Velocity – refers to the rate that data is being produced, recorded and analysed. Big Data is generated in everyday life. It includes point of sale data when a product is purchase, social media data, travel data, for example. Therefore, people generate big data-relevant information nearly constantly, and technology is now developing to the point where this information can be recorded in real time. The rise and growth in smartphones, wearables[30] and sensors has led to rapid growth in the volume of data generated.[31]

Variety – data is drawn from a wide range of sources, in both structured and unstructured forms (for example, videos, emails, social media posts, credit card purchases, clickstream data, security cameras, loyalty card tracking, sensor data and policy and account documentation). Some of these can be collected from within a company, and some from outside. The heterogeneity of the data is one of the challenges of big data analysis. It has been estimated that structured data, found in tabular form or relational databases, represents between 5 to 15 percent of overall data, while unstructured data, for example, e-mails, videos and blogs, make up about 85 percent.[32]

Veracity – the value of big data in business is positively correlated with its reliability and applicability. The result of data analysis is only as good as the data used and the appropriateness of the analytical method.

Value – data needs to add value to the business, and businesses need "clear understanding of the business value it will bring."[33]

In summary, when companies use big data, they adopt technology and data processing techniques to collect large datasets from both conventional and unconventional sources, and analyse those data to inform their business decisions and activities. The application of big data in a business may be an evolutionary or incremental process, rather than a sudden switch.

[27] Reinsel et al. 2017, p.3-4
[28] Facebook 2014
[29] Statista 2018
[30] Small personal devices that can be worn, for example, on a person's wrist, and can collect, analyse and transmit data.
[31] Gandomi & Haider 2015, p.138
[32] Gandomi & Haider 2015, p.138; Marr 2015
[33] Marr 2015

2. The power of big data

This section of the report illustrates government and businesses' use of big data, through a number of case studies showing that:

- the adoption of big data techniques can be socially transformative and beneficial
- company initiatives that develop and use big data engage with a large proportion of Australians today
- interconnected devices and technologies and predictive analytic techniques can be harnessed to help people and businesses in ways that we can scarcely foresee today.

2.1 A variety of uses across industries

There is a lot of hype around big data use in financial services. In the financial services sector, the development of tools to deliver better products and services, such as artificial intelligence, application program interfaces ("APIs") and digital comparison tools depends on access to and analysis of data.

The application and analysis of large and varied information is increasing in many industries (see case studies, section 2.2).

> *Every sector in the economy is using data to grow – from predicting weather patterns and optimising harvesting in agriculture, to improving patient diagnosis and treatment in the health industry, to enhancing the management of remote infrastructure in mining.*[34]

Research conducted on 200 medium and large French companies determined that, currently, the most common source of big data for companies is online portal content and point of sale data (rather than purchasing third party data), and the majority relied on visual analytics software for analysis.[35]

The current projects detailed on the NSW Government's Data Analytics Centre ("DAC") website highlight the scope and diversity of the application of big data. Among the 22 priority projects listed (as of Jan 2018) are projects aimed at forecasting, predicting or improving education and vocational training, social welfare, emergency response times and outcomes, public transport, corporate insolvency, water pricing, heatwave impacts and workplace safety. DAC takes data from Government sources to solve difficult or 'wicked' problems, that is, problems that seem unsolvable with standard techniques (Innovation NSW). To protect privacy, such data are aggregated and anonymised, but they can still be analysed to identify patterns, trends and solutions.[36]

Population health research through big data is also a rapidly growing field worldwide. A quick search delivers thousands of recently-published scientific papers on the subject. Khoury and Ioannidis, for example, argued that using technology to analyse population statistics to determine correlations and identify disease pathways and sources could save significant effort and many lives.[37] The Productivity Commission also argued that more detailed analysis available via big data can support decision making and service provision.[38]

Like financial services, many other sectors are also using data to develop new products and services, and improve efficiency.

> *Effective use of data is increasingly integral to the efficient functioning of the economy. Improved availability of reliable data, combined with the tools to use it, is creating new economic opportunities. Increasing availability of data can facilitate development of new products and services, enhance consumer and business*

[34] PWC 2014, p.1
[35] Raguseo 2018, p.194
[36] Innovation NSW
[37] Khoury & Ioannidis 2014
[38] Productivity Commission 2017, p.60

outcomes, better inform decision making and policy development, and facilitate greater efficiency and innovation in the economy.[39]

French research has indicated that the benefits of using big data included increased employee productivity, better products and services, expanded corporate capabilities and improved management information. However, survey participants also mentioned the risks to privacy and security from collecting data.[40]

Industry body Tech America identified several areas in which big data could play a role in future government. These areas are also applicable to commercial enterprises:

- replacing or supporting human decision-making with automated algorithms
- reducing inefficiencies within an agency
- creating transparency
- improving performance by enabling experimentation to discover needs and expose variability
- improving ROI [Return on Investment] for IT investments
- improved decision-making and operational intelligence
- providing predictive capabilities to improve mission outcomes
- reducing security threats and crime
- eliminating waste, fraud, and abuse
- innovating new business models and stakeholder services.[41]

2.2 Case studies

Case study 1: Retail Loyalty Cards - Woolworths

Big data can be used by retailers to improve customer service and increase sales through targeted marketing. The use of loyalty cards, seen by consumers as a reward system, is effective in gathering data that can drive sales and business decisions. Eighty eight percent of Australians over age 16 belong to a loyalty program.[42] Woolworths' CEO recognised these advantages in 2014.

Data driven insights continue to assist with the transformation of our business. Through our investment in Quantium, we can better understand the needs of our customers and deliver a better shopping experience.[43]

Woolworths has over 9 million Rewards Card members: about 37 percent of Australia's population.[44] When signing up for cards, Woolworths collects customer details including name, age, address and gender. Then, when the customers purchase goods at brand affiliates such as Caltex, BWS or Woolworths, the cards track consumer spending patterns. The promise of a reward encourages people to swipe their loyalty cards at the point of sale, delivering personalised purchase information to the retailer.

In 2013, Woolworths purchased a A$20m stake (50 percent shareholding) in Quantium Group, a data analytics company group.[45] In 2017, this investment was estimated to be worth A$200m, with partners including NAB,

[39] Productivity Commission 2017, p.v
[40] Raguseo 2018, p.194
[41] TechAmerica 2012, p.12
[42] OAIC 2016a
[43] Woolworths Group 2014
[44] Woolworths Group 2018
[45] Business Insider 2017

Foxtel, Facebook and Qantas.[46] Woolworths has also established a Supplier Connect portal that gives suppliers free access to some of this customer data.[47]

Given that Woolworths' rewards program is one of the largest in Australia, the Office of the Australian Information Commissioner (OAIC) assessed the program in 2016. The OAIC review examined the collection and management of personal information and concluded that:

- The loyalty program is used primarily to determine which products and offers are most relevant for members based on purchasing data. Woolworths Rewards then promotes offers to certain customer groups, mostly by e-mail.
- The data is also used to measure the success of particular campaigns, using de-identified data on which e-mails are opened and which offers are used. The data uses a randomly-assigned Customer Reference Number (CRN) and transaction history, rather than the customer's name or other identifying information. This transaction history includes basket contents, store location, register number, date, time, and any offers redeemed by the customer at Point of Sale.
- Quantium's analysis uses CRNs, which it cannot link back to the personal information or identify of the individual[48].

In 2014, Woolworths launched its own branded car insurance. Choice Magazine reported that car crash data was combined with purchasing data to find correlations between shopping habits and insurance risk.[49] Big W also has branded credit cards through VISA that can track spending outside Woolworths Group stores. It is worth noting that other retail industry participants have connections to the general insurance industry or own branded car insurance products (for example, Coles).

Case study 2: Facebook Disaster Maps, Social Media

Data gathered through social media platforms such as Facebook and Twitter have been applied by analysts to predict socio-political events such as the Brexit outcome, Trump's election win and the Australian 'Yes' vote to marriage equality.[50] The same platforms are playing increasingly important roles in disaster management, ranked as the fourth most popular means of accessing information in an emergency event.[51] The NSW Rural Fire Service's use of social media and apps such as its *Fires near me NSW* application have been credited with saving lives and managing disasters including in the recent Tathra fires.[52]

> *Maps help us in so many ways–from distributing relief supplies to preparing communities for disasters. By sharing anonymized location, movement, and Safety Check data with the American Red Cross, Facebook is helping us sharpen the essential tools we need for targeting communities in need, delivering aid, and fighting disease.*[53]

The 2016 Louisiana floods were one of the worst disasters in American recorded history, destroying more than 60 000 homes. The estimated inundation flood map, prepared after the flood for the East Baton Rouge Parish, was created using data from many sources and refined using comments on Facebook and Twitter.[54]

> *The map is powered by a compilation of various data inputs – including 911 call-outs, Baton Rouge Fire Department search and rescue data, 311 requests for service, street-level damage assessments from City-Parish staff and other public officials, debris collection routes, road closure information, NOAA imagery, Civil Air Patrol imagery, and FEMA DFIRM flood hazard areas. To complement these datasets, the City-Parish has received – and continues to receive – numerous comments from the general public via social media and*

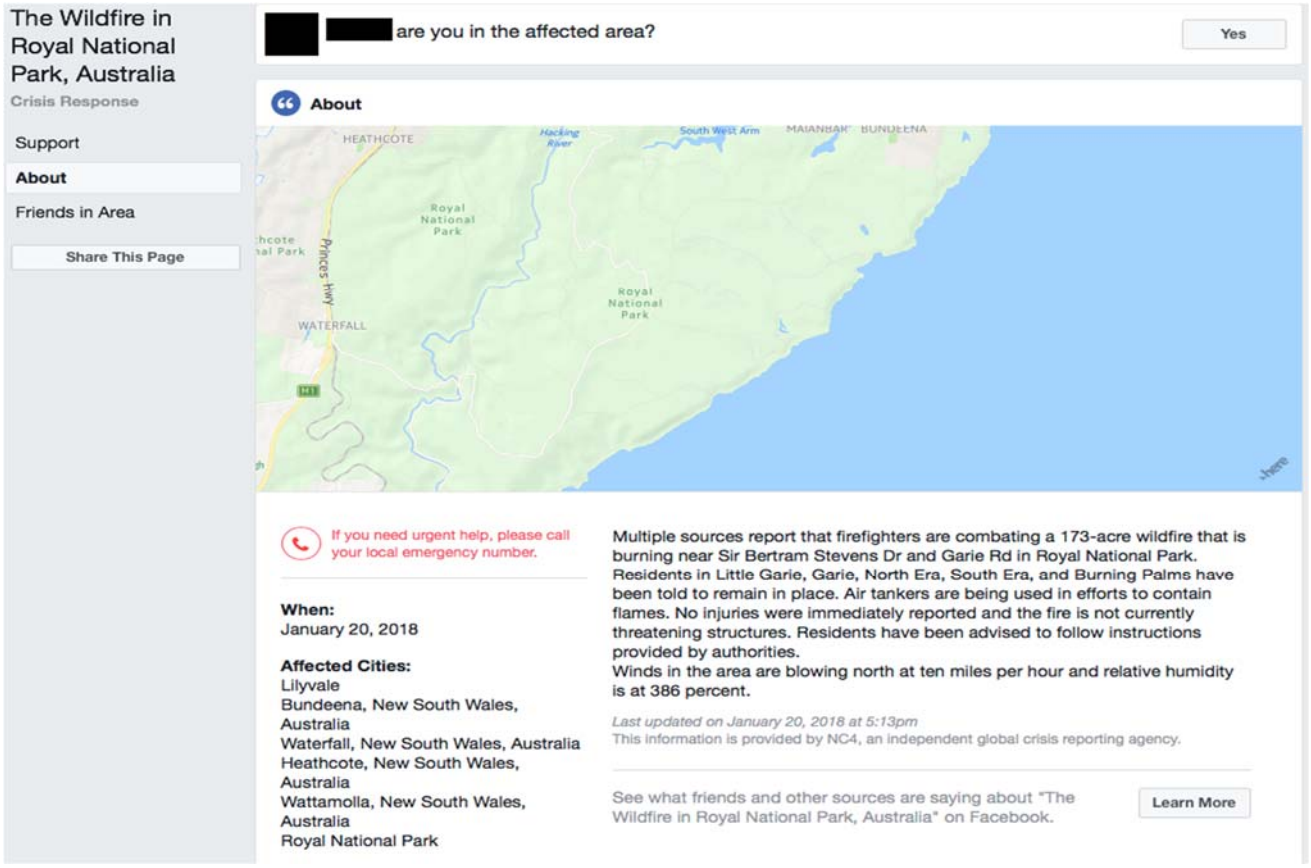
[46] AFR 2017
[47] AFGC 2016, p.5
[48] OAIC 2016a, p.5
[49] Choice 2017
[50] BBC 2016
[51] Kim and Hastak 2017
[52] PwC, 2017b; ABC PM, 2018
[53] Mashable 2017
[54] Kim and Hastak 2017

