ePub^{WU} Institutional Repository

Sarah Spiekermann-Hoff and Jana Korunovska

Towards a value theory for personal data

Article (Accepted for Publication)
(Refereed)

http://epub.wu.ac.at/

Towards a Value Theory for Personal data

Sarah Spiekermann & Jana Korunovska

Institute for Management Information Systems
WU Vienna, Welthandelsplatz 1, 1020 Vienna, Austria

ABSTRACT

Analysts, investors and entrepreneurs have recognized the value of personal data for Internet economics. Personal data markets thrive, and personal data is viewed as "the oil" of the digital economy. Yet, ordinary people are barely aware of these developments. Marketers collect personal data at relatively low cost in exchange for free services or discounts. But will this be possible in the long term, especially in the face of privacy concerns? Little is known about how users really value their personal data. In this paper, we build a value theory for personal data that is based on the user perspective. Based on a survey experiment with 1269 Facebook users, we identify core constructs that drive the value of volunteered personal data. We find that privacy concerns are less influential than expected and influence data value mainly when people become aware of data markets. In fact, market awareness or "asset consciousness" is the single most influential factor driving willingness-to-pay for one's personal data. Furthermore, we find that people who build a sense of psychological ownership of their data value it more. Finally, our value theory helps to unveil market design mechanisms that will influence how personal data markets thrive: First, we observe a majority of users become reactant if they are consciously deprived of control over their personal data; many drop out of the market. We therefore advice companies to consider user-centered data control tools to have them participate in personal data markets. Second, we find that in order to create scarcity in the market, centralized IT architectures (reducing multiple data copies) may be beneficial.

Keywords: data protection, privacy, psychological ownership, personal data markets, data valuation, WTP

Total number of pages: 64

INTRODUCTION

"Personal data is the new oil of the Internet and the new currency of the digital world." With these words Meglena Kuneva, Europe's former Consumer Commissioner, expressed an economic reality that is increasingly manifest on a global scale: Personal data (hereafter abbreviated as "PD") is emerging as a new "asset class" (Horowitz and McConnell, 2002; World Economic Forum, 2011: 5). This new asset class is traded on booming data markets. Many online companies view their stock market valuations as a function of the data assets they hold about their users. The Boston Consulting Group predicts that the economic use of PD can deliver up to EUR 330 billion in annual economic benefit for organizations in Europe by 2020 (Rose *et al.*, 2012).

However, the legitimacy of PD as an economic asset can be challenged from both economic and human rights' perspectives. Economically, PD has the traits of a typical public good rather than a commercial good (Varian, 1992; OECD, 2013): It is difficult to effectively exclude any party from using it. Electronic services collect data so ubiquitously today and are so interconnected that it is hard to control who transfers and processes what data for what purposes. Also, PD has a non-rival nature: The use of a data point by one party does not prevent another party from using the same data point as well. These characteristics lead to well-known market problems for public goods, namely asset overuse and potential degradation (Rittenberg and Tregarthen, 2011). Value degradation in particular is a data market challenge because PD is abundantly supplied: In 2013, users sent or received over 100 billion emails per day (The Radicati Group, 2013). Every day, more than 4,7 billion content items are shared on Facebook (Internet.org, 2013), and millions of people use loyalty cards for their purchases. Against this background, an open economic question is how much PD can ever be worth.

PD is an intangible asset class. The domain of corporate accounting has developed cost-, market-, and income - approach methods to derive appropriate valuations for intangible assets (Reilly Jr. and Schweihs, 1999). Applying such market and income approaches, the OECD has tried to derive a monetary estimate for the value of individual data points by using market capitalization and net income per individual records (OECD, 2013). But the conclusions from this work were unsatisfactory. "All valuations coming out of the methodologies should be used cautiously, with the understanding that the monetary estimates of values will be context dependent," (OECD, 2013: 4).

What's more, PD valuation cannot be approached without considering the human-rights boundaries of PD use. People's legal right to information self-determination in some countries (Federal Republic of Germany, 1949), European data protection legislation (European Parliament and the Council of Europe, 1995) and international agreements on privacy standards (Council of Europe, 1950; OECD, 1980; OECD, 2012) put "data subjects" legally in the loop regarding whether and for what purposes their PD is used (European Parliament and the Council of Europe, 1995). This right has recently been strengthened by the European Court of Justice (see i.e. attribution of a 'right to be forgotten' to Europeans and invalidation of the 'Safe Harbor Agreement' with the US). Some legal scholars argue that PD is the "property" of people (Schwartz, 2004; Purtova, 2012). Therefore, PD value theories must integrate the "price psychology" of those who supply the data. This paper does so, proposing major theoretical building blocks for personal data valuation from a user perspective.

Up to now, from the point of view of service providers, people have willingly shared PD in exchange for free services. But in reality, most users do not know that the service is free only because they provide their PD. Most of them do not read the terms and conditions about the commercial nature of the data-service exchange (Smithers, 2011). The US White House Report on Big Data and Privacy recently stated, "Only in a fantasy world do users actually read these notices and understand their implications ..." (The White House, 2013: xi). This ignorance is not a firm foundation for a sustainable market. Furthermore, the "free" mentality underlying today's data-service exchange (Anderson, 2009) is eroding. People are concerned about a loss of privacy in PD markets (Fujitsu, 2010) and start using protective software (Figure A-1, Appendix A). Also data management tools are becoming available to users, both to conceal the information users exchange (Dingledine *et al.*, 2004; Camenisch *et al.*, 2005; Hansen *et al.*, 2008) and to determine conditions of use based on policies (Casassa Mont *et al.*, 2003; Nguyen *et al.*, 2013).

If people take control over their data through new tools as well as legal enforcement personal data markets will change and people will play an active role in them. But do people view their communication traces as something valuable at all that they own and need to manage? What factors influence people's valuation of their data? And how important are privacy concerns for that valuation? We have no answers for these questions. We need a value theory for personal data valuation from a user perspective.

Researchers in the domain of information privacy have begun to explore the value of PD. They have found that people have a "willingness to pay" (WTP) to protect their PD (Krasnova *et al.*, 2009) and to pay premium prices at websites that have better privacy policies (Tsai *et al.*, 2007; Jentzsch *et al.*, 2012). A few studies have also looked into the "willingness to accept" (WTA) money for data (Cvrcek *et al.*, 2006; Hann *et al.*, 2007). They found that the sensitivity of the data (Grossklags and Acquisti, 2007), the nature of the data recipient (Cvrcek et al., 2006) and the context of information sharing (Huberman *et al.*, 2005) influence compensation expectations. However, all privacy research has focused only on the privacy dimension of data valuation.

In this paper, we go further. We find that three dimensions influence the value of PD for users: First, a sense of psychological ownership of their data and engagement with the data; second, how the data market is designed or technically organized in terms of data portability, data storage and data control; and third – in line with privacy research – how users perceive data markets' morality.

We test our value theory based on a study we conducted with 1269 regular Facebook users. Facebook users assessed the value of the data on their Facebook Timeline. We chose Facebook because, as of 2015, this outlet probably holds one of the most extensive collections of individual PD. In this work, PD is defined in line with European Data Protection Law and OECD guidelines, which regard it as "any information relating to an identified or identifiable individual (data subject)," (OECD, 1980: 13).

In the next section, we present the reasoning behind our value theory and the hypotheses we used to establish and test it. Then, we describe the methodology of the experimentally varied questionnaire study we conducted and present our results. In a discussion section, we expand on our contribution to theory and how our data supports our reasoning. We also show how our PD value theory is relevant to PD market design and IT service design. Finally, we draw major conclusions from our work.

REASONING BEHIND THE PERSONAL DATA VALUE THEORY

Market pre-condition: people value their data

Before we can build a theory around PD valuation, we need to ensure that the asset we are talking about is really perceived as an asset. As outlined above, PD has the traits of a public good. Data supply is abundant. People say that they are concerned about their PD use, but they still reveal so much about themselves that stated privacy attitudes and observed behavior contradict each other (Berendt *et al.*, 2005). This "privacy paradox" has called into question the true value PD has for people. Preibusch, Krol et al. (2012) argued that people deliberately over-disclose without any thought about the potential monetary value of their digital traces. PD has so little production cost that its value may not be high. Grossklags and Acquisti (2007) found that people would not pay even 25 cents to protect non-sensitive pieces of information. And Mayer-Schönberger (2009) suggested that older PD is of so little value that it could even be deleted after it passed a certain age. These findings suggest that users may not value their PD asset. One side of the market would not participate?

However, this low-value perspective has been challenged. Scholars suggest that people run through a privacy calculus in which they consciously weigh the benefits of disclosing PD against privacy costs (Dinev and Hart, 2006). Hann, Hui et al. (2007) postulated that websites will eventually need to offer consumers money in exchange for their data. Startups now build PD "vault technologies" with the idea that people will start to trade their PD (Campell, 2012). Studies have shown that people are willing to pay to protect their data from secondary uses; for example, Krasnova, Hildebrand et al.(2009) found that people would pay Facebook between EUR 0.98 and EUR 3.68 per month if the platform promised to use only demographic data instead of the full set of their PD. Against this contradictory evidence we hypothesize that PD has *some* monetary value for people, the variance of which is subject to the value theory we postulate:

Hypothesis 1: People value personal data at more than 0 EUR.

Market awareness and valuation of personal data

Scholars have noted that most people are not aware of PD markets or understand that they are exchanging PD for free services. "Consumer ignorance leads to a data market in which one set of parties does not even know that negotiation is taking place," (Schwartz, 2004: 2078). Goods with common-good characteristics, such as clean air, are not normally perceived as tradable "assets." For PD markets to thrive with users at the table a precondition is that people build up an "asset consciousness."

To understand asset consciousness, think of young children at play. Often, one can observe strong reactions – "MY car," "ME!" – when a child picks up another child's toy (Isaacs, 1933; Levine, 1983). When party A learns about party B's interest in something that A possesses, A's perception of the value of the item increases. In economics, the link between asset consciousness and asset valuation has been proven in game theory: Ultimatum games between two players have shown for instance that when party A learns that party B can derive *extra* monetary gains from a shared monetary amount (asset), the expectations of A about what B should share with them rises (e.g., Smith and Walker, 1993).

In PD markets, the effects of such an asset consciousness are hard to measure in isolation from privacy concerns. When people learn that their PD is actually a traded asset, privacy concerns will arise in parallel with asset consciousness (Smith *et al.*, 1996; Nissenbaum, 2004). In an experiment on location data, Cvrcek, et al. (2006) showed that 25-57 percent of study participants who learned that their information would be used not only for academic purposes but also for commercial ones increased their fees for study participation. Cvrcek and his colleagues interpreted this rise in compensation expectations as a result of increased privacy concerns. However, the increased money amount could also have been caused by asset consciousness. We therefore combine asset consciousness and privacy concerns and call the combined construct "market awareness." We hypothesize:

Hypothesis 2: Market awareness drives the valuation of personal data.

