
The Value of Privacy - Empirical Research, Using Drivers as an Example

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Abstract:

Purpose: The paper assesses expectations regarding the amount of discount in insurance premium, which could compensate insured for loss of privacy should it transpire that one's driving style is to be monitored.

Design/Methodology/Approach: The analysis is carried out using data collected through a survey conducted on a sample of clients of insurance companies. As part of the analysis, Pearson's Chi-Square Test is used. It is based on comparing empirical values with expected values, where expected values are treated as variables that would occur if there were no relationship between them.

Findings: Analysis showed that 75% of the respondents who would allow the possibility of concluding a UBI type contract at all would expect a discount of up to 30% of their current premium. While a maximum of 15% discount relates to as many as 37,45% of the respondents. The factors like gender, age, education, and place of residence of the respondents influence the level of expectations.

Practical Implications: The paper conducts an empirical study on the impact of the loss of privacy on the discount in insurance premium thus the topic might be of interest to insurance companies and their clients making the final insurance purchase decision.

Originality/Value: Is the first study when UBI expectations are explained in terms of Poland one of the biggest insurance market in CEE region. The findings might have a practical and science value. From practical point of view, it gives the insurance professionals the knowledge of the expected level of possible decrease in premium that might result in intensification of UBI. From scientific point of view the study provides useful information for further research especially in terms of factors that determine the level of expectations.

Keywords: Privacy, insurance telematics, client acceptance, usage-based insurance (UBI).

JEL codes: G22, G14, D82.

Paper Type: Research Paper

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1. Introduction

Goldfarb and Tucker (2013) showed that new technologies allow organizations to monitor the real behavior of clients at very low cost. In addition, the progressive development of vehicle monitoring techniques as well as the collection and analysis of collected data (*insurance telematics*) give insurers the possibility to assess risk based on driving style (*Usage-Based Insurance or UBI*). Although this is a chance for a more precise risk assessment, attempts to use information on driving style, in the process of the calculation of premiums, has led to quite vocal criticism of such an approach. First, the violation of the privacy was one of the main reasons for a reserved attitude to telematics insurance. The technical solutions applied may violate the privacy of the insured by providing quite comprehensive information, not only about driving style or the number of kilometers travelled, but above all, details of when and where the insured is moving (*location data*). Studies show (Laudon, 1996; Derikx, de Reuver and Kroesen, 2016), that a small financial incentive can convince the insured to share this information with the insurer while that incentive, being negligible (Goldfarb and Tucker, 2013).

Above all, advocates of privacy protection raise arguments regarding the lack of transparency, *vis-à-vis* access to the data collected and with regard to those entities who would have such rights, as also, last but not least, the purpose of processing the data received. As an example, they give the possibility of gaining access to data collected by authorities, such as the police or the Road Transport Inspection Department, in order to analyze it in the prosecution of road-traffic offences. Some US insurers have long offered the possibility of providing parents with data collected on how their offspring use their vehicles (Higgins, 2005).

Although these activities are primarily intended to improve the safety of young drivers, they can still be treated as a violation of their privacy. It is also not possible to rule out the treatment of telematic data as evidence in a court of law. References to registers of so-called 'black boxes' are quite common in Canada and the United States (Green and McClafferty, 2005). However, one should bear in mind that in many cases the protection of the privacy of one party, guaranteed by law, is in conflict with the economic interests of the other party. This may limit the freedom of contracts concluded on the market and prevent insurers from carefully assessing risk and, consequently, all insured drivers are burdened equally with a premium higher than that determined by a free market (Lewicka-Strzałecka, 2003).

The purpose of this article is to estimate the amount of discount in an insurance premium that could compensate the insured for the loss of privacy, associated with the introduction of a monitoring of driving style. Such discount can be treated as the price for the privacy of the insured since it reflects the monetary value at which insureds feel able to disclose their private information. Also, the attempt at identifying factors, other than the income that could have a real impact on the subjective value of privacy, was made.

