CHAPTER 5

InsurTech

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Abstract Traditional challenges insurers face include: (1) asymmetric information—the inability to price a policyholder correctly; (2) moral hazards—the change of attitude following cover; and (3) claims management. In this chapter, we discuss how disruptive technologies are evolving in the insurance sector and the challenges faced in their implementation. We show how large and continuous datasets are transforming the general insurance markets and their business processes, as well

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as enticing desirable policyholder behaviour and streamlining claims management. We then discuss how artificial intelligence is improving traditional insurance processes from the first point of contact to claims management. We also examine the use of artificial intelligence as a means of interacting with prospective clients and existing policyholders. Finally, we explain how blockchain technology can transform the structure of the insurance market to a peer-to-peer format.

Keywords InsurTech · Insurance · Telematics · P2P insurance

5.1 Introduction

It appears that the age-old business of insurance is finally in the throes of change. Incumbent insurance companies are under threat not only from tech giants such as Amazon entering the market (Seekings 2017), but also from agile start-up entities, that are leveraging the power of technology to innovate their way to market share. This utilisation of technology to improve efficiency and savings in underwriting, risk pooling and claims management from the current insurance model has come to be known as "InsurTech", deriving inspiration from the more well-established concept of "FinTech".

This chapter starts off by describing the process and challenges of a traditional insurer. This is followed by a discussion of future developments in InsurTech. These developments are then discussed in light of the big data paradigm, artificial intelligence (AI) techniques and distributed ledger infrastructures (also known as blockchains or distributed ledge technologies [DLT]).

5.2 How Does Insurance Work?

The business of insurance involves risk transfer from the policyholder to the insurer. The insurer pools similar risks in homogenous groups and pays out any claims from the collected premiums and sometimes from own reserves. The consequence of such risk pooling is a lower variability of outcomes and less likelihood of extreme payouts. For example, consider the probability of a delayed flight as 10% and the cost incurred being €100 if this happens. If ten individuals on separate independent flights pool their risk, the probability of all of them having a delayed flight and hence paying out €100 each is 0.00000001%.[1] In a typical scenario, the insurer would charge above €10 (the fair price) as a premium to cater for claims, contingency, management costs and profits.

The insurer goes through the process of underwriting on being approached to provide cover, that is assessing whether the risk should be taken on board and at what price and then in the event a claim is notified, a claims management process is initiated. Two main challenges faced by insurers are 'adverse selection' and 'moral hazard'. The latter refers to the policyholder changing attitude following attainment of insurance cover (e.g., not locking the doors of a property as knowing the property is insured). 'Adverse selection' is typically the outcome of asymmetrical information whereby a policyholder ends up being pooled (and priced) in a specific risk group despite having a riskier profile. This may have been the case whereby the insurer does not use particular information in pricing risk or this information was possibly withheld. Throughout this chapter we discuss how technology is enabling insurers to price policyholders actuarially fair and reduce moral hazard by controls or gentle prompting.

5.3 The Big Data Paradigm

In today's world, data is becoming an indispensable commodity, leading industries to transform their business processes and value chains into data-driven ones. In the insurance industry, one can relate to this "phenomenon" by observing how *historic insurance models* became more adaptive by making provisions for this ever-growing flow of data through various heterogeneous (unstructured/semi-structured) sources such as sensors or social media. This is often called *Big Data*, which is characterised by the 5 dimensions (5Vs): Volume (how much), Velocity (how fast), Variety (different kinds), Veracity (truthfulness and trustworthiness) and Value (the worth of data).

This proliferation of data, or "big data", has allowed the InsurTech businesses and more forward-thinking established insurance companies to harness a unique selling proposition and competitive advantage over

[1] On the other side of the scale, the probability of no one having a delayed flight is 90.438% which is lower than 99%.

other market participants. We now examine three different areas in which big data has impacted the insurance world, to date: Telematics, Wearable Technology and the Internet of Things (IoT).

5.3.1 Telematics

A key consideration of insurance is to ensure that it charges adequate premiums by pricing its products appropriately. Within the automotive insurance industry, insurers have, for a long time, proxied the risk of policyholders making an accident related claim via rating factors such as drivers' age, gender,[2] postcode, car model and claims experience. The underlying assumption is that these rating factors are predictive of the likelihood of claim. For example, a young driver with a sports car is deemed to be more likely to be involved in an accident than a middle-aged driver in a sedan and thus is priced accordingly. This pricing mechanism is problematic in the sense that some of the young drivers in question may actually be a much lower risk, in terms of driving ability, irrespective of their car type and age status. This mispricing can lead to adverse-selection where the low-risk individuals move out of the insured pool and seek cover elsewhere, eventually leading to what is known as the adverse-selection spiral. Telematics seeks to overcome this issue by using on-board technology to monitor and assess the driving behaviour of each individual driver, thus moving insurance from a pooled pricing model to a more individual specific model where the underlying risk is more closely monitored (Barbara et al. 2017).