Engagement and psychological ownership in valuation of personal communication data

The value of assets is driven (at least in part) by their production cost. For intangible assets, the cost approach in accounting uses the time spent on the creation of an asset to derive its value. Facebook users are not paid for creating and maintaining profiles. But users do incur a transaction cost that could be linked to their opportunity cost of lost income. Transaction cost was shown to relate to people's value perceptions (Rindfleisch and Heide, 1997). In fact, in an earlier study on Facebook users, we found that users who update their information on the platform on a daily basis value their profiles more than those who do not (Bauer et al., 2012). In the literature on psychological ownership, researchers link people's *engagement* with artifacts to how they treasure them and perceive them as theirs: "All men have an invincible inclination to appropriate in their own minds, anything which over a long, uninterrupted period they have used for their work, pleasure, or the necessities of life. Thus, a gardener, after a certain time, feels that the garden belongs to him," wrote Simone Weil (Weil, 1952: 33). Against the background of these arguments, we hypothesize that people who constantly update their Facebook Timeline and hence spend a lot of time on the platform value their PD more than those who don't:

Hypothesis 3: Engagement is positively related to users' valuation of their personal data on the platform.

Engagement is a behavior that is strongly associated with "psychological ownership." Psychological ownership describes people's perceptions of property or possession toward tangible and intangible goods (Pierce *et al.*, 2003). It is a mental state reflected in the question "What do I feel is mine?" (Wilpert, 1991). Locke (1690) argued that we own our labor and ourselves; therefore, we are likely to feel that we own all that we create, shape, or produce. Because people engage with and create their Facebook profiles, they could develop a sense of psychological ownership for the data that constitutes these profiles. Psychological ownership is generally known to drive value perceptions. Thaler (1980), for example, found an "endowment effect," which is that people ascribe more value to things because they *own* them or have owned them for a while. Marketing experiments have proven that a stronger sense of psychological ownership for an object increases one's valuation of that object (Peck and Shu, 2009). Psychological ownership and its ensuing object valuation is created in response to a feeling of being at home, perceptions of personal efficacy and identity through the objects possessed (Furby, 1978; Rudmin, 1991; Dittmar, 1992; Pierce *et al.*, 2003). We argue that such

psychological ownership perceptions can also influence PD valuation if the data is volunteered and hence consciously created on a platform.

Pierce, et al. (2003) has reviewed how possessions help people to create a place, symbolically captured by the concept of "home." Home can provide an individual with a context in which to dwell, a sense of belonging, connection, psychic comfort, pleasure and security (Weil, 1952). We argue that people can build such perceptions of home on Facebook and in other virtual environments because they receive a kind of exclusive territory from the platform in which they are free to dwell, decorate and display themselves as they like. In virtual worlds like Second Life, they can even create visual representations of homes, which they legally own. We therefore expect that people who perceive their Facebook Timelines as a kind of home will value their PD on that wall more:

Hypothesis 4a: Perceptions of feeling at home are positively related to the valuation of one's personal data on the platform.

Another dimension of psychological ownership is grounded in the effectance motive. Furby (1978) postulated that the motive for possession stems from the individual's need for effectance, which is the production of effects upon the environment and the ability to produce desired outcomes in the environment. "Possessions," she noted, "have an instrumental function – they make possible certain activities and pleasures. In other words, they enable one to effect desired outcomes in one's environment," (Furby, 1978: 60).For example, having a beautiful garden or house embellishes a living area. We expect that people who feel that they are efficacious through their contributions on Facebook will value their profile more:

Hypothesis 4b: Perceptions of being efficacious through one's information are positively related to the valuation of one's personal data on the platform.

Numerous psychological ownership scholars have suggested that, in addition to serving an instrumental function, possessions also serve as a symbolic expression of identity (e.g., Porteous, 1976; Abelson and Prentice, 1989; Dittmar, 1992). People communicate their identity to others and achieve recognition and social prestige through their objects, for example, through their cars, watches or houses. "Possessions can act as signs of the self and role models for its continued cultivation," (Rochberg-Halton 1984:339 in Pierce et al., 2003). Transferring this notion to the social network context, people may use their information on Facebook to demonstrate a part of their identity. The same may be true for blogs, personal avatars, and so on. People not only demonstrate their true identity, they also actively pursue "impression management" (Richter *et al.*, 2011). Thought leaders and pop stars often use Facebook to communicate their public identity. People who successfully establish identity through the PD should value their PD more:

Hypothesis 4c: Identity construction through one's information is positively related to the valuation of one's personal data on the platform.

Finally, we hypothesize that the value of personal data will increase with the number of friends people have online. Generally, the more friends we have, the more personal communication data is likely to be created, on Facebook and elsewhere. This volume argument is, however, just one reason why we believe that the number of friends drives the value of personal communication data. In social theory scholars measured the utility from interaction with friends in money terms and found a positive correlation (Powdthavee, 2008) (Kahneman *et al.*, 1997).

Hypothesis 5: The number of friends in one's Facebook network is positively related to the valuation of one's personal data on the platform.

Market design in valuation of personal data

Supply-side economics is typically driven by the scarcity of the goods on offer. This scarcity can depend on the marginal cost of production of a good. It can also depend on the degree to which a market is designed to (artificially) embed scarcity. Artificial scarcity by market design has been used to create incentive compatible markets for common goods (Holzinger, 2008), for example, the market for CO2 emissions. Similar mechanisms could be envisaged for PD markets. However, we must consider how abundant or scarce individuals perceive personal data to be and how such perceptions drive data valuation. We hypothesized above that the low cost of PD creation online and near-zero marginal cost for reproduction of data could lead to low data valuation. In fact, decentralized IT architectures are a technical market design choice that motivates data reproduction. Huge low-cost storage capacity on the client side encourages users to keep multiple copies of their PD. For instance, the same digital photos are often kept on DVDs, stored on hard disks and virtual clouds, sent to friends via email and shared on Facebook. As a result, a greater number of copies of one's personal communication data should lower the value of each individual copy because the information is available elsewhere:

Hypothesis 6: People who have more copies of their data value it less.

Another market design dimension that may influence people's data valuation is data portability. Data portability is the possibility to "transfer data from one electronic processing system to and into another," (European Commission, 2012:9). On Facebook, data portability means that users are able to easily transfer their communication data to another social network platform or to another service. This ability would make them independent of Facebook and reduce the ramp-up time on new applications. The same data could be used for multiple purposes. In the offline world, such use-flexibility is valued by consumers. For example, if I can wear one dress at multiple occasions it is an argument for valuing it more. As a result, marketing theory recognizes that a product's final value is composed of multiple components, including further product use (Neap and Celik, 1999). Against this background, we expect:

Hypothesis 7: Data portability increases the value of the personal data of Facebook users.

Finally, we question whether people's control over their data can influence their perception of data value. The US Federal Trade Commission identifies notice and choice as major privacy mechanisms that grant consumers some control over their PD use (FTC, 2000). In Europe, the law refers to informed consent (European Parliament and the Council of Europe, 1995). Through either an opt-in control mechanism (EU) or an opt-out option (US), both legislations grant people a final say over whether their data can be used or sold. Academic models of PD markets treat PD as a commodity that can be traded by individuals who control the terms and conditions of sale (Laudon 1996, Aperjis and Huberman 2012).

In behavioral economics of privacy, scholars found evidence that individuals who feel more in control over the release of their PD disclose more (even when it comes to sensitive information) (Brandimarte *et al.*, 2012). Transferring these insights to the valuation of PD, we hypothesize:

Hypothesis 8: People without control over the sale of their personal data value their information higher than people with control.

Market morality in valuation of personal data

The inclusion of morality expectations into prices is a well-known economic practice. For example, insurance premiums include charges to offset false claims (Abraham, 1985). From a user perspective, morality concerns in PD markets relate to their expectations of companies' privacy behavior. If such expectations are not met, people will be concerned that their privacy could be breached, leading to personal exposure, identity theft, or exclusion (Solove, 2006). Privacy researchers have shown that more privacy concerns lead to a higher valuation of PD (Grossklags and Acquisti, 2007; Hann *et al.*, 2007).

Privacy concerns take different forms. Krasnova, Günther, Spiekermann, & Koroleva (2009) distinguish between organizational privacy threats, accessibility threats and social threats. Organizational threats refer to risks associated with secondary uses of people's data. For example, people might increase the value of their information to compensate for the risk that they incur when third parties such as credit rating agencies or future employers analyze their data. Accessibility concerns relate to unwanted degrees of personal exposure. Users have accessibility concerns when they perceive that too many parties could see too much about them. For example, Facebook's original policy to set all users' profiles by default to "public" increases peoples' accessibility. If people perceive that their PD is too accessible, they might value their information more to compensate for the high degree of exposure. Finally, social concerns relate to cyber bullying. Social privacy concerns may lead people to see their information on a social network as a point of weakness and lead them to post less on a social network to avoid bullying from the start. As a result, the meager data they provide may be less valuable than that of heavy posters.

Based on these arguments, we expect the three types of privacy concerns to relate to data valuation on social networks and hypothesize that:

Hypothesis 9a: Higher organizational privacy concerns are positively related to the valuation of one's personal data on Facebook.

Hypothesis 9b: Higher accessibility privacy concerns are positively related to the valuation of one's personal data on Facebook.

Hypothesis 9c: Higher social privacy concerns are negatively related to the valuation of one's personal data on Facebook.

METHODOLOGY

In cooperation with a major tech-news portal, we conducted a questionnaire-based online experiment. People were invited to share their views on Facebook. The questionnaire told participants to imagine that one day they logged into Facebook and could not access their information. Instead, a message from Facebook CEO Mark Zuckerberg appears. The message says that Zuckerberg is tired of the business and intends to shut down the platform.

Participants were randomly assigned to one of five conditions: In four conditions, we

measured participants' willingness to pay (WTP) for their data. We told them that Zuckerberg planned to delete all the PD on the platform. Paying would allow them – in conditions 1 and 2 – to safeguard their data (more precisely: their "entire Facebook profile including all information on their wall (postings, comments, pictures, videos, links), in their photo albums, video sites and friend contacts"). In two other conditions (3 and 4) – our *market aware* conditions - we told them that a "trustworthy" third-party company was interested in buying all this data of theirs. By paying, participants could not only safeguard the data but also avoid a sale of their data to a trustworthy third party. We described the third-party company as "trustworthy" because we wanted to streamline participants' expectation that their data would be shared in a legitimate PD market player.