2. Privacy and its Value - Literature Review

Privacy is a concept which has been widely studied for over a century in many scientific disciplines such as philosophy, psychology, sociology, law, and engineering (Smith, Dinev, and Xu, 2011). Such disciplines as economics, finance, IT, and telecommunications have also been included in recent times. Privacy is a value that stimulates the independence of the individual as well as social development (Solove, 2008). Whenever technical progress allows new ways to access, collect and process information, privacy concerns arise. The public is increasingly concerned about the level of the security of their privacy and is willing to take all available measures that can protect them from its loss (Paine *et al.*, 2007). At the same time, most consumers consider the disclosure of personal data as an integral part of modern life, necessary to gain access to products and services (Preibusch, 2013).

It is important to understand the concept of privacy and the value that an individual assign thereto. There are many definitions of privacy in the literature. It has traditionally been conceptualized as the individual's right to control access to information concerning himself/herself. Westin and Ruebhausen (1967), for example, defined privacy as the ability to determine independently *when, how* and *to what extent* information about the individual is passed on to others. Altman (1976), on the other hand, considered privacy as a dialectical and dynamic process for determining the boundaries which allow selective control of access to the individual or to his/her group.

Utilitarians perceive privacy more as an interest than as absolute law (Derikx, de Reuver, and Kroesen, 2016). Clarke (2006), for example, defines privacy as the interest an individual sees in preserving his personal space in a state undisturbed by other people or organizations. In this study, we used the utilitarian view on the definition of privacy, according to which it is possible to sell privacy in exchange for the potential benefits that an individual can obtain. This approach has been used in several studies where privacy has been treated as a type of subject of exchange, consisting in the disclosure of data on the individual in exchange for the benefits associated with the provision of specific services (Laudon, 1996; Dinev and Hart, 2006; Hann *et al.*, 2007; Li, Sarathy, and Xu, 2010; Chorppath and Alpcan, 2013).

Stigler (1980) and Posner (1978; 1981) considered privacy in the context of the efficiency of markets. Stigler defined privacy as a limitation of the ability to collect and use private information. Referring to the markets of goods and services that are effective only when the requirement of the clearly specified ownership of resources is met, he treated private information as the property of the individual. Posner, on the other hand, interpreted privacy as the embezzlement of information, in, for example the concealment of information of a negative nature; he stated that the right to privacy has a negative impact on general well-being. However, both researchers recognized that market regulations, aimed at protecting privacy, are not necessary

because they are ineffective. This view is in line with the approach of the Chicago school of economics, according to which economic interventions worsen the functioning of markets and lead to inefficiencies.

Hirshleifer (1980), going a step further, emphasized the importance of privacy as a property right that must provide the individual with control over himself/herself and his/her time. The issue of the loss of privacy could be solved by an appropriate allocation of property rights. Varian (2002), on the other hand, perceived the loss of privacy as the source of the occurrence of social costs. He argued that when two parties negotiate the exchange of information, they have full control over the fulfilment of their goals. However, if the buyer resells to a third party the information which he/she has acquired, his/her own purposes may differ from the original owner's purposes; this may result in a negative, external effect. Notwithstanding, and before the above external effect can take place, one can protect oneself by strictly defining contractual arrangements that will regulate the possible intentions or goals of using the information acquired.

Stigler (1980) has shown that the individual is able to allow his/her privacy to be violated only if he/she considers this to be an effective move. That is to say that he/she can allow the credit bureau to gain access to his/her data, to obtain a lower interest rate on such as a loan. At the same time, one should be aware that the pricing of privacy, carried out by individual entities, is not the same for everyone. Some people value privacy more highly and guard it more stringently than others. Hollis and Strauss (2007) and Filipova-Neumann (2007) looked at privacy issues from the point of view of insurance economics. The researchers observed that those insureds who are less concerned about the invasion of their privacy tend to gain greater benefits under UBI as compared to those who value their privacy more highly.

Under the conditions of perfect competition and once having left a portfolio, the average premium will increase for those insured who remain in the portfolio and will also result in attempts, by those insured who value their privacy more highly, to switch to UBI systems. Although they will be in a worse position from the point of view of usability, it is a better solution for them than staying in an insurance portfolio with traditional tariffs. Ultimately, the authors indicated that such insured would be in a worse position, regardless of the decision they make, *vis-à-vis* a possible change of the type of insurance. These are high-risk insurers or those with a very high valuation of their own privacy.

