**Disruption in Auto Insurance: Customer Likelihood to Adopt Technology Innovation**

**with Usage Based Insurance Model and Telematics**

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1. **Abstract**

This paper focuses on the demand side to investigate factors that affect customers’ decision to adopt technology innovation in the auto insurance industry with the introduction of the usage-based insurance (UBI), known as pay-as-you-drive and pay-how-you-drive models, and the integration of telematics devices. With data to be collected from 200 individuals, the analysis is conducted based on the extended unified theory of acceptance and use of technology (UTAUT2) and behavioral intuitions from the decision making theory in insurance. The analysis reveals patterns of affecting factors and compares different groups of targeted audience to provide car insurance companies with insights into product development and marketing strategy to achieve higher adoption rates in the market.

1. **Introduction**
2. **Insurance landscape**

Insurance is one of the oldest businesses, tracing back to as early as the origin of human’s trading activities (Mills, 2017, p.5). For centuries, this conservative and heavily regulated industry revolves around its risk sharing management principles and mainly favors old, experienced players that have good regulatory understanding and possess great financial capability. With little changes throughout time, the insurance industry is seen to be outdated with lack of efficiency and flexibility in its operation and policies. However, the recent advances in technology have brought about much room for the industry to adopt innovations, and thus, the industry is believed to be “ripe for disruption” (Lewis, 2017).

Unlike sustaining innovation, which refers to the incremental improvements on existing products that enhance and sustain its performance over time, disruptive innovation instead creates a new market and value network that can displace the existing technology (Christensen, 1997, p.11). Markides (2006) suggested another type of innovation, strategic or business-model innovation, which is the formation of a different business model in an existing business, not to discover but to redefine current products and services and how they are provided to customers. Therefore, while sustaining or strategic innovation helps established firms maintain and improve their current values, disruptive innovation is likely to disrupt and change the whole industry. The insurance industry in general and the auto insurance industry are witnessing potentials to be disrupted with the advances in technology, mainly with the usage-based insurance model and the integration of telematics devices. These technologies help auto insurance thrive with a shift away from the ineffective traditional pricing model, an overall improved performance, more personalized risk premium, better claiming process, and better customer service.

However, an instant shift to a disruptive technology tends progress faster than market demand and create products that customers do not immediately need (Christensen, 1997, p.11). In other words, firms pursuing disruptive technology are going ahead of time, and are rather producing for the successive generations. This alters its existing values that contribute to their previous and current success in the market and firms may fail due to the loss of current customers. Therefore, it is essential to study the demand side of the market to examine factors that affect customer’s decision to adopt technology, especially in the insurance industry since consumer behaviors tend to be anomalous from benchmark models when it comes to risks as they are easily affected by emotions and biases (Kunreuther, Pauly & McMorrow, 2012, p.39-41). This paper combines the technology adoption study, the extended unified theory of acceptance and use of technology (UTAUT2) (Venkatesh, Thong & Xu, 2012) with behavioral intutions from the decision making theory in insurance with a focus in the auto insurance sector to better understand the demand side of the auto insurance market with the presence of disruptive innovations.

The paper is organized as follows: in the next section, I will present an overview of the U.S. Auto Insurance Industry as it approaches disruption, followed by the review of the traditional pricing model and introduction of the UBI model with the integration of telematics devices. Next, I will discuss relevant literature and introduce the research models. The data will be presented, followed by results, findings and discussions. Finally, I will conclude the paper and suggest further research.