Furthermore, we varied the method for safeguarding the data. One possibility was to only download it to a personal hard drive (conditions 2 and 4). The other was a data portability scenario where participants could transfer their data to another social network (conditions 1 and 3). This setup resulted in a 2x2 between-subject design (Figure 1).

FIGURE 1
Summary of the 2 x 2 experimental design for WTP

	Data portability conditions	Download conditions
Market unaware conditions	Manipulation 1. Data will be deleted. Pay to prevent deletion by transferring it to another social network.	Manipulation 2. Data will be deleted. Pay to prevent deletion by saving it to a hard drive.
Market aware conditions	Manipulation 3. Data will be sold. Pay to prevent sale by transferring it to another social network.	Manipulation 4. Data will be sold. Pay to prevent sale by saving it to a hard drive.

Unlike the first four conditions summarized in Figure 1 a fifth condition measured the willingness to accept money (WTA) for personal data. In contrast to condition 3, participants in condition 5 had no choice over the sale of their data. They were told that they could transfer their data to another social network (data portability), but a copy of it would be sold to a trustworthy company no matter what. Participants were asked only whether they wanted a share in the money made by Facebook and, if they did, how much they would want (WTA). This condition 5 is closest to how PD markets work today. Depending on the legal environment, people cannot prevent the sale of their personal information. We used this condition to test the effects of a market design parameter we consider important for PD markets, that is, personal control over information sharing (hypothesis 8). A WTP manipulation would not have worked here because it implies choice.

To ensure external validity, all scenarios' stories were presented in a Facebook atmosphere: the survey's background picture was a grayed-out Facebook profile, and Zuckerberg's well-known profile picture brought the bad news. In an open question format, we asked people to justify the WTP or WTA amounts they provided. Participants seemed to be invested in the scenarios because the answers they gave to this question were quite emotional and framed as if the scenario had really happened.

In all conditions, participants were informed that safeguarding their data would be easy. In conditions 1, 3 and 5, they were told that "at the click of a button" they could transfer their entire data to a "similar" social network. They were additionally informed that most Facebook users would transfer. This information was given to avoid the influence of transaction costs on WTP/WTA amounts or the influence of varying beliefs about the success of the new platform.

Quantitative measures

The willingness to pay (WTP) measure we employed in the study was extensively pretested (Bauer et al., 2012). In a pre-study, we compared four different methods for measuring Facebook users' WTP for their PD. These methods included different versions of the contingent valuation method (CVM) (cf. Ciriacy-Wantrup, 1947) and the Becker, DeGroot and Marschak (BDM) procedure (Becker *et al.*, 1964). We decided to adopt CVM without any incentive. Instead, an iPod Shuffle was raffled among all participants of the survey without any relation to the WTP elicitation method so that the incentive did not affect the WTP results.

To manipulate people's control over data release, we also measured WTA with the CVM. We briefed participants as follows: "Facebook gives you the possibility to share in the profit. Do you want a share in the proceeds from the sale? If yes, how much money do you want for your Facebook information? (if not, please note down zero)."

Beyond people's monetary valuation, we also asked participants for the *perceived* value of their personal data. On a 9-point scale, they stated how much they agree or disagree with the following statement: "I consider my Facebook information as valuable" (1 = completely disagree at all, 9 = completely agree). Hereafter, we refer to this scale as "data appreciation".

We measured privacy concerns by employing a scale developed by Krasnova, Günter, et al. (2009) that distinguishes between organizational privacy and accessibility threats.

To measure psychological ownership, we considered existing scales from the organizational sciences. However, these scales mostly relate to employees' psychological ownership for tangible organizational assets (Mayhew *et al.*, 2007; Avey *et al.*, 2009). Consequently, we constructed four subscales for psychological ownership along the theoretical dimensions outlined above: feeling efficacious through digital possessions, building self-identity with their help and feeling at home in a digital environment. We asked directly about engagement and number of friends.

Finally, we developed a three-item scale to control for whether respondents have multiple copies of or can easily reproduce their Facebook information. Table B-1 in Appendix B presents all of the scale items, their respective factor loadings (including goodness of fit indices for CFAs where applicable) and the reliability of the scales.

Qualitative measures

In addition to quantitative measures, we used an open question format to ask participants to justify their WTP and WTA. Across the scenarios, 92 percent of the participants answered this question. An initial content analysis resulted in 19 categories for WTP/WTA justifications. Table C-1 in Appendix C contains a summary of these categories with definitions, examples and frequencies. Three independent coders assigned answers to these 19 categories; in cases where participants stated more than one reason, coders discriminated between the category for the primary reason, the one for the secondary reason and so on. For primary reasons, intercoder

reliability was substantial, with Krippendorff's Alpha α = .63 and average pairwise percent agreement at 67 percent (Freelon, 2010). When we inspected the justifications, we identified an aggressive tone in many of them. We therefore decided to code the qualitative data also for the presence or absence of reactance (a negative reaction in response to absence of choice). Zero denoted no reactance. One denoted reactance (e.g., "Since I would have turned away from Facebook anyways for their miserable privacy practices," "A symbolic Euro since the data is mine anyways," "1 Euro for a piece of shit"). Intercoder reliability for reactance was moderate, with Krippendorff's Alpha α = .42 and average pairwise percent agreement at 74 percent.

Sample and procedure

1298 regular Facebook users completed our online questionnaire. We subtracted 29 outliers, making our total sample 1269 respondents. Table B-2 in Annex B contains the excluded outliers and how we derived them. 83 percent of the participants stated that they log in to the platform at least once a day. 69 percent were males, and the age ranged from 12 to 77, with a mean age of M =30 (SD=10). The median monthly salary was Mdn = 1500 EUR. On average, it took the participants 24 minutes to complete the questionnaire.

To investigate our hypotheses, we conducted several analyses. First, we analyzed the absolute values of the data we collected. Second, we analyzed the qualitative comments for all the conditions. Third, for conditions 1 to 4 we conducted two regression analyses: a binary logistic regression for the WTP and a multiple linear regression for the perceived valuation scores. For the WTA condition 5, we conducted a multinomial logistic regression and a multiple linear regression. Listwise deletion was used for all the regression analyses (resulting in smaller samples).

For the binary logistic regression (conditions 1 to 4), we dichotomized the WTP variable into zeroes for participants who did not want to pay anything for their data (WTP = EUR 0) and ones for those who would pay something (WTP>EUR 0). We then performed a stepwise logistic regression on the WTP as an outcome variable. We used logistic regression because the WTP variable and its respective errors were heavily skewed (with a strong tail around EUR 0). A linear regression with absolute WTP amounts broke the assumptions of homoscedasticity and normally distributed errors. None of the usual data transformation normalized the distribution. Furthermore, the results of a linear regression with heteroskedasticity-consistent standard error estimators (Hayes and Cai, 2007) would have explained less than 10% of the variance in WTP (with results pointing in the same direction as the logistic regression). To complement the less granular WTP analysis, we added a linear regression on the variable that asked for people's perceived data value, or *data appreciation*. For this variable, all the assumptions for a linear regression were met. Data appreciation was significantly correlated with WTP ($r_s(1002)$ = .28, p<.001).

RESULTS

Market pre-condition: market awareness and how people value their data

For all five conditions, the distribution of the WTP and WTA amounts were strongly skewed to the left, with over half of the participants not wanting to pay or accept *any* money for their data. Sample t-tests and ratio tests reveal that the mean and median value for the whole

sample is no different than zero, i.e., the 95 percent confidence interval of the mean and the median for the entire sample includes zero ($t(1268) = 1.86$, $p > .05$, 95 percent CI of mean [EUR -1.75, EUR 68.44], 95.1 percent CI of median [EUR 0, EUR 0]. These results contradict hypothesis 1; on average, people do not value their personal communication data above € 0. The introduction of a market as-is must therefore be questioned. The number one justification given for WTP values was that "the data has no value" (see Table B-3 and Table C-1). Table 1 summarizes the confidence intervals for the means and medians across conditions and in the whole sample.

Insert table 1 around here

Despite the initially discouraging data valuation of € 0, our data showed that the *share* of users with EUR 0 WTP/WTA as well as the right tail of the value distributions differed considerably between manipulations. For the two groups with no market awareness, the median WTP was 0 EUR, and on average 64 percent of the respondents (67 percent in group 1 and 60 percent in group 2) would not pay a cent to save their PD from being deleted. On the other hand, participants in the market-aware conditions were willing to pay notably more: The percentage of respondents not ready to pay anything dropped to 40 percent (40 percent and 39 percent respectively), and the median WTP for one's data was Mdn = EUR 5. One quarter of the respondents in the WTP market-aware groups would spend EUR 50 for the profile information. 5 percent were even willing to pay more than 200 EUR (compared to 15 EUR in the market unaware groups). These figures show that valuation is significantly affected if people learn that a market exists for their data: The median difference tests between the complementary first and third conditions, the complementary second and forth conditions as well as the difference between the combined market-unaware (mu) conditions with those that were market aware (ma) were all significant ($U_{1\&3} = 19314.50$, $z_{1\&3} = 7.93$, $p < .001$, $U_{2\&4} = 21706.00$, $z_{2\&4} = 6.51$, $p < .001$, $U_{mu\&ma} = 81982.50$, $z_{nma\&ma} = 10.21$, $p < .001$). The logistic regression of WTP for PD presented in Table 2 confirms this finding. When everything is held constant, the single factor with the highest impact on data valuation is the awareness that a market for PD exists ($b = 1.05$, $SE = .21$, $OR = 2.87$, $p < .001$). When people are informed that their data will be sold, they become almost three times more likely to pay for it, lending strong support to hypothesis 2. That said, data appreciation is only marginally related to market awareness ($b = 0.33$, $SE = .19$, $\beta = .07$, $p < .10$).

Insert table 2 around here

Data valuation, market awareness and market morality

Awareness of a PD market could lead people to monetarily value their PD more, because they become asset conscious. But as we outline above, awareness of PD markets could also be a privacy manipulation (prime). People are known to fear the secondary uses of their data (Smith, Milberg et al. 1996). If the market awareness prime (conditions 3 and 4) increased privacy-related fears, we should observe this in our data. Indeed, when controlling for an interaction effect between privacy concerns and market awareness, we found that effect was significant ($b = 0.39$, $SE = .18$, $OR = 1.48$, $p < .05$). People with higher organizational privacy fears were willing

to pay more money only in the market aware conditions. Yet, at the same time, we found that the market awareness conditions primed our respondents to declare lower organizational privacy concerns ($t(996) = 3.84$, $p < .001$) (see also Table B-3). The the separate contribution of the interaction effect to our WTP model is small: It contributed only 0.5 percent additional explanatory power to the 6 percent Nagelkerke R^2 increase that the market awareness manipulation causes. The main PD value shift therefore seems to be attributable to asset consciousness and not privacy concerns.

