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The impact of telematics on the motor insurance landscape and on customer behaviour in the case of Italy

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I hereby declare that the thesis with title

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has been composed by myself autonomously and that no means other than those declared were used. In every single case, I have marked parts that were taken out of published or unpublished work, either verbatim or in a paraphrased manner, as such through a quotation.

This thesis has not been handed in or published before in the same or similar form.

Zurich, 30.01.17

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Abstract

With 4.8 million black box equipped cars, Italy is the market with the highest coverage of usage-based insurance (UBI) motor policies worldwide and is still expected to grow. This thesis gives an overview about telematics in the Italian market, analyses the impact of telematics on the motor insurance landscape and examines the customer behavior when it comes to the purchase of a telematics based insurance policy using a data set of 3'525 questionnaires answered by motor insurance customers in seven countries. My findings indicate that the acceptance towards the installation of a black box varies between the customers in the examined countries and between their demographic characteristics (age, gender, employment etc.). The analysis revealed that 66% of the customers in Italy would equip their car with a black box and therefore share data with insurance companies if they can benefit from premium discounts or value-added services. There are first indications that telematics have a positive impact on the driving behavior.

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List of abbreviations

ABI	Association of British insurers
ADAS	Advanced driver assistance systems
ANIA	Associazione Nazionale fra le Imprese Assicuratrici (National association of Italian life and non-life insurance companies)
cf.	confer (lat. for 'compare with')
CLA	Cigarette lighter adaptor
EBA	Emergency brake assist
eCall	Emergency call
ECU	Electronic control unit
e.g.	exempli gratia (lat. for 'for example')
et al.	et alii (lat. for 'and co-workers')
etc.	et cetera (lat. for 'and other things')
f./ff.	folio/foliis (lat. for 'and following')
FNOL	First notice of loss
GPRS	General Packet radio service
GPS	Global positioning system
i.e.	id est (lat. for 'that is to say')
IT	Information technology
IVASS	Istituto per la Vigilanza sulle Assicurazioni (Institution for the supervision of insurance in Italy)
MTPL	Motor third party liability
NCD	No claims discount
OBD	On-board diagnostics
UBI	Usage-based insurance

OBU	On-board units
OEM	Original equipment manufacturer
p.	page
PAYD	Pay-As-You-Drive
PHYD	Pay-How-You-Drive
SVT	Stolen vehicle tracking
TPL	Third party liability
TPS	Third party service
TSP	Telematics service providers
UBI	Usage-based insurance
UK	United Kingdom
US	United States
VAS	Value-added services
WHO	World Health Organization

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1 Introduction

Digital disruption and innovative technology have led to a tremendous shift in the automotive industry over the last decade and change continues to happen at high pace. Traditional cars develop to semi-autonomous vehicles and are likely to become fully autonomous vehicles in the future.

A key factor, which enables these developments, is telematics. One can be define telematics as the combination of computers and wireless telecommunication technologies, with the goal of efficiently transferring information over vast networks. In 1988, the *European Economic Community* launched first programs to experiment vehicle telematics[1]; ten years later the *Progressive Insurance* in the US issued the first telematics policies.[2] However, telematics only started to achieve significant market penetration in the last few years.

Nowadays, with 10 million active policies at the end of 2015 and an assessed amount of 33 million policies in 2016[3], telematics potentially allow inter-vehicle-communication and information exchange vehicle-to-infrastructure and vehicle-to-vehicle. This means, that two vehicles can warn each other of obstacles or hazards on the roadway and cars can be rerouted by intelligent traffic signs.

Next to telematics, the so-called semi-autonomous advanced driver assistance systems (ADAS) accelerate the development towards autonomous vehicles. ADAS include safety-enhancing features such as emergency brake assist (EBA), side-view (blind spot) assistance, forward collision and lane departure warning systems. Between others, the two car manufacturers, which are influencing the market, are Daimler and Tesla. The Mercedes Model S is fitted with several sensors, which read the road ahead to adjust steering, speed and brakes. Besides that, the software installed on Tesla Model S software enables driving with an autopilot on US highways. Various other car manufacturers have built emergency auto-brake functionality into their cars. The next step will be fully autonomous vehicles where a car per-

[1] Omnim2m (2015)
[2] Migholding (2014)
[3] Visiongain (2016)

forms all driving functions by itself and communicates independently with the surrounding environment.[4]

The combination of ADAS and telematics has extensive consequences on the road safety and therefore on the insurance sector. According to latest evidence, technology-assisted and autonomous driving will cut the frequency and costs of road accidents, which are mostly caused by human error (>90%).[5]

Telematics is all about data – but the data registered by sensors is only raw material. The auto insurance sector created the most successful use case in using this data. The collected data turn themselves into actionable knowledge affecting all the insurance value chain's components and bringing an unprecedented level of innovation to motor insurance, until now mostly considered as very traditional and adverse to changes. Through telematics, insurers are able to perform better risk segmentation and pricing, thanks to the data captured from the vehicles, describing real-time driver behavior. Moreover, telematics facilitate claims handling based on crash detection and reconstruction.[6]

Telematics and ADAS have an influence on the loss ratio of insurance companies. Individual premiums will eventually decline as semi-autonomous vehicles prevent accidents and telematics allow insurers to incentivize drivers if they drive more consciously. However, putting this into a global perspective, we still expect the overall premium volume to increase a rising population and growing economies in emerging markets lead to an increase in the number of cars and consequently insurance policies.[7]

Telematics and all the data collected by telematics devices are a door opener for fairer pricing of motor insurance for individuals. We expect that customers perceive usage-based insurance (UBI) as a fairer system compared to the traditional motor tariffs, as they have to pay in function of how much risk they take: individuals therefore might change their driving behavior as careful driving gets rewarded. Consequently, not only insurance companies but also customers will benefit from telematics.[8]

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[4] Litman (2016) Autonomous Vehicle Implementation Predictions
[5] World Health Organization (2015)
[6] Karapiperis et al. (2015), p. 5
[7] Karapiperis et al. (2015), p. 19 f.
[8] Karapiperis et al. (2015), p. 41

The range of services available to customers is wide and embraces benefits like emergency calls (eCall), efficient claims handling processes, weather alerts based on geo-localizations, highway and parking area tolling, anti-theft services if the installed telematics device registers a different-than-usual driving style and the possibility to recover a stolen vehicle.[9]

Beyond the benefits for the insurer and the customers, telematics could potentially answer social and environmental problems. Fostering innovative mobility solutions like car sharing, for instance, it can help improving traffic and air quality conditions in our cities and make more efficient use of resources. By accounting for individual risk taking, it improves horizontal equity amongst motorists.[10]

With almost 6 million telematics based insurance policies, Italy is the leading market worldwide.[11] One of the reasons for the success of telematics in Italy is the average high premium amount one needs to pay to insure a car for motor third party liability (TPL). Insurance companies, which offer telematics-based insurance products, answered to this problem with a strong value proposition touching the core of the customer's pain points. The message of rewarding drivers financially for a certain driving behavior and support them in case of accidents and stolen cars was just fostered to the needs and expectations of Italian customers.

Legislators supported this development. In order to face this issue, legislators incentivized drivers to install black boxes as a way to obtain from insurers discounts on the original tariff already some years ago. Although such system clearly does not make full use of the telematics' potential from a tariffing perspective, revealed itself extremely useful in accident reconstruction and stole vehicles' recovery, to the benefit of the insurance companies. In Italy and abroad, insurance companies are developing and adapting various innovative solutions to make the adoption of such technologies more attractive to end users.

This thesis analyzes and discusses the telematics value proposition of insurance companies, the customer perception, changes, which telematics bring to the motor insurance landscape and how telematics will potentially influence our daily life beyond motor insurance.

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[9] Karapiperis et al. (2015), p. 44
[10] Karapiperis et al. (2015), p. 41
[11] Mohan (2017)

1.1 Objective

The first objective of this work is to analyze the buying behavior of motor insurance customers in Italy when it comes to black boxes, telematics and telematics-based insurance policies.

Based on the analyzed data set, we will identify whether consumers would buy a telematics-based insurance policy and – if yes – how this policy should look like from a consumer's perspective. Even though the work is focused on Italy, as being the most advanced telematics market, comparisons are drawn to the US and UK (being the second and third largest telematics markets) as well as to other European markets.

The second objective of this work is to show, how telematics change the motor insurance landscape. During the course of this thesis it will be evaluated, how telematics create an impact on motor insurance and how insurers and consumers can profit from it. It will be further analyzed, in how far telematics have an impact on the driving behavior of drivers who are insured with a telematics-based insurance policy.

1.2 Approach

This work starts with a theoretical framework, which clarifies the most important terms when it comes to telematics and motor insurance. In a second step, we will take a closer look at the Italian market as being the most advanced telematics market worldwide. After this, we will deep-dive into the results of a customer survey, which reveals insights of the buying behavior of customers and the aspects, which would make a customer, buy a telematics-based insurance product. Next, we will have a closer look on how telematics change the customer journey of a motor insurance product and how insurers and customers could benefit from telematics. At the end, we will evaluate the impact of telematics on the motor insurance landscape and will have a look on how telematics can change the world even beyond motor insurance.

Out of scope

Telematics is a broad topic in all its facets. Therefore, the following aspects related to telematics are not part of this work but will be mentioned when relevant:

- Legal aspects and regulations

- Moral questions when it comes to telematics and especially to accidents
- Data protection and privacy will be mentioned in terms of the impacts of telematics, but will be largely disregarded
- Fully autonomous vehicle is the next revolution and will be mentioned, but will not be the core of the thesis
- Scoring is beyond the scope

2 Theoretical framework

2.1 Definitions

2.1.1 Automotive and technology terminology

2.1.1.1 Telematics

Telematics is an interdisciplinary field that has been formed by telecommunication and data processing. We can define Telematics as the combination of computers and wireless telecommunications technologies, with the goal of efficiently transferring information over vast networks to improve many business functions or government-related public services. The Internet itself is one noteworthy example of telematics, since it depends on a number of computer networks connected globally through telecommunication backbones.[12] Vehicle telematics can determine the behavior of a vehicle most efficiently and give life updates of a vehicle, which helps to diagnosis an issue. GPS/GPRS navigation, integrated hands-free cell phones, wireless safety communications and automatic driving assistance systems all are covered under the telematics term and functionality.[13]

Furthermore, Telematics can help to improve the efficiency of an organization and have a wide range of applications, like trailer tracking, vehicle tracking (also fleet management[14]), container tracking, satellite navigation, wireless vehicle safety communications, vehicle mileage capture etc. To address some of the noteworthy practical examples: By using the applica-