With reference to the above considerations, regarding the monitoring of the driving style of the insured, the precise specification of the collection, storage and use of information, obtained by the insurer could not occasion any loss of privacy perceived by the insured, nor eliminate external effects and social costs. However, this solution has no practical feasibility, because there are privacy protection costs that can arise even when the rights and obligations of the data collector are clearly

defined in the contract. From the point of view of the individual, his/her privacy can therefore be jeopardized when he/she believes that (Filipova-Neumann, 2008):

- a larger amount of information may be collected and stored than was originally agreed,
- during the risk assessment, errors may arise resulting from a faulty analysis of the data obtained by insurers,
- the insurer may, implicitly, use the data in breach of the goals set out in the contract,
- the insurer may allow access to information to third parties who are not authorized under the contract.

Several authors have developed methods that should protect the privacy of the insured during the handling of insurance, using telematic data. Iqbal and Lim (2006), for example, proposed a solution in which the premiums are calculated directly in the vehicle. No data regarding vehicle positioning or driving style would be disclosed and only the aggregated and anonymized data, necessary for the correct risk assessment of the insured, would be transferred to the insurer. This approach lacked practical feasibility. It also ignored the implementation costs of non-standard infrastructure.

A similar approach can be found in the work by Troncoso *et al.* (2011) describing the *PriPAYD* model. According to their model, the data collected should be stored in an on-board device, which is also used to calculate the premium. This system would also give end users constant (e.g., on-line) access to the data collected, which enables them to review the rates quoted by the insurer.

3. Compensation for Surrendering Privacy

Laufer and Wolfe (1977) suggested that the individual evaluates the potential consequences of disclosing personal information by juxtaposing or weighing up the anticipated benefits against the losses resulting from the disclosure of personal information. This means that privacy concerns, related to the conclusion of a contract, using insurance telematics, should be compensated in order to convince consumers to purchase insurance. According to Hann *et al.* (2007), the negative effects related to privacy concerns can be limited in two ways:

- by specifying a detailed privacy policy and by regulating the possible use of the personal data obtained,
- by offering additional benefits to the insured, both in cash and as additional services.

Thus, attempts have been made to estimate the value of telematic data assigned to it by individual entities. Some studies aimed to determine the monetary value that would encourage the individual to disclose information, while others focused on the

conditions that would have to be met for respondents to be willing to share information of a private nature.

For example, Danezis, Lewis, and Anderson (2005) conducted an experiment on a group of students who were offered financial incentives in exchange for the possibility of using information regarding the location of their mobile phones. The selection of individuals subjected to the examination took place on the terms of a reverse auction, during which candidates could submit offers regarding the compensation they might expect for disclosing location data. Offer values ranged from £0 to £400 with an average of £27. This research gave grounds for determining the value of privacy³.

According to Barkhuus and Dey (2003), most users of mobile devices, such as smartphones and tablets, have no concerns about disclosing their location data, especially if this information does not leave their devices. Iachello *et al.* (2005) showed that concerns may arise at the point where user data is forwarded in an automated manner because users want a sense of control and want to decide themselves whether to transfer their data to other entities. At the same time, they do not want this information to reach entities other than those recipients for whom it is intended. Having the option of deciding on the possible disclosure of information about their location, users do not see the need to be coy or to lie about their whereabouts (Hermann, 2016).

As part of some research, attempts were also made to ascertain the factors determining the conditions under which individuals are able to share their location data. These include the recipient or entity for which the data is intended, the current location of the entity and his/her current mood (Consolvo *et al.*, 2005; Anthony, Henderson, and Kotz, 2007).

The following parts of the article present the results of a study aimed at a preliminary estimation of the value attributed to private information by Polish clients of insurance companies.

4. Research Results

4.1 The Way of Data Collection

The analysis was carried out using data collected through a survey conducted on a sample of clients of insurance companies from April 1 to July 9, 2018. Since Poland has developed one of the largest insurance markets among all the CEE countries, we find it reasonable to use it as the basis for our research. Participation in the study

³*It should be borne in mind that this value, which was estimated on a sample of students, may be underestimated, relative to the results that could be obtained over the course of a full study.*

was completely voluntary and free. The respondents were asked to complete a standardized questionnaire containing 8 closed questions and 10 demographic questions.