1. **Traditional auto insurance and UBI Pricing Models**

US auto insurers use a main method to price premium: risk pool. Although the formula varies across different companies, they categorize costumers based on certain factors to calculate risks and determine premium rates, including driving history, followed by demographic factors, age, gender, location, vehicle type, marital status, annual mileage, and credit score [[1]](#footnote-1). These numbers are modeled to estimate the likelihood of the policy holder to file a claim in the future, and perceived riskier drivers are to pay higher rates for their insurance plan. For instance, married women, who are over 25 years old, drive less expensive car, live in rural area with good driving record, pay cheaper car insurance as they are perceived to possess less risk due to the traditional calculation model [[2]](#footnote-2). However, there has been increasing belief that the way insurers calculate risk to price premium is unfair, since these data is based on historical records of people who share the same profile. This has very little relevance to how people actually drive and barely reflects their actual driving behaviors and habits at an individual level. For example, sex discrimination in auto insurance premium pricing is found out to be incorrect and inefficient (Butler, Butler & Williams, 1988) and minority neighborhoods are charged higher though they possess the same risk[[3]](#footnote-3). In other words, the current pricing system is unfair as low mileage and safer drivers are subsidize the insurance costs for those who drive more annually and more dangerously (Tselentis, Yannis & Vlahogianni, 2016). This calls for UBI, a better and fairer pricing system which measuring methods made easier over time with the help of technology and telematics devices.

UBI, as its name suggests, determines the insurance costs based mostly on driver’s usage. This includes Pay-as-you-drive (PAYD) and Pay-how-you-drive (PHYD) schemes (Tselentis et al., 2016). The PAYD model calculates price based on the mileage driven, while the PHYD model estimates price based on driver’s driving behavior, including speed, acceleration, and hard braking (Verbelen, Antonio & Claeskens, 2017). Instead of paying a fixed premium every month, drivers pay a small fixed portion of premium with an addition of the measured mileage and multiplied with a fixed rate every mile driven (as small as cents per mile) or an estimation of safe driving behavior. Studies have found out that UBI has many advantages over the traditional pricing system. First, annual mileage as a rating variable is an extremely powerful predictor for insurance claims (Lemaire, Park & Wang, 2015). With this model. companies estimate risks better, enhance pricing accuracy, and consumers save more on premium payment. Second, drivers’ driving behavior is considerably improved, since they are paying for how they drive, resulting in lower accident rates which benefits both the drivers and the insurers (Soleymanian, Weinberg & Zhu, 2016). It is further estimated that the benefit in reduction in insured accident costs and due to per-mile premiums would be $9.8 - $12.7 billion nationally, or $58 - $75 per insured vehicle (Edlin, 1999). Finally, this model encourages less vehicle usage, reduces traffic congestion and fuel consumption, which is eventually beneficial for the environment. As we can see, the innovative UBI model brings about benefits for both insurers and drivers, as well as economy, society and environment (Husnjak, Peraković, Forenbacher & Mumdziev, 2015).

Insurers collect drivers’ information for the UBI model via in-vehicle telecommunication devices, also known as telematics. These devices are installed in the vehicle and directly record the drivers’ behavior and mileage as they drive. The elements measured include miles driven, places driven (GPS), trip length, speed, rapid acceleration, hard braking, et cetera [[4]](#footnote-4). Insurers will then use analytical tools to analyze drivers’ driving behavior patterns to determine the most personalized auto insurance plan and price for their customers. With the development of technology, telematics is increasingly available with the help of smart devices, smart phones, applications, that easily record, transmit, and let both companies and consumers access to information online.

Ideal as it may sound, the UBI model does have some drawbacks. Security and privacy is the greatest concern raised from this model, as insurers are able to track down drivers everywhere they go. The GPS cannot be turned off since it is always necessary to record the driver’s driving mileage and behavior to determine the price. Miettienen & Stenback (2015) call for greater privacy policy because as firms acquire costumer-specific information for personalized pricing, consumer surplus and total welfare are harmed when evaluated over a two-period horizon. Foster, Prudhomme, Koscher & Savage (2015) refer to this vehicle tracking devices as “telematics failures”, as they pose a great threat for the vehicles to be easily discovered and targeted by remote attackers. On another note, the National Association of Insurance Comissioners address the challenges for insurers since the technology is costly to implement, while lower premiums could put even more pressure on the overall profitability 4. This may greatly affect the decision to adopt of this technology for both insurers and customers, as it is adding more risk to the risk management practice.

1. **Approach disruption**

As the UBI model and telematics wholly change how auto insurance works and how it’s written, this innovation is promising to disrupt the industry in near future. The UBI model is tremendously growing in the US auto insurance sector and it is expected that 70% of all auto insurance in the US will implement the UBI model by 20204. However, the decision whether or not to follow disruptive technology is the so called ‘dilemma’ that companies have to face in any industry that is ripe to disrupt. In response to this dilemma, incumbents and new entrants embrace different strategies to approach disruption. This section provides a brief review on the supply side and how firms approach disruption with this innovative UBI model and telematics.