Besides the conditional influence of organizational privacy concerns on WTP, privacy *accessibility* concerns also relate to WTP ($b = .50$, $SE = .09$, $OR = 1.64$ $p < .001$). Users with accessibility concerns are 1.6 times more likely to pay for their data. The relationship between organizational threats and accessibility privacy concerns with WTP is mirrored in the linear regression results on data appreciation. Social privacy concerns however play no role in explaining WTP or data appreciation. All in all, these results lend support for hypotheses 9a and 9b: a perceived lack of market morality, manifest in privacy concerns, influences people's valuation of their data. Social threats have no importance for our participants.

An unexpected result of our analysis that is related to market morality is that we found reactance to be a significant predictor of WTP ($b = -.62$, $SE = .30$, $OR = .54$ $p < .05$). Participants who reacted more aggressively to our manipulations were more likely to *not* pay anything for their data. This finding does not mean that they appreciate their data less, as the linear regression (table 3) confirmed ($b = -.12$, $SE = .27$, $ß = -.02$ $p > .05$).

Data valuation, engagement and psychological ownership

While the relationship between privacy concerns and PD valuation was rather marginal, people's engagement on Facebook as well the motives behind psychological ownership were strongly related to WTP as well as data appreciation. Study participants declared themselves to be highly engaged on the platform (45 percent of them agreed that they keep their pages up to date, $M = 5.31$, $SD = 2.31$). Feeling at home with one's data was also pronounced (37 percent of the participants agreed that they felt at home or connected to their page, $M = 4.60$, $SD = 1.68$), followed by identity construction (34 percent agreed that they engage in identity management $M = 4.21$, $SD = 2.17$) and then efficacy (20 percent agreed that they contribute a lot with their profiles ($M = 3.70$, $SD = 1.90$)).

```
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```
Insert table 3 around here
```
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```

Engagement and motives connected to psychological ownership were significantly related to monetary data valuation. For WTP (Table 2), users who are more engaged with Facebook attribute more value to their profile ($b = .39$, $SE = .09$, $OR = 1.47$, $p < .001$). Respondents who were one standard deviation more engaged than the average user were 1.5 times more likely to offer to pay something for their data. This result is the same for identity construction. When users demonstrate their identity by disclosing PD on Facebook, this information is more valuable ($b = .41$, $SE = .09$, $OR = 1.50$, $p < .001$). Perceived effectance, that is, people's feeling that they contribute to Facebook through their data, is also positively related to data valuation ($b = .28$, $SE = .09$, $OR = 1.32$, $p < .01$). Finally, feeling at home was the only

non-significant motive of psychological ownership in relation to WTP. The overall contribution of these 4 variables is a 9 percent unique explained variance of WTP, which was the most explained variance in a single regression step. The importance of all psychological ownership dimensions (including friends) is confirmed when linearly regressing on the perceived data appreciation (table 3). Here, psychological ownership motives and number of friends are all significant, and they explain 13% unique variance (R^2 = .13, ΔF (4, 832) = 34.91, $p<$ .001). Engagement contributes 5% to the R^2. Taken together, the findings confirm hypotheses 3, 4b, 4c and 5 and partially confirm hypothesis 4a.

The number of friends on Facebook has a significant but small influence on perceived data appreciation (b =0.00, SE = .00, β = .10, p <.01) and for the WTP amounts (b = .00, SE = .00, OR = 1.00, p < .05), confirming hypothesis 5. The beta values, though significant, are almost zero because the friends scale ranges from 0 friends to a possible 5000 (the Facebook limit), and the betas depict the influence of one additional friend on the data valuation.

Data Valuation and Market Design

Data portability did not cause higher data valuation as expected. There were no significant WTP differences between condition 1 (pay to download the data) and condition 2 (pay to transfer the data to another social network) ($U_{1\&2}$= 33925.00; $z_{1\&2}$= 1.86; p < .10), between condition 3 (pay to download the data and prevent it from sale) and condition 4 (pay to transfer the data to another social network and prevent it from sale) ($U_{3\&4}$= 261985.50; $z_{3\&4}$= .26; $p_{3\&4}$ > .05), or between the download (no service utility (nsu)) and transfer (service utility (sc)) conditions combined ($U_{nsu\&su}$=119815.50, $z_{nsu\&su}$=1.46, p > .05). The logistic regression analysis also showed the data portability manipulation to be not significant for WTP at the 5% level and only marginally so at the 10% level (b = -.29, SE = .18, OR = .75, .05 < p < .10), but in the opposite direction. This result is mirrored by the linear regression (b= 0.28, SE = 0.17, β = .05. p < .10), this time in the hypothesized direction, indicating that data portability is not a significant nor stable predictor of data appreciation.

Multiple copies of PD, in contrast, are an important driver of WTP. Table C-1 shows that having a copy of one's data is the third most important reason given for WTP overall and the single most important in the market unaware conditions. Respondents who have multiple copies of their data were 1.6 times less likely to pay for their data (and prevent data loss). Nagelkerke R^2 indicates a four percent increase of explained variance in WTP through this variable (Table 2). The result is mirrored in perceived data appreciation (Table 3), where respondents who had a copy of their Facebook information declared lower valuation for it. These results give support to hypothesis 6. People who have more copies of their communication data value a single copy of it less and are willing to pay less than people who do not have copies of their data.

Willingness to accept money for personal data

A fifth condition measured WTA: How much money do people want for their data if Facebook sells it and they can receive a share of the sale? We expected WTA amounts in condition 5 to be higher than the amounts in the otherwise identical WTP condition 3 for two reasons. First, the WTP/WTA gap is the well-known concept that people demand more money for a good than they are willing to pay for it themselves (Horowitz and McConnell, 2002). Second, we deprived people of control over their data in condition 5 and, theoretically, less

control is associated with a higher cost of disclosure and hence a higher data value (hypothesis 8).

A U-test reveals that respondents in condition 5 wanted more money for their PD than respondents in condition 3 were willing to pay for theirs ($U = 265758.50$, $z = -2.15$, $p < .05$). Also, respondents in condition 5 reported valuing their data more than in any of the other conditions (ANOVA F (4,1237) = 5.43, $p < .001$, $b = -.58$. SE = .29, $p < .05$, see the predictor variable "control" in Table 3). "Data *has* value" was the second most common reason stated for WTA (Table B-3). This result goes in line with hypothesis 8 that less control leads to higher data valuation. What we cannot say is whether this observation is not – at least in part– also due to the WTP/WTA gap.

That said, we witness (similar to Acquisti et al., 2013) a quasi U-shaped distribution of WTA amounts that hints at a distinct pricing psychology in condition 5: First, median WTA was zero EUR, with 54 percent of participants not wanting even a cent for their PD. Since we are measuring people's willingness to receive money, this finding contradicts rational actor behavior: Normally, people want to be compensated. Second, 25 percent of WTA respondents asked for extremely high prices (beyond EUR 3750 per profile) that are well beyond any amounts stated for profile information in other scientific studies (i.e., Grossklags and Acquisti, 2007).The outlier threshold for this condition 5 is EUR 25.150.642, an unrealistically high amount, far greater than the EUR 4006 threshold for condition 3. Common sense tells us that such extreme differences between WTA and WTP amounts cannot be explained solely by the WTP/WTA gap.

To explore this further, we decided to distinguish between three types of respondents in the WTA condition: (1) those who wanted extreme amounts over EUR 4006 (the outlier threshold of the comparable condition 3), (2) those who irrationally did not want any money from the sale of their data and (3) those who stated apparently reasonable prices between these extremes. We performed a multinomial logistic regression to test the differences between these 3 types of respondents. The results of the multinomial regression are presented in Table 4.

....
Insert table 4 around here
....

We found that when everything else is held constant, stating extremely high prices (type 1) does not differ from the refusal to accept money (type 2) but differs from stating a moderate amount (type 3) only by the presence of reactance.

Among the participants who refused to accept money, 61 percent were judged to be reactant. And among those who asked for unrealistically high amounts, 52 percent were judged to be reactant. In contrast, only 17 percent of comments were reactant in the middle, more reasonable group of respondents. In all other conditions (1-4), around 25 percent of participants showed reactance (Table B-3 in Appendix B).

To test our full set of hypotheses on WTA and prevent the strong influence of reactance from distorting this analysis, we conducted a stepwise linear regression analysis on the WTA amounts that were desired by the 43 users in the middle group (see Table 5). Median WTA in this group is EUR 500, an amount far beyond the median WTP of EUR 5 found in condition 3.

We cannot know the degree to which the WTP/WTA gap causes this difference in data valuation. However, the independent variables that we hypothesized to be relevant for data valuation explained 33 percent of the variance in WTA (R^2= 0.33, Table 5).

We find that privacy concerns relate to the prices stated: Confirming hypothesis 9a, more organizational privacy concerns lead to higher WTA (b = 218.67, SE = 95.79, p <.05). In contrast, more accessibility fears (b = 216.79, SE = 87.60, p <.05) related to smaller WTA. As we discuss below, this negative relationships does not necessarily contradict hypothesis 9b that accessibility concerns are positively related to PD valuation.

In line with the findings reported above, engagement (b = 243.05, SE = 104.20, p<.05) and feeling at home (b = 252.99, SE = 88.69, p<.01) with one's data on Facebook are positively related to WTA money for the data. In contrast, efficacy through one's data and identity construction are not significantly related to WTA. Equally, the number of friends and data storage were not related to WTA amounts.

································
Insert table 5 around here
································

DISCUSSION OF RESULTS

Our study results suggest that users' valuation of PD probably requires to distinguish between value drivers that are important in the short term for people's market participation and more stable value drivers that determine PD valuation in the long-term (see figure 2). The short-term drivers could also be regarded as market pre-conditions as we have argued above.

In the short term: market awareness drives data valuation

Our most surprising result is that 39-67 percent of participants were not ready to pay a single cent for all of their PD on Facebook. When our sample was not made explicitly aware of PD markets, median WTP was 0 EUR, and 75 percent of the respondents were unwilling to pay more than 2 EUR. Furthermore, 31 percent of the justifications for the stated amounts were related to the data simply being worthless, not significantly sensitive or both (see Table B-1). This result makes us question whether PD markets can exist at all. If people view their personal communication traces as a common good, how can companies build markets on them? Could it be that possessions need to be "experienced" in order to be valued by people, as Jon Pierce suggests (Pierce, 2003)?

That said, people's initial valuation of their data changes when they become aware that their data could be traded. WTP median values rose from 0 EUR to 5 EUR per profile, and 25 percent of the sample were willing to pay more than 50 EUR. For a fourth of the sample in condition 5, expectation to be paid for their data (WTA) reached over 3750 EUR per profile. These absolute figures must be regarded with caution because we did not use an incentive-compatible design for our study. Still, they clearly proof that market awareness will be a key driver for PD valuation in the short-term as people learn about the existence of personal data markets.