email to clarify areas that were (or were not) inundated by floodwaters during this recent flooding event. As this feedback is received, modifications are then made accordingly to the estimated flood inundation area. The City-Parish Department of Information Services – GIS Division oversees the development and ongoing updating of this map, with additional data continuing to be collected from a variety of sources. All new data is analysed and then used to improve the accuracy and validity of the estimated flood inundation area.[55]

In June 2017, Facebook announced a disaster map initiative to assist aid and emergency organisations during natural disasters.[56] The disaster maps use 'aggregated de-identified Facebook data' to provide response organisations with an additional source of information when coordinating emergency responses. In the 2017 Peru flood, data on Facebook usage revealed population density areas, where people were moving to, and when people checked in as safe, using Facebook's 'Safety Check' function (figure 2).[57] Facebook shares this information with aid agencies such as UNICEF and the Red Cross.

When people use Facebook with location services activated, their latitude and longitude is recorded. Facebook can aggregate data across both time and space, so it is possible to determine how many people are in a certain area at a certain time. This information can then be used to help direct aid resources such as food, first aid and water.

Figure 2-1: Example of Facebook Safety Check Page



Given that traditional communications systems can be damaged during emergency events, additional sources of information are valuable. Facebook is also developing a pilotless solar aircraft, Aquilina, that will deliver internet into remote areas and areas without internet during natural disasters.[58]

[55] ArcGIS
[56] Facebook Newsroom 2017
[57] A function whereby Facebook users can advise that they are in an affected area, check in to say they are safe, and prompt friends to do likewise.
[58] Facebook 2016

3. Big data in insurance

This section of the report explores the adoption trajectory and the potential uses of big data that the insurance industry in Australia may employ, including the impacts that big data may have on the industry's existing business operations and the implications this may raise in relation to various aspects of Australia's consumer protection laws. Key points include:

- anecdotal information suggests that adoption of big data techniques by the Australian general insurance industry has tended to lag behind more active adoption in leading overseas jurisdictions
- adoption has potential to transform general insurer's internal operations, value chain and their customer interactions in fundamental ways
- these changes have flow through implications for competition and consumer protection regulation.

3.1 Adoption trajectory

Insurance is a changing market, and new technology affects how insurers operate, design and price insurance. In Australia, some insurance companies are already engaging with FinTech businesses to enhance their data analytical capabilities (that is, using big data):

> *Australian insurers are getting more actively engaged; with IAG and Suncorp, being partners of Stone & Chalk [a Sydney-based FinTech hub], as well as investing and partnering with Fintech companies, such as Trov, and enhancing their data and analytics capabilities.*[59]

In the UK, the use of big data in insurance was described by the Financial Conduct Authority as follows:

> *Big Data is being used across the product lifecycle, in pricing, product design, marketing, distribution and sales, claims handling and fraud detection. While firms' underlying pricing models have not changed fundamentally, they are increasingly using additional internal and external data to supplement the information they receive from consumers. This is improving firms' ability to predict the likelihood of an insured event occurring and a consumer's propensity to claim.*[60]

In the United States, a 2016 survey[61] of major US insurance company executives found two thirds of insurers surveyed, currently use predictive models for underwriting and risk selection, a 10 per cent increase compared to the previous 2015 survey. The insurers surveyed expect to achieve increasingly pervasive use of predictive modelling techniques to gain competitive advantage in personal and commercial lines insurance.

The areas of their business they expect to use these big data techniques and gain most competitive advantage over the next two years (2017 and 2018) are show in the extracts below.

[59] KPMG 2017c, p.21
[60] FCA 2016a, p.7
[61] Willis Towers Watson, 2016

Figure 3-1: Current and projected top predictive modelling uses

Personal lines

	Now*	Two years
Report ordering	34%	74%
Fraud potential	28%	70%
Claim triage	18%	59%
Litigation potential	23%	54%
Case reserving	9%	41%
Marketing & advertising	21%	39%

Commercial lines

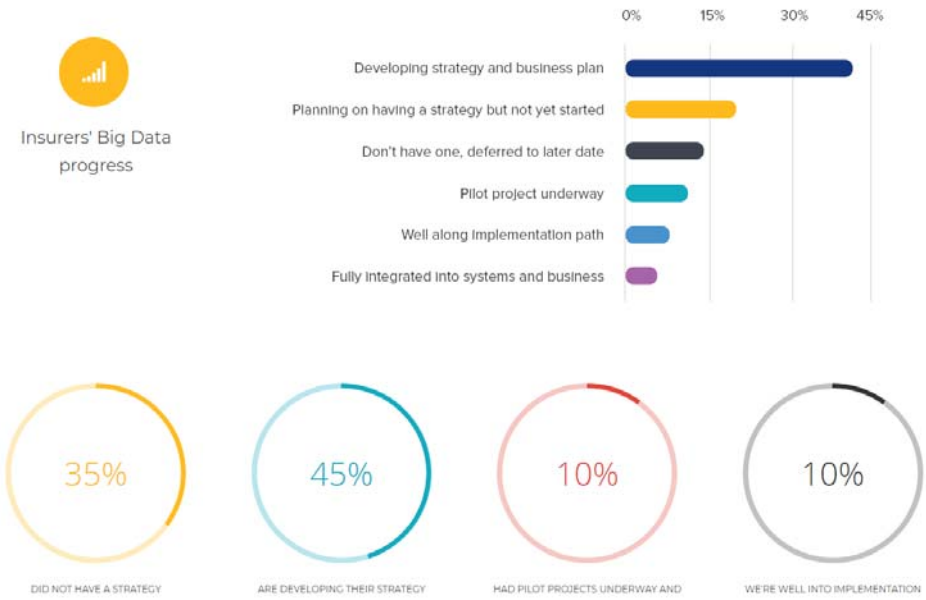
	Now	Two years
Claim triage	15%	66%
Fraud potential	14%	55%
Litigation potential	10%	50%
Report ordering	17%	48%
Case reserving	8%	48%
Loss control	2%	39%

Source: Willis Towers Watson, 2016.

In Australia, implementation of big data techniques in general insurance markets appears to be lagging on the international journey, but this is changing rapidly.

A recent survey[62] of 30 Australian and New Zealand insurers found that only 10 per cent of respondents felt they were well into implementation and had pilot projects underway. While 35 per cent of respondents did not have a big data strategy, 45 per cent are developing their strategy, as the figure below shows.

Figure 3-2: 2018 survey of Australian and New Zealand insurer's Big Data progress



Finity 2018, *Big Data Survey Results,* http://www.finity.com.au/analytics/big-data-survey-results#matrix

The survey does not identify the respondents nor the companies they represent. However, given the high degree of concentration in the general insurance market in Australia, it is possible that initiatives implemented by only one or two of the larger insurers can have a significant reach in the NSW general insurance industry. The survey also found that nearly 30 per cent of respondents expected to implement big data initiatives within 6 months, with a total of 85 per cent having implementation timeframe targets of two years or less.[63]

[62] Finity 2018
[63] Finity, 2018

3.2 Implications for insurance services

McKinsey & Company argued that the use of big data in insurance will affect business models, the relationships between insurers, brokers and customers, and the design of insurance and related products (box 2).

Box 2: Impact of big data on insurance services

Enhancing existing business models. Carriers are using data analytics to radically redefine their role by providing agencies with the tools to integrate data-driven decision making into areas such as cross-selling and reducing customer churn. These analytics tools spotlight the highest-value clients and high-potential leads so agents can invest resources more efficiently, predict customer churn more accurately to help improve retention, and generate broker-peer comparison analytics to identify additional sales opportunities.

Strengthening channel relationships. Carriers are using data analytics to strengthen broker relationships. AXA's EB360 platform, for example, offers a suite of analytics-powered tools to help brokers track the status of applications, manage compensation, and commissions and monitor progress on business goals. The tools, which are optimized to minimize data entry and enable rapid quoting, help brokers manage their business more effectively, and thus strengthen the broker-carrier relationship.

Changing relationships with consumers. Insurers are fundamentally changing their relationship with consumers using real-time monitoring and visualization. Consumers who agree to let insurance companies track their habits can learn more about themselves, while insurers can use the data to influence behaviour and reduce risks. In auto insurance, for example, telematics are being used to monitor consumer driving habits in real time. By harnessing the resulting insights, insurers can offer usage-based policies and determine claims liability easily and accurately.

Redesigning products. The Climate Corporation is using data and analytics to redefine the crop insurance market. The company uses data on weather patterns, soil characteristics and other key crop attributes at the field level to reduce farmers' risks by designing policies that protect farmers from losses due to weather and other adverse events.

Creating new business models. Sonnet, Canadian insurer Economical's entrance into the direct channel, relies on a "data hub" to allow consumers to efficiently obtain online quotes and bind coverage for homeowner's and auto insurance. The data hub quickly aggregates information from numerous databases to streamline the buying experience. At most insurers, consumers must answer more than 20 questions to get an auto insurance quote; Sonnet requires fewer than 10. The approach appeals to tech-savvy consumers with relatively straightforward insurance needs, while those seeking more assistance with their insurance decisions can purchase through Economical's broker partners.

Establishing new adjacent businesses. A large commercial insurer has formed partnerships to offer policyholders just-in-time solutions such as the maintenance of heating, ventilation and air-conditioning equipment in commercial buildings. The solutions are based on monitoring and diagnosing vibration and sound patterns to detect declining performance and predict failures, which reduces the total cost of ownership.

Source: Libarikian et al, 2017, Harnessing the potential of data in insurance, p. 2-3

Effective use of predictive analysis can reduce human error, and improve pricing and risk assessment, and risk underwriting. The expected impacts of these changes, however, are not straightforward. They can vary across types of insurance and policy holders. Overall, access to big data is likely to affect how insurance products are designed and marketed, how claims are assessed and paid, and how risk is assessed and managed.

In addition, the collection and use of big data has implications for consumer protection and privacy. Governments need to consider how best to ensure that the rights of consumers are protected as more of consumers' personal data is collected and used by insurance companies and other businesses. The Financial Conduct Authority in the UK, for example, has recognised these risks.