While dominant incumbents in the industry are leaders in developing sustaining technology, these large companies are slower and more difficult to adjust to technology innovations (Christensen, 1997, p.14). Although they succeed in enhancing their existing capabilities to serve current customers, they may fail in the long term because it cannot live up to constant changing demand and expectations. In addressing this dilemma, the only advice back then is to create an independent organization from the existing firm to follow disruptive technology that operates with a different cost structure and achieve profit from low margins (Christensen, 1997, p.14, p.139). Later, O’Reilly & Tushman (2016, ch.2) encouraged companies to be “ambidextrous”, to “exploit” their current valued capabilities and “explore” potential disruptive technology and strategy at the same time. Incumbents in the auto insurance industry either invest in innovation and research or collaborate and form partnerships with technology and insurtech startups. For example, incumbent firms implement the UBI model in addition to their traditional pricing system: Allstate developed the behavior-based pricing program Drivewise in 2010 and launched the mobile application version in 2014, Liberty Mutual also developed Onboard Advisor to reward drivers for how safe they drive, The Hartford implemented TrueLane, a plug-in device that collects time, speed and location data, StateFarm rewards drivers for how safe they drive[[5]](#footnote-5), et cetera. Other than that, Progressive takes advantage of existing resources provided by startups by forming partnerships with insurtech startups Zubie and Censio to collect behavioral driving data and implement the UBI model with Snapshot[[6]](#footnote-6). These companies are pursuing the goals to maintain its position in the old traditional market while trying to win the new insurtech market created and embracing disruptive innovation by diversifying its products and customer base. The collaborations create a win-win situation to both partners: while big companies make use of the existing technology from the startups, they provide substantial helps from their experience to these new companies that might not be so familiar with the fundamental principles and regulations in the rigid insurance industry.

On another note, according to Venture Scanner Insurtech Report in Q1 2017, there have been more than 114 auto insurance startups that provide telematics technology to customize insurance policy and premium, receiving a total funding of $6.5 billion[[7]](#footnote-7). Metromile is one of the most prominent startups in this sector, founded in 2011 with current over $50 million revenue.

Since it’s best for new entrants to enter at the lower end of the market and achieve profit at the low margins (Christensen, 1997, p.17), disruptive insurance innovation first comes in low-cost products to capture the low end of the market the cost-effective solutions and cheap products that these companies offer meet the expectation of customers to reduce the cost for insurance as much as possible. This is reasonable since customers from the high end market mostly do not need or cannot use the new technology with lower price. However, disruptive technologies tend to create worse products, at least in the short run (Christensen, 1997, p.11). Metromile’s real performance does not seem to live up to what is advertised, since the companies receive more than 80% of negative reviews from customers, mainly about tough times with the difficult claiming process, slow response and that the company does not fully pay for what is supposedly covered[[8]](#footnote-8). This puts not only the company’s credibility and reputation under question, but also insurtech startups’ capability in general. Clearly, while new comers have to go extra miles to build their reputation, perfect products, customer service and capability, they face a threat of failure at any moment in the meantime due to the poor performance, leading to lack of interest and trust from customers. Christensen, Raynor & Van Bever (2013) advised companies to live with ambiguity and be patient about growth, so great tenacity is required from insurance startups to come up with the best strategy and capture the market at the best time since it takes time for customers to adjust their interests and adapt with innovations in the long term.

As the auto insurance industry in the US is drastically changing to catch up with the pace of technology innovation, it is important to study the gap between supply and demand in this transmission period since demand for disruptive technology are always unpredictable and it takes time for consumer’s expectation to adapt. The main focus of this study, factors that affect consumer’s decision to adopt innovative models in auto insurance industry, will be reviewed and presented in the following sections.

1. **Literature Review**

For the purpose of this paper, I will review relevant studies in two main streams, consumer’s technology innovation adoption perspective in general and behavioral intuition for their decision in insurance, and refer to some relevant study in adoption of innovation in insurance and UBI, to provide greater insights into consumer’s behavior and the demand side of the market.