The telematics technology devices (also known as a "black box") can pick up diverse driving metrics such as location, time of day, mileage, driving frequency, behaviour around hazardous zones, speed, rates of acceleration and braking habits. These metrics can then be considered in a more accurate and individualised pricing model, which ultimately allows the previously trapped pooled policyholders to break free from their features such as age and prove their worth as safe drivers that are a good risk and unlikely to have an accident and hence claim. Not all policyholders are bound to profit from this as pricing accuracy may lead in certain individuals being priced out of the market, as the previously good risks that were subsidising their premium, are now priced on a more personalised basis.

[2] Although it is now illegal to base any insurance pricing on gender with the European Union.

5.3.2 Wearables

Wearables are typically viewed as being those of a wrist-borne nature (e.g., FitBit and the Apple watch), however, the technology is now generating masses of data from a variety of sensors embedded in devices (e.g., medical technology) to fashion items such as jewellery, clothing and shoes. These devices are becoming more affordable to the general public, and similar to the uptake of telematics, insurers are benefiting from this surge of available data to improve upon their pricing models.

Potential wearable derived biometric information includes those from physical activity (e.g., number of steps, time spent sitting, miles cycled), cardiovascular measures (heart rate, heart rate variability, ECG, blood pressure), sleep data (quantity and quality), body temperature, galvanic skin response, blood sugar and even pollution exposure. It should come as no surprise, therefore, that the main insurance interest from wearable data comes from health long-term care insurers and to a lesser degree life insurance companies.

In a similar fashion to telematics, wearables provide the insurer with a means to determine, or at least get closer to, the true underlying risks of the insured policyholder. The opportunities for wearables, in the insurance world, potentially go beyond that of refinement of current morbidity and mortality models. They also provide the insurer with a means by which they can improve their marketing efforts (e.g., providing free wearables as has already been done in the UK [Stables 2016]), reduce customer churn through greater engagement and touch points (e.g., from monthly premium discounts) and potentially even motivate healthy behaviour change as well as alerting customers to health concerns (and hence reducing moral hazard).

Whilst the opportunities for insurance companies in this space do indeed appear to be great, the nascent nature of wearables for insurance purposes means that there are many issues and considerations to overcome before their use becomes mainstream. Chief amongst these issues is the accuracy of pricing models and reliability of the devices.

5.3.3 Smart Homes and the Internet of Things (IoT)

The network of physical devices embedded with sensors and connectivity, allowing the transmission and communication of data has come to be known as IoT. Applications range from smart home devices (e.g., smoke alarms, thermostats and fridges) to environmental monitoring (e.g., examining air and water quality) and has permeated the market to such an extent that forecasts suggest that by 2020 IoT will consist of as many as 30 billion objects (Nordrum 2016) and will have a global market value of $7.1 trillion (Hsu and Lin 2016).

As per telematics and wearables, IoT also facilitates the provision of a multitude of new data sources of interest to the insurance world. And again, as per telematics and wearables, the opportunities to use this data extend beyond pricing power (e.g., discounts to customers that lock their sensor-based windows and doors when away from the house). Smart home devices, for example, allow the insurer to potentially move towards being proactive in terms of managing risks. The traditional insurance model has been one of zero intervention prior to a claims assessment, but the data from IoT smart home sensors opens the potential for a new type of customer interaction. A relationship whereby the insurance company now takes an active role in engaging with the customer between the point of sale and claim. For example, the data from a sensor monitoring water pressure could be used to alert the policyholder of a leakage problem before substantial damage occurs.

5.3.4 Big Data: Trustworthiness and Privacy Concerns

In Big Data, veracity is one of the main Big Data dimensions. Whilst in the past this was frequently overlooked as long as data was being harvested from multiple heterogeneous sources, veracity is nowadays a more pressing issue (e.g., due to an increase in public discourse on fake news). Simply put, veracity deals with data uncertainty due to inconsistencies and deliberate deception. These problems create obfuscated data, hindering accurate and correct future analysis and understanding of data and leading to potential insurance fraud.

A second issue in harvesting data from multiple sources is privacy. Personal data might have been generated (e.g., GPS location from mobile device) or harvested (e.g., social networks) from multiple heterogeneous sources. Ethically, data owners (including insurers) should ask the consent of their customers prior to use this data for analysis purposes. Furthermore, businesses with customers in Europe have to comply with the General Data Protection Regulation (GDPR) which looks after the privacy and protection of an individual, addressing problems such as how personal data can be used in this data-driven technological age

(EU 2016). It will be interesting to follow how insurers may use social credit schemes, which monitor also social circles to create a 'credit score' (Gapper 2018), in their underwriting processes in light of these issues.