The questions in the survey reflect some of the risk factors used by insurers in their risk assessment and pricing processes, such as insured sex, age, how long they have had their driving licenses, the approximate distance he/she travels by car per year or place of his/her residence (defined by the place's absolute number of inhabitants; the division into individual ranges commonly used by insurers was adopted). Also, additional questions relevant to the UBI were included, designed to investigate, insurers' willingness to allow for some form of invasion of their privacy in exchange for an additional financial incentive, their interest in the insurance contract based solely on telematic data, their subjective assessment of their own driving skills as well as their readiness to review their driving styles in an attempt to reduce annual insurance expenses.

That way of data collection was selected to conveniently reach the target respondents (clients of insurance companies) who are generally not easily approachable. Thus, we were able to extend the scope of the study, i.e., such a scope was geographically widely spread to the whole domestic market. Also, respondents have adequate time to give well thought-out answers which are their own words (so it is free from the bias of the interviewer). The questionnaire was available online which allowed the respondents to complete it at a convenient time and place. Answers were collected in a spreadsheet and did not allow for the subsequent identification of those respondents. The questionnaire was designed in such a way that it enabled the opinions of the clients of insurance companies on their expectations regarding financial benefits resulting from the conclusion of a UBI-type contract to be examined.

Before starting the target research, some pilot studies were carried out, mainly to refine the research tool in terms of affordability and intelligibility of the notion used in the questionnaire. Pilot research covered 15 respondents. After using the guidance obtained from the respondents, all observations in the pilot study were removed and were not taken into account during the analysis.

We used two non-probability sampling techniques to select the sample, convenience (accidental) sampling and snowball sampling. The first consists in the accidental selection of individuals for the test because they were in the right place at the right time. The second consists in the selection of representative units for the sample, independently indicating the next units that should be examined. However, the main disadvantage of this technique should be considered, which is the possibility of incorrect typing of subsequent units by indicating individuals with many similar characteristics. Using the above techniques, it is possible to obtain lower representativeness of the sample, which would not be the case with a probabilistic selection.

Although the sample is diversified in terms of its demographic characteristics, it is important to note that the representativeness of the research sample may be smaller than if we opted for probability sampling. However, the choice of non-probability techniques has been limited by the restrictions that do not allow us to test the entire population of motor vehicle owners in selected country. It was because units in the population are unknown and there was no possibility of individual identification for the needs of this study. A larger and more representative sample may give a broader representation to the measurement of client perceptions. In order to reach a larger number of respondents, a future study can be carried out in cooperation with the Polish Insurance Guarantee Fund or the Central Register of Vehicles - organizations that possesses complete information on vehicles in Poland and their owners. The information collected via the questionnaire is mainly of a qualitative nature; it allows the subjective attitude of the respondents to the issues raised in the questionnaire questions to become clear.

Additionally, the responses were mostly collected from owners of private cars, and not from those of carriers and other types of vehicles. Hence, the results cannot be completely relevant or consistent when applied to all policyholders. The novelty of the subject justifies the sample selection that is not optimal. The authors realize that, however, the research should be treated as a contribution to the previous papers and further research in the field.

4.2 Sample Characteristics

Data, collected by means of the questionnaire, represented the opinion of some 690 respondents, of whom 90.44% were owners of vehicles for which they were personally responsible. The remaining respondents did not have their own vehicle, nor did they take part in making decisions regarding their insurance; any information obtained from them, therefore, would not have been used during the analysis of the data. The research sample was diversified in terms of the gender and age of respondents, with just over half (52.24%) being male (Table 1) and with the largest group being between 36 and 40 years of age (20.67%); around 70% of those were up to 40 years old. The average age in the sample tested was 36.5 years. The largest group were men aged from 31 to 35 with 67 people being surveyed; the least numerous groups were women aged 56 to 60 (6 observations).

The sample shows a significant advantage of respondents with higher (75.80%) and secondary (21.79%) education. A small share of respondents with primary or lower secondary education and basic vocational education may have given their reasons, mainly in the form of a questionnaire survey, which:

- was directed to people who own and insure a motor vehicle,
- required access to the Internet to complete the questionnaire.