Rogers (2003) defines innovation adoption as the consumer’s decision to take full use of an innovation. Different models have been developed based on information technology, sociology, psychology and marketing perspectives, including Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behavior (TPB), Combined TAM and TPB, Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), Social Cognitive Theory (SCT), et cetera. Venkatesh et al. (2003) developed a comprehensive model called Unified Theory of Acceptance and Use of Technology (UTAUT) and later extended it to UTAUT2, taking a focused consumer context. As technological innovations, especially the disruptive ones emerge, they tend to create cheaper, simpler, smaller, and, frequently, more convenient to use products. However, these product performance is typically perceived to be worse, at least in the near-term, since their value proposition are not previously understood (Christensen, 1997, p.11). Understanding factors that affect consumers’ responses to a product with new technology, especially when they have no previous experience with, is crucial for product development and marketing to get a higher adoption rate and avoid product failure (Park, Gunn, Lee & Shim, 2015).

Much of the factors for technological innovation adoption mention above can be answered with behavioral explanations. In fact, behavioral economics is a much broader field that explores why and how sometimes people make irrational decisions that do not follow the prediction of traditional economic models. According to (Kunreuther et al., 2012, p.8), classical economics use the expected utility theory of choice to assume how individuals make decisions under uncertainty. In fact, insurance decision involves comparability in terms of loss, and is greatly influenced by risk perception, biases, emotions, information availability and social norms (Buzatu, 2013). Therefore, consumers tend to make irrational decisions in the insurance in general. In auto insurance, consumers do not have the choice whether to purchase a plan, since it is required by the regulation of the US. Their decision now is considered between the costs associated when purchasing one, and the amount of coverage that they get.

Many of the existing studies address the innovation adoption in some recent technology, such as mobile banking, e-commerce, but studies on factors that affect innovation adoption in insurance and the specific auto insurance sector are still limited. Pahuja & Chitkara (2016) examined factors that affect consumer’s decision on adopting internet and technology in purchasing insurance and found out that “sustainability”, “cost effective” and “operational benefits” are the main determinants. This study has certain limitations as it only tested these 3 variables without basing on any established model and thus did not provide a more comprehensive scope of factors. Azzopardi & Cortis (2013) concluded that adoption of UBI and telematics depends mostly on telematics providers increasing the perceived control by insurers over managing this technology. However, this conclusion is drawn mostly from the supply side perspective, as they found out that UBI greatly improved vehicle management and insurance risk.