5.4 Artificial Intelligence

Insurers have already started embracing the use of AI techniques to make sense out of the big raw data and obtain useful insights. Techniques such as deep learning, neural networks and natural language processing, amongst others, are helping in improving business operations and as a natural consequence customer's satisfaction.

5.4.1 Machine Learning and AI in the Underwriting Process

It is very likely that all underwriters will be using machine learning and AI as predominant technologies behind their underwriting decisions over time. Workflows of Big Data processing techniques and AI algorithms enable underwriters to process and understand far more data than traditional processes as well as provide more accurate underwriting predictive assessments. With more predictive models, underwriters can apply more adequate premiums and thus enabling underwriters to reduce their loss ratios.

Motor insurance premiums are traditionally charged for a predetermined amount for a period of twelve months. This buffet-style approach, where you pay the same amount irrespective of use, would not apply if priced via a telematics device (Azzopardi and Cortis 2013) as explained in the earlier section. This device enables data between the insured vehicle and the insurer's central management system to be sent instantly. This means that with the help of AI techniques, insurance companies develop a system of adaptive continuous pricing, instead of having a one-off yearly payment.

Traditional life insurance underwriting involves an underwriter asking a specific set of questions to predict life events of the proposer/s. Lapetus Solutions, a US-based InsurTech start-up, have developed an AI system and is currently partnering with life underwriters to provide quotations using facial analytics technology. This system comprises sensory analytics as well as dynamic questioning. To receive a quotation, the client just needs to send a self-portrait photograph (a "selfie") and this technology will use the image provided to examine the individual's physical features and determine the health status, disease susceptibility and longevity (Lapetus Solutions 2017). From the photo provided, the facial analytics technology in this system examines a considerable number of regions on the face in order to provide data to underwriters relating to Body Mass Index (BMI), estimated age and smoking indication. Furthermore, the system scientifically formulates specific questions that vary depending on the responses provided. These will provide more insight and veracity into the individual longevity as opposed to the standard questions normally found in life insurance proposal forms. The advantage of such system is that the whole process only takes a few minutes to complete.

The insurance industry has also started to adopt the use of AI in health and accident insurance. Innovations such as implanted sensors and wearables that make use of AI provide insurers with valuable data regarding the insured's health. This AI technology would also be advising and educating customers about bad lifestyle choices which may ultimately lead to lower costs for both policyholders and insurers.

5.4.2 AI in Claims Management Process

Presently, AI is also taking over administration associated with run of the mill claims. In one particular case in Japan, an AI system has replaced a team of 30 employees calculating payouts for policyholders (McCurry 2017).

This is not all doom and gloom from an employment perspective as developments may lead to claims handlers dealing with the more challenging claims rather than the tedious ones. For example, Lemonade, a start-up property insurance company, has developed an automated claims process and filing a new claim became relatively easy. The smartphone application will ask the policyholder some generic questions to gather basic information on the claim. The insured does not have to complete a claim form but provide a summary of the claim such as what property was damaged, through the smartphone camera. The data provided will be analysed by the AI and run through 18 anti-fraud algorithms. Non-complex claims are approved within seconds whilst complicated claims are handed over to humans in the claims department.

The use of technology is not only pointing out but also easing the management of complex claims such as, making use of drones to take aerial photos of significant property damage and image analytics to quantify the extent of the damage (Cognizant 2017).

Fraud is reported to represent 10% of all claims in Europe (Insurance Europe 2013). Rather than relying on experienced humans to detect fraud, insurance companies are opting for AI to investigate certain dishonest patterns. An Australian tech company developed an AI fraud investigation system that provides support to insurance companies in the detection of fraudulent claims. Whilst the scope of this AI technology is to assist claims handlers in preventing fraud, it also reduces administration costs for insurance companies. The system can investigate social media accounts, criminal records, property and vehicle history and other documentation submitted with the claim, thus enabling more time for the claims department to analyse results and close claims in a timely manner. Similar services that weed out possible fraudulent policyholders at underwriting stage are available in the market (e.g., ThreatMetrix).

5.4.3 AI in Customer Interaction

The insurance industry is seldom considered as the most innovative with respect to customer services. Despite this view, some insurance companies started to make some progress and introduced the use of chatbots in their day-to-day operations in a similar fashion to other industries. Chatbots are an AI system that are normally linked with messaging applications such as Facebook Messenger, with the main purpose of interacting with existing and prospective clients, thus acting as a virtual customer service representative. These chatbots would interact with clients by determining which insurance products would be most appropriate based on their requirements and answer queries using natural language.