[12] Sundeep / Vardhan (2013), p. 554
[13] Sundeep / Vardhan (2013), p. 555
[14] For example, Delivery trucks, taxi companies and maintenance companies can use this sophisticated electronics to track workers and manage driver, speed, fuel, health and safety and therefore has a positive impact on the efficiency and productivity and can reduce the overall transportation and staff costs. (cf. Sundeep / Vardhan (2013), p. 555)

tion of vehicle telematics called trailer tracking, the current location and position of a vehicle's trailer unit in real-time. All kind of automobiles – be it your truck, bus in your fleet (so-called fleet management), private vehicles, security vehicles and even two wheelers, can be tracked by yourself wherever you are. The container tracking system helps us to locate the current location of the container and determine the time spent in any place of congestion. In this case, vehicle telematics can enable a more accurate and precise container tracking. Satellite navigation in the perspective of telematics can be described as safely guiding a vehicle to an unknown place to reach destination safely. By using a GPS navigation system it makes it easier to get an overview of the current position and the landmarks around it and guide by displaying the route map along with the distance between starting point and destination, in-comparison to the traditional paper map. Wireless vehicle communication ensures car safety and road safety. Wireless vehicle communications have both an inter vehicle communication and a vehicle-to-vehicle (i.e. information exchange between two vehicles that warn each other of obstacles or hazards on the roadway[15]), whereby the second one is built with electronic devices, which aid the purpose of exchanging safety information like road hazards and the locations and speeds of vehicles. In this example, by using telematics, vehicle-to-vehicle, vehicle-to-infrastructure (i.e. wireless communication between vehicles and components of the infrastructure, e.g. intelligent traffic signs, infotainment, carmakers etc.) and infrastructure-to-infrastructure communication is possible. In near future, vehicles may directly interconnect to other cars and trucks with the wireless system and therefore may have a positive impact on wireless vehicle safety communications and emergency warning system and will enormously decrease road accidents and traffic problems, e.g. if brakes applied in the first vehicle, automatically all the vehicles moving behind will slow down. Vehicle mileage capture, is another pratical application of vehicle telematics, where it sends the total distance travelled by vehicle and history of the vehicle where it has been. This kind of application can also used to detect if any problem occurred in a vehicle.[16]

The vast amount of data in terms of storage and analytics, along with the lack of standardization in telematics devices, present significant challenges to insurers in their effort to successfully integrate telematics in their information technology (IT) infrastructure. The main players in the telematics ecosystem – auto manufacturers, insurance companies and telematics ser-

[15] Bécsi / Aradi / Gaspar (2015), p. 1

vice providers – are competing for a larger market share by developing their own telematics solutions and products.[17]

2.1.1.2 Connected Car

Nowadays the focus of traditional automotive digital technology has shifted from optimizing vehicle's internal function to developing the car's ability to connect with the outside world and enhance the in-car experience. The so-called *connected car*, a vehicle that is able to optimize its own operation and maintenance as well as the convenience and comfort of passengers using onboard sensors and internet connectivity.[18]

Some of the main functions of a connected car include automatic roadside assistance in case of crashes, information calls to telematics service providers (TSP), stolen vehicle tracking (SVT), remote service (vehicle on/off, vehicle lock/unlock) etc.[19] Mobile devices, like smartphones are important for the connection and has to be compatible with their owners' vehicles.

Furthermore, safety regulations and laws will affect the connected car market in general. The eCall as an example is the first regulation, that will immediately have an impact on the connectivity of cars in the European Union, as from March 2018 all vehicle types will have to be fitted with this feature.[20] Consequently, a car has to be equipped with a black box, GPS tracking and a SIM card to make the eCall work. The power of regulation is obvious, as driver distraction may become a topic for governments to regulate what a driver is allowed to do while driving and which actions need to be limited to a non-moving position.[21] While embedded connectivity systems are meanwhile fitted in many new cars, used cars are rarely equipped with them. In general, cars need to be able to connect to end customers' mobile devices using cables, Bluetooth or other technologies, enabling them to fully access the contents of these devices. In order to connect them and solve the discrepancy between new and used cars, a brought-in solution might well be a suitable solution, e.g. the use of interface such as OBD2 to connect the car to the smartphone.[22]

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[16] Sundeep / Vardhan (2013), p. 554 ff.
[17] Karapiperis et al. (2015), p. 14
[18] McKinsey&Company (2014)
[19] Dakroub / Shaout / Awajan (2016), p. 2
[20] European Commission (2016)
[21] Martignoni (2014), p. 7
[22] Martignoni (2014), p. 8

2.1.1.3 Autonomous Vehicle

The autonomous car is the future of driving and will have a significant impact on motor insurance. There is a visible and major technological development of the traditional car over the semi-autonomous vehicle to the future fully autonomous vehicle. People driving the current generation of cars with a few automated features (semi-automotive vehicle), such as the semi-autonomous ADAS, including safety-enhancing features such as emergency brake assist (EBA), forward collision and lane departure warning systems, side-view (blind spot) assistance, are having fewer accidents than they did before in traditional cars with no such bells and whistles.[23]

2.1.2 Devices Terminology

There are multiple solutions to connect a vehicle, each of which has strengths and weaknesses. Some of these were established in the customer market (e.g. embedded navigation systems, OBD devices and smartphones) while others have been developed for commercial vehicles (e.g. standard black boxes).[24]

In the graph below (Figure 1), the share of devices used globally is highlighted, based on the quarterly record of the 225 UBI programmes in the world today. It is visible, that OBD Dongle is the most widespread device, followed by black boxes, original equipment manufacturer (OEM), Smartphone and other devices (e.g. windscreen device etc.).

[23] McKinsey&Company (2015), p. 49 ff.
[24] Ptolemus (2016), p. 139

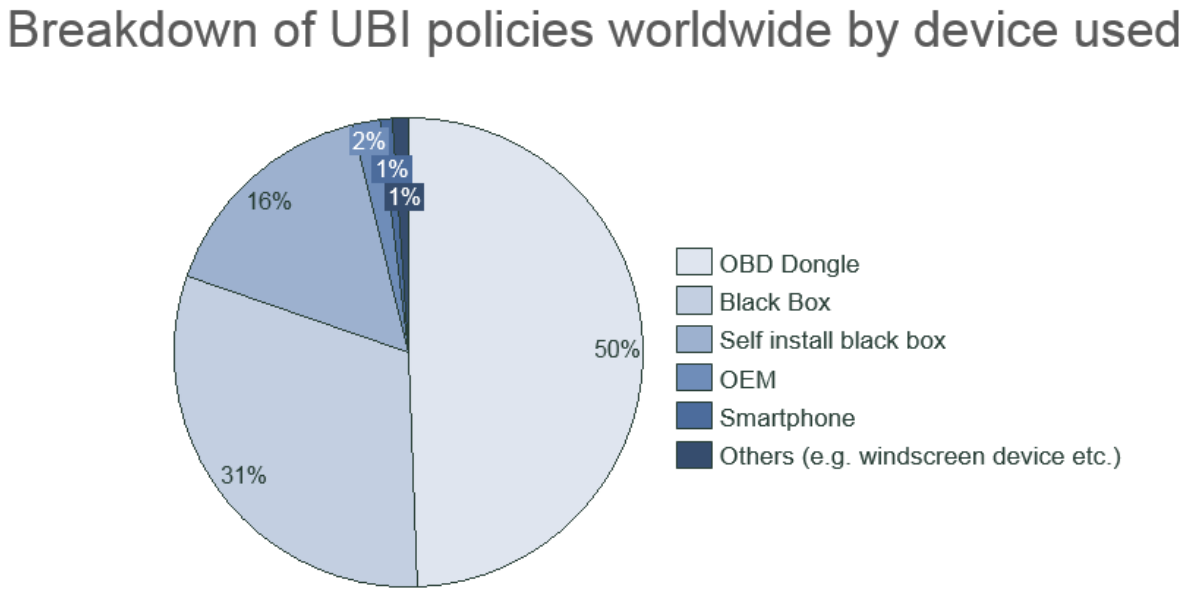

Figure 1 Own illustration based on Ptolemus (2016), p. 125

Looking at the existing devices, the factor cost, which differs between each device, plays an important role for the decision of insurers. The cost for hardware, including the indirect cost for installation, maintenance, and logistics, limits the scalability of the UBI-programs and lowers their deployment. Therefore, insurance providers are seeking scalable end-to-end solution.[25]

2.1.2.1 Black Box

Black boxes are hardware devices, which are also called *On-board units* (OBU). Black box car insurance, also known as telematics, is a type of policy that calculates your premium based on how you drive. The black box can be used with both Pay-As-You-Drive (PAYD) and Pay-How-You-Drive (PHYD) (explanation later on in 2.1.3.3), but it is most applicable for PHYD since it can provide some of the most in-depth and detailed data on driving behavior. Because PHYD approach tend to be the most sophisticated of telematics, UBI products require devices like the black box with integrated acceleromaters to track a variety of performance data. For instance, a GPS box is installed in the car, or a smartphone app can be used with some providers, which then measures the performance of the driver, e.g. braking (sharp braking), cornering (take corners gently), speed (staying within the limits), miles (drivers with lower mileague usually get lower premiums) etc., by transmitting information back to the in-

[25] Händel et al. (2014), p. 1 f.

surer. Black box car insurers send frequent feedback to the insured driver, which is accessible online, so you can monitor the driving performance and will select trends that will affect how your premium is calculated.[26] Furthermore, black boxes are especially equipped for first notice of loss (FNOL) services, providing early notice in the case of theft and valuable information for forensic crash reconstruction in the event of an accident. However, it is not portable and because of the high installation and administrative costs, e.g. in Germany, installing the black box costs about 80-100 €[27], it tends to be the most expensive solution.[28]

Compared to an OBD dongle, the black box provides the insurer universal compatibility with all vehicles, whereas OBD has been implemented in different ways depending on each OEM. Furthermore, black boxes can provide higher precision, higher reliability insurance services (due to crash reconstruction data, more accurate and higher frequency data sets etc.) than basic OBD devices that do not collect GPS location data or, in some cases, acceleration or braking events. Additionally, black boxes offer customers value-added services (VAS), from stolen vehicle recovery to eCall. As a result, black boxes offer a higher revenue potential to the insurer and larger loss reduction potential, in countries with higher fraud and theft rate.[29]

2.1.2.2 OBD Dongle

The dongle is a self-installed device provided by the insurer to be used for a certain time, usually for six months.[30] On-Board Diagnostics (OBD) dongles predominantly exist in North America, but are now starting to appear in Europe and Asia.[31] OBDs was initially developed for car manufacturers (OEMs) to monitor vehicle engines, in order to reduce vehicle emissions by measuring the performance of major engine components. To fulfil the amount of these emissions, which is regulated by law and regulations, complex exhaust emission control and cleaning systems are installed by OEMs on cars.[32]

OBD dongle brings lower or no installation- and decommissioning costs[33] and high reliability that makes it the most suitable choice for new and emerging telematics UBI markets.[34]

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[26] Which? (2016)
[27] Ptolemus (2016), p. 134
[28] Karapiperis, et al. (2015), p. 9 f.
[29] Ptolemus (2016), p. 624
[30] Telematics Update (2014), p. 11
[31] Ptolemus (2016), p. 140
[32] Ptolemus (2016), p. 448
[33] Ptolemus (2016), p. 624

However, for crash reconstruction, the dongle is not the ideal device because it can become loose, vibrate or get knocked by the driver.[35]