> *In September 2016, we published a feedback statement on Big Data. We found that Big Data is facilitating a range of benefits for consumers in motor and home insurance, by transforming how they deal with retail insurance firms, encouraging more innovation in products and services and streamlining parts of the customer journey. We also, however, found some concerns about data protection rules and the use of data.*[64]

Some of the solutions to these concerns could involve industry self-regulation,[65] but they could also involve government regulation.

3.3 Impact on products and service

Big data is changing the way insurance products are designed and marketed and the ongoing relationship of insurers with their customers, including through claims management. The relationship is expected to change further in the coming years, resulting in a more customised and individually targeted approach to customer service and insurance products.

Some studies have argued that such changes are necessary to meet consumer demand and expectations. In 2012, EY argued that insurers needed to connect with their customers and understand their customers' needs better[66]. A subsequent survey in 2014 stated that most customers across the Asia-Pacific region (including Australia) had a clear preference for more frequent, personally relevant, communications from their insurer.[67] In 2016, KPMG also argued that, generally, insurers have not fully recognised the fundamental change to their business model needed: that they need to become more customer-focussed.[68]

Similar disruptions from data and technology are occurring across the financial services sector. PwC estimated that data-driven innovation in financial services and insurance in 2013 increased the sector's gross value added by A$6.6bn.[69] A MagnaCarta Communications survey indicated that financial institutions felt that about one-third of their revenues were at risk from new technologies.[70] A later PwC survey also indicated that 88 percent of incumbents are increasingly concerned about losing revenue to innovators.[71]

To date, the demand for insurance products that include financial technology has lagged the broader financial services sector,[72] but consumer adoption of insurance products that incorporate financial technology is now growing rapidly. On average across international markets, 33 percent of digitally active consumers regularly use FinTech services. This has increased from 16 percent in 2015.[73] In insurance, however, the average international adoption rate has increased from 8 percent in 2015 to 24 percent in 2017.[74] The only sector that grew more quickly was money transfer and payments.

Research indicates that Australian consumers are generally relatively happy with their insurers, although they do see room for improvement.[75] After value for money, being easy to deal with was ranked by Australians as the second more important characteristic in their relationship with their insurer.[76] In the past, insurance companies have not had an ongoing relationship with their customers, and 89 percent have made little or no effort to retain

[64] FCA 2017, p.31
[65] Insurance Council of Australia 2017, p.30
[66] EY 2012, p.33
[67] EY 2014, p.29
[68] KPMG 2016, p.1-2
[69] PwC 2014, p.15
[70] Hardie et al 2017, p.16
[71] PwC 2017, p.2
[72] EY 2017, p.14
[73] EY 2017, p.6
[74] EY 2017, p.14
[75] PIRAC Economics 2017, p.29
[76] EY 2014, p.10

customers.[77] As noted above, commentators are now arguing that this attitude needs to change, and many are pointing to big data as the primary tool for insurance companies to better understand customer needs, and to engage with and respond to their customers.[78]

Product design

In Australia and overseas, there have already been product design changes in the insurance industry because of big data. One of the earliest big data products offered were telematic devices for motor vehicle insurance (case study 4). The use of these devices illustrates several areas where insurance companies can innovate. There are also possible innovations in products on offer (for example combining insurance with other risk management services), as well as in risk assessment and pricing. Section 0 discusses the use of technology to assess customer risk.

Case study 3: Auto Insurance – QBE

QBE insurance has developed the 'Insurance Box': a comprehensive car insurance product that bases the insurance policy cost on the way the vehicle is driven. Traditionally, car insurance premiums are based on backward-facing, general sociodemographic factors, vehicle characteristics and, if available, claims history. Insurers may obtain age, gender, employment, postcode and vehicle model data to set the premium. However, there are obvious limitations in a static and backwards-facing assessment of risk.

QBE was the first company in Australia to introduce a device called the Insurance Box, developed by an Australian company, Intellitrac.[79] It is fitted to the dashboard of a car, and uses GPS to collect and transmit data such as where the car is driven and stored, speed, braking, cornering and distance travelled. The data collected is analysed to personally price the driver's insurance policy to reflect their collision risk[80]. The product was initially targeted at younger drivers, who, lacking a driving record and claims history, are subject to higher insurance premiums. Better drivers are charged lower premiums and the company stated that good drivers can save up to 30 percent on premiums when they renew their policy (Autotalk). Riskier drivers, on the other hand would pay more for their insurance. However, these drivers can choose a different policy or provider, or modify their behaviour so that future premiums are lower.

In addition, drivers are given feedback on their driving habits and improvements are suggested via a DriveScore dashboard. If the device detects a collision or excessive speeding or braking, the driver is sent an SMS. In the event of a collision, the SMS also contains the immediate contact number for claims (QBE 2018). Drivers can add the Insurance Box app to their smartphones, which also recognises behaviour such as texting while driving. The box can be activated to track the car in the event of theft. The company stated that all stolen cars fitted with the device have been recovered.[81]

Data are also de-personalised and aggregated to assist with road safety campaigns. Professor Stevenson at Melbourne University is doing research using QBE data to track whether providing young drivers with incentives for good driving can reduce fatalities.[82]

PwC has argued that devices such as the telematic devices discussed in Case Study 3 have reduced traffic accidents among participants by 30 percent.[83] The take-up of telematic-based motor vehicle insurance is growing in the UK. Between 2014 and 2015, the number of policies increased by 40 percent. In December 2015, 2

[77] EY 2012, p.35
[78] EY 2014, p.16
[79] Canstar 2014
[80] QBE 2018
[81] Herald Sun 2017
[82] University of Melbourne
[83] PwC 2014, p.41

percent (455 000) of UK motor vehicle insurance policies were telematic policies.[84] Transport for NSW recently announced it would conduct a telematics trial to improve young driver behaviour.[85]

Telematic devices are also being considered in home insurance. Such devices can monitor water, electricity and security equipment. They can detect problems early, minimising any damage. For example, Habitat is an insurance package offered by BNP Paribas Cardif in Italy, which includes a box and sensors. In the event of an emergency (fire, flood, power outage), an alert is sent to the customer's smartphone and a security centre, so that both can respond quickly.[86] Similarly, in Germany, Deutsche Telekom and Allianz offer a combination of home monitoring, insurance and emergency assistance services. If a problem is detected, the customer's smartphone and Allianz's emergency hotline are notified. Allianz can then organise and pay for the repairs directly.[87]

Other products are also helping consumers understand and manage risk.

> *US-based commercial property insurer FM Global, for instance, offers a service called "RiskMark" to help its clients better understand the risk exposure of their properties. FM Global inspects each property and collects up to 500 digital photos, notes and data points such as construction parameters and geographic information. The insurer analyses this data to assess risks and offers recommendations to lower risk levels. The "RiskMark" service also allows clients to compare the risk profiles of various locations and helps them prioritize their risk management efforts.*[88]

> *Nest has established partnerships with American Family Insurance and Liberty Mutual Insurance to offset the costs of a Nest Protect smoke detector, and establish a monthly discount for homes that link their Nest smoke detectors to the insurance firms. The insurer subsidises the cost of the smoke detector for the insured, with the product then sharing data with the insurance firm so it knows if the insured's house has working smoke detectors.*[89]

UBIMET is a service that sends early weather warnings so customers can take precautions, such as securing outdoor furniture, closing windows or parking their vehicle under cover:

> *Severe weather warnings are sent out via SMS, e-mail or push notification between 48 hours to 15 minutes prior to the arrival of a severe weather event. The alerts concern significant weather events such as thunderstorms, gales, heavy rain, freezing rain or snow. The warnings also cover hurricanes and tropical cyclones in the USA and Australia.*[90]

Research by UBIMET indicates that 97 percent of customers find the warning useful and want the service to continue, and 79 percent act when they receive the warning.[91]

In all these examples, big data-based products potentially reduce the risk for the insurer and the customer, reducing the cost of the insurance component of the package, and reducing the likelihood of a claim and the associated inconvenience and additional expense for the customer.

Finally, insurance products are likely to become more personalised. For example, telematic devices can track and verify mileage, and be used to develop usage-based car insurance for drivers that only occasionally use their car, or insurance that is charged based on distance travelled[92].

[84] FCA 2016a, p.13
[85] Transport for NSW, 2018
[86] BNP Paribas Cardif 2015
[87] FCA 2016a, p.15
[88] Capgemini Consulting 2015, p.6
[89] Actuaries Institute 2016, p.36
[90] UBIMET
[91] UBIMET 2017, p.2
[92] IAIS 2018, p.21

There are various such products available in the US where consumers are able to either pay per mile or receive a low-mileage discount at renewal, and, we have recently seen the development of pay per hour insurance in the UK market.[93]

…Tokio Marine & Nichido Fire Insurance Company launched DOCOMO One Time Insurance jointly with NTT DOCOMO, a mobile communications company. NTT DOCOMO users will get a text message with a product recommendation the first time they arrive at a golf course saying, in effect: "We see that you have arrived at the golf course. Our insurance will cover the expenses of treatment for any injuries and damage liabilities. Would you like to be insured?" The product's design is based on users' golf playing characteristics and allows them to be insured on a daily basis.[94]

EY estimated in 2016 that there were 5 million active usage-based insurance policies in 35 countries. It predicted that such policies would increase to 15 percent of the market by 2020 in Europe, Asia and the Americas.[95]

Application and renewal processes

Big data can also be used to simplify the insurance application and renewal processes. In the past, much of an insurance company's risk assessment relied on information provided by the customer when applying for or renewing cover. Big data tools that collect data continuously, or use external data sources to pre-populate forms, can make these processes quicker and easier for customers.[96]

In addition, big data may also increase the sophistication of insurance comparison and selection tools. For example, being able to provide potential customers with more information about the value of insurance options based on their individual risk and circumstances. A UK start-up company, Brolly, markets itself as:

… your free personal insurance concierge, powered by AI, and available through our mobile app. Brolly is being built to make it incredibly easy for you to understand, manage and buy the insurance you need, using the Brolly Advisor, Brolly Locker and Brolly Shop.[97]

Launched in 2016, it is expected to provide three interrelated services:

Brolly's technology combines data aggregation and insurance product integrations to connect with customers using its purpose-built tools: 'Brolly Locker' (scanning and secure management of all existing policies), 'Brolly Adviser' (advising which products customers should consider buying and why based on analysis of existing portfolio), and 'Brolly Shop' (app analyses the current market to ensure the customer has the best product coverage and value for money – advising to switch to other providers if necessary) – the Shop is yet to be released.[98]

These types of services make it easier for customers to select and purchase appropriate policies.

Marketing

Research indicates that customers are willing to buy more insurance products if they are convenient and deliver value.

Across all markets in the region, customers cite convenience (simplicity) and better service as the drivers for repeat purchasing. Value or cost also feature in the responses… [99]

[93] FCA 2016a, p.17
[94] ATKearney
[95] EY 2016a, p.3
[96] FCA 2016a, p.32; MLC 2016, p.6
[97] Brolly
[98] Ohr 2017
[99] EY 2012, p.33

Better-targeted marketing can help deliver this convenience and value. It saves costs for the insurer, but also provides relevant information to the customers without forcing them to waste time sifting through information or offers that they are not interested in. Some companies have already had successes with this type of targeting.