Having chatbots that are powered by AI enables digital interaction with policyholders and prospective clients simpler and faster than with a human element. In recent years, insurance intermediaries have also invested in chatbots, for example, to provide real-time insurance quotation comparisons through messaging applications. Such chatbots can also provide clients with recommendations as to what insurance product would best suit their needs.

5.5 Distributed Ledger Technologies

Distributed Ledger Technologies provide opportunities for disruptive developments within the insurance industry. DLTs can be beneficial to current insurers in their processes but could also create a competitive form of peer to peer insurance networks.

5.5.1 Improving Current Processes Using DLTs

DLTs aim to transform the process of verifying not only transactions (like in cryptocurrencies) but also verification of identities and smart contracts.

Mainelli and von Gunten (2014) summarise the effect of DLTs for insurance within four domains: identity, time, space and mutuality. Using DLTs through the identity checking can improve the underwriting and Know Your Customer requirements for an insurer (Mainelli and Smith 2015; Mainelli and von Gunten 2014). These are particularly useful for a product, individual or data that has gone through a chain of custody or changes. Identity improvements could also potentially limit multiple claims for the same incident. For example, in the case of a travel delay, the policyholder would not be able to claim twice for the same incident.

Consider an alternative scenario whereby health and financial transactions are shared over a DLT. At the policyholder's permission, the insurer may be able to quote a premium for health insurance without the need to provide the data from scratch by filling in forms. Moreover, creating models of this personal data and analysing it together with external data (e.g., from personal wearables provided by the insurance company), this enables real-time adjustments to coverage and pricing, hence reducing the time cycles of insurance products. Conversely, DLTs may lead to a lengthening of time as transactions recorded on DLTs cannot be erased or changed, altering the general perception of longer term contracts.

Whilst the current insurance business model is localised as each insurance product is developed by country, market and region; DLTs are distributed over a network of computers. This may increase the space 'covered' by insurance worldwide. For example, Lorenz et al. (2016) argue that DLTs may be particularly useful in microinsurance within emerging markets, citing the example of crop insurance for farmers. Any such coverage may be automated as claims are paid automatically due to weather conditions without the need of an on-the-ground evaluation. The rewards of DLTs within claims management are not restricted to esoteric insurance practices. The implementation of a smart contract would imply an immediate payment on the delivery of parts following a motor vehicle damage claim (Mainelli and von Gunten 2014).

5.5.2 P2P Insurance

The diminishment of space may result in the generation of more peer-to-peer (P2P) insurance practices. This would act like a mutual, being Mainelli and von Gunten's (2014) fourth domain of possible effect of a DLTs on insurance. This may lead to a reshaping of the insurance industry for particular coverages in the same manner that AirBnB and Uber/Grab have disrupted their respective industries. Mainelli and von Gunten (2014) explain that P2P networks may lead to some insurance to function like a Protection and Indemnity Club (P&I Club) rather than a mutual. Considering the example of a delayed flight, costing €10 per person each, a group of ten independent individuals may be able to create a mutual coverage. In a P&I Club format, they would pass some process to join, pay a certain amount per year (say €10) and be ready to add supplementary funds should this not be enough. For example, if a total of two claimed, then the claim costs would be €200, meaning that every participant should pay in an additional €10. If no one claimed, a profit of €100 is shared between the participants (€10 each).[3]

We also envisage the possibility of a similar P2P structure through DLTs with reinsurance added to cover in case that the total premiums do not cover the claims. This would replace the need to add funds should the reserves not be enough to pay out claims.

5.6 Conclusion

Insurers have been accused of being slow to adapt to new technologies as 50–70% of insurers' IT budget is spent on running costs rather than research and development (Acord and Equinix 2014). It is clear that Big Data is already and has further potential to revolutionise the insurance business. Areas such as telematics, wearables and IoT are providing a plethora of data which, when combined with advances made in AI, are enabling a much more personalised product to be developed for the consumer. Furthermore, a very different customer relationship is starting to emerge, from these data sources, allowing the insurer to engage more meaningfully with policyholders. Consequently, big data is likely to

[3] We are ignoring management costs or investments profits for simplification purposes.

continue to transform the industry on a large scale for the foreseeable future. DLTs, the IoT and AI are starting to disrupt the insurance market as we know it today. The extent to which disruption occurs and how exactly the disruption will happen remains to be seen. However, it seems InsurTechs will play an increasing role as the digital innovation in the insurance world unfolds.

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