Table 1. Structure of the Sample by age range and gender of the respondents

Age range	Gender (%)		Total
	Female	Male	
18 - 25	52.13 (49)	47.87 (45)	(94)
26 - 30	57.30 (51)	42.70 (38)	(89)
31- 35	45.97 (57)	54.03 (67)	(124)
36 - 40	50.39 (65)	49.61 (64)	(129)
41 - 45	51.22 (42)	48.78 (40)	(82)
46 - 50	25.00 (11)	75.00 (33)	(44)
51 - 55	36.36 (8)	63.64 (14)	(22)
56 - 60	37.50 (6)	62.50 (10)	(16)
> 60	37.50 (9)	62.50 (15)	(24)
Total	47.76 (n=298)	52.24 (n=326)	100.00 (n=624)

Source: Research and own calculations.

By analyzing the education and the place of residence (Table 2), is noticeable that respondents with higher and secondary education are concentrated mainly in cities with over 200,000 inhabitants. On the other hand, those with primary or lower secondary education and basic vocational education mostly live-in smaller towns. This distribution is in line with expectations.

Table 2. Structure of the sample, according to the level of education of the respondents and their place of residence

Level of education	Place of residence [population] (%)					Total
	Countrys ide	Towns ≤5,000	Towns 5,000 - 50,000	Towns 50,000 - 200,000	Cities >200,000	
Basic or lower secondary	—	100.00 (1)	—	—	—	(1)
Basic vocational	14.29 (2)	35.71 (5)	14.29 (2)	21.43 (3)	14.29 (2)	(14)
Secondary	13.24 (18)	7.35 (10)	22.79 (31)	11.03 (15)	45.59 (62)	(136)
Higher	10.15 (48)	1.06 (5)	9.51 (45)	9.30 (44)	69.98 (331)	(473)
Total	10.90 (n=68)	3.37 (n=21)	12.50 (n=78)	9.94 (n=62)	63.30 (n=395)	100.00 (n=624)

Source: Research and own calculations.

Considering the size of the respondents' place of residence, as in the case of their education, factors determining the form of the study resulted in the appearance of a significant over-representation of respondents living in big cities with more than 200,000 inhabitants (63.3%). For comparison, rural residents have a share of less than 11%. In all categories of towns, there is a noticeable differentiation of respondents in terms of gender and age. The largest group are men inhabiting cities with over 200,000 inhabitants (35.57%) while the least numerous is that section of men declaring their residence to be in locations with less than 5,000 inhabitants (1.28%).

Considering the average, annual distance covered by a vehicle, the most numerous groups are drivers who travel between 10,001 km to 15,000 km a year - 29.17%. The second largest group was characterized as those driving between 5,001 km to 10,000 km - 23.08%. The least numerous proportion (11.06%) were respondents who did not travel more than 5,000 km in a year. The median of the average distance covered by the respondents was 14,629.2 km.

In the case of those categories which divide the respondents in terms of the distances they travel in one year, one can observe gender differences. It can be observed that groups of women more often declare themselves as travelling significantly shorter distances in a year than men. The categories are also differentiated with respect to the age and place of residence of the respondents. In the case of the first characteristic, the average, annual distance travelled by a vehicle, increases with the age of the driver. The situation was similar in the case of the respondents' place of residence, where the declared values increased along with the increase in the size of the location where the respondents resided.

Respondents who were asked about the premium for third-party liability insurance they had paid recently, usually declared premium costs which did not exceed PLN 1,000 (70.67%). The dominant is in the range between PLN 601 and PLN 800, that is, 25.16% of respondents, while the median is PLN 1,028.53. Premiums below PLN 401 were declared by 4.97% of respondents while premiums from PLN 1,501 to PLN 2,000 were declared by 6.89%. In the case of the whole range of premiums paid, variation is noticeable due to the gender of the respondents, their place of residence and age. As expected, the value of the premiums declared decreases with the age range of the respondents but increases with the increase in the size of their town of residence.

Respondents, when asked about the subjective assessment of their skills, rated themselves in the main, as 'rather good' (45.51%) and 'good' (37.5%) drivers. Only seven of them, that is, slightly more than 1% of all respondents asked, rated themselves 'poor' or 'rather poor'. The above distribution of the evaluation concerns both men and women, with no significant differences between the representatives of both genders. There is also a tendency to increase self-esteem with the age of respondents, where people aged 46 and upwards have never once described

themselves as ‘rather poor’ or ‘poor drivers’. To correctly classify the respondents, information was also obtained regarding their *insurance history*, that is, the number of years of compulsory third-party liability insurance for vehicle owners. According to the responses obtained in the survey, 70.35% of respondents had insured their vehicle for more than 4 years.