2.1.2.3 App / Smartphone

Nowadays, cars were already connected because everybody owns a mobile phone and brings it in the car. Smartphones as stand-alone devices or embedded connected systems (e.g. eCall) linked to vehicle's system, or cigarette lighter adaptor (CLA) plugs are lower cost solutions than vehicle-fixed sensors, because there are no device, installation or data connectivity costs to the insurers (and no additional cost to the customers). They offer an attractive platform for insurers to interact with customers and VAS, like navigation, driver real-time feedback mechanismen (e.g. of harsh braking, speeding etc.)[36], traffic, local search etc., to check the driving behavior and vehicle health statistics.[37] The gathered data reflects the risk of the driver, measured with the smartphone and appropriate installed software. The characteristics of the data quality provided by the smartphone are accuracy (conformity between sensor information and actual value), integrity (reliability of sensor information and system quality indicators), availability (geographical coverage for which the sensor information is available) and continuity of service (availability of the service over time without unplanned interruptions during the intended working period).[38]

Insurer are reluctant to use a smartphone as the data-collecting OBU, because they are afraid that the smartphone data is not reliable, because it could be tampered and therefore offer to hackers possibilities of security breaches.[39] Furthermore, smartphone-based insurance telematics have not yet succeeded to enter the market on a large scale. However, the reliance on fixed installed devices, OBD dongles, or smartphone is likely to remain dominant and provides an efficient means for data transfer for the next several years. One reason can be that automobile manufacturers are increasingly equipping new vehicles with telematics capabilities that do not require additional hardware, i.e. transforming a UBI program from a

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[34] Karapiperis et al. (2015), p. 15
[35] Ptolemus (2016), p. 447 ff.
[36] Händel et al. (2014), p. 10
[37] Ptolemus (2016), p. 267
[38] Händel et al. (2014), p. 1, 3
[39] Ptolemus (2016), p. 151

program that uses customized hardware electrically connected to the vehicle, to a program based on a stand-alone smartphone as a measuring sensor and communication device.[40]

2.1.2.4 Embedded Device (by OEM)

While at an early stage, embedded telematics provided services such as remote diagnostics, navigation and infotainment services, now they can deliver UBI services. The connection of the embedded module to the vehicle's electronic control unit (ECU) enables the record and transmission of data about the vehicle's performance.[41] The strengths of embedded telematics range from product differentiation to improved customer relationship management.[42] However, embedded telematics are faced with challenges such as comparatively high cost for the customer, lack of standardization, compatibility with insurance solutions and obsolescence.

There is a share of the number of new connected cars sold globally, which are connected with an embedded SIM card from the original equipment manufacturer (OEM) (smartphones and wearables), or tethered architecture where the OEM embedded device only require connection from the mobile device or are integrated in the vehicle. While the three solutions to connect vehicles will grow initially at the same speed, according to forecasts, the long term advantage will certainly go to the fully embedded OEM systems, as manufacturers first use eCall as a platform and then require connectivity for autonomous functions.[43] Berg Insight estimates that approximately 12 % of all cars sold worldwide in 2013 were equipped with an OEM embedded telematics system.[44] Here, OEM is a company that produce a part or subsystem that is used in another company's end product and is sold under the own name of the company, e.g. people who build their own computers can buy graphics cards or hard drives from Intel or other retailers. Referring to the automotive industry, a person who wants to do his own car repairs, he can buy OEM parts directly from the manufacturer or a retailer.[45] A number of telematics-based offering have already been launched by OEMs such as BMW, Toyota, Volvo, Renault.[46]

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[40] Händel et al. (2014), p. 2
[41] Karapiperis et al. (2015), p. 16
[42] Berg Insight (2014), p. 2
[43] Ptolemus (2016), p. 403
[44] Berg Insight (2014), p. 2
[45] Investopedia (2016)
[46] Ptolemus (2016), p. 174

The Third Party Service (TPS) eCall will provide a major impulse to the entire telematics industry by driving OEM involvement in this field. It will allow OEMs to collect the data, filter calls and transmit cases to the emergencies. While the European Commission will only make eCall mandatory, OEMs need to define strategies on how to transform this constraint and cost into an opportunity. Since in-vehicle equipment needed for the eCall could be used for additional services, OEMs need to consider the possibility of providing data or other VAS to third parties (insurance companies, importers, garages etc.) or to drivers directly[47] that these services in turn, can be transform into revenues and cover the cost of the equipment.[48]

Because of the relatively straightforward process of exchanging data by the technology devices, for many manufacturers the connected features open many entry points to new security threats, like potential hackers that can lead to loss of vehicle and potentially life, by potentially causing accidents and remotely controlling vehicles. Therefore, one of the challenging piece for many manufacturers is to enable consolidation, security and customer privacy.[49]

However, Ptolemus Consulting Group predict, that the future of insurance telematics will predominantly consist of hardware models, like black box, stand-alone OBD dongles, Bluetooth-enabled dongles connected to smartphones, stand-alone smartphone apps, windscreen devices and embedded telematics devices.[50] Since every model shows both strengths and weaknesses in comparison with each other, depending on its target and model, each insurer should define its own strategy and choose the technology that best fits their needs.[51]

2.1.3 Insurance Terminology

2.1.3.1 (Traditional) Motor Insurance

Most current insurance policies use static / statistical criteria to evaluate drivers' risks, age, gender, vehicle make and age, place of residence, occupation etc. So e.g. in case of *age*, in general mature drivers have fewer accidents than less experienced drivers, hence insurers charge more for young drivers below age 25. Moreover, the principle is that the more *miles*

[47] Ptolemus (2016), p. 531
[48] Ptolemus (2016), p. 135
[49] Bécsi / Aradi / Gaspar (2015), p. 2, 4
[50] Ptolemus (2016), p. 805
[51] Ptolemus (2016), p. 624

you drive, the higher the probability of having an accident, meaning you will pay more if you drive your car to (a long distance) work, than you drive only occasionally. Regarding *gender*, as a group, women tend to get into fewer accidents, have fewer driver-under-the-influence accidents and eventually less serious accidents than men. So, all other things being equal, in general women have to pay less for auto insurance than men. These factors can affect the premium of the insured and help to determine how likely the insured are to have an accident. After a certain period, insurers take into account the customer's historical claims profile, often called the 'No Claims Discount (NCD)' status and reward 'safe drivers', by giving them lower premiums and / or a no-claims bonus.[52] Besides some advantages, e.g. a known level of premium in advance, traditional motor insurance is faced with some disadvantages, e.g. it takes into account primarily statistical risk factors rather than individual factors, or furthermore limited control, which creates fraud incentive.[53]

2.1.3.2 Telematics-based Insurance Policy (Usage-based insurance)

In mature markets, the current motor insurance environment is challenging due to the limitations of the mutualisation model. In such a situation, telematics offers insurers the opportunity to revolutionise the automobile insurance and the perception of the policyholders. Therefore, customers pay for insurance based on their usage, which leads to an uncertain premium level.

There are five new, dynamic parameters besides the two criteria mentioned above (statistical criteria, historical claims profile), on which telematics insurance is based:

The *distance* travelled is still a primary factor in the UBI sector today and recognized as an appropriate factor for making predictions. *Time* reflects the time of the day the drivers are on the road and highlights specific higher risk ranges for them to avoid, which also includes potential fatigue and distraction issues. The parameter *place* focuses on the type of road, traffic and driving (urban or country lanes). *Context* is where external data sets are added to the algorithm to take into account where the vehicle was and when the event was recorded to qualify, whether it was appropriate or not, e.g. the contextualized data will differentiate, if a driver accelerates on a slip road or in front of a school. Finally, the parameter *driving be-*

[52] Insurance Information Institute (2016)
[53] Ptolemus (2016), p. 137

havior reflects the driver's risk profile expressed through a score, calculated from various datasets provided by the device.[54]

Telematics-based insurance are data and services that benefit insurance carriers and insurance customer, which includes usage-based insurance[55], crash and claims management, anti-theft, car health / maintenance, and location-based value-added services (VAS) and are growing in demand.[56] Products based on how often, where and how people drive can result in more attractive premium charges for those who drive more responsibly than their peers do.

2.1.3.3 Pay-As-You-Drive (PAYD) vs. Pay-How-You-Drive (PHYD)

Pay-As-You-Drive (PAYD) (also called distance-based, usage-based, or mileague-based) and *Pay-How-You-Drive* (PHYD) are essential parts of the usage-based insurance scheme. This type of automobile insurance calculates its costs based on the vehicle type and its actual driving record and measures factors such as time, place, and distance.[57]

PAYD a simple type of telematics-based insurance product based direct on the number of kilometers driven. In 2006, *Hollard Insurance*, the international insurance group, launched in South Africa the first commercial PAYD policy based on a black box solution. The tariff behind this product can be described as cents-per-km and therefore the insurance pricing is converted to a variable cost i.e. the higher the mileage, the higher the price for insurance. However, it is still important to determine in which risk group the insured person belongs, as the mileage-risk-relationship is even stronger within different risk groups.[58]

Even if PAYD tariffs do not consider the driving habits of the insured such as speed, breaking behavior, location, time and hence lack the ability to fully assess the driver's risk[59], distance-based pricing can help reduce total insurance and claims costs, vehicle crashes, traffic congestion, energy consumption or pollution emissions as an positive environmental impact.[60] This leads to increased safety, because vehicle crashes should decline more than mileage (a 10% mileage reduction is predicted to reduce crashes by 12-15%), i.e. higher-risk motorists

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[54] Ptolemus (2016), p. 74 f.
[55] Insurance premiums dependent on type of vehicle used, measured against time, distance, behaviour and place (cf. Ptolemus (2016), p. 74).
[56] Ptolemus (2016), p. 569 f.
[57] Martignoni (2014), p. 15
[58] TDM Encyclopedia Victoria Transport Policy Institute (2015)
[59] TDM Encyclopedia Victoria Transport Policy Institute (2015)
[60] Litman (2011), p. 63

(who currently pay high premiums per vehicle-year) would pay higher per-mile fees, and would therefore have the greatest incentive to reduce their mileage more than average.[61]

PHYD is the most advanced of usage-based insurance (UBI) products, which is often known as telematics or 'black box' insurance, engages GPS to measures multiple parameters of driving behavior, such as mileage, speed, location (type of roads), time (night time driving between 23:00 and 04:30), distance, acceleration etc., to create a very detailed overview of the risk characteristics of the insured. Some of the PHYD products offer a feedback platform to advise the insured on ways to improve their driving, such that the insured can benefit from a rate improvement. Furthermore, telematics use has the potential to improve the frequency and severity of claims by incentivizing good driving habits and enabling quicker emergency services notifications and assistance in case of an accident (eCall) and hence decreasing the bodily insury costs as well as preventing death scenarios.[62] *Progressive* Insurance Company was one of the first insurers who implement PHYD in the US and reported premium revenue for UBI policies reaching 1 billion USD in 2012.[63]

2.1.4 Data Terminology

2.1.4.1 Driver Behavior Data

Aside from the choice of the most suitable device, the other technological challenge and importance is achieving a critical mass of data necessary for an effective telematics, i.e. collecting and analyzing tremendous amounts of driving data.[64] In general, the insurance industry is focusing not only on driving behavior, but also on environment data (i.e. road type and conditions, traffic patterns etc.), which depends on exposure-related driving variables such as mileage, duration of driving and number of braking or speeding events.[65] Driving behavior reflects the driver's risk profile and driving performance expressed through a score calculated from various datasets produced by the device[66], i.e. driving behavior is not focusing on where and when people travel but on how they do so. Therefore it is assessed on several criteria like acceleration, speed, braking, cornering, distance, or road sign detection[67] and also ana-

[61] Litman et al. (2016), p. 27
[62] Association of British Insurers (ABI) (2013), p. 1 f.
[63] National Association of Insurance Commissioners (2016)
[64] Karapiperis et al. (2015), p. 12
[65] Tamir (2014), p. 6
[66] Ptolemus (2016), p. 75
[67] Ptolemus (2016), p. 81

lyse the influence of circumstances like cell phone use, driving under influences, or sleepiness in order to identify accident-causing risk factors and adress crash prevention.[68] Driver behavior data is one of the various telematics data (e.g. average claim cost, claims frequency, average speed etc.), which will be rated, priced and underwritten.