We hypothesized that market awareness effects are fueled by two sentiments in particular: asset consciousness and increased privacy concerns. In comments provided for the WTP conditions, many participants emphasized their data ownership: comments like "this is my data," "my intellectual property," or "I have the rights," were the third most frequent justification for WTP in the market aware sample and the fourth most frequent in the overall sample (Table B-1). In fact, participants made three times as many ownership-related comments in the market-aware conditions as they did in the market-unaware conditions. This finding suggests that with market awareness comes asset consciousness which influences how people value their data.

That said, we also found a significant interaction effect between the market awareness condition and *organizational* privacy concerns. Three times as many participants mentioned privacy in their WTP justifications in the conditions with market awareness (jumping from 7 to above 22 percent). Interestingly most of the privacy-related comments in the market-aware condition did not talk about a fear of losing privacy. Instead, participants justified their low WTP with the argument that they had nothing private to hide on Facebook. The absolute degree of organizational privacy concern in the market-aware conditions even *decreased* (see Table A-3). This finding seems contradictory: On one hand, people talk more about privacy and significantly increase the WTP for their data. On the other hand, they speak as if they have nothing to hide and have lower organizational privacy concerns. Given the verbal explanations of our participants, we believe that this contradiction could be due to a rationalization of disclosure behavior. People reveal a lot on Facebook, but when they are confronted with the potential secondary use of their data, they downplay their concerns. "I don't share anything that could not be known by anyone," is a typical comment. More research may be interesting in this area. For our value theoretical model we note that organizational privacy concerns arise as a part of market awareness and this interaction drives up the value of PD (in terms of both WTP and PD appreciation).

In the short term: lack of data use control can trigger market drop-out

A unexpected result of our analyses is how fragile the value attributions actually are. Every day, online services are opened and closed, and PD is sold and lost, even by major online brands. Still, when our study participants learned about such a development on their Facebook account a relatively large proportion of them developed feelings of reactance that significantly influenced their valuation behavior. When our participants were situated in a market design that mirrors real current conditions (condition 5), where they effectively had no control over their data being sold, the share of reactant comments increased from around 25 percent in conditions 1 through 4 to 49 percent (Table A-3). This increase in negative emotion seems to have led to a market dropout of 78.5% of the participants. They either did not want any money for their data or demanded extreme amounts. In the multinomial logistic regression across all users' WTA, reactance was the only difference between rational and irrational behavior and explained 29% (Nagelkerke R^2) of the differences between people who asked for reasonable amounts and people who either asked for unrealistic amounts or did not ask for anything. These findings bear a clear message for the designers of PD markets: Users want to be in control of their data. If market awareness rises and people are left out of the loop when their data is shared, people will become aggressive. "I don't give Facebook a cent" or "I refuse to be put under pressure by Facebook" were typical remarks that participants made.

Figure 2 separates market awareness, its interaction with organizational privacy and data use control from the more long-term drivers of PD value. This is because in some years from now, when people are generally aware of data markets and when data use control is a settled issue, these variables won't drive PD value any more. They are not part of a more fundamental long-term PD value theory. Their influence is therefore also visualized with a dotted line in figure 2. Still, they seem to be vital pre-conditions for the market to develop at all.

FIGURE 2
Confirmed Constituencies of a Value Theory for volunteered Personal Data
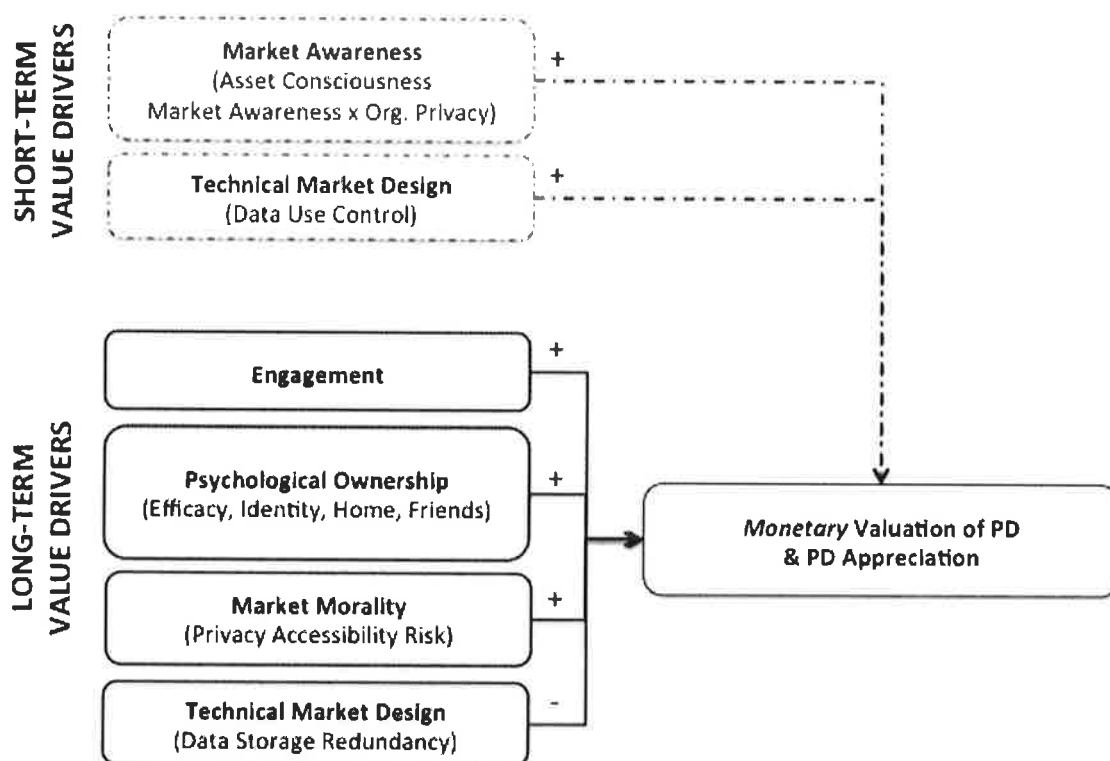
Towards a long-term value theory for personal data

Our study found that factors relating to the phenomenon of psychological ownership greatly influence people's PD valuation. What traditionally builds psychological ownership, identity construction, efficacy and engagement strongly relate to PD value. Taken together, these factors contribute to the explanation of 12 percent unique variance of WTP, 18 percent unique variance of perceived data appreciation and 18 percent of variance in WTA (for those respondents who were not reactant). People who engage with Facebook more often value their data more, are more willing to pay to protect its loss and will accept more money for it when it's sold. This result is not surprising because the volume of data to protect is probably larger, and

the transaction cost to produce it is higher. The perception of being at home with one's Facebook data is only related to profile appreciation and WTA money (for respondents who were not reactant). Surprisingly at first, it does not drive WTP. However, similar effects may exist in the offline world: If you work in someone else's garden and put your creativity and love into it, then you value it a lot and would except money for your work, but you would not pay for it on top of having done the work. Perceptions of being at home therefore do play a role for users' data valuation. Users want to be compensated for their "homes" when they are sold.

When looking into market morality in terms of privacy we have already outlined that organizational privacy concerns influence PD value in interaction with market awareness. Another privacy threats that we find to directly influence PD valuation (independent of market awareness) is the fear of being too accessible. Accessibility concerns mean that users fear that they have revealed too much about themselves in the past. Users who view themselves as more accessible are more willing to pay to protect their data and appreciate it more. They are less willing to accept money for it though. More research is needed to understand this apparent contradiction.

Finally our study looked into how technical market design factors influence PD value. We identified data storage redundancy as a major driver for WTP and data appreciation. To have a copy of one's data was – as a unique variable – the most influential factor increasing Nagelkerke R^2 by 4%. The more copies one has the less one values individual copies. The second market design variable we hypothesized to be relevant is data portability. In offline markets, portability is a key value driver. The IT and electronics industry has a rich history of creating compatibility standards for portability. Our data gives us very limited insights into the effects of portability. Across manipulations, data portability was barely significant as a value driver.

IMPLICATIONS

Companies operating in the digital economy and engaging in personal data markets can pull some fundamental learnings from our study: In the short term, the PD value difference caused by market awareness is a warning signal for today's PD market players. When consumers learn that their data is a tradable asset, they value their data significantly more. In fact, market awareness is the single most influential factor driving WTP for one's PD on Facebook. It may be therefore that companies cannot count on the (quasi) free provision of PD in the future in exchange for some service. Our study suggests that consumers may engage in a more sophisticated "data value calculus" when they get asset conscious.

Companies may be tempted – also in response to people's asset consciousness – to lobby for less user control over subsequent data uses. Our study suggests that this may not be a good strategy. We observe over 50% of users becoming reactant if they are consciously deprived of control over their data. We also observe market dropout reactions. Depriving people of data control may not be a good foundation for a trustful personal data market. Instead we would recommend companies to look into user-control tools that allow them to participate in the market.

When it comes to the long-term PD value drivers, we identify psychological ownership dimensions as particularly important. Today digital service companies mainly promote people's engagement online, such as their visits and the time spent on a company's sites. Our value theory suggests that companies should dig deeper into how people actually construct identities on their

sites, what makes people feel efficacious and identify with their data.

We also identify the technical design of digital service markets as key for users' value perceptions. So far, massive storage capacity has been heralded by the IT industry. From a user perspective, it certainly enhances individual freedom, privacy and flexibility over how to handle one's data. From a PD value perspective, though, it reduces the appreciation of the data. The old economic rule of scarcity and valuation applies to our personal digital data just as much as it does to physical goods. For example, suppose that someone has their photographs stored in only one place, a cloud, and uses that source to display the photographs on other platforms. No decentralized storage is provided. Our study suggests that, in this scenario, people would value their PD much more than they do right now. If personal data markets are to strive, PD market players must consider how to create scarcity in an environment where the evolution of our devices pushes for PD abundance.

LIMITATIONS

Before concluding, we want to outline three limitations of our study: One is that we investigated only volunteered and rich communication data on one platform. We recognize that today's PD markets also use the observed and inferred data that people don't volunteer, data created by companies in the course of service transactions and analysis (World Economic Forum, 2011). Additional insight is needed into how data subjects perceive that kind of data.

A statistical limitation of our study is that we could not prove causality for all the variables we observed, in particular for the psychological ownership construct, which we also did not measure directly. It was modeled only as a second order construct. We hope that future research can build on our insights and questionnaire items and delve into more detail on psychological ownership perceptions and their value relevance online.