4.3 The Method

As part of the analysis, Pearson's Chi-Square Test was used; this applies the study of the relationship between two, nominal variables *X* and *Y*. It is based on comparing empirical values with expected values, where expected values are treated as variables that would occur if there were no relationship between them. In order to describe the contingency measurements, we used:

Tschuprow's *T* coefficient;
 Pearson's *C_{adj}* coefficient;
 Cramér's *V* coefficient, while *V* interpretation was made based on Cohen's proposal shown in Table 3.

Table 3. Classification of the strength of the relationship, as determined by Cramer's *V* according to Cohen

<i>df</i>	Strength of the relationship		
	Weak	Medium	Strong
1	.10	.30	.50
2	.07	.21	.35
3	.06	.17	.29
4	.05	.15	.25
5	.04	.13	.22

Source: Own study based on Cohen 1988, pp. 25-27, 79-80.

4.4 The Test Results

During the survey, 624 clients of insurance companies were asked about their attitude to motor insurance with a tariff based on telematic data, 526 of those who agreed to the conclusion of such a contract were also asked for the level of premium discount that would be enough to acquire the insurance. The above level of discount, both with regard to its relative value and in nominal terms, is treated, in this study, as the price for the privacy of the insured, since it reflects the monetary value at which insured persons feel able to disclose their private information, such as their driving style or data about their locations over specific periods of time.

The results of the independence tests, performed as part of the analysis, are presented in Table 4. As one can see, expectations regarding the financial incentive to conclude a UBI-type agreement are influenced, at the significance level of $\alpha=.05$, primarily by the subjective attitude of respondents to this type of insurance contract,

their gender, their age, and their place of residence. In most cases, apart from the relation to UBI, the contingency observed between variables is, however, indistinct as is indicated by the values of individual indicators T , V and C_{adj} .

Table 4. Relationship between the discount in premiums expected and the individual characteristics of the respondents

Feature	χ^2	$\chi^2_{\alpha=0.05}$	df	T	V	C_{adj}	p -value	Test result
Gender	34.3220	9.4877	4	.1658	.2345	.2851	<.0001	Variables are not independent
Age	48.3523	41.3371	28	.1210	.1392	.2931	.0098	Variables are not independent
Education	9.7116	9.4877	4	.0882	.1248	.1546	.0456	Variables are not independent
Place of residence	28.5838	21.0261	12	.1150	.1236	.2378	.0045	Variables are not independent
Self-evaluation	14.6894	15.5073	8	n/a	n/a	n/a	.0655	Independent variables
Distance	23.6500	26.2962	16	n/a	n/a	n/a	.0974	Independent variables
Insurance history	9.3052	21.0261	12	n/a	n/a	n/a	.6767	Independent variables
Premium	26.6636	31.4104	20	n/a	n/a	n/a	.1450	Independent variables
Attitude to UBI	749.2214	21.0261	12	.5887	.6326	.8392	<.0001	Variables are not independent

Source: Research and own calculations.

Table 5. Expected discount in premiums in exchange for agreeing to the monitoring of driving style

Consent monitoring driving style	to the	Premium discount expected (%)				Total
		≤15%	(15%-30%>	(30%-45%>	>45%	
Would rather consent	not	19.32 (34)	29.55 (52)	26.14 (46)	25.00 (44)	(176)
Would rather consent	rather	44.96 (107)	43.70 (104)	7.56 (18)	3.78 (9)	(238)
Would definitely consent	definitely	50.00 (56)	38.39 (43)	4.46 (5)	7.14 (8)	(112)
Total		37.45 n=197	37.83 n=199	13.12 n=69	11.60 n=61	100.00 n=526

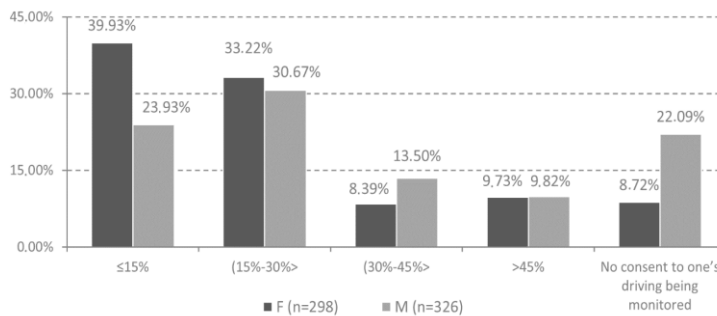
Source: Research and own calculations.

As can be seen in Table 5, expectations regarding a possible financial incentive decrease as willingness to conclude an agreement with the UBI tariff increases. That relation does not seem to be surprising and can be intuitive. Half of the respondents who would be willing to permit monitoring and nearly 45% of those who were rather more determined to do so, decided that a discount of up to 15% would be sufficient.

In contrast, as expected, their opinion is shared by just over 19% of respondents who are unlikely to be interested in disclosing information about their driving style. These people value their privacy more highly and the incentive they would expect would need to be somewhat greater than for the other two groups.

Gender is another feature that differentiates the responses where women generally expect lower discounts in exchange for agreeing to their driving style being monitored: 39.93% of women are satisfied with a discount of up to 15% as compared to 23.93% of men. This is shown in Figure 1.

Figure 1. Discount expected in insurance premiums, according to the gender of the respondents



Source: Own calculations.

The age of the respondents also influences the level of discount they expect. A tendency is visible in which the expectations regarding the amount of the discount first increases and then decreases with the age of the respondents (Table 6). This applies to both men and women equally.

Table 6. Discount expected in insurance premiums, in exchange for agreeing to one's driving style being monitored

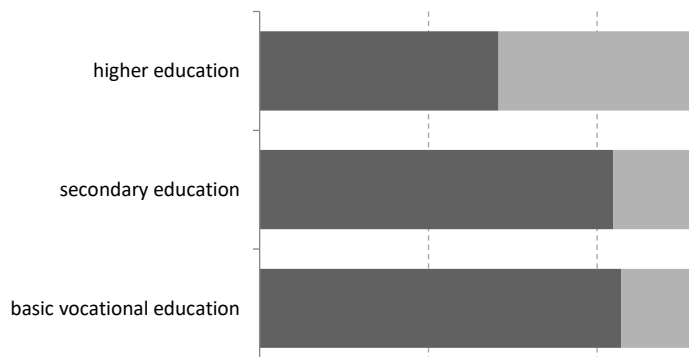
Age range	Discount expected, in exchange for consenting to one's driving being monitored (%)				No consent to one's driving being monitored (%)	Total
	≤15%	(15%-30%>	(30%-45%>	>45%		
18 - 25	35.11 (33)	30.85 (29)	12.77 (12)	8.51 (8)	12.77 (12)	(94)
26 - 30	33.71 (30)	24.72 (22)	7.87 (7)	12.36 (11)	21.35 (19)	(89)
31- 35	39.52 (49)	25.00 (31)	12.90 (16)	7.26 (9)	15.32 (19)	(124)
36 - 40	20.93 (27)	31.78 (41)	14.73 (19)	13.95 (18)	18.60 (24)	(129)
41 - 45	34.15 (28)	39.02 (32)	6.10 (5)	7.32 (6)	13.41 (11)	(82)

Age range	Discount expected, in exchange for consenting to one's driving being monitored (%)				No consent to one's driving being monitored (%)	Total
	≤15%	(15%-30%>	(30%-45%>	>45%		
46 - 50	18.18 (8)	31.82 (14)	13.64 (6)	13.64 (6)	22.73 (10)	(44)
51 - 55	18.18 (4)	54.55 (12)	13.64 (3)	4.55 (1)	9.09 (2)	(22)
56 - 60	43.75 (7)	43.75 (7)	—	6.25 (1)	6.25 (1)	(16)
> 60	45.83 (11)	45.83 (11)	4.17 (1)	4.17 (1)	—	(24)
Total	31.57 (n=197)	31.89 (n=199)	11.06 (n=69)	9.78 (n=61)	15.71 (n=98)	100.00 (n=624)

Source: Research and own calculations.

As can be seen in Figure 2, most of those surveyed with higher education usually agree to have their driving style monitored but they do expect higher premium discounting in relation to other groups of respondents, considering their level of education. Approximately 70% of the respondents, with secondary and vocational education, are satisfied with a discount of up to 30% of the current premium rate, whereas only 60% of respondents with a higher education would be satisfied with such compensation for their loss of privacy.

Figure 2. Premium discount expected, due to the education level of the respondents



Source: Own calculations.

Analyzing the expectations of the respondents regarding possible premium discounting in the context of their place of residence (Table 7), it can be seen that the utter unwillingness to disclose information about their driving style is declared mostly by residents of large cities with a population of above 200,000. Also, the members of this group more frequently declare their wish to obtain the highest level of discount than other respondents. Similar results can also be observed among those respondents living in towns of up to 5,000 inhabitants, but these comprise only a

small group of some 21 respondents; therefore, the information obtained from them would be considered less important than that obtained from other groups.

Table 7. Premium discount expected, due to the size of the place of residence

Place of residence (population)	Discount expected, in exchange for consent to one's driving being monitored				No consent to one's driving being monitored	Total
	≤15%	(15%- 30%>	(30%- 45%>	>45%		
Countryside	42.65 (29)	26.47 (18)	13.24 (9)	8.82 (6)	8.82 (6)	(68)
Towns ≤5,000	38.10 (8)	19.05 (4)	14.29 (3)	9.52 (2)	19.05 (4)	(21)
Towns 5,000 - 50,000	34.62 (27)	38.46 (30)	14.10 (11)	6.41 (5)	6.41 (5)	(78)
Towns 50,000 - 200,000	38.71 (24)	29.03 (18)	17.74 (11)	4.84 (3)	9.68 (6)	(62)
Cities >200,000	27.59 (109)	32.66 (129)	8.86 (35)	11.39 (45)	19.49 (77)	(395)
Total	31.57 n=197	31.89 n=199	11.06 n=69	9.78 n=61	15.71 n=98	100.00 n=624

Source: Research and own calculations.

5. Conclusions

The present study suggests that to convince insured persons to change to UBI, technical solutions that protect their privacy, as well as adequate financial incentives should be employed. These incentives, thanks to the adjustment processes taking place at the level of the insurer's portfolio, may be lower than the subjective value of the privacy of the insured. That relates especially to those insureds who value their privacy most. In addition, not only the value, but also the form taken by the incentive has a major impact on its effectiveness. When designing a new UBI tariff, the consequences of the insured's concerns ought not to be overlooked prior to increases in premium, in such cases as improper driving. A tariff, based primarily on the sanctions system, could not bring the expected results.

The analysis showed that when limiting the issue solely to financial incentives, the median of the expected discount amounts to slightly more than 21% of the sample studied. Analysis also showed that 75% of the respondents who would allow the possibility of concluding a UBI type contract at all would expect a discount of up to 30% of the value of their current premium. Whereas a maximum of 15% discount applies to as many as 37.45% of the respondents. Expectations vary, depending on the gender, age, education, and place of residence of the respondents. The main impact, however, is the established attitude to insurance using telematic data. Therefore, reliable insurance education in this area is important, as this would allow

the propagation of knowledge not secured by elements of a subjective nature or inconsistent with the actual state.

Potentially, according to the results obtained as part of the study, a discount of between 15% and 30% of the premium should, therefore, be sufficient to compensate for any loss of privacy for insureds, when introducing any monitoring of driving style. In nominal terms, this amount sets the price of privacy because it reflects the monetary value for which the insured would be amenable to partially surrendering their privacy when revealing data on their driving style and location.

It is important that the study was conducted at a time when a significant increase in average premiums for the compulsory TPL insurance of vehicle owners was still observable on the Polish market. Consequently, some low-risk insureds, as well as those who take out insurance with lower-than-average premiums, may be concerned about potential increases in premiums, having changed their type of insurance product to the UBI. In such cases, the value they attribute to the preservation of their privacy may be higher than the potential benefits obtained through a change in insurance type. This type of behavior may not be observed on the market during the stabilization period of average premiums.

The analysis and conclusions formulated so far do not fully cover the topic and should be treated as a contribution to further research in this area. It is advisable that another research be carried out in the future, the one with a greater sample of respondents and with a larger number of factors that could affect the respondents' approach to UBI, e.g., their income.

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