Only considering individual observational measures, such as visual recording, traffic flow and cognitive activities is not sufficient to quantify an accurate prediction of driver behavior, because it requires an understanding of a large number of conditions (context), which will be explained in detail below (chapter 2.1.4.2).[69]

2.1.4.2 Contextual Data

Although the driver is the main actor in the driving activity, driving is not an isolated activity and the wider context in which the driver constantly interacts with its immediate environment and the vehicle, should be considered.[70] On the one hand, contextual data can be understood as external data sets, which take into consideration where the vehicle was and when the event was, e.g. the contextualized data will differentiate an acceleration on a slip road or in front of a school.[71] On the other hand, it includes watching, listening and feeling the information from the road (surrounding information like traffic flow, weather conditions, and infrastructure) or the vehicle and the required acitivities around driving the vehicle as well as possible distraction like radio, children at the back etc.[72]

Concretely, context-aware systems can improve the driver's handling of a car by augmenting the awareness of the cars state (e.g. following distance), the environment (e.g. road conditions), the physiological and psychological state of the driver (e.g. current attention level, fatigue) and therefore have a great capability to save lives and prevent accidents and injuries on the road.[73] To capture contextual data, ADAS uses sensors, high definition mapping, vehicle-to-infrastructure communication or vehicle-to-vehicle communication.[74] Linking GPS data and driver context information enables answering existing research questions more precisely and opens up the opportunity to approach new ones. Demographic and policy data can be

[68] Ippisch (2010), p. 21
[69] Rakotonirainy / Maire (2005), p. 4
[70] Rakotonirainy / Maire (2005), p. 1
[71] Ptolemus (2016), p. 75
[72] Ptolemus (2016), p. 420
[73] Rakotonirainy / Maire (2005), p. 3
[74] Ptolemus (2016), p. 420

compared on their accident response, considering corresponding variables like gender, motorist age, marital status, subsequent years of accident-free driving and others. Furthermore, contextual information is useful for the comparison of standard and telematics customers. Investigating the demographic differences between both populations may allow identifying driver subgroups to whom telematics-based vehicle insurance especially attracts. This would therefore simplify more precise target marketing of those products.[75]

To illustrate how the car state and environment changes will be captured and how the various institutions interact to each other, the Swiss Re's approach on telematics solution will be explained below.

2.2 Swiss Re's Approach on Telematics Solution

Swiss Reinsurance Company Ltd. (founded in 1863) a leading wholesale provider of reinsurance, insurance and other insurance-based forms of risk transfer, deals with global customers, which are insurance companies, mid-to-large-sized corporations and public sector customers.[76] It is the world's second-largest reinsurer (revenues: 30 Mrd. USD) after Munich Re.[77] The group structure consist of the following three business units: Reinsurance (largest business), Corporate Solutions, Life Capital.[78]

Within the global function Reinsurance an organizational unit, called 'Automotive Solutions' was created at the beginning of year 2016.

[75] Ippisch (2010), p. 128
[76] Swiss Re (2016a)
[77] Carrier Management (2015)
[78] Swiss Re (2016b)

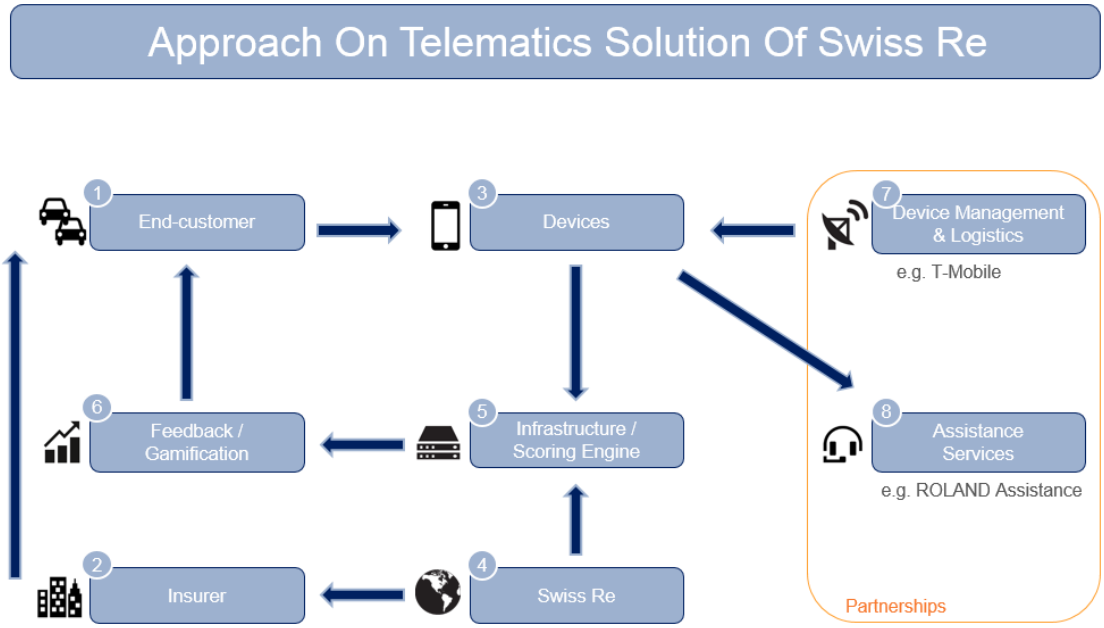

Figure 2 Swiss Re approach on telematics solution (own illustration based on Swiss Re internal presentation)

Figure 3 shows the approach of Swiss Re's telematics end-to-end solution:

An end-customer (1) buys a telematics-based insurance policy by a usual insurer (2). Together with its policy, the customer gets a device (3) (e.g. black box, OBD dongle, smartphone etc.) installed in his car. In this illustration, the insurer uses the Swiss Re telematics solution (4).

The device collects driving data. The driving data (e.g. driving condition, is sent to a scoring engine (5) of Swiss Re. Swiss Re does the scoring based on the collected data and provides the insurer with a scoring for a specific driver. Based on the scoring the driver's risk and therefore the driver's insurance premium is calculated.

Customers can receive the data as regular feedback (6) on their driving behavior to their mobile phone. On the mobile phone, customers can review their driving behavior, the distance travelled etc. and adjust their driving style to lower their insurance premiums. Drivers can even compare the results of their driving behavior to their family and friends because of the tracking device and therefore are able to improve their driving habits.

Device management and logistics (7) are responsible to install the devices, to transmit the data from the black box to the mobile phone app / Swiss Re scoring engine and to assist customers (help desk).

Assistance services (8) are connected to the devices as well. As soon as there is an issue with the car, assistance services can automatically locate the vehicle and take action accordingly, e.g. call the police, ambulance etc. (safety and security services, such as roadside assistance, eCall etc.)

3 Overview of the Italian Market

Italy is the market with the highest coverage of UBI-based motor policies worldwide. Black-boxes exist since 2003 in Italy and were initially implemented to track stolen cars. Nowadays every motor insurance has to offer a telematic tariff by regulation. UK established telematic based tariffs as first country in the mid 1990 included eCall since 2015. In US one in ten motor insurance is a PHYD tariff.[79] When focusing on black boxes-based solutions only[80], with 4.8 million black box equipped cars, Italy is ahead of the US (3.3 million) and UK (0.6 million) (Figure 1).[81] The insights behind those figures were collected by the Connected Insurance Observatory – a think tank hosted by Bain & Company and ANIA (the national association of Italian life and non-life insurance companies) with support of IVASS (Institution for the supervision of insurance in Italy). More than 30 insurance, reinsurance companies and others, which focus on spreading innovation culture in the insurance sector, shared their experiences and their view on the potential of telematics.[82]

[79] Thiele, J / Schmidt-Jochmann, C. (2015), p. 33
[80] While in Italy black boxes are the prevailing solution, in other countries other solutions are becoming increasingly popular, such as dongles, OBD-2 devices or phones as a device.
[81] Bain & Company (2016a), p. 5
[82] DigitalTech International (2016)

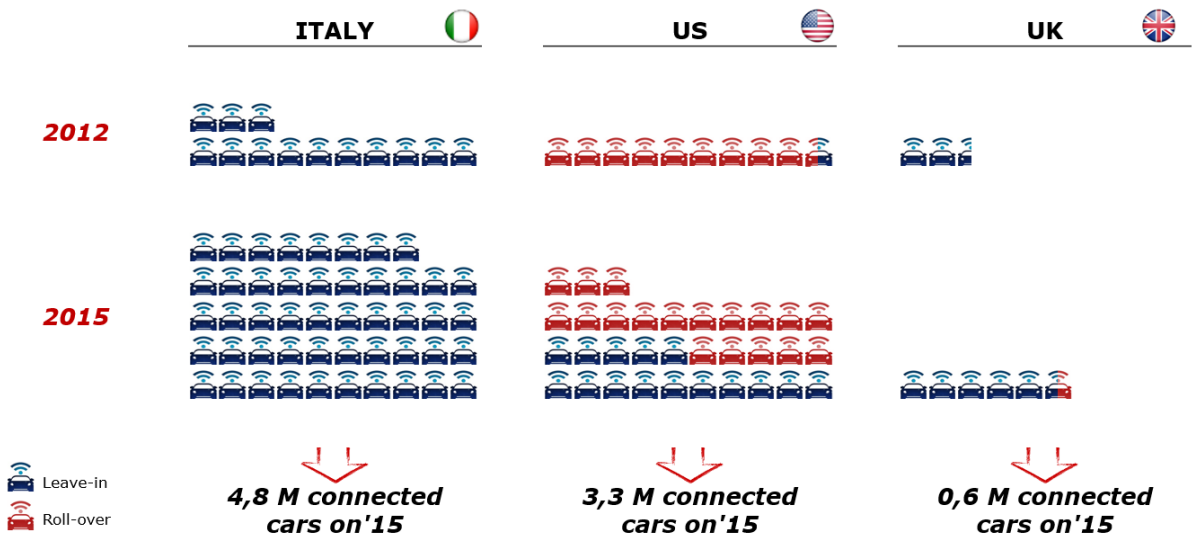

Figure 3 Numbers of connected car insurance policies categorised in "Leave-in" and "Roll-over" (cf. Bain & Company (2016a), p. 5)

Figure 1 also points out the difference between two different customer types. "Roll-over" customers try out a black box and move back to traditional motor insurance after a certain time, whereas "leave-in" customers go beyond the trial phase and stick to a black box based insurance policy. In the short time period of usually 3 months, "roll-over" customers do not provide enough data to have sufficient evidence regarding driving behavior and claims and therefore mostly benefit from a price effect but are not able to take advantage of value-added services such as claim handling. "Leave in" customers who transfer completely into the new insurance model generate value for both, the customer and the insurer.