Finally, in condition 5, we added a WTA condition because we wanted to take away participant's control over the sale of their data. In doing so, we were aware of the WTP/WTA gap. We could have better investigated this gap if we had asked our study participants for their WTA a share of a potential data sale in a scenario where they allow Facebook to sell their data set. This condition would have more clearly aligned condition 5 with condition 3 and granted us more insight into the WTP/WTA gap. However, we chose to prioritize the manipulation of market control and its effect on data valuation. We recognize that we therefore have only a very indirect and limited insight into the WTP/WTA gap that played a role in our study.

CONCLUSION

Our exploratory study on how people value their information on Facebook is the first theoretical contribution to better understand people's valuation of a new asset class: Personal Data. We take the perspective of users, who should be the original sellers of data in PD markets, and we identify a rich spectrum of variables and constructs that drive or relate to their potential compensation expectations. Computer ethicist Luciano Floridi once wrote: "'My' in 'my information' is not the same as 'my' in 'my car' but rather the same as 'my' as in 'my body' or 'my feelings'; it expresses a sense of constitutive belonging, not of external ownership, a sense in which my body, my feelings, and my information are part of me but are not my (legal) possessions," (Floridi, 2005, p. 195). At first sight, our results suggest that Floridi is wrong. In our study, market awareness was the most important driver of PD valuation. Asset consciousness

is a highly valuable source for understanding PD valuation, at least in the context of "volunteered data" (World Economic Forum, 2011:7). Yet, Floridi is right in the sense that people build up feelings of psychological ownership for their online profiles. They feel at home online, build identity, feel efficacious. If they do so and have friends' data in their own communication traces, they value their data traces even more. Taken together, the psychological mechanisms of building a connection with one's data are also more important for data subjects' price expectations than some classical economic variables and market design mechanisms such as data portability. That said, one market design mechanism that should not be underestimated is people's control over their data. Our data shows that if people are aware of a personal data market but not in control over the sale of their data, they get angry. This reactance then leads to unrealistically high price expectations or a defiant withdrawal from the market.

REFERENCES

Abelson, R.P. and D.A. Prentice. (1989). Beliefs as possessions: A functional perspective. In: Attitude structure and function, A. R. PratkanisS. J. Breckler and A. G. Greenwald, (Eds.). Erlbaum, Hillsdale, NJ: pp: 361-381.

Abraham, K.S. (1985). Efficiency and fairness in insurance risk classification. *Virginia Law Review*, 71(3): 403-451. doi: 10.2307/1072963.

Anderson, C. (2009). Free - the future of radical price. London: Random House Business Books.

Acquisti, A., L. John and G. Loewenstein (2013). "What is Privacy Worth?" The Journal of Legal Studies, 42(2): 249-274.

Avey, J.B., B.J. Avolio, C.D. Crossley and F. Luthans. (2009). Psychological ownership: Theoretical extensions, measurement, and relation to work outcomes. *Journal of Organizational Behavior*, 30: 173-191.

Becker, G.M., M.H. DeGroot and J. Marschak. (1964). Measuring utility by a single-response sequential method. *Behavioral Science*, 9(3): 226-232. doi: 10.1002/bs.3830090304.

Bauer, C., Korunovska, J. and S. Spiekermann (2012). On the Value of Information - What Facebook Users are Willing to Pay. In: Proceedings of 20th European Conference on Information Systems (ECIS 2012), Barcelona, Spain.

Berendt, B., O. Guenther and S. Spiekermann. (2005). Privacy in e-commerce: Stated preferences vs. Actual behavior. *Communications of the ACM*, 48(4): 101-106.

Brandimarte, L., A. Acquisti and G. Loewenstein. (2012). Misplaced confidences: Privacy and the control paradox. *Social Psychological and Personality Science*, 4(3): 340-347.

Camenisch, J., A. Shelat, D. Sommer, S. Fischer-Hübner, M. Hansen, H. Krasemann, G. Lacoste, R. Leenes and J. Tseng. (2005). Privacy and identity management for everyone. In: Workshop On Digital Identity Management (DIM). ACM Press, Fairfax, Virginia, USA: pp: 20 - 27.

Campell, M. (2012). This means war. In: NewScientist. San Francisco: pp: 42-45.

Casassa Mont, M., S. Pearson and P. Bramhall. (2003). Towards accountable management of identity and privacy: Sticky policies and enforceable

tracing services. HP Laboratories Bristol.

Ciriacy-Wantrup, S.V. (1947). Capital returns from soil-conservation practices. *Journal Farm Economics*, 29: 1181-1196.

Council of Europe. (1950). European convention on human rights. E. C. o. H. Rights (Ed.). Rome.

Cvrcek, D., M. Vashek, M. Kumpost and G. Danezis. (2006). A study on the value of location privacy. In: Workshop on Privacy in Electronic Society (WPES'06). ACM, Alexandria, Virginia, USA: pp: 109-118.

Dinev, T. and P. Hart. (2006). An extended privacy calculus model for e-commerce transactions. *Information Systems Research*, 17(1): 61-80.

Dingledine, R., N. Mathewson and P. Syverson. (2004). Tor: The second-generation onion router. In: 12th USENIX Security Symposium. San Diego, USA.

Dittmar, H. (1992). The social psychology of material possessions: To have is to be. New York: Hemel Hempstead and St Martin's Press.

European Commission. (2012). Proposal for a regulation of the european parliament and of the council on the protection of individuals with regard to the processing of personal data and on the free movement of such data (general data protection regulation). In: 2012/0011 (COD), E. Commission (Ed.). Brussels.

European Parliament and the Council of Europe. (1995). Directive 95/46/ec of the european parliament and of the council of 24 october 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data. In: L 281/31. Official Journal of the European Communities.

Federal Republic of Germany. (1949). Basic law for the federal republic of germany. O. Journal (Ed.). Bonn.

Floridi, L. (2005). The ontological interpretation of informational privacy. *Ethics and Information Technology*, 7(4): 185-200. Available from http://dx.doi.org/10.1007/s10676-006-0001-7. doi: 10.1007/s10676-006-0001-7.

Freelon, D.G. (2010). Recal: Intercoder reliability calculation as a web service. *International Journal of Internet Scienc*, 5(1): 20-33.

FTC, F.T.C. (2000). Fair information practice principles. F. T. Commission (Ed.).

Fujitsu. (2010). Personal data in the cloud: A global survery of consumer attitudes. Tokyo, Japan.

Furby, L. (1978). Possessions in humans: An exploratory study of its meaning and motivation. *Social Behavior and Personality*, 6: 49-65.

Google Inc. (2013). Google trends. [WWW document] http://google.com/trends (accessed 16th September 2014).

Grossklags, J. and A. Acquisti. (2007). When 25 cents is too much: An experiment on willingness-to-sell and willingness-to-protect personal information. In: 6th Workshop on the Economics of Information Security. Pittsburg, PA.

Hann, I.-H., K.-L. Hui, S.-Y. Lee and V.P.L. Png. (2007). Overcoming online information privacy concerns: An information-processing theory approach. *Journal of Management Information Systems*, 24(2): 13-42.

Hansen, M., A. Schartz and A. Cooper. (2008). Privacy and identity management. *IEEE Privacy & Security*, 6(2): 38-45.

Hayes, A.F. and L. Cai. (2007). Using heteroskedasticity-consistent standard error estimators in ols regression: An introduction and software implementation. *Behavior Research Methods*, 39(4): 709-722.

Holzinger, K. (2008). Transnational common goods - strategic constellations, collective action-problems, and multi-level provision. New York: Palgrave Macmillan.

Horowitz, J.K. and K.E. McConnell. (2002). A review of wta/wtp studies. *Journal of Environmental Economics and Management*, 44(3): 426-447.

Huberman, B., E. Adar and L. Fine. (2005). Valuating privacy. *IEEE Privacy and Security*, 3(5): 22-25.

Internet.org. (2013). A focus on efficiency: A whitepaper from facebook, erricsson and qualcomm.

Isaacs, S. (1933). Social development in young children. London, UK: Routledge & Kegan Paul Limited.

Jentzsch, N., S.P. Preibusch and H.A. Harasser. (2012). Monetising privacy - an economic model for pricing personal information. E.-E. N. a. I. S. Agency (Ed.). Krete.

Kahneman, D., P. Wakker and R. Sarin. (1997). Back to bentham? Explorations of experienced utility. *Quarterly Journal of Economics*, 112(2): 375-406.

Krasnova, H., O. Günther, S. Spiekermann and K. Koroleva. (2009). Privacy concerns and identity in online social networks. *Identity in the Information Society*, 2(1): 39-63. doi: 10.1007/s12394-009-0019-1.

Krasnova, H., T. Hildebrand and O. Günther. (2009). Investigating the value of privacy in online social networks: Conjoint analysis. In: International Conference on Information Systems (ICIS 2009). Association for Information Systems, AIS Electronic Library (AISeL), Phoenix, USA.

Levine, L.E. (1983). Mine: Self-definition in 2 year-old boys. *Development Psychology*, 19(4): 544-549.

Locke, J. (1690). Two treatises of government. London, UK: Awnsham Churchill.

Mayer-Schönberger, V. (2009). Delete: The virtue of forgetting in the digital age. New Jersey, USA: Princton University Press.

Mayhew, M.G., N.M. Ashkanasy, T. Bramble and J. Gardner. (2007). A study of the antecedents and consequences of psychological ownership in organizational settings *Journal of Social Psychology*, 147(5).

Neap, H.S. and T. Celik. (1999). Value of a product: A definition. *International Journal of Value-Based Management*, 12: 181-191.

Nguyen, C., P. Haynes, S. Maguire and J. Friedberg. (2013). A user-centred approach to the data dilemma: Context, architecture, and policy. In: The digital englightment yearbook 2013, M. Hilebrandt, (Ed.). IOS Press, Brussels.

Nissenbaum, H. (2004). Privacy as contextual integrity. *WASHINGTON LAW REVIEW*, 79(1).

OECD. (1980). Oecd guidelines on the protection of privacy and transborder flows of personal data.

OECD. (2012). Guidelines on the protection of privacy and transborder flows of personal data.

OECD. (2013). Exploring the economics of personal data: A survey of methodologies for measuring monetary value". In: OECD Digital Economy Papers. OECD, Paris.

Peck, J. and S.B. Shu. (2009). The effect of mere touch on perceived ownership. *Journal of Consumer Research*, 36(3): 434-447.

Pierce, J.L., T. Kostova and K.T. Dirks. (2003). The state of psychological ownership: Integrating and extending a century of research. *Review of General Psychology*, 7(1): 84-107.

Porteous, J.D. (1976). Home: The territorial core. *Geographical Review*, 66: 383-390.

Powdthavee, N. (2008). Putting a price tag on friends, relatives, and neighbours: Using surveys of life satisfaction to value social relationships. *The Journal of Socio-Economics*, 37(4): 1459–1480.