> *Hiscox then redesigned its website in a way that made it easier for customers to generate quotes for their specific requirements. In addition, Hiscox segmented its customer base in order to deliver customized content on its website, such as customized product recommendations and testimonials. Hiscox's efforts have helped increase conversions for its online quote process by nearly 10%.*[100]

Interest in the use of big data for marketing is also growing. A 2014 US survey of 75 insurers indicated that, while the highest use of big data by property and commercial insurers at that time was in risk planning and evaluation, customer acquisition was the area predicted to grow most quickly and have the greatest use by 2016 (SMA 2014, p.4). Cignifi, a US mobile data analytics firm, for example,

> *…analyses numerous mobile data variables, such as voice calls, mobile money transactions, mobile savings, social networks and demographics to determine a premium appropriate for different customer segments. The aim is to enable its microinsurance partners to tailor SMS/text message based marketing efforts to specific customer segments in order to increase the likelihood of acceptance.*[101]

In addition to the benefits from better understanding customers, there are several other potential applications of big data to marketing insurance. For example, analysis of external data sources, such as social media, can highlight when a customer's circumstances have changed, and therefore when they might be interested in different types of insurance products or need to change their existing products.[102]

Big data can also be used to identify new customer segments and target tailored products to those segments.

> *Customers with special insurance needs, such as covers for pets or expensive gadgets, often find it difficult to find the right policy or attractive rates. Advanced analytics tools allow insurers to find and service such customers. UK-based startup "Bought By Many", for instance, analyses search engine and social media data to identify groups of customers with uncommon insurance requirements. Bought By Many then approaches insurers on behalf of the group, in order to negotiate better rates for them.*[103]

In addition, big data can equip front line staff to respond to customers more effectively. Realtime analysis of customers that contact a call centre can help call centre staff to offer the information and products that the customer needs. MetLife Wall, for example, draws information from over 70 administrative systems and provides call centre staff with a touch screen display to quickly view information on the caller. The display shows all the caller's policies and transaction history, and helps to answer questions, solve problems and tailor the engagement to the specific customer.[104]

As with all marketing techniques, there are also potential issues with ensuring data protection and privacy, and that practices are fair and do not pressure people to buy products they do not want or need. Consumer protection is discussed in more detail in section 4.1.]

Claims processes

The use of big data and the associated technology has the potential to make claims processes quicker and easier. Insurance companies can become aware of a potential claim more quickly, and be in a better position to identify legitimate claims and respond in real time.

[100] Capgemini Consulting 2015, p.5
[101] IAIS 2018, p.11
[102] Nicoletti 2017, p.120
[103] Capgemini Consulting 2015, p.6
[104] MongoDB 2018

A US survey of property and commercial insurance companies, conducted by WNS DecisionPoint, identified significant reductions in the time taken to process and decide claims for those companies that used big data analytics.[105]

As described in case study 4, telematic devices can inform the insurer that there may have been an accident. This information can be used to provide customers with immediate information and assistance, such as contact details for a claim, or proactively offered a towing service or a loan car, rather than just covering the cost of these services.[106]

Telematic devices installed in homes can also send information to the insurer when a problem is detected, so the insurer can respond proactively, rather than the customer needing to make a formal approach to initiate a claim. Connected devices and social media can also help confirm the validity of a claim, streamlining the claims process.

> *For example, motor telematics devices can record location, speed, braking, acceleration and whether airbags were deployed (although this varies across devices). Connected home devices have the ability to confirm details about heating, plumbing and security or possibly whether a house was occupied at the time an incident occurred.*[107]

Some claims processes could be made automatic, without the need to formally file a claim. For example, "a claim from a farmer with crop hail insurance could be resolved based on a weather report and satellite surveillance of the field, without the farmer having to file a claim."[108]

> *India's IFFCO-Tokio (ITGI) insurance company is using Radio Frequency Identification (RFID) chips that are injected under the skin of the animal for its livestock insurance policies. These chips are accessible through a reader, which allows an insurance official to verify that the RFID reading coincides with the identification number on the policy when a farmer reports a claim. The aim of this product is to reduce the number of fraudulent cases and to expedite the claims process.*[109]

Insurers could also use big data analytics to reduce their cost of processing claims. For example, data mining techniques could be used "to cluster and score claims in order to prioritize and assign them to the most appropriate employee based on their experience on claim complexity."[110]

> *Insurance companies like AIG and Japan's Fukoku Mutual have been using artificial intelligence–based "agents" and "virtual engineers" to support live claims agents and increase productivity.*[111]

3.4 Fraud control

Fraud has a significant impact on insurance companies and policy holders.

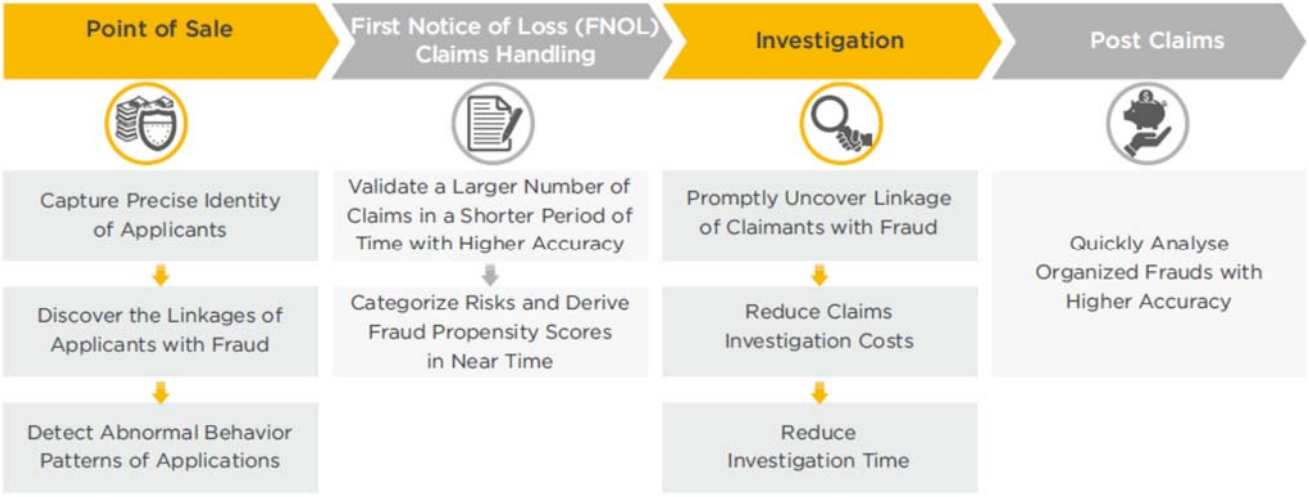
In the UK, insurance fraud was "estimated to cost policy holders up to £50 each per year, and the country more than £3 billion".[112] In the US, it was estimated that fraudulent claims totalled US$34bn for property and casualty insurance, and a survey of US personal and casualty insurers estimated that fraud increased premiums by 3 to 5 percent.[113]

[105] WNS DecisionPoint 2016, p.20
[106] EY 2016a, p.4
[107] FCA 2016a, p.33
[108] Oliver Wyman & ZongAn 2017, p.15
[109] IAIS 2018, p.11
[110] Exastax 2017
[111] Reinsel et al. 2017, p.19
[112] HM Treasury 2016, p.3
[113] WNS DecisionPoint 2016, p.1,7

In NSW, soft tissue injury claims made under compulsory third-party insurance fell by 24 percent after NSW set up Strike Force Raven to investigate insurance fraud. The strike force stopped one organised crime syndicate, which had been responsible for creating A$1m in fraudulent claims.[114]

Insurance fraud can occur at any stage in the insurance process (figure 3, below). It includes application fraud and bogus, fictitious or intentionally inflated claims, and can extend to sophisticated organised crime.[115]

Figure 3-3: Application of Fraud Analytics over the Policy Life Cycle



Source: WNS DecisionPoint 2016, Insurance Fraud Detection and Prevention in The Era of Big Data: Curbing Fraud by Application of Advanced Analytics Across Policy Lifecycle, p.10

Big data analytics are particularly useful to help detect organised, premeditated fraud. Case study 4 illustrates benefits that have been achieved in this area in Canada. Other jurisdictions have experienced similar benefits.

Case study 4: CANATICS

CANATICS (Canadian National Insurance Crime Services) is a not-for-profit organisation established in 2015 by the Canadian insurance industry. The Anti-Fraud Task Force estimated that in 2010, the value of fraudulent claims in Ontario alone ranged from C$768m to C$1.56bn, adding between C$116 and C$236 to the average premium[116]. In response to these findings, the industry created CANATICS. Seventy five percent of insurance companies in Ontario are members.

Auto fraud tends to fall into three categories: opportunistic, organised or premeditated. Opportunistic claims relate to people claiming more than the damage caused by the actual accident, for example, also claiming for existing damage. Participants in organised and premeditated fraud are often involved in a pattern of fraudulent events, such as staged collisions[117]. However, as fraudulent parties often move from one company to another, it can be difficult for individual companies to track criminals. CANATICS focusses primarily on organised and premeditated fraud. The industry members provide pooled data, and CANATICS uses data analytics tools to flag suspicious claims.

Other examples have included:

[114] Kidd 2017
[115] HM Treasury 2016, p.3
[116] Ontario Ministry of Finance, 2012, p.5,7
[117] Ontario Ministry of Finance, 2012, p.4

- The Insurance Fraud Bureau of the UK which operates several databases, including the Insurance Fraud Register. Between 2011 and 2014, the Bureau oversaw over £40m reduction in fraudulent motor claims.[118] The UK insurance fraud taskforce emphasised the importance of data sharing and analysis in detecting and preventing fraud.[119]
- Santam in South Africa, which improved fraud detection and reduced claims processing time by assessing all incoming claims against identified risk factors. The claims were allocated to risk categories, separating potentially fraudulent and higher-risk claims from lower-risk claims. This approach resulted in Santam identifying patterns that led to the company uncovering a major motor vehicle insurance fraud syndicate. It also reduced the time to assess low risk claims from 3 days to less than an hour.[120]
- Hyundai Marine & Fire Insurance which also uses data analysis to compare current claims and similar past claims, to identify fraud. It uses a numerical model to analyse claims against a large number of business rules (which would difficult for investigators to check individually). The model computes a single score for its fraud probability, so that low risk claims can be paid more quickly and more attention can be paid to higher risk claims. Social network analysis is also used to identify gang fraud. By "applying analytics on claimant's social network data", connections between individuals "who are/were involved in fraudulent activities" can be revealed.[121]Using this approach, Hyundai Marine & Fire Insurance has lowered its fraud rate by 20 percent.[122]

Close to home in NSW, the State Insurance Regulatory Authority and other government agencies are working with the NSW DAC to find a way to combat compulsory third party insurance fraud using machine learning approaches.[123]

At an individual claim level, data analytics can also help companies verify legitimate and fraudulent claims more quickly.