Several characteristics can indicate which customers are increasingly opting for a telematics-based insurance policy. As telematics penetration changes from over 16% for new vehicles to 9% for vehicles over 22 years of age, it is apparent, that black boxes are more common in new vehicles due to the interest of the customer for the stolen vehicle service and the discount on the theft cover.[83]

ANIA conducted a research with insurance companies relative to 86,6% of premiums written in 2014 in motor liability in the Italian market and found out, that the discounts offered by telematics installed attract especially young people between 18 and 28 years (22%). The interest decreases with an increasing age of the drivers (up to 42 years) and increases again for drivers, which are around 50 years. A likely explanation is linked to the true decision maker

[83] Carbone (2016a), p. 5

or key influencer, who is often one of the parents who buys and pays for their childrens' motor insurance.[84]

Additionally, the amount of premium paid gives an indication about the customers who are buying a telematics-based insurance policy. From the customers who pay high premium costs (> 900 €), 15% decided themselves for a black box contracts with a usage-based tariff. Customers who pay a lower premium (< 400 €), are more likely to choose a non-UBI motor policy.[85] The overall trend shows that customers increasingly would opt for a telematics-based insurance product.

Differences not only exist between clusters of costumers but also among the geographical origin of the customers. At the end of 2014 there was a higher penetration of black boxes in the Southern part of Italy (20%) compared to the North (9%). When looking at volume of Motor third party liability (MTPL) contracts, within the policies priced below 400 € (almost half of the Italian telematics portfolio), only 20% originate from South, more than 40% come from the North, the rest refers to central Italy and main Islands (Sicily and Sardinia).[86] Last but not least, we observe a higher presence of boxes installed among customers in suburban areas than in urban centers.[87] Figure 2 shows the penetration of telematics-based insurance policies by Italian district and by the average MTPL premium.[88]

Based on different clusters of customers and geographical areas, insurance companies become better in developing specific value propositions to target different customer segments what raises the knowledge and awareness about telematics of both, insurers and their customers. This not only gives a push in sales for telematics-based insurance products but also reflects in lower premiums for drivers in South Italy.

[84] ANIA (2016), p. 17
[85] IVASS (2016), p. 14
[86] ANIA (2016), p.18, IVASS (2015), p. 18 ff.
[87] ANIA (2016), p. 18
[88] Bain & Company (2016b), p. 7

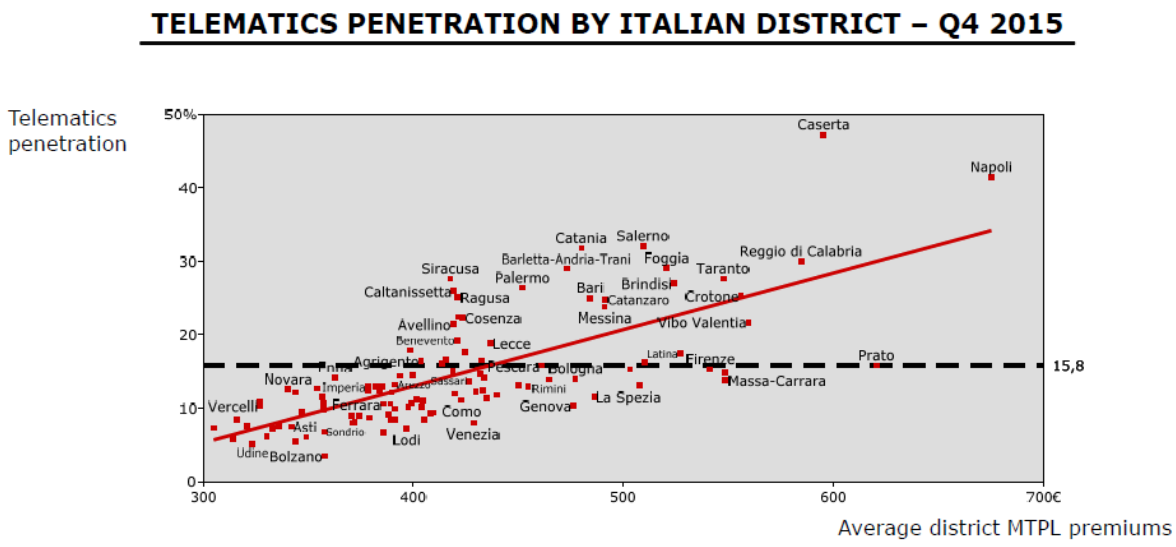

Figure 4 Telematics penetration based on average district MTPL premiums (cf. Bain & Company (2016b), p. 7)

To conclude, nowadays the typical customer of a telematics-based insurance policy aged between 18 and 28, drives a comparably new car[89], lives in the South of Italy and pays a high car insurance premium. However, customers are expecting to be more heterogeneous in the future.[90]

While customers benefit from lower premiums and value added services, telematics also adds value for the insurer. By looking at the Italian best practices, one can identify certain critical success factors. The most important element is telematics' capacity to improve the insurance bottom line: a significant self-selection effect exists on customer acquisition and material savings related to claims settlement, provided that adequate processes are in place and telematics data is used accordingly. The second aspect relates to the benefits arising from the introduction of value-added services offered to (and paid by) the driver.[91]

Nowadays UBI policies are mostly based on mileage. The first types of telematics products on the market did not have any variable component linked to telematics information, only an up-front flat discount.[92] At the next level, insurers introduced UBI-related PAYD (pay as you drive) policies in conjunction with the black box. Today, they still represent around 25% of

[89] Bain & Company (2016a), p. 6
[90] ANIA (2016), p. 18
[91] Bain & Company (2016a), p. 7
[92] Carbone (2015a)

the 34 telematics solutions currently available on the Italian market.[93] These solutions monitor mileage (distinguishing sometimes between driving during the day, the night, the weekend and/or itineraries) and premium is calculated as adjustment to the base premium, due in the following year. Another well-known telematics approach leverages on the usage of a telematics box, a self-installing OBD dongle or, most recently (with Progressive in the US) an app (phone as device) for a period of 75 days, after which the customer gets a price adjustment based on own driving style.[94]

Looking forward, there is a visible trend towards UBI policies, based on driving behavior. PHYD (pay how you drive) policies are yet not that common on the Italian market like PAYD policies but are the next frontier in terms of advanced UBI products. The concept of PHYD and the interest for it seem to increase rapidly. They integrate information gathered on mileage with an analysis of the customer's driving style, made around number and the intensity of accelerations and stops, driving timetables, speed, location and other variables, such as weather conditions, time of day / of the week.[95]

On a global scale, Italy has clearly the most advanced experience in combining car insurance contracts with hardware and using this data stream throughout the insurance value chain, in contrast with other countries, where it is still a niche value proposition.[96]

4 Customer perception and behavior on telematics

There are significant challenges to make telematics adoption accepted by customer.[97] Since many of them have concerns about the data they shared with insurance companies, particularly related to GPS location, braking patterns and speed. Specifically, they do not know how their insurer will handle this information (storage, sharing with third parties, like marketing companies or police enforcement) and ultimately protect privacy.[98] But also insurance companies are concerned with data privacy. Even though insurance companies have dealt with

[93] Carbone (2015c)
[94] Carbone (2016c)
[95] Carbone (2014)
[96] Carbone (2014)
[97] Karapiperis et al. (2015), p. 23
[98] Karapiperis et al. (2015), p. 5

sensitive data in the past, telematics require additional, technological effort in order to deal with data appropriately and to fulfil the requirements of regulators and privacy laws.

Additionally, there are region-specific regulations and requirements for UBI programs, which limit data usage[99] and create operational complexities. On one hand, regulators lower premiums for good driving performance; on the other hand, they do not have a definite attitude towards raising premiums for bad driving, which 'hurts insurers' competitiveness.[100]

Another challenge is to overcome the disproportionate effect of sale of UBI to customers with a low- or moderate-income. Every customer should have the same access to essential insurance products, which are especially crucial for low-income customers, more reliant on these products than wealthy customers are.[101]

However, the latest customer survey by Bain & Company and SSI shows a different trend and will be evaluated and explained below.

In 2015, 5% of all motor insurance customers decided to switch from a traditional motor insurance to an insurance policy based on a black box.[102] Additionally, the overall retention of customers with a telematics-based insurance policy is increasing in the course of the time. The increasing retention rate is linked to the increasing interaction frequency between customers and insurers, which contains knowledge creation and exchange of information and transparency.[103]

Customers recognize, that telematics offers many valuable benefits for customers and the society as a whole. For them, the key drivers for choosing a telematics-based UBI are lower premiums, enhanced safety and improved claims experience.[104] Here within, the perceived value of premium discounts and value-added services (VAS), such as theft protection, is higher than the perceived costs to install the black box and subscribe for VAS.[105]

A recent survey conducted by Bain & Company and SSI for the Connected Insurance Observatory polled 3'525 final customers in seven countries (Austria, France, Germany, Italy, Spain, UK, US) and reveals interesting insights about how customers perceive telematics, how their

[99] Karapiperis et al. (2015), p. 52
[100] Reddy (2012), p. 9
[101] Karapiperis et al. (2015), p. 51 f.
[102] IVASS (2016), p. 31
[103] IVASS (2016), p. 36
[104] Karapiperis et al. (2015), p. 5

preferred telematics insurance product would look like and how they rate VAS attached to an insurance product.

The data collection took place between July and August 2016 using the method of online panels. According to each surveyed country, questions were asked in five languages.

Table 1 Overview of survey participants

Country	**N**	**%**
Austria	500	14.2%
France	507	14.4%
Germany	500	14.2%
Italy	508	14.4%
Spain	503	14.3%
UK	502	14.2%
US	505	14.3%
Total	**3525**	**100%**

Table 1 shows the number and the percentage of the respondent number per country.

The samples were drawn from a population of 18 years and older, whereby the overall number of respondents is evenly distribute over the age range (18-24, 25-34, 35-44, 45-54, 55-64, 65-74, >74) for each single country and counts about 500.

The working population was defined as working full-time (35 hours a week or more) or part-time (less than 35 hours a week). The non-working population includes job seekers, full time students, retired and disabled people. Self-employed, unemployed and homemakers were excluded from the survey. The present sample comprises 48.2% of female and 51.7% of male respondents, for each single country, the distribution is quite similar.

Price is the number one factor when choosing a motor insurance offer. Other secondary factors include services offered by the insurance company and its trustworthiness. Consequently, possible discounts on an auto insurance premium could be key for customers to buy a telematics-based insurance product.

[105] IVASS (2016), p. 20

Figure 5 shows the likelihood of having a black box installed per country.[106] In Italy, 66% of the auto insurance customers surveyed would have a black box fitted in their cars to receive VAS and a discount on their auto insurance premium. This result underlines that the propensity of Italian customers towards telematics is very positive. Even though the majority of the surveyed customers in the US und UK is more skeptical, they would still accept a black box installed in their cars. Different is the opinion of German, French and Austrian customers who consider unlikely to buy an insurance product linked to a black box. However, the fact that technology improves and becomes cheaper could make it attractive in the future to markets previously excluded.