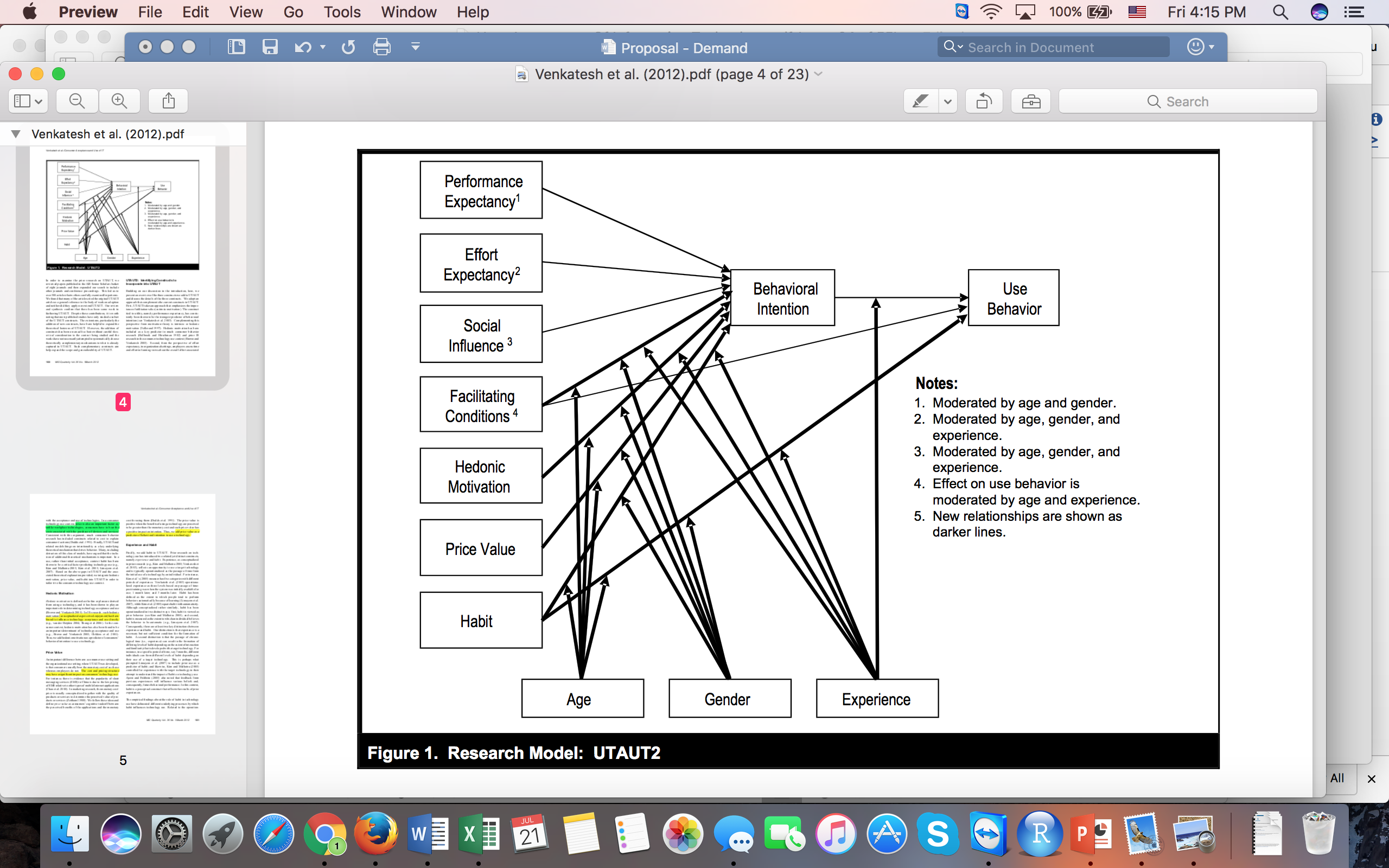
On barriers that hinder adoption of innovation in insurance, Pahuja & Chitkara (2016) found out that there are problems related to security, customer, and insurer. Customers lack resources and knowledge to adopt new technology, show great fear of loss of confidential information, sharing of database and illegality of electronic operation. The study also pointed out that customers are reluctant and resistant to change from traditional method, which is similar to the findings of Azzopardi & Cortis (2013) that clients having good relationship with traditional insurer may ignore to try any change in technology. On security and privacy, Foster, Prudhomme, Koscher & Savage (2015) find out that vehicle tracking devices pose a great threat for the vehicles to be easily discovered and targeted by remote attackers. A survey conducted by Rainie & Duggan (2017) shows that 45% of respondants find the tradeoff of personal information for benefits of telematics based insurance not acceptable. They do not feel comfortable having their location tracked and perceive this as an invasion of privacy and safety risk.

On current status of UBI in the US, according to Nielsen’s report [[9]](#footnote-9), UBI is quickly gaining attraction, especially among younger drivers. The adoption rate of UBI policies rises from 13% in 2013 to 20% in 2015. Regarding demographic factors, millennials born in 1977-1997 are quicker to adopt UBI, and upscale millennials, those whose income is greater than $75,000 are more likely to use this program. Great growth is witnessed in the adoption of UBI, promising a tremendous increase in acceptance of this technology in near future with the help of existing high-technology platforms and devices.

The reviewed literatures suggest that there are still limited studies conducted on innovation adoption in auto insurance with this innovative UBI model. While the potential of the UBI model is promising with many benefits, there are certain factors that hinder costumers to adopt this new technology. The hype of current trends in insurtech with promising numbers of UBI adoption inspires a more comprehensive research incorporating a wide range factors that influence customer decision to adopt innovative insurance models. This paper aims to develop from the established foundation with technology adoption models and behavioral intuition in insurance decision to contribute insights from the demand side to the relatively new study field of insurtech.