> *Consider, for example, the insights that could be gained simply by integrating social media data with claims data to identify potentially fraudulent activity (such as pictures of a workers compensation claimant riding a roller-coaster) or to quickly verify evidence of flood damage through geo-tagged photos on Flickr. Claims could be reduced, liabilities more accurately assessed and risks better monitored.*[124]

Telematic devices can also help verify whether there has been a motor vehicle accident or damage to a home, for example, by monitoring whether airbags were deployed and therefore identify legitimate claims quickly.[125]

Overall, the benefits to existing policy holders include faster claims processing for low risk legitimate claims and reduced premiums due to reduced insurance costs.[126] Some commentators suggest that using big data to analyse claims would also help to reduce the instances where the insurance company treats a legitimate claim as potentially fraudulent. This would benefit customers who would have had legitimate claims delayed by more detailed investigation.[127]

3.5 Impact on risk assessment and pricing

Data that contributes to improving the assessment of risk of customers is important to insurers. Companies with the most accurate risk assessment and targeting often have a competitive advantage over other insurers.[128] Big data provides new sources of information that create opportunities for:

[118] HM Treasury 2016, p.43
[119] HM Treasury 2016, p.57-58
[120] IBM 2013, p.4
[121] WNS DecisionPoint 2016, p.17
[122] ATKearney
[123] NSW Department of Treasury 2017
[124] KPMG 2015, p.3
[125] FCA 2016a, p.33
[126] FCA 2016a, p.33
[127] WNS DecisionPoint 2016, p.21
[128] Mäder et al 2014, p.18

- a more granular risk assessment that looks more closely at individuals, their behaviour, and the characteristics of what is being insured, not just high-level indicators such as location or vehicle type
- access to more sources of forward looking data, not just information provided by the customer in their application or claim form, or information accumulated through past claims history
- better information for customers, increasing their awareness of risk and helping them to better control risk
- better management of business risks such as the risk of fraud
- improved prediction of individuals' risks and associated cost dimensions for the business and the types of cover being offered
- capabilities to understand individuals' 'willingness to pay' for different cover options (discussed in section 4.2)

For example, in December 2017, QBE announced a A$65m investment in artificial intelligence company Cytora. The Cytora Risk Engine uses a machine learning algorithm, QBE internal data and external data to assess individual's risk.[129] External data includes data from social media, news and media platforms, government data and proprietary data. The platform helps target and price risk.

This potentially allows a more precise and accurate assessment of risk, that can benefit many customers, but some may be worse off. Concerns focus on fairness and whether the price of insurance should reflect each person's risk of making a claim, the impact this can have on people's access to insurance, and whether there are opportunities to discriminate among customers and charge prices that do not reflect cost or risk.

Insurance company witnesses to the Insurance Monitor's May 2016 public inquiry[130] all considered risk analysis and risk based pricing to be areas of focus for continuous improvement by their companies. Insurers provided varying responses to questions about the extent to which they applied (individual) risk based pricing and in relation to the systems, techniques and ratings schemes used by each insurer to generate the 'technical price' (the purely 'risk-informed' price) and in terms of how that technical price may vary from the premium prices actually charged to consumers.

Some insurers stated to the Insurance Monitor that individual property-level risk analysis plays a material role in accurately estimating the level of risk in a portfolio and in enabling the insurer to balance and achieve its targeted or optimal level of risk. However, the extent to which insurers considered more granular pricing of risk can or should be applied, must be balanced with individual insurer's goals or strategies to deliver fair and equitable premiums to customers, both individually and collectively (i.e. in a pool of insured persons).

Insurers stated to the Insurance Monitor that they saw considerable challenges in quantifying the impact of greater use of risk-based pricing on premiums as the changes have been implemented incrementally over a long period of time. One response to the Insurance Monitor attributed an increase in both the spread and range of premium prices in its portfolio to greater use of risk based pricing. That response also noted that risk based pricing has reduced the scale of cross subsidisation across the population, particularly in relation to flood and fire risks; the costs of which may be less widely spread across a geographic area or across a more focussed population than historically has been the case.

The key expected impact of big data on risk assessment is a more accurate, forward-looking assessment of individuals' risk.

> *Big Data means that insurers can move the boundary between risk assessment based on aggregate modelled behaviour and risk assessment based on the observed behaviour of the individual.*[131]

[129] Insurance News 2018
[130] ESLIM 2017b
[131] FCA 2016b

The industry perspective is that when insurers understand the true source of risk more accurately they can give better information to their customers, so that customers better understand what drives risk, and have more control over their level of risk, and therefore the premium they pay. This can occur in two ways.

First, individuals who are relatively low-risk compared to the risk profile of their aggregated demographic, are more likely to be able to demonstrate they are low risk and get cheaper insurance. For example, young drivers with a telematic device in their car may be able to demonstrate good driving practices and avoid paying a higher premium based on their demographic.[132]

Second, people have more knowledge and incentive to reduce the risks they can control (case study 5). The Actuaries Institute has argued that incentive-based risk reduction is expected to become more common, and cited examples where this is already happening.[133]

Case study 5: MLC – Life Insurance

In 2015, MLC life insurance launched the 'MLC on Track' health and wellness program that incorporates data from wearable technology (smart watches, Fitbit). This technology is also used in other countries: for example, Discovery Limited in South Africa, and several US based health insurers (the largest and first was the John Hancock Vitality program)[134]. Policy holders in the Vitality program receive a complimentary Fitbit and discounts for healthy food. In return for allowing the company access to smartwatch data, policyholders can save up to 15 percent on annual premiums[135].

MLC's program tracks activity through the policyholder's smartwatch. Customers are given targets and wellness scores based on their activity, sleep and resting heart rate. Through the program, participants can receive up to a 10 percent reduction in premium[136]. In Dec 2016, MLC advised that 17 percent of new policy holders signed up to the program[137].

It is too early to assess the financial impact of such policies on the underwriter or the impact on claims. The data gathered by the insurer and the feedback from customers is expected to influence policy holder behaviour and premiums. Over time, this information may enable insurers to create individualised products and services[138].

Better risk assessment implies fewer cross-subsidies in the pricing of insurance. For example, safe drivers do not pay more to cover the cost of more dangerous drivers. Progressive Insurance in the US, for instance, has reduced the premiums paid by many drivers by 15 to 30 percent, based on telematic information that demonstrated good driving practices.[139] However, for about 20 percent of drivers, the telematic information indicated that their driving behaviour was high risk, and their premiums have increased.[140]

Most commentators say this is a good outcome, as it encourages people to reduce risk, but some raise equity concerns. For example, in the Northern Australian general insurance market, concerns about access to and the price of insurance have prompted a number of governmental inquiries and concern from locals since 2010-11.

In theory, when individuals can act to reduce risk, they benefit from both reducing the likelihood they will suffer a loss and reducing their insurance premiums. In addition, where the impact of a loss goes beyond the individual

[132] Actuaries Institute 2016, p.15
[133] Actuaries Institute 2016, p.14-15
[134] Actuaries Institute, 2016, p.31
[135] John Hancock Institute
[136] Canstar 2015
[137] MLC 2016, p.2
[138] Productivity Commission 2017, p.54
[139] Oliver Wyman & ZongAn, 2017 p.26
[140] Actuaries Institute, 2016 p.15, 34

affected, for example because of resulting medical costs, or calls on police, disaster or recovery services, then there are broader benefits to society if people reduce these risks.

Some argue that natural disasters such as flood and fire fit into the category of an uncontrollable risk, and individuals cannot reduce this risk.[141] However, while individuals cannot control a particular flood or fire, some can take steps to mitigate the risks and some can choose where they live. This control may be reduced for disadvantaged people who cannot afford to move, even if their premium increases, or for people who need to live in a particular location for other reasons, but even these residents can implement additional protections to minimise damage if a disaster does occur.

Finally, if insurance companies can assess risk more accurately and price it appropriately, their costs fall, as they do not need to factor in as large a buffer to cover the risk that their assessment is wrong. In a competitive market, these cost savings would generally be passed on to consumers.

> *… lack of data or uncertainty about risk generally leads to conservatism and pricing at the higher end of the spectrum. Lack of appropriate data can also limit the availability of insurance cover in some instances, such as cover for mental health conditions…Having comprehensive and accurate data not only reduces cross-subsidisation between consumers, but also provides greater certainty to insurers about the extent of risk they are taking on; reducing the cost and increasing the availability of insurance cover.*[142]

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[141] Actuaries Institute 2016, p.22
[142] Insurance Council of Australia 2016, p.3

4. Implications for regulation

4.1 Consumer protection concerns

Use of big data raises a number of consumer protection concerns that appear to fall into three categories. They include concerns about:

1. Whether data security and privacy could be compromised.

2. Discriminatory practices and access to insurance. That is, concerns that big data analytics could be used to discriminate (including on price) against some consumers or groups of consumers, result in business practices that disadvantage consumers, or reduce vulnerable and disadvantaged consumers' access to insurance.

3. Marketing practices and product suitability.

A study by the UK FCA found that overall big data use will benefit insurance consumers, but expressed that the FCA retained reservations (which are discussed later in this paper):

> *While our findings were largely positive, we did find concerns about some aspects of the impact of Big Data. While we do not consider that these concerns require us to launch a full-scale market study, we did note there was a lack of clarity among stakeholders as to who should address these concerns. … Our work identified two areas where increased use of Big Data has the potential for mixed outcomes with cause for concern that some consumers may be worst off. … the concern is the potential consequences of increased 'risk segmentation'… the second concern is about 'pricing practices' which do not reflect a consumer's risks or the cost to serve"*[143]

Data security, privacy and responsible use of data

Data security and privacy concerns include whether insurers have the systems and structures in place to protect people's information and whether consumers have given informed consent for an insurer to access and use their information. A US consumer survey conducted in 2015 indicated that while 80 percent of consumers were willing to purchase usage-based insurance, over 35 percent had concerns about the privacy implications.[144] A 2018 consumer survey across the US, Europe and Asia-Pacific (including over 1,000 in Australia) recently found that nearly two-thirds of 18-34 year olds would be happy for their insurance provider to use third party data and collect data about their behaviour if it meant they were provided with a more personalised service and lower premiums. By contrast, the cohorts aged 35-54 (45%) and over 55's (27%) had more reservations about sharing personal data.[145]

One concern is that customers may not be aware of the data their insurer has access to, and may consider that use of their information (even if they have voluntarily broadcast that information on social media) is an invasion of their privacy.[146] Such concerns are exacerbated where consumers are unable to detect if the data used is reliable or correct due to the complexity of machine-based algorithms. The complexity of big data may make it difficult for consumers to understand what data is being used and how it is being used to assess their risk,[147] may make it difficult for consumers to give informed consent to the use of their data, or to raise concerns if they think their data is being misused. Lack of transparency can make people less willing to share data.[148] There are also

[143] FCA 2016a, p.7, paragraphs 1.14, 1.17, 1.18.
[144] Capgemini Consulting 2015, p.8
[145] MuleSoft, 2018, p.30
[146] Actuaries Institute 2016, p.5
[147] European Commission 2017, p.18
[148] Capgemini Consulting 2015, p.11

associated concerns about whether people who do not want to share their data will be disadvantaged by being required to pay higher premiums.[149]

Most commentators agree that these concerns are important and need to be recognised and managed.[150] For example, the Productivity Commission noted that:

> *Allowing and enabling data more generally to be available and used widely would provide enormous benefits, but there are risks involved. These risks vary with the nature of the data holding, and the environment and purpose for which it is used... These risks — and the desire for privacy and confidentiality — should not be downplayed or trivialised. They are real and important. But, many of them are able to be managed with the right policies and processes…* [151]

Such concerns are not limited to insurers' use of data. The same issues are being considered in financial services and across the economy more broadly.

Governments in Australia have recognised the risks associated with data ownership, privacy and use of data.