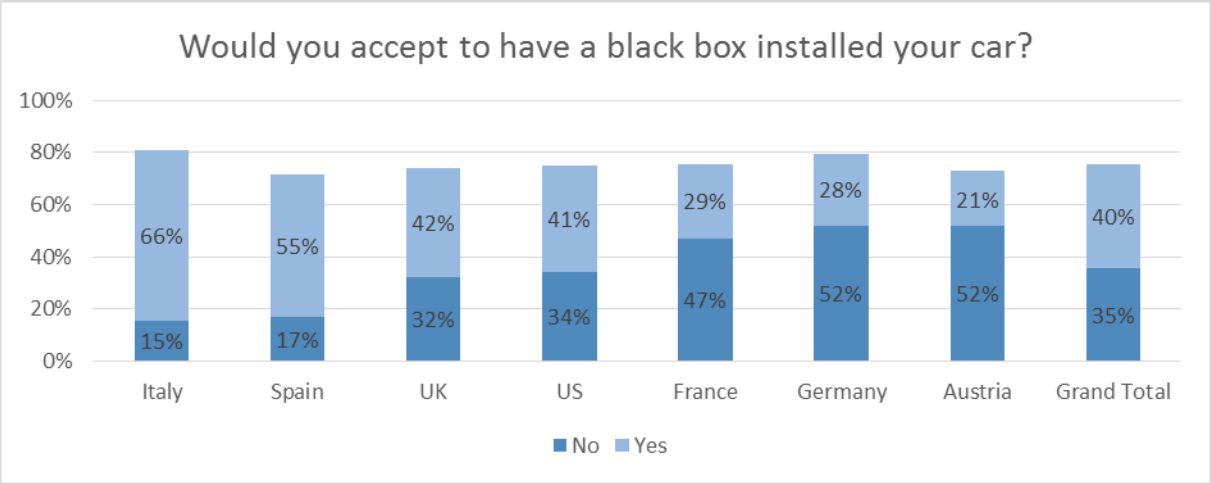

Figure 5 – Likelihood of having a black box installed in a car

The inclusion of additional varaibles in the analysis shows, that the salary and the kilometers driven (per year) of the survey participants have an influence on the decision whether a customer would accept having a black box installed in his / her car or not.

In Italy, the acceptance of a black box is increasing with an increasing salary of the potential customer (Figure 6). Customers with a salary below 20'000 € only 55-56% would accept having a black box installed in their cars. With an incrasing salary, the willingness of using a black box rises up to 82% for the potential customers with a yearly salary above 100'000 €. The same trend is visible for all other survey countries.

[106] Customers who are neutral are exluced from this illustration

A potential explanation could be that customers with higher salaries drive cars that are more expensive, pay more for their motor insurance and therefore are attracted by potential premium reductions in combination with a black box.

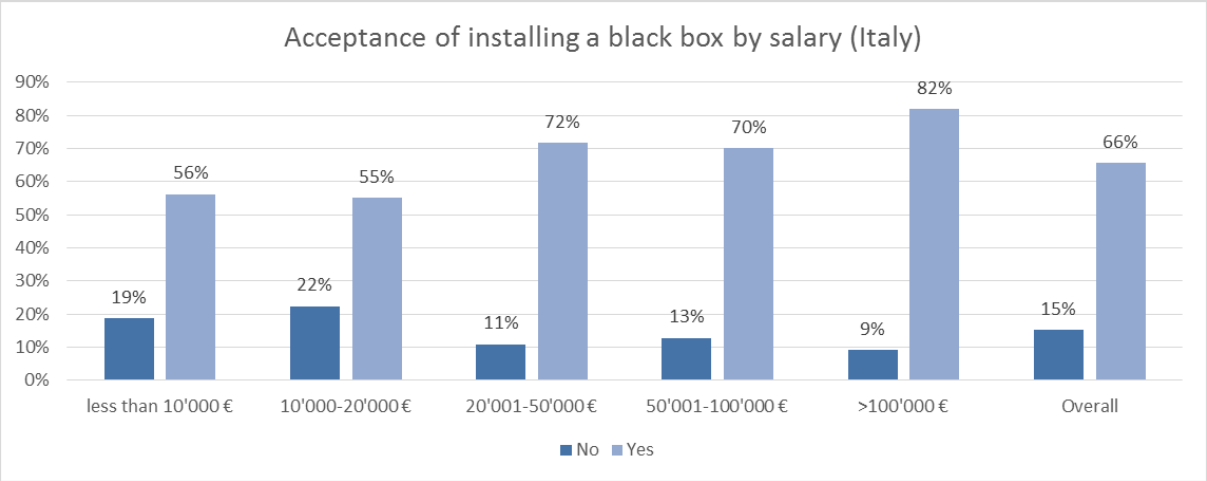

Figure 6 – Back box acceptance by yearly salary

A look at the kilometers driven per year among all surveyed countries reveals that the more the participants drive, the more willing they are to get a black box fitted in their cars.

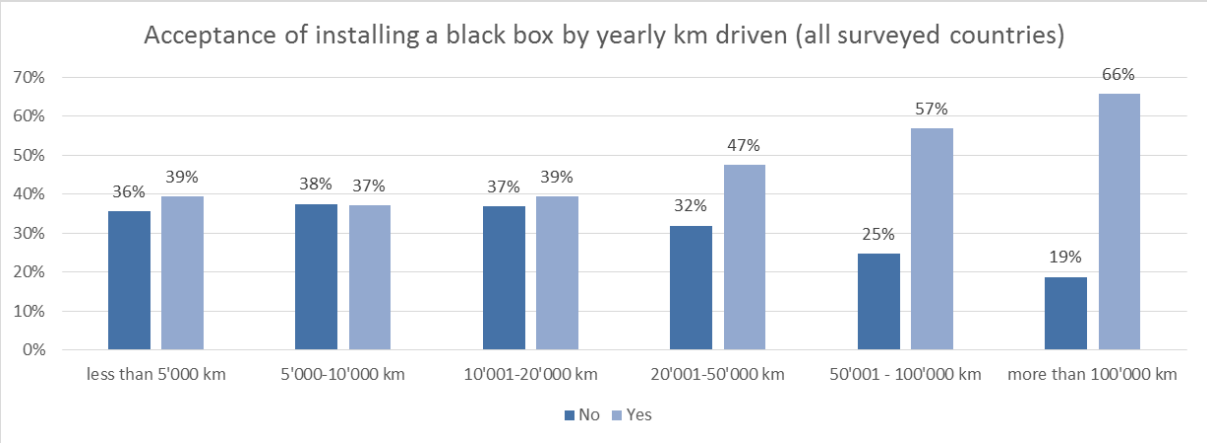

Figure 7 – Black box acceptance by kilometers driven (per year)

There are different options to individualize premiums in order to reach price-sensitive customers. Premium reductions can be given, to recognize improved driving performance or voluntary reductions of mileage driven.[107] With UBI programs, fixed costs can turn into varia-

[107] Karapiperis et al. (2015), p. 44

ble costs (associated with mileage driven) and can be attributed to existing classes and risk categories for premium calculation. Insurers have the opportunity to build specific value propositions for specific customer segments in order to increase acceptability of UBI products. As an example, lower-income, urban and "multi-car" households, can benefit from the flexible pricing and the ability to pay more affordable premiums.[108]

In Italy, customers prefer fixed discounts every month, known upfront at the start of the policy rather than variable discounts linked to kilometers driven or the driving behavior (Figure 6).

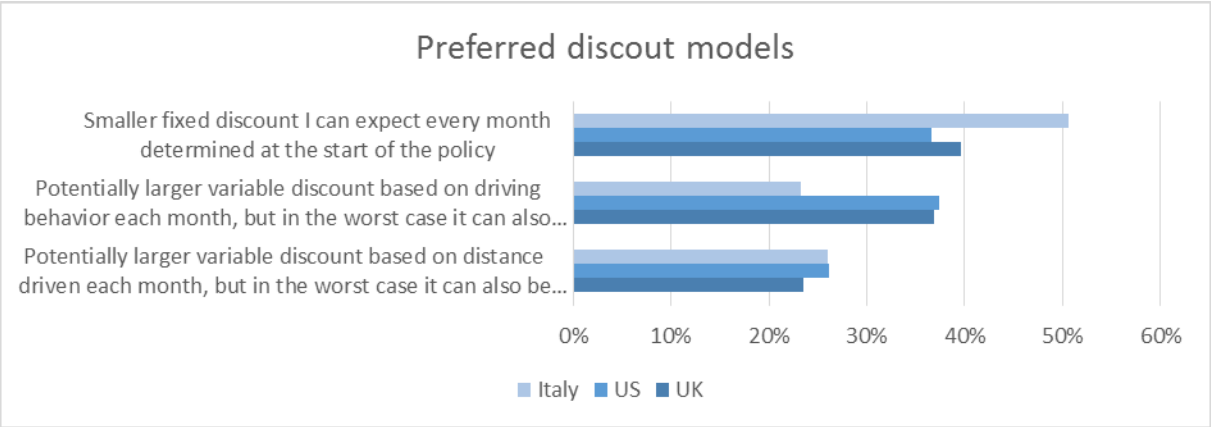

Figure 8 – Comparison of preferred discout models

According to the survey, customers in Italy who would be willing to use a smartphone app (46%) alone or in combination with a black box (71%) consider different discount types as beneficial: 35% would prefer to pay premium at the moment of subscription with cash-back or integration at the end of the year, 34% would rather pay a small subscription fee and a variable monthly premium based on their driving behavior.

Telematics based insurance policies have the potential to make roads safer. Especially for young drivers, the tracking of rapid acceleration, speeding and sharp turns can have an educational effect.[109] Once insurance companies incentivize their customers to drive better, the number of accidents and their severity could potentially go down, with the undoubtful benefit of saving lives. Rewarding customers for safe driving in turn enables more transparency, since the link between driving behavior and premium is way fairer than traditional pricing scheme.

[108] Karapiperis et al. (2015), p. 45
[109] Karapiperis et al. (2015), p. 45 f.

Another question asked was about those rewards motivating best to enhance driving behavior. The highest motivation factor of all participants from all countries is the monthly discount. The secondly ranked motivation factor differs among countries: it could be either a discount at renewal or a cash-back for not having had an accident at year-end (see Figure 9).