1. **Research Model**
2. Extended unified theory of acceptance and use of technology (UTAUT2)

Venkatesh et al. (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT) that integrates elements from eight individual models that generalize patterns in people’s behavior to adopt new technology. The four core variables that mainly affect the behavioral intention to accept new technology are (i) performance expectancy, (ii) effort expectancy, (iii) social influence, and (iv) facilitating conditions. Gender, age, experience and voluntariness of use are other demographic factors that affect the listed variable that vary in an individual level. Later, Venkatesh et al. (2012) extended on the first model, “tailored it in a consumer use context” and developed UTAUT2. Three other variables added are (v) hedonic motivation, (vi) price value and (vii) habit to better explain the complex relationship from these inputs to consumer decision that leads to technology usage behavior. The model is presented in Figure 1 below.



According to the group of authors, UTAUT2 has substantially improved the variance explain in behavioral intention (from 56% to 74%) and technology use (40% to 52%) compared to the original UTAUT model. Many studies have used this model to explore consumer technological innovation adoption behavior. For instance, Oliveira, Thomas, Baptista & Campos (2016) used this model to study the adoption of Mobile Payment, and Park, Gunn, Lee & Shim (2015) to study the adoption of a new kind of digital cookbook.

1. Security and Privacy Perception

As mentioned in the previous section, studies have shown that security and privacy pose great concern to consumers to the decision to adopt the UBI model (Miettienen & Stenbacka, 2015, Foster et al., 2015). In a similar study about consumer adoption to mobile payment, Oliveira, Thomas, Baptista & Campos (2016) integrated the variable “Perceived Technology Security” as one of the predictor to the existing UTAUT2 model. Therefore, adding this variable to the model for the purpose of this research is essential.

1. Search cost and Switch cost

Rational consumers face search cost as they continue to search for the better product and provider until the marginal cost of searching exceeds the marginal benefit, and switch cost as they change their supplier from one to another. Honka (2010) quantified the magnitude of search cost and switch cost and found out that they both are substantial in the context of consumers’ choices in the U.S. auto insurance industry. The same study discovered that search costs and customer satisfaction are main drivers of the high retention rate observed in the U.S. auto insurance industry. Therefore, I would like to integrate this predictor into the model, to examine if people who already have an auto insurance policy (who would face both search cost and switch cost when considering new insurance model) and people who are soon to purchase an auto insurance policy (who would only face search cost) would decide differently when it comes to adopting a new auto insurance model.

1. Risk Aversion

As addressed by Christensen (1997, p.11), disruptive products are typically cheaper, simpler and easier to use, but they lack other features that current customers have valued from traditional products. To illustrate, new insurance products are offered at more reasonable prices, with maximum convenience and easy access thanks to the help of technology, bringing simplified solutions that shift away from the old rigid, heavily regulatory-based systems. However, when it comes to risk coverage, customers usually prefer incumbents with long tradition, substantial experience in the field, regulatory assurance, and stable financial capability to cover their claims when needed. The behavioral intuition behind this that when it comes to risk, consumers are usually willing to purchase insurance premium that is higher than expected loss as they are more sensitive to the increased probability of a loss (Kunreuther et al., 2012, p.109). In other words, consumers may not feel safe when the flexible and low price they pay with the new model can give them as much assurance as the traditional high price one. I will add this variable to see how assured consumer would feel about their risk coverage if they are to adopt the new model and if they can feel a better peace of mind.

1. **Research design and method**
2. Participants

Participants in this study include 200 individuals at Mount Holyoke College in Massachusetts, US that either already have or will soon enroll in an auto insurance plan, regardless or ages, sex, gender, marital status, occupation. Participants will be recruited through an email that provides them with a hyperlink to the online survey.

1. Data collection

The online questionnaire consists of 31 statements about consumer’s perspectives towards UBI and telematics. It is anonymous that the questions are testing different variables from the research model described above. Each answer is scaled from 1 to 5 (1 = Not at all, 5 = Completely).

1. Data analysis

Data will be combined to examine the relationship between each variable to the likelihood to adopt innovations in auto insurance. A reliability test of the scale will be tested using Cronbach’s alpha.

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