- NSW has a Data Sharing Taskforce set up to develop "ethical and privacy-preserving frameworks which support automated data sharing to facilitate smart services creation and deployment".[152]
- In May 2016, the Office of the Australian Information Commissioner released a Draft Guide to big data and the Australian Privacy Principles for comment.[153] And in its 2017 report on data availability and use, the Productivity Commission recommended that consumers should have a comprehensive right to access and transfer their data held by public or private organisations. It also argued that privacy legislation should still apply, consumers should have access to a broader complaint handling process, and they should be able to find out which third parties, if any, have access to their data.[154] In response, the Australian Government set up a Data Availability and Use Taskforce to implement these recommendations. It has emphasised the need to improve data availability to encourage innovation and competition and maintain consumer choice, while also protecting privacy and security and managing risk.[155]

More recently, on 9 May 2018, the Government decided to legislate a Consumer Data Right "to give Australians greater control over their data, empowering customers to choose to share their data with trusted recipients only for the purposes that they have authorised. The Right will be implemented initially in the banking (Open Banking), energy, and telecommunications sectors, and then rolled out economy-wide on a sector-by-sector basis."[156]

In announcing the Government response to the Open Banking Review, The Hon Scott Morrison MP, Treasurer, stated that "Open Banking has the potential to transform the competitive landscape in financial services and the way in which Australians interact with the banking system", elaborating that the ACCC will be responsible for promoting competition and customer-focussed outcomes within the system, while the OAIC will ensure that privacy protection is a fundamental feature of the system. The ACCC welcomed the consumer data right and stated that "it is a fundamental competition and consumer reform, will improve consumers' ability to compare and switch between goods and services on offer … encourage competition between service providers, leading not only to better prices for customers but also more innovation of products and services."[157]

Given the importance of consistency in using the same data across industries, coordinated approaches that look broadly at big data use are clearly recognised as important by all levels of government.

[149] European Commission 2017, p.18
[150] Insurance Council of Australia 2016, p.2
[151] Productivity Commission 2017, p.8-9
[152] ACS 2017, p.2
[153] OAIC 2016b
[154] Productivity Commission 2017, p.14-19
[155] Department of Prime Minister and Cabinet
[156] The Treasury, Consumer Data Right, 9 May 2018
[157] ACCC, MR82/2018, ACCC welcomes consumer data right

Discriminatory pricing practices and access to insurance

Specific concerns about discrimination and poor business practices related to the use of big data include:

- whether information is knowingly or inadvertently used to facilitate discrimination among customers based on factors other than risk and cost
- the adoption of marketing practices that encourage consumers to buy products they do not want or need
- reduced access to affordable insurance for disadvantaged consumers.

As well as assessing a person's risk, big data could be applied to identify other factors that may be used to differentiate the price of insurance.[158] In other cases, insurers may unknowingly price discriminate based on identified risk factors that correlate with certain losses but have no causation effect. Given that a lot of big data analytics relies on harvesting a wide range of data using complex machine-based algorithms, it is possible that some correlations that are identified by the algorithms could be spurious or of negligible effect or (in worst cases) based on discriminatory factors in some respect, but this would be difficult to detect.

Some commentators have highlighted serious reservations about machine-learning techniques and their use in developing proxies and correlations that are not backed by causal relationships. Concerns include that the company applying the proxy may not know how it was developed, and that the proxies themselves may be discriminatory, or may confuse and exacerbate correlations rather than examining causality. For example, O'Neill highlighted that machine-learning developed pricing models may "place us into groups we cannot see, whose behaviour appears to resemble ours. Regardless of the quality of the analysis, its opacity can lead to gouging".[159]

O'Neill cites researchers at Consumer Reports that found that credit scores were used to generate insurer e-scores using a proprietary algorithm, that also incorporated demographic data that counted more towards price than the consumer's actual driving record, or that included discriminatory characteristics or that created self-perpetuating biases.

Those concerned about such discrimination argued that, despite anti-discrimination laws, it may be difficult to prove that insurance practices are discriminatory if data sources are complex and opaque. The US Federal Insurance Office noted that:

> *…certain big data methodologies may hide intentional or unintentional discrimination against protected classes "by generating customer segments that are closely correlated with race, gender, ethnicity, or religion." Moreover, the existence of a pattern does not necessarily mean the pattern is significant or predictive and, therefore, may not be an appropriate basis for pricing.*[160]
>
> *Big data, such as online shopping habits that show intolerance to price changes, could also be used to identify customers that are less likely to shop around.*[161] *Insurers may then charge loyal customers more for their insurance.*[162]

This behaviour is most concerning if it disadvantages vulnerable or disadvantaged customers. It is arguably less concerning if the customers adversely affected are high income customers who, for example, make a measured decision that it is not worth their time and effort to shop around. For now, the size of this problem is unknown. The FCA in 2016 noted that "we received limited responses from GI firms about their use of Big Data in pricing practices for reasons other than risk or cost"[163] but that 'other firms' "mentioned using non-linear techniques, e.g.

[158] European Commission 2017, p.18; FCA 2017, p.32
[159] O'Neill, Chapter 9, No Safe Zone: Getting insurance, p.164
[160] Federal Insurance Office 2016, p.6
[161] European Commission 2017, p.18
[162] Federal Insurance Office, p.6
[163] FCA 2016a, p.9, paragraph 1.29

machine learning techniques (which involves developing computer algorithms that can grow and change with new data)".[164]

Some governments ban certain types of price discrimination in some areas of insurance.[165] For example, some US states ban price discrimination based on sex or gender.[166] A number of US states have also banned or restricted the use of price optimisation in personal lines insurance[167]; and the National Association of Insurance Commissioners (NAIC) has foreshadowed that in 2018 its Working Group on Big Data will consider modifying its requirements over insurers' use of consumer data in personal lines insurance products, including preparation of model laws and regulations.[168]

Access concerns may arise when vulnerable or disadvantaged consumers who previously had access to insurance are now assessed as higher risk and can no longer buy affordable insurance. Problems are most acute when the risks being assessed are beyond the consumers' control and they are classified as uninsurable risks.

For example, income is correlated with health outcomes, therefore more granular risk assessment might make it more difficult for low income families to get access to private health cover. The issues for general insurance are less clear. Concerns have been raised about accessibility of affordable home and contents insurance, but it is uncertain whether big data will exacerbate this problem.

The UK Financial Conduct Authority identified a number of these concerns, including the risk of greater price discrimination and whether vulnerable groups (such as people with disabilities) are still able to access reasonably priced insurance. The Authority concluded that many consumers benefit from the use of big data, but risk segmentation does not always work in favour of all consumers. It analysed information from a survey of brokers that specialise in consumers with non-standard risk, and data from two major price comparison websites. It concluded that the concerns about greater price dispersion and reduced access to affordable insurance had not yet materialised; however, it noted that it would continue to monitor the potential exclusion of high risk consumers and engage with the UK government about possible responses if problems were identified.[169].

Other suggestions to address concerns include giving consumers full information about how their risk is being assessed[170] and giving the regulator the power to review the algorithms used to analyse data and assess risk.[171]

Product suitability and unfair practices

Effective competition among insurance companies is one way to help ensure consumers get good value for money. For competition to work and benefit consumers, both the demand and supply sides of the market need to work well.

One business practice of concern is whether the information provided through big data would contribute to pressure selling and upselling insurance products people do not want or need, or pay too much for. For example, using big data:

> *…to enhance cross-selling at the point of sale, when the consumer is less likely to shop around. Where firms are planning on using Big Data in marketing to present additional or add-on products during the sales process, there is a greater risk that consumers may not shop around and/or may be less price-aware than they would be when choosing a standalone product. (FCA 2016, p.31)*

Examples of cross selling in Australia might include the additional product features presented to customers by many insurance company's websites. For example, options to bundle multiple insurance classes (life plus car

[164] FCA 2016a, p.15, paragraph 2.21
[165] BEUC 2017, p.3
[166] Federal Insurance Office 2016, p.19-20
[167] NAIC, 2016
[168] NAIC, 2018
[169] FCA 2016, p.8
[170] Actuaries Institute 2016, p.29
[171] IAIS 2017, p.15

plus home and contents) for a multi-product discount; or to take up 'high value item', 'portable valuables' or similar cover options when purchasing simple contents cover. Less benign examples of add-on sales or cross selling, which do not appear to be enabled primarily by big data, recently include the Australian Securities & Investments Commission (ASIC) actions over unfair conduct by insurers in relation to add-on insurance and extended warranties via car dealers or finance brokers. As a result of the investigations, as at 25 January 2018, insurers have agreed to refund over $120 million to customers.[172] The European Consumer Organisation, BEUC, argued that big data analytics makes the engagement with consumers more personalised, and that this could "give consumers the impression they are getting real advice, with all the regulatory protections attached, while in fact they are just being purely sold financial products."[173] It may also be more difficult for consumers to compare products that are highly individualised and complex.[174]

The legislative protections available to consumers in relation to unfair practices and product suitability in Australia are evolving; so their applicability to issues raised by conduct enabled by big data techniques remains uncertain. It is worth noting that the general insurance industry is exempt from unfair contract terms prohibitions or equivalents framed under the Australian Consumer Law that apply to most other industries including financial services; while consultation processes were recently completed by the Treasury in relation to design and distribution obligations for financial products, to ensure that products are targeted at the right people.[175]

4.2 Possible effects on competition

Information asymmetries, consumer participation and choice

Consumer protection issues such as those discussed above have the potential to entrench information asymmetries in the favour of insurance companies over consumers and ultimately affect the degree of workable competition in a market. Work by the Insurance Monitor has suggested that action is needed to address imbalances and enable consumers to more effectively participate in the general insurance market.

The Insurance Monitor is aware from the literature on behavioural economics that consumers face cognitive challenges that affect their ability to process information quickly and rationally.[176] This can present opportunities for insurers to exploit consumers by deliberately confusing them through spurious product differentiation or through price discrimination, both of which are facilitated by the use of big data.

On the positive side, big data may have some impacts on consumer choice. As noted above, big data can be used to improve the sophistication of comparison tools, which may assist consumers in choosing among policies and insurers. Changes in marketing practices, however, will need to be monitored so that new practices do not put pressure on consumers to buy products they do not want or need.

One issue highlighted in the 2016 Financial Conduct Authority review was that using telematic data could potentially make it difficult for customers to switch insurers. The Authority made the following comments:

> *We have not received any evidence that consumers using telematics currently experience difficulties in switching providers nor complaints from firms relating to the lack of portability of telematics data. However, we recognise this has the potential to occur in the future if telematics increase in popularity.*

[172] ASIC, 2018
[173] BEUC 2017, p.6

[175] Treasury, 2018, https://treasury.gov.au/consultation/c2017-t247556/
[176] Interestingly, in 2016 in the UK, the Competition and Markets Authority (CMA) concluded there were adverse effects on competition (on the demand side) in the energy markets in Great Britain including a domestic weak customer response and a microbusiness weak customer response including actual and perceived barriers to access information and to switch providers. To address these imbalances, the CMA made an order that requires energy companies to provide the Gas and Electricity Markets Authority (GEMA) with contact details for customers that have been on one or more default tariffs for three or more years; enables customers to opt out of receiving additional mail from non-suppliers; and enable GEMA to share customer information with competing suppliers, to enable them to send promotional material about alternative offers to consumers (CEMA, 2016). This type of policy response has not, to the Monitor's knowledge, been applied previously to address consumer side disparities in a market.

We are aware that there have been industry discussions about standardisation, which we note has not yet found an appropriate solution. We would strongly encourage the industry to consider further how best to address this issue, as ownership of data should not become a barrier to effective competition. Should ownership of telematics data become a barrier to switching in the future, this is an area where we would consider use of our competition powers.[177]

Price optimisation

The Insurance Monitor previously flagged his interest in the impact of big data on insurance pricing in the May 2017 Public Inquiry, commenting that big data is presenting opportunities for insurers to apply pricing techniques such as price optimisation. Price optimisation is a technique where premiums may be set to reflect individual characteristics unrelated to risk or cost but operating on the buyers' willingness or capacity to pay.