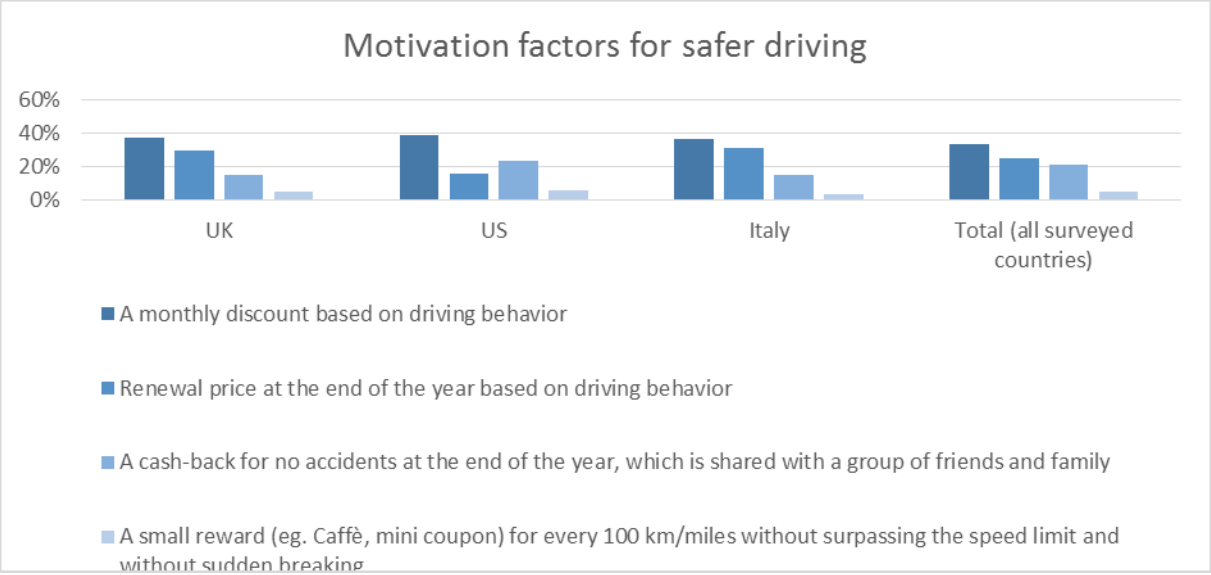

Figure 9 – Motivation factors for safer driving

Next to the possibility of reduced premiums and easier claim handling processes, customers having a device or smartphone app installed, can benefit from a variety of value-added services, such as roadside assistance, help in case of an emergency and recovery of stolen vehicles.[110]

The participants to the survey ranked several value-added services based on their perceived attractiveness (Figure 10). Even though country-specific preferences differ, anti-theft services, easier claims handling and a car finder feature are highly appreciated across all surveyed countries. Parental control and personalized non-insurance offers are of the least interest among participants.

[110] Karapiperis et al. (2015), p. 46

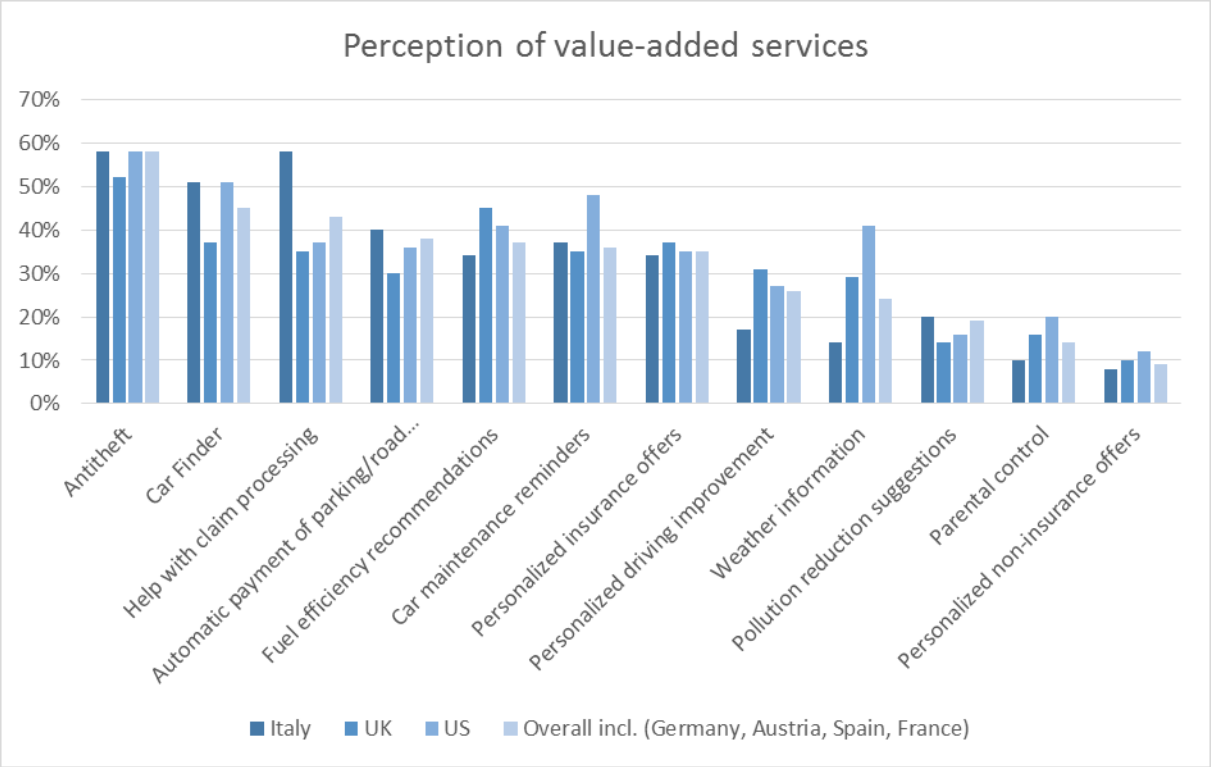

Figure 10 – Perception of value added services

A joint global customer survey from The Boston Consulting Group (BCG) and Morgan Stanley, which was conducted in 11 countries in 2016, shows similar results:

Over 70% of the surveyed customers already switched to a usage based insurance (UBI). Cost reduction and a better control of motor insurance costs were the main reasons for it. Customers are also willing to share driving and location-related data for a lower insurance premium, even though this varies between countries.[111] Especially, when it comes to value-added services, 53% of the respondents are willing to pay in addition for vehicle theft tracking and 43% for automated emergency calls. This willingness to pay for extra services is higher amongst young drivers.[112]

The following customer journey will illustrate, how and when these additional services come into play.

[111] The Boston Consulting Group (2016), p. 49
[112] The Boston Consulting Group (2016), p. 50

4.1 Case Study: Services enabled by telematics enrich the entire journey of a car driver

The whole customer journey offers a variety of opportunities regarding insurance-related services, which are shown in the three customer journey stages below (Figure 5):

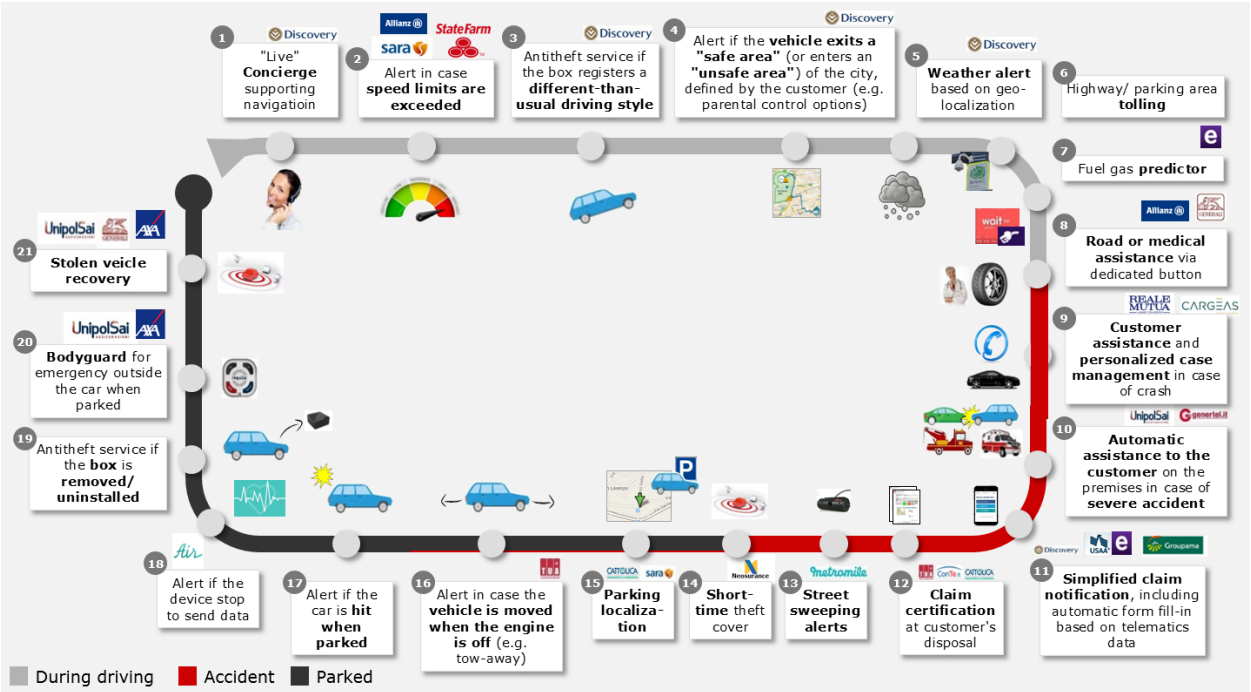

Figure 11 Opportunity to reinvent the claims customer experience (cf. Bain & Company (2016a), p. 10)

While a car is driving, services such as speeding alert, insurance companies may offer weather alerts or fuel cost predictors. Additionally, anti-theft is a relevant service that sends signals to the customer if the black box registers different driving styles compared to the usual ones.[113]

In case of crash, the client can be contacted proactively by an assistance company and – depending on the gravity of the accident – help (e.g. road or medical assistance) can be sent directly to the location of the car. Furthermore, the assistance company can take care of all logistics, which have to be organized after a crash. One step further, insurers are focusing on simplifying the first notice of loss (FNOL) procedure in case of car accidents, which can be realized with e.g. a new app available all over Italy.[114]

[113] Carbone (2015b)
[114] Carbone (2015b)

When the vehicle is parked, alerts can be automatically sent out by the black box, when the vehicle is moved or damaged, or even when the black box is removed or uninstalled. This also enables the possibility to locate a parked vehicle.[115]

The three Italian insurance companies TUA, Cattolica and Cargeas have recently launched innovative services, which come close to the ones presented in the customer journey above.[116] The car insurance company Metromile launched the street sweeping alert, as one best practice in Los Angeles and San Diego in 2015.[117]

The following paragraph will examine in a more detailed way how insurance companies can leverage telematics and additional services during their value creation process.

5 Value Proposition of Telematics

Telematics, as one of the most relevant digital innovations, has a tremendous impact on the motor landscape given the constant rise of UBI insurance policies' penetration, which brings advantages to insurers and allows low premium come along with profitability.[118]

Based on intensive research conducted by Matteo Carbone, Principal at Bain & Company and expert in the field of insurance and telematics in Italy, telematics bring several main benefits for the insurance sector.