Preibusch, S.ö., K. Krol and A.R. Beresford. (2012). The privacy economics of voluntary over-disclosure in web forms. In: Workshop in the Economics of Information Security (WEIS). Berlin.

Purtova, N. (2012). Property rights in personal data: A european perspective. Uitgeverij BOXPress.

Reilly Jr., R. and R. Schweihs. (1999). Valuing intangible assets. New York: McGraw Hill.

Richter, D., R. K. and J. vom Brocke. (2011). Internet social networking: Research state of the art and implications for enterprise 2.0. *Business & Information Systems Engineering*, 3(2): 89-101.

Rindfleisch, A. and J.B. Heide. (1997). Transaction cost analysis: Past, present, and future applications. *the Journal of Marketing*: 30-54.

Rittenberg, L. and T. Tregarthen. (2011). Principles of macroeconomics. In: Chapter 6. Measuring Total Output and Income. Flat World Knowledge, Washington, D.C. .

Rose, J., B. Röber and O. Rehse. (2012). The value of our digital identity. In: Liberty Global Policy Series, L. Global (Ed.). Liberty Global Policy Series.

Rudmin, F. (1991). To have possessions: A handbook on ownership and property. Corte Madera, CA Select Press.

Schwartz, P.M. (2004). Property, privacy, and personal data. *Harvard Law Review*, 117(7): 2056-2128.

Smith, J.H., S. Milberg, J. and S. Burke, J. (1996). Information privacy: Measuring individuals' concerns about organizational practices. *MIS Quarterly*, 20(2): 167-196.

Smith , V.L. and J.M. Walker. (1993). Monetary rewards and decision cost in experimental economics. *Economic Inquiry*, 31(2): 245-261.

Smithers, R. (2011). Terms and conditions: Not reading the small print can mean big problems. In: The Guardian. London.

Solove, D.J. (2006). A taxonomy of privacy. *University of Pennsylvania Law Review*, 154(3): 477-560. Available from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=667622.

Thaler, R. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization*, 1(1): 39-60. Available from

http://www.sciencedirect.com/science/article/pii/0167268180900517. doi: http://dx.doi.org/10.1016/0167-2681(80)90051-7.

The Radicati Group. (2013). Email statistics report, 2013 - 2017. S. Radicati (Ed.). Palo Alto.

The White House. (2013). Consumer data privacy in a networked world: A framework for protecting privacy and promoting innovation in the global digital economy. US Government, Washington D.C.

Tsai, J., S. Egelman, L. Cranor and A. Acquisti. (2007). "The effect of online privacy information on purchasing behavior: An experimental study," In: The 6th Workshop on the Economics of Information Security (WEIS). Pittsburgh, USA.

Varian, H. (1992). Microeconomic analysis. New York: Norton & Company.

Weil, S. (1952). The need for roots: Prelude to a declaration of duties towards mankind. London: Routledge and Kegan Paul Ltd.

Wilpert, B. (1991). Property, ownership, and participation: On the growing contradictions between legal and psychological concepts. In: International handbook of participation in organizations: For the study of organizational democracy, coo-operation, and self-management, R. Russell and V. Rus, (Eds.). Oxford University Press, New York: pp: 149-164.

World Economic Forum. (2011). Personal data: The emergence of a new asset class. I. World Economic Forum (in collaboration with Bain & Company (Ed.).

World Economic Forum. (2011). Personal data: The emergence of a new asset class. World Economic Forum (in collaboration with Bain & Company), Cologny: pp: 5.

TABLES

TABLE 1.
Confidence Intervals for Mean and Median WTP/WTA in the Different
Manipulations

Manipulation	Median	95% CI for Median			Mean	95% CI for Mean	
		Lower Bound	Upper Bound	Actual Coverage		Lower Bound	Upper Bound
Total sample (WTP or WTA)	€ 0	€ 0	€ 0	95.1%	€ 33	€ -2	€ 68
1 WTP data portability – no market awareness	€ 0	€ 0	€ 0	95.4%	€ 3	€ 2	€ 4
2 WTP download – no market awareness	€ 0	€ 0	€ 0	96.2%	€ 7	€ 5	€ 9
3 WTP data portability + with Market awareness	€ 5	€ 1	€ 10	96.1%	€ 42	€ 28	€ 56
4 WTP download + with Market awareness	€ 5	€ 1	€ 10	96.3%	€ 71	€ 43	€ 99
5 WTA + data portability + Market awareness	€ 0	€ 0	€ 30	95.1%	€ 160	€ -8	€ 33

Note: The confidence interval for the median is constructed without any distribution assumptions.
The actual coverage level may be greater than the specified level; WTP = Willingness to pay, WTA
= Willingness to accept,

TABLE 2:
Logistic Regression of WTP. Conditions 1 – 4

Predictor	Step 1			Step 2			Step 3			Step 4			Step 5		
	B	SE	OR	B	SE	OR	B	SE	OR	B	SE	OR	B	SE	OR
Constant	-.47	.11		-.47	.11		-.81	.16		-.60	.18		-.39	.20	
Market Awareness	.88	.16	2.42***	.91	.16	2.47***	.98	.17	2.67***	.88	.17	2.41***	1.05	.21	2.87***
Engagement				.32	.08	1.38***	.31	.08	1.36***	.32	.08	1.38***	.39	.09	1.47***
Psychological ownership															
Identity construction							.36	.08	1.43***	.38	.09	1.46***	.41	.09	1.50***
Feelings of home							.13	.09	1.14	.14	.09	1.15	.12	.09	1.13
Efficacy							.22	.09	1.24*	.24	.09	1.27**	.28	.09	1.32**
Number of friends							.00	.00	1.00**	.00	.00	1.00*	.00	.00	1.00*
Market Design															
Data Portability										-.23	.17	.80	-.29	.18	.75†
Have a copy										-.44	.09	.65***	-.49	.09	.61***
Market morality															
Privacy Concerns Organizational treat													-.10	.12	.90
Privacy Concerns Accessibility treat													.50	.09	1.64***
Privacy Concerns Social treat													.08	.09	1.08
Privacy concerns Organizational treat X Market Awareness													.40	.18	1.49*
Reactance													-.62	.30	.54*
Reactance X Market Awareness													-.18	.42	.83
Nagelkerke R² (sig. of step)	.06***			.09***			.18***			.22***			.30***		

Except for the number of friends and manipulation dummies, we used factor scores of our measures (privacy concerns, psychological ownership and having a copy) as predictor variables.
Note: B=estimated coefficient; SE = standard error; OR=odds ratio; * p<.05; ** p<.01, *** p<.001, † p <.10
Dependent variable willingness to pay (yes/no) N=676 (scenarios 1 to 4)
Hosmer and Lesmeshow Chi²(8)= 11.69, p=.166

TABLE 3
Linear regression Valuation of Already Disclosed Data

	Step 1			Step 2			Step 3			Step 4			Step 5			Step 6		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Constant	4.32	.13		4.33	.13		4.05	.14		3.87	.16		4.41	.32		4.28	.32	
Market Awareness	.59	.17	.12**	.57	.17	.11**	.58	.16	.11***	.46	.16	.09***	.32	.18	.06†	.33	.19	.07†
Engagement				.57	.08	.23***	.53	.08	.21***	.53	.08	.21***	.53	.08	.21***	.51	.08	.21***
Psychological ownership																		
Identity construction							.45	.08	.18***	.45	.08	.18***	.45	.08	.18***	.45	.08	.18***
Feelings of home							.34	.08	.14***	.34	.08	.14***	.33	.08	.13***	.34	.08	.14***
Efficacy							.57	.08	.23***	.58	.08	.23***	.57	.08	.23***	.57	.08	.23***
Number of friends							.00	.00	.10**	.00	.00	.10**	.00	.00	.10**	.00	.00	.10**
Market Design																		
Data Portability										.43	.16	.08**	.30	.17	.06†	.28	.17	.05†
Have a copy										-.15	.08	-.06†	-.15	.08	-.06*	-.16	.08	-.06*
Data Control													-.47	.23	-.07*	-.31	.23	-.05
Market morality																		
Privacy Concerns Organizational treat																.22	.11	.09†
Privacy Concerns Accessibility treat																.31	.08	.12***
Privacy Concerns Social treat																.02	.07	.01
Privacy concerns Organizational treat X Market Awareness																.34	.15	.10*
Reactance																-.12	.27	-.02
Reactance X Market Awareness																.29	.35	.05
R^2 change (sig of step)	.01**			.05***			.13***			.01**			.00*			.05***		
R^2	.01			.07			.20			.20			.21			.26		

Except for the number of friends and manipulation dummies, we used factor scores of our measures (privacy concerns, **psychological** ownership and having a copy) as predictor variables.
Note: B=estimated coefficient; SE = standard error; β=standardized coefficient; *p<.05; **p<.01, ***p<.001, †p<.10
Dependent variable: valuation of data (9 point scale) N=839 (all conditions)

TABLE 4
Multinomial Logistic Regression of WTA. Condition 5

Extreme group WTA > 4006 EUR N = 47	Moderate group N = 38 0 EUR < WTA < 4006 EUR			Zero group N = 81 WTA = 0 EUR		
	B	**SE**	**OR**	**B**	**SE**	**OR**
Intercept	.05	.38		-.33	.35	
Engagement	-.30	.28	.74	-.29	.21	.75
Psychological ownership						
Identity construction	.06	.26	1.06	.10	.20	1.11
Feelings of home	-.26	.26	.78	.01	.19	1.01
Efficacy	.39	.25	1.47	-.30	.19	.74
Number of friends	.00	.00	1.00	.00	.00	1.00
Market Design						
Have a copy	.44	.27	1.55	.26	.21	1.29
Market morality						
Privacy Concerns Organizational treat	-.06	.24	.94	.10	.19	1.10
Privacy Concerns Accessibility treat	.40	.24	1.49	-.13	.19	.88
Privacy Concerns Social treat	-.17	.24	.84	-.16	.20	.85
Reactance	-2.04	.60	**.13****	.34	.40	1.40

Nagelkerke R^2 = **.29*****

Note: B=estimated coefficient; SE = standard error; OR=odds ratio; *p<.05; **p<.01, ***p<.001
N = 166

TABLE 5
Linear regression WTA (people who wanted nothing for their data or wanted more than 4006 EUR excluded from the analysis)

	Step 1			Step 2			Step 3			Step 4		
	B	SE	ß	B	SE	ß	B	SE	ß	B	SE	ß
Constant	520.71	81.77		659.00	175.58		662.35	178.18		885.22	181.64	
Engagement	129.28	95.41	.21	115.28	100.45	.18	118.40	102.31	.19	243.05	104.20	.39*
Psychological ownership											'	
Identity construction				-5.59	94.23	-.01	-1.06	96.72	.00	56.95	91.98	.10
Feelings of home				175.25	89.45	.35†	177.51	90.93	.35†	252.99	88.69	.50**
Efficacy				-69.85	100.22	-.11	-79.03	106.44	-.13	-135.46	106.05	-.22
Number of friends				-.19	.41	-.09	-.18	.41	-.08	-.38	.40	-.18
Market Design												
Have a copy							33.47	117.08	.05	106.80	116.29	.15
Market morality												
Privacy Concerns Organizational treat										218.67	95.79	.40*
Privacy Concerns Accessibility treat										-216.79	87.69	-.42*
Privacy Concerns Social treat										-189.91	90.41	-.38*
R² change (sig of step)		.04*			.11			.00			.18*	
R²		.04*			.15			.15			.33	

Note: B=estimated coefficient; SE = standard error; ß=standardized coefficient; p<.05; **p<.01, ***p<.001, †p <.10
Dependent variable willingness to accept (yes/no) N=43 (condition 5, respondents with non-extreme answers (0 < WTA < 400 EUR)

APPENDIX A. USERS WAKING UP ON THEIR DATA

The rising trend of browser extension (add-on) "Ghostery" on Google Search, retrieved from Google Trends September 2014

Interest over time ⑦
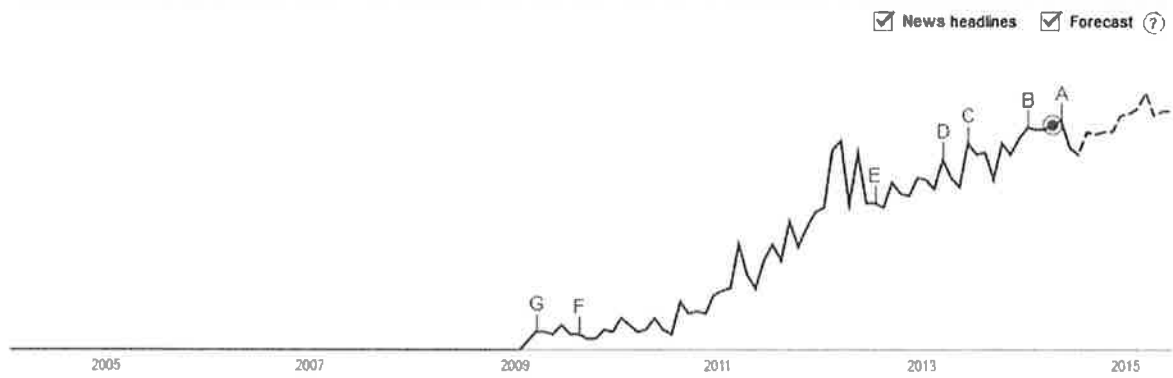
APENDIX B. DETAILED TABLES OF RESULTS

TABLE B-1
Factor Loadings, Reliability Of The Scales and CFA Results for the Second Order Constructs Privacy Concerns and Psychological Ownership

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.	Component								Reliability
	1	2	3	4	5	6	7	8	Cronbach's Alpha
PRIVACY CONCERNS Scale: 1strongly disagree -- to 9 strongly agree CFA goodness of fit indices (Chi^2(40) = 149.7; p= .000; CFI= .98; AGFI = .96; RMSEA = .05									.88
OT1: I am often concerned that Facebook could store my information for the next couple of years.	.843	.064	.150	.036	-.021	.001	-.115	-.054	
OT2: Every now and then I feel anxious that Facebook might know too much about me.	.791	.072	.276	.013	.076	-.035	-.047	-.063	
OT 3: I am often concerned that Facebook could share the information I provide with other parties (e.g., marketing, HR or government agencies).	.868	.059	.108	-.014	-.032	-.056	-.059	.008	
OT 4: I am often concerned other parties (e.g., marketing, HR, governmental agencies) could actually collect my publicly available information on Facebook.	.821	.178	.139	.009	-.028	-.033	-.039	.013	.91
OT 5: It often worries me that other parties (e.g., marketing, HR, governmental agencies) could use the information they have collected about me from Facebook for commercial purposes.	.845	.103	.142	.003	.001	-.061	-.038	.011	
ST1: I am often concerned that someone might purposefully embarrass me on Facebook.	.226	.865	.243	.058	.104	.018	-.029	-.040	
ST2: It often worries me that other users might purposefully write something undesired about me on Facebook.	.237	.877	.224	.027	.076	.056	-.038	-.002	.87
ACC1: It often worries me that I do not restrict the access to my Facebook profile properly for some people.	.263	.093	.731	-.005	.030	-.042	-.023	.003	
ACC 2: There are people among my friends lists, who should actually not be able to see my Facebook profile.	.053	.128	.736	.103	.039	.057	-.077	-.029	
ACC 3: Sometimes I feel like I have revealed too much about myself on Facebook.	.352	.074	.699	.017	.070	.059	.050	-.049	.78
ACC 4: My Facebook friends could gain information about me from by Facebook profile that should actually not be public.	.170	.138	.751	.102	.013	.011	.091	-.063	
Psychological ownership Scale: 1strongly disagree -- to 9 strongly agree CFA goodness of fit indices Chi^2(58) = 327.2; p= .000; CFI= .957; AGFI = .923; RMSEA = .068									.89
	1	2	3	4	5	6	7	8	Cronbach's Alpha
EFF1: I am sure that I contribute a lot to Facebook.	.031	.043	.097	.756	.133	.208	.230	.033	
EFF2: I feel that I increase the quality of Facebook.	.043	.021	.080	.830	.196	.045	.108	.013	.78
EFF3:I think that I set high standards for Facebook profiles with my profile.	-.018	.027	.061	.694	.185	.213	.111	.015	
IC1: For me it is important that I present myself well on Facebook.	.019	.078	.048	.199	.847	.129	.087	-.034	
IC2: I use Facebook to present myself in good light.	-.009	.056	.057	.146	.849	.101	.152	-.015	.87
IC3: I like that Facebook gives me the possibility to make a good impression on others.	-.011	.043	.041	.165	.825	.146	.197	-.002	
H1: On my Facebook page I feel a bit at home .	.024	-.023	.137	.162	.139	.638	.347	-.109	
H2. I feel connected to my Facebook page.	-.027	.059	.066	.269	.235	.691	.292	-.082	.79

	1	2	3	4	5	6	7	8	Cronbach's Alpha
H3: I feel very pleased to be part of the Facebook world with my profile.	-.183	.080	-.077	.194	.135	.695	.177	.004	
ENG1: Using Facebook, I keep my friends up to date concerning what is happening in my life.	-.140	.014	.035	.105	.135	.188	.833	-.014	
ENG2: I take the time to keep my Facebook page up to date.	-.040	-.029	-.036	.182	.171	.364	.696	-.012	.84
ENG3: When I have to say something, I share it on Facebook.	-.126	-.066	-.004	.190	.179	.113	.805	.000	

Having a copy of the PD
Scale: 1strongly disagree – to 9 strongly agree

	1	2	3	4	5	6	7	8	Cronbach's Alpha
HC1: If I wanted, it would be easy for me to re-provide all my Facebook information.	-.086	-.095	.022	-.087	.025	.340	-.253	.621	
HC2: I have a copy from a lot of my Facebook profile information (photos).	-.024	-.002	-.057	-.057	.015	.102	-.069	.787	.60
HC3: Since I have a copy from most of my information, it would not be bad if the Facebook information is deleted.	.017	.024	-.077	-.077	-.080	.000	-.210	.801	

TABLE B-2.
Distribution of the stated WTPand WTA amounts

MANIPULATION	WTP	Frequency	Percent	Cumulative Percent
1. TRANSFER	0 EUR	183	63.8	63.8
	1 EUR	29	10.1	73.9
	2 EUR	6	2.1	76.0
	3 EUR	1	.3	76.3
	5 EUR	14	4.9	81.2
	10 EUR	16	5.6	86.8
	15EUR	3	1.0	87.8
	20EUR	13	4.5	92.3
	25 EUR	2	.7	93.0
	30 EUR	2	.7	93.7
	35 EUR	1	.3	94.1
	50 EUR	4	1.4	95.5
	Outliers (outlier threshold = 64 EUR):			
	100 EUR	6	2.1	97.6
	200 EUR	4	1.4	99.0
	500 EUR	1	.3	99.3
	1000 EUR	1	.3	99.7
	150000.EUR	1	.3	100.0
	Total	287	100.0	
2. DOWNLOAD	0 EUR	162	59.3	59.3
	1 EUR	26	9.5	68.9
	2 EUR	2	.7	69.6
	3 EUR	1	.4	70.0
	5 EUR	20	7.3	77.3
	10 EUR	31	11.4	88.6
	15 EUR	3	1.1	89.7
	20 EUR	8	2.9	92.7
	25 EUR	1	.4	93.0
	50 EUR	6	2.2	95.2

		70 EUR	1	.4	95.6
		100 EUR	7	2.6	98.2
		150 EUR	1	.4	98.5
		Outliers (outlier threshold = 176 EUR):			
		200 EUR	1	.4	98.9
		500 EUR	1	.4	99.3
		20000 EUR	1	.4	99.6
		1000000000 EUR	1	.4	100.0
		Total	273	100.0	
3.	TRANSFER + MARKET CONSCIOUSNESS	0 EUR	91	40.3	40.3
		1 EUR	10	4.4	44.7
		2 EUR	2	.9	45.6
		3 EUR	1	.4	46.0
		5 EUR	15	6.6	52.7
		10 EUR	20	8.8	61.5
		20 EUR	19	8.4	69.9
		25 EUR	4	1.8	71.7
		30 EUR	3	1.3	73.0
		40 EUR	1	.4	73.5
		50 EUR	20	8.8	82.3
		75 EUR	2	.9	83.2
		80 EUR	1	.4	83.6
		99 EUR	1	.4	84.1
		100 EUR	22	9.7	93.8
		130 EUR	1	.4	94.2
		150 EUR	3	1.3	95.6
		200 EUR	3	1.3	96.9
		300 EUR	2	.9	97.8
		500 EUR	2	.9	98.7
		600 EUR	1	.4	99.1
		666 EUR	1	.4	99.6
		1000 EUR	1	.4	100.0
		Outliers (outlier threshold = 4006 EUR):			
		Total	226	100.0	
4.	DONLOAD+ MARKET CONSCIOUSNESS	EUR	92	38.5	38.5
		1 EUR	18	7.5	46.0
		2 EUR	3	1.3	47.3
		3 EUR	1	.4	47.7
		5 EUR	11	4.6	52.3
		10 EUR	18	7.5	59.8
		12 EUR	1	.