The Insurance Monitor noted that the use of price optimisation could signal a significant departure from the traditional risk-based approach to determining premiums and that insurers' approaches to price optimisation and the legal issues they may pose either now or potentially in the future in relation to the price exploitation prohibition, will be areas of further consideration and consultation by the Insurance Monitor as the ESL reform progresses.

Businesses in most markets operate in competitive environments that range between the theoretical concepts of perfect competition, to pure monopoly.

In a theoretically perfectly competitive market, there are many businesses; none have market power and there are no barriers to entry. None of the businesses have any discretion as to the price that they charge; and the price for the good or service is negotiated by each consumer on the basis of perfect information about the product they are buying. Consumers have all the bargaining power. At the other extreme, a pure monopoly has discretionary power to charge more and supply less or pursue other pricing goals. It has no direct competitors and it can price without any threat of a competitor entering its market. It is the price setter and consumers must pay whatever the business requires.

Economists generally speak of three types of 'price discrimination' that are available to companies with some degree of market power:

- Third order price discrimination, or 'group pricing'
- Second order price discrimination, 'menu pricing' or 'versioning'
- First order, 'perfect' price discrimination or 'price optimisation'.

Group pricing refers to charging different prices to different classes or groups of customers, where the differences are no cost-related but reflect differences in the groups' responsiveness to price changes. This strategy may be employed where the company knows the value that different groups of people place on a product. The characteristics that businesses typically used to differentiate different consumers include location; time; age, income or profession, but there can be many more depending on the product. Group pricing strategies can also encompass strategies to cater to classes of people such as new (or switching) versus repeat or long-term customer segments; for whom 'loyalty', 'no claim' and 'bundle-cover' discounts may resonate.

Menu pricing, or versioning, is where businesses offer many different versions of a product at different prices to consumers, allowing the customer to select the version they prefer. In general consumer goods, typically this can be when both branded and 'white label' goods are made by one manufacturer (whether or not they are then sold through one or many different retailers).

Perfect price discrimination occurs where businesses charge individual customers different mark ups over the cost price of products or services, for the same product or service. The mark up is determined based on how

[177] FCA 2016a, p.18

price sensitive the individual is; each customer is charged the maximum price that he or she is willing to pay for that good or service.

The difference between what a consumer is willing to pay and what they have been charged (where this is lower) is known as the "consumer surplus". Achieving perfect or first order price discrimination requires that the business knows exactly how much the consumer is willing to pay. The data and information that insurers rely upon to implement individually targeted risk-based pricing may also enable them to implement price optimisation.

Insurers capturing the consumer surplus

The effect that price optimisation has in relation to the price paid by individual consumers depends on decisions made by their supplier, and the consumer's propensity to switch providers, but the technique is implicitly designed to erode the 'consumer surplus' and increase prices, to the maximum price possible before a consumer will switch suppliers, as the figure below shows.

Figure 4-1: Distribution of the consumer surplus without and under 'Perfect Price Discrimination'

The figure to the above left, shows a market for an identical good without any price discrimination. Everyone pays the same market price (P1) but there are some consumers who would be willing to buy the good at a much higher price. This difference between the market price and the price people are willing to pay, summed across all consumers, is called the 'consumer surplus' and is represented by the grey shaded area. The blue area is the producer's profit or 'producer surplus'.

The figure to the above right, shows where a producer is able to charge each consumer the maximum amount they are willing to pay by charging each consumer a different price. This is known as perfect price discrimination. As the figure shows, by charging each consumer a different price based on the maximum they are willing to pay (represented by prices P2 and P3), the producer is able to capture the consumer surplus and turn it into producer surplus or profit as represented by the blue area. Some proponents argue that extracting consumer surplus from the wealthy enables cross subsidisation for the poor. It is also possible that people who previously would not have purchased, would if the price was less than the cost of supply. There remain a number of questions as to the likelihood of occurrence of either of these scenarios.

Price discrimination may be necessary in some cases because it enables a feasible market to function. This is particularly relevant to utilities such as electricity, where block pricing, or second-degree price discrimination, is common (for example, based on the time of supply). However, this may not be the case in insurance, as noted by Thomas (2012):

"For products where marginal costs are very low relative to fixed costs, a standard justification of price discrimination is that it may make feasible markets which would not otherwise exist. A simple example will illustrate this. Suppose a consultant has two potential customers for a report, with reservation prices of US$700 and US$1,000. Suppose that opportunity cost of writing the report is US$1,500. If the same price has to be charged to each customer, the report will not be written. But if US$650 can be charged to one customer and US$950 to the other, the report gets written and everyone is better off. Real examples of this phenomenon include software, where reduced prices for schools and similar institutions often apply; academic journals which charge lower subscription rates to individuals than to libraries; and passenger airlines, where price discrimination can often facilitate opening a new route in a network. But in insurance, marginal costs are generally a significant proportion of total costs. Insurance is often compulsory or effectively compulsory, leaving little scope for expanding market size. Thus one of the arguments which may justify price discrimination in many markets has little application in insurance."[178]

Differences in new business versus renewing policies – so called "inertia pricing"[179] – is one example of this since the costs associated with securing new business is arguably higher than for maintaining renewing policies, yet insurers appear to impose a higher mark-up for the latter.

Feasibility to price discriminate

Pursuing any price discrimination strategy requires that the market be less than perfectly competitive, and that the businesses in it be able to exercise some degree of market power.

The Insurance Monitor considers this is entirely feasible in the NSW general insurance market. Economic analysis by the Monitor found that there is clear room for improvement in the effectiveness of competition, on the basis that:

- Conventional indicators relating to market structure indicate high concentration, some material barriers to entry relating to prudential requirements, and patterns of entry/exit which indicate that establishing a new business at efficient scale is very difficult.
- Indicators relating to the market conduct and the conduct of consumers suggests that the product differentiation and the proliferation of brands is not always in consumers' interests. Evidence on switching is mixed, but it appears that consumers' difficulty in comparing offers and general disengagement is likely limiting switching behaviour.
- Indicators relating to market performance indicate a mixed performance on prices and profit (with more profit accruing to the larger insurers), and limited signs of innovative or other consumer-benefitting changes. A material degree of price dispersion for identical or very similar insurance products exists, which reduces confidence that prices are reflecting efficient costs.

This work corroborates recent market studies by bodies including the Senate Economics References Committee[180] considered that competition in the general insurance market is not fully effective and that consumers would benefit from increased competition. The Productivity Commission also considered that "In general insurance, market concentration is high and camouflaged, with a proliferation of brands but far fewer actual providers. Consumer confusion on product differences is attributable to the poor quality of information required to be provided to consumers and, to a lesser degree, the incentives faced by advisers." [181]

Thomas (2012) argues, even before the big data revolution, that the power for insurers to price discriminate was high:

[178] Thomas (2012), op cit, page 35.
[179] Thomas (2012), op cit. page 30-31
[180] Senate Economics References Committee, 2017
[181] Productivity Commission, 2018, Overview, p.2

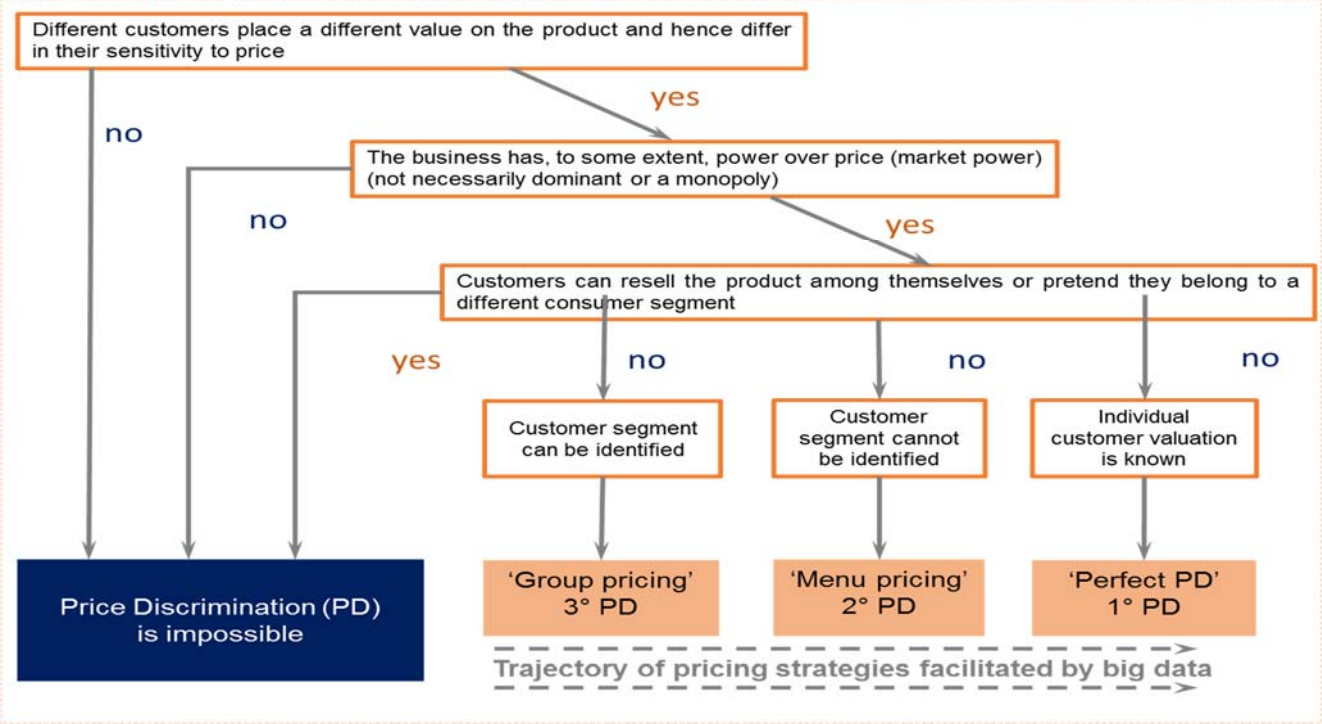
"Insurers tend to have much greater power to discriminate than many other types of firm, for three reasons: better data, price opacity, and the infeasibility of arbitrage. As regards data, risk assessment means that insurers have a pretext to obtain much better data on their customers than other types of firm, and its reliability is enhanced by the legal doctrine of utmost good faith, which encourages prospective customers to answer questions honestly. In other markets, the power of firms to discriminate is limited because prospective customers are often anonymous, or can strategically misrepresent their characteristics to the firm without fear of penalty. As regards price opacity, risk-related individual price variations in insurance make non-risk-related price discrimination more opaque, and hence more difficult for customers to identify and challenge than in other markets. As regards arbitrage, this is not possible in insurance, because contracts are specific to an individual. In this respect, insurance products are unlike products such as books or online subscription services, where resale between customers can often undermine price discrimination."[182]

Price discrimination is not illegal per se in Australia, nor in most international jurisdictions, but it can give rise to consumer unease and, at times, concerns which may be actionable in different contexts. For example, price optimisation is banned in some US states and the practice has some corollary to 'price gouging' legislation in certain US states which curb price increases on essential supplies in disaster situations. In Europe, the European Court of Justice ruled in March 2011, in the case of *Association Belge des Consommateurs Test-Achats and Others vs. Conseil des ministers*, that risk-based gender variations (linked to price discrimination) in insurance prices would no longer be permitted for new policies sold in the European Union after 21 December 2012.