The offering of services in addition to the motor insurance policy itself can enhance the *frequency of the interaction* between the insurer and the customer. Customers of traditional motor insurance usually have three touchpoints with their insurers: When signing-off an insurance policy, when cancelling an insurance policy and after an accident in case of claims. With telematics, this interaction pattern changes: Customers might frequently login to their insurance portal or use an app provided by their insurers in order to see their last trips or their recent driving behavior. At every interaction, an insurance company can offer additional services[119], which easily attract customers. The range of these services is unlimited (e.g. vouchers, conversation of miles driven into other mileage programs etc.). To conclude, an in-

[115] Carbone (2015b)
[116] Carbone (2015b)
[117] Metromile (2015)
[118] Carbone (2016b)

creased interaction between insurance companies and customers presents a huge potential for cross-selling and up-selling and insurers can profit from the additional source of income by identifying and developing new customized solutions. [120]

As a step forward, insurers want to develop *loyalty and behavior modification programs* and focus on gamification and reward mechanisms as an alternative to premium discounts. This can include a score- and prize-based system related to driving behavior. Insurers can retain an incremental share of generated value through telematics and can therefore provide value for customer. The integration of driving behavior's monitoring and reward-system mechanisms may have a greater influence on customer's behavior than a tariff with a recalculated premium based on the same variables, which differs between different countries and cultures.[121]

Another benefit is the ability of extensive *knowledge creation*[122]. In the course of the time, insurers can collect huge amounts of data. The combination of car data, driver's behavior data and contextual data enables insurers to assess risks better, categorize customers and offer customized premiums and discount models. Insurance companies focus on *risk selection* especially when acquiring new clients or when renewing a policy. Risk behavior propensity of a driver can be identified and selected through integration of (traditionally used) static variables and collected telematics data. Based on this, price adjustments are possible and a customized and black box based insurance product can be offered.[123]

The possibility of incorporating vehicle and driving data into the parameters of an MTPL tariff is essential for insurers in order to enable *risk-based pricing and/or individual pricing*. It is also possible to monitor the 'quantity' and 'level' of risk exposure over the period of coverage and therefore the pricing can be adapted to each individual customer, (i.e. a customer will get a discount based on the driving behavior registered in a certain time period). The incorporated variables either can refer to the mileage only (PAYD) or can also consider other data in terms of driving behavior (PHYD).[124]

Insurers address the opportunity to generate additional value on the *claims handling* through the combination of telematics-based insurance in combination with a black box and the us-

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[119] Carbone (2016b)
[120] Carbone (2015d)
[121] Carbone (2015d)
[122] Carbone (2016b)
[123] Carbone (2015d)

age of data detected by sensors, in order to improve substantially both customer experience and *loss ratios*. Throughout the information gathering process, claim verification (anticipating the First Notice of Loss), claim description (of the crash dynamic, e.g. braking, speed, cornering etc. via direct contact with the client) and the possibility of rerouting to an own network of repair shops can be anticipated and therefore makes the whole process fast and efficient. The analysis of the data which is gathered throughput the process can identify potential risk factors such as risky driving habits, car maintenance issues and weather conditions. The sophisticated use of this data could make loss prevention to the next innovative milestone to lower loss expenses.[125]

To conclude, all these factors could lead to increased profits and insurers may benefit from a *better profit and loss situation*.[126]

However, the insurance sector faces a double challenge: first, introducing a new, creative approach to product development and second, to become able to manage both gamification dynamics and partner ecosystems in order to build up a reward system. To ensure that the development of UBI and telematics will take the right turn, insurance companies have to create transparency in their pricing to make alignment of interests with insurers possible.[127]

How telematics evolve and change the insurance landscape will be highlighted in the following chapter.

6 How telematics change the insurance landscape

The combination of ADAS and telematics has extensive consequences on the road safety and therefore on the insurance sector. According to a recent World Health Organization (WHO) study, technology-assisted and autonomous driving will cut the frequency and costs of road accidents.[128]

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[124] Carbone (2015d)
[125] Carbone (2015d)
[126] Silvello (2016)
[127] Carbone (2015d)
[128] World Health Organization (2015)

A research by Morgan Stanley and Boston Consulting Group estimates, that the use of smart devices could drop motor insurance claims by 15-25%.[129]

The Italian National Association of Insurance Companies (ANIA) conducted a survey with Italian insurers about telematics and connected motor insurance, asking them about their opinion regarding advantages and perceived obstacles.

The main expected advantage in motor telematics is risk-based pricing (66%), followed equally by risk selection (11%), value-added services (11%) and eliciting low risk conducts and customer loyalty (11%). There is no special benefit deducted from the control over losses.[130]

According to the participating insurers, connected insurance has a high impact on the actuarial function (32%) and the marketing / product design (35%).[131]

Not having a clear strategy (34%) and difficulties in data management (34%) are perceived as the main obstacles regarding connected insurance, followed by privacy management and the implementation costs. None of the surveyed insurers sees a potential "lack in demand".[132]

One of the most influential questions is the one, whether telematics reduces the frequency of claims and is therefore actually capable, to make roads safer.

ANIA analyzed a sample relative to 86.6% of premiums written in 2014 in the motor liability insurance and found out, that the overall claims frequency equals 4.77%.[133]

The analysis of the overall caused claim frequency of vehicles with black box and without black box showed, that the difference of 5.4% is relatively low. However, this difference becomes more significant once the results are controlled for some key variables, such as the province of residence or the age of the driver.[134]

The caused claims frequency of vehicles with black box and drivers aged between 18 and 25, living in Napels equals 6.08%. A vehicle without black box and a driver in the same age living

[129] ANIA (2016), p. 8
[130] ANIA (2016), p. 29
[131] ANIA (2016), p. 31
[132] ANIA (2016), p. 33
[133] ANIA (2016), p. 20
[134] ANIA (2016), p. 19

in the same province caused a claims frequency of 8.31%. These values equal a total difference of 26.8%.[135]

Therefore, the most significant result of the analysis is that the black box installed in a vehicle reduces claims frequency on average of about 20%, all the other factors being equal.[136] The geographical area factor seems to have the highest interaction level with black box absence / presence, as the average "standardized" claims frequency reduction results in 20%.[137] Additionally, there is a positive and significant correlation between "standardized" change and either the penetration of black box and the incidence of frauds.[138]

To conclude, these results show that black boxes have the potential to reduce accidents, claims and therefore risk for the insurer. There are possible explanations for this finding:

Either good driver opt for a black box, or drivers with a black box drive more carefully.

Finally, it can be assumed that black boxes reduce insurance fraud or inflated claims.

7 Conclusion and Outlook

7.1 Conclusion

During the course of this work we learned, that Italy is the most advanced market when it comes to telematics. We also learned, that consumers of motor insurance policies in Italy are willing to buy a telematics-based insurance policy because the advantages clearly outrange the disadvantages. Possible reductions in premiums and the perceived value of additional services have a higher weight than the fear of sharing personal data and data related to the driving behavior of individual customers. This work also pointed out, that telematics is not only beneficial for customers but also for insurance companies as they are able to increase their revenues by selling additional services, by developing more accurant risk profiles of drivers and by avoiding claims fraud. Even though it is not yet conclusively proven that black boxes and telematics-based insurance policies have a positive impact on the driving behavior

[135] ANIA (2016), p. 8
[136] ANIA (2016), p. 22
[137] ANIA (2016), p. 23
[138] ANIA (2016), p. 24

and therefore lead to a reduced number of accidents and claims, there are several indications, which lead into this direction. Therefore, the motor insurance landscape is about to change.

To conclude, telematics represents a significant but complicated opportunity and can create value in many ways. The 'winners' in telematics, as well as the ultimate potential of the industry including the value creation, is yet to be determine.[139] On this way, Italy could serve as a role model for other European countries – and worldwide.

7.2 Outlook

When the concept of telematics was developed around 30 years ago, it took some time until the beneifts of telematics were recognized and the idea of telematics actually started to grow. In 1988, it was tested with first pilots, whether telematics make sense at all and whether it can add value to a traditional car. In the early 200s a few pioneers, who believed in the future of telematics, rolled out the first telematics products and confirmed, that there is a ROI of the use case. Step by step other players entered the market, built up substantial knowledge, fostered their own approach and tried to focus on absorbing the full potential of this new technology.

Nowadays, we are moving from the learning phase to the growth phase (Figure 13). Next to traditional telematics service providers, many other industries from consulting companies, over car manufacturers, to (re-) insurers are trying, to step into the market as well as they do not want to lose the opportunity to be part of this new journey.

[139] Sundeep / Vardhan (2013), p. 557

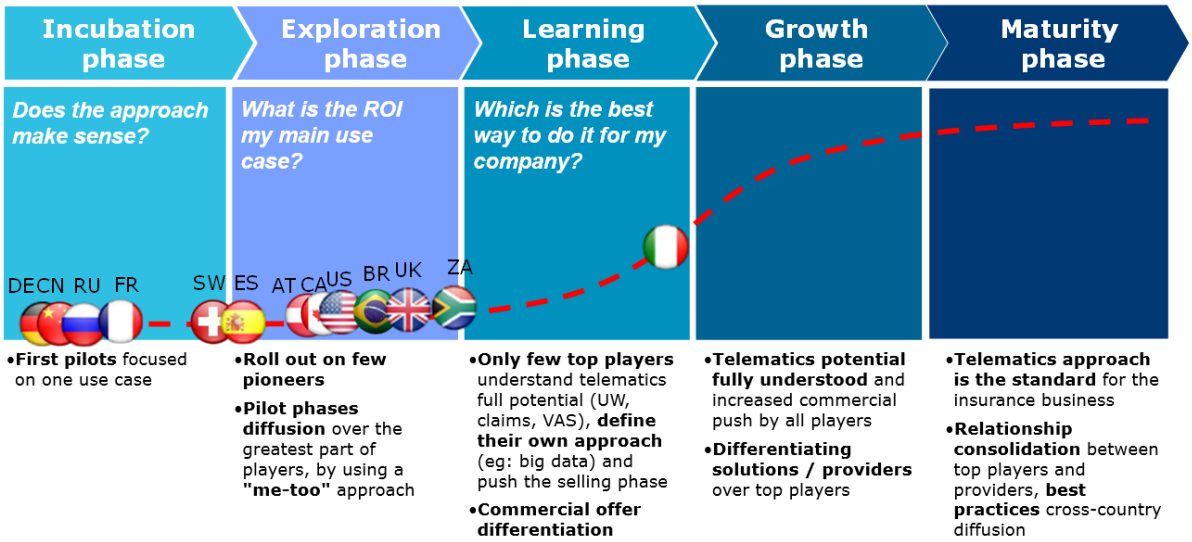

Figure 12 Maturity phases of telematics adoption (c.f. IVASS (2016), p. 17)

It is expected, that telematics will accelerate at an even higher pace in the upcoming years. In Europe, there has also been a rapid increase in telematics popularity (driven by Italy, but the UK, Germany and France might see UBI subscriptions take off in the next 5 years). By 2020 it is expected that there are more than 100 million telematics based policies sold, which are expected to generate in excess of EUR 250 bilion in premiums by the end of the decade.[140]

Consumers will constantly gain a better understanding of telematics and companies will find innovative ways to leverage the data collected by the corresponding devices far beyond the motor landscape.

Health wearables are collecting health data and potentially can revolutionize the health sector if data would be send automatically to a doctor or to an insurance company. Smart home devices can make houses and apartments more secure and bring the ability to monitor components of a house in order to prevent fire or other types of damage and therefore prevent losses for insurance companies.

Last but not least, telematics path the way towards autonomous driving, for which telematics technology is core.

[140] Ptolemus (2016), p. 15

Connected cars, connected homes and connected lifes could merge into a connected world, which will bring not yet seen benefits, but also risks to insurance companies and their consumers.

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