Price optimisation could, hypothetically, have fallen foul of the long-repealed 'price discrimination' provision under the former *Trade Practices Act 1974*. The price discrimination prohibition was repealed, partially in preference to the protections available under other anti-competitive conduct provisions in that Act.[183]

The following diagram shows where different types of price discrimination strategies can be pursued by businesses, the preconditions for a strategy to be applied.

Figure 4-2: Types of price discrimination and preconditions



Source: FCA, October 2016 *Occasional Paper No.22. Price discrimination and cross-subsidy in financial services*, p.13

[182] Guy Thomas, Non-Risk Price Discrimination in Insurance: Market Outcomes and Public Policy, 2 The International Association for the Study of Insurance Economics 1018-5895/12, The Geneva Papers, 2012, 37, (27–46), page 34-35

[183] These examples are prohibitions that have or do attract diverse views whether the prohibition provides net benefits, particularly where there is no limitation on the operation of the provision to exceptional circumstances.

The Monitor suggests that insurer's pricing strategies currently adopt some elements of both group and menu pricing; that is, historically we can observe:

- Group pricing strategies differentiating pricing for new (or switching) customers versus long-term customer segments including the many 'loyalty', 'no claim' and 'bundle-cover' discounts offered by most insurers.
- Menu pricing strategies; particularly at the brand level.

In Australia, the Productivity Commission illustrated that there is a proliferation of general insurance brands (more than 30) that are owned or operated, largely, by four or five large companies in each insurance class and in each class account for more than 70% and potentially almost 90% market share of the relevant market.[184] On data reported to the Insurance Monitor as at April 2018, the twelve largest insurance companies operating in commercial and residential property classes of the general insurance market in NSW, operate or underwrite over 250 insurance brands.

The different brands may have different pricing strategies, which allows insurance companies to meet and market to the price expectations of different customer segments.

Increasing significance of price discrimination

The extent to which general insurance companies operating in NSW employ price discrimination is presently unclear. Insurers responding to questions posed by the Insurance Monitor at a public inquiry in May 2017 about the use of price optimisation techniques were quite varied, with insurers each offering their own interpretation of the concept of price optimisation.

In the Monitor's October 2017 *Summary of the Public Inquiry* (page 37-38), he summarised the evidence given by the witnesses. Three insurer's witnesses stated that they do not use price optimisation, however the definitions that were used for the practice and the qualifications provided with the responses did not unequivocally rule out the practice or provided illustrative examples of their use that were relatively benign.

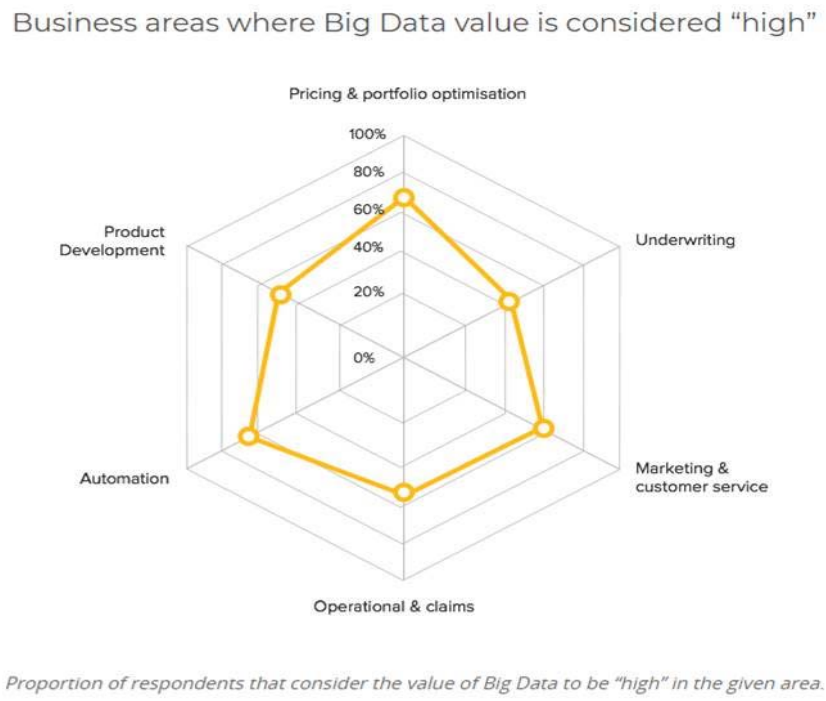
It seems very likely now that individual price discrimination will become more prevalent in the future.

The Monitor is in the process of analysing data that may provide additional insights on this matter.

Results from the Finity 2018 Big Data Survey cited below at Figure 4-3 indicate that insurers now consider the value of big data for pricing and price optimisation to be higher than in other uses.

[184] PC, 2018, pp. 320, 326

Figure 4-3: 2018 survey of Australian and New Zealand insurer's Big Data progress: Business areas where Big Data value is considered "high"



Finity 2018, *Big Data Survey Results,* http://www.finity.com.au/analytics/big-data-survey-results#matrix

The survey cited above suggests that within the next few years, insurance company's capability and their incentives to employ price optimisation techniques based on big data will increase.

Insurer moves to adopt price discrimination depends in part on consumer inertia.

Consumers who are willing to challenge their insurer's pricing, to shop around, and if necessary, switch insurers in response to higher pricing will signal that they are unwilling to give companies their consumer surplus.

5. Implications for the Insurance Monitor

Big data will potentially have a significant impact on the general insurance industry. The implications for the Insurance Monitor may involve changes that:

- affect the role of the Insurance Monitor in relation to price monitoring
- impact the Monitor's obligation to report on the effects of the ESL reforms on the take-up of insurance and
- raise implications in relation to the prohibited conduct provisions of the Act.

5.1 Price monitoring functions

The use of big data is expected to result in more diversity in the products and prices for home, contents and motor vehicle insurance. Big data techniques may make it more complex to determine the basis for price changes and those changes' connection to cost and risk. It also may complicate the assessment of the impact of changes in the ESL on prices.

This affects the Insurance Monitor's price monitoring activities, which under section 10 of the Act require him to monitor prices for the issue of regulated contracts of insurance to: assess the general effect of the ESL reform on prices charged by insurance companies for regulated contracts of insurance; and to assist in the consideration of whether insurance companies are engaging in prohibited conduct.

There is also expected to be more, and more varied, businesses involved in the insurance value chain.[185] Insurers' data collection and analysis activities may be contracted to new technology companies or sourced from third-party suppliers. It may also mean that the businesses whose activities create risks that affect consumer rights may not have a direct relationship with those consumers.

5.2 Insurance take up

Increasing use of big data will affect the way insurance is priced, and may lead to some higher-risk individuals being denied access to affordable insurance. Such changes in pricing may affect the take up of insurance. It may be more challenging for the Monitor to assess and report on the impact of ESL reform on the levels of insurance coverage pursuant to sections 9(2)(d) and 11 of the Act, if the industry accelerates its use of big data.

The insurance sector in Australia has been relatively slow to adopt the use of big data.[186] Even in the UK, where adoption is much higher, research in 2016 by the Financial Conduct Authority found there has been no evidence that use of big data by insurers has reduced the coverage for high risk customers, increased price dispersion, or resulted in more affordable insurance for people with non-standard risk.[187]

Given the range of possible effects, the net result is still unclear. Some aspects of the use of big data are predicted to reduce the number of people insured and some are predicted to increase insurance take up.

[185] IAIS 2017, p.6
[186] Productivity Commission 2018, p.337-338; Finity, 2018
[187] FCA 2016a, p.23, 26

5.3 The price exploitation prohibition

Section 14(1) of the Act provides as follows.

> *For the purposes of this Act, an insurance company engages in* ***price exploitation*** *if:*
>
> *(a) the insurance company issues (or has, at any time during the relevant period, issued) a regulated contract of insurance, and*
>
> *(b) the price for the issue of the regulated contract of insurance is unreasonably high having regard to:*
>
> *(i) the emergency services levy reform, and*
>
> *(ii) the emergency services contributions required to be paid by the insurance company, and*
>
> *(iii) the historical emergency services levy rates charged by the insurance company, and*
>
> *(iv) the costs of supplying insurance against loss of or damage to property, and*
>
> *(v) any other matters prescribed by the regulations.*

Under section 21 of the Act, the Insurance Monitor has the ability to issue guidelines to insurers about when conduct may be regarded as constituting prohibited conduct. The Insurance Monitor must have regard to any Guidelines issued under section 21 of the ESLIM Act, in deciding to give an insurance company a contravention notice, a prevention notice, to issue any person with a substantiation notice, or to issue a public warning statement. The NSW Supreme Court may have regard to any Guidelines issued by the Insurance Monitor, under section 21 of the Act, when determining whether to make any order relating to prohibited conduct.

The Insurance Monitor's December 2017 *Guidelines on the prohibition against price exploitation* are the version that is currently in effect. A number of the Guidelines' criteria have a connection to operational changes that may be made by insurance companies through their use of big data techniques that may enliven the Monitor's price monitoring and investigation and enforcement powers in connection with the prohibition against price exploitation.

Guidelines 1, 2, 5, 12, 13 and 14 below may be particularly relevant to different circumstances under consideration by insurance companies issuing regulated contracts of insurance in NSW, and to the consideration of whether a price for such a contract is unreasonably high, having regard to the circumstances provided in the Act.

> ***Guideline 1:*** *The prohibition on price exploitation applies at the level of the price of an individual contract of insurance within the scheduled classes issued by an insurance company and regulated under the ESLIM Act.*
>
> ***Guideline 2:*** *The prohibition on price exploitation relates to the total price charged for a regulated contract of insurance and the major components of the price, including the base premium (including re-insurance costs), ESL, GST and duty, and brokerage or commission.*
>
> ***Guideline 5:*** *Changes in ESL rates over time should not be unfair to individual policyholders taking into account all relevant circumstances. Excessively sharp changes in rates over time should be avoided where possible.*
>
> ***Guideline 12:*** *The Insurance Monitor expects that each insurer will be able to justify the approach it adopts as to when and how to recover their contribution liabilities from policyholders. Where possible, insurers should consider adopting an approach to re-introducing ESL rates that offsets to some degree the tapering pattern that applied to the removal of rates under the former contribution scheme.*
>
> ***Guideline 13:*** *The Insurance Monitor will examine the reasonableness of base premium increases where there are concerns about their coincidence with ESL changes, the size of the movements compared to normal inflationary pressures, and changes in cost or pricing methodologies.*

Guideline 14: *Insurance companies should be able to provide sufficient information to justify their pricing decisions for contracts of insurance regulated under the ESLIM Act.*

The ways in which those guidelines may be relevant are manifold and there are a number of questions that bear further consideration by insurance companies and the Insurance Monitor. To illustrate; big data has the potential to affect the price of an individual contract of insurance, including the base premium, ESL and total premium collected by the insurer. It may affect insurer profitability and the costs of supplying insurance against loss of or damage to property. 'Fully optimised' base premiums may result in total premium price changes to individual contracts of insurance or to different policyholders across a range of classes of regulated contracts of insurance. As the base premium changes, the approach of applying a consistent ESL *rate* across classes of insurance may result in differences to the ESL *amounts* charged by each insurance company to its policyholders. Whether this approach remains fair in a particular policyholder's instance is an open question.

The Insurance Monitor's role and functions are intimately connected to industry developments in this space and insurance companies are reminded to carefully consider the consumer and legal ramifications of their big data initiatives prior to implementation during the period of ESL reform. As highlighted by Guideline 14, insurance companies should be able to provide sufficient information to justify their pricing decisions for contracts of insurance regulated under the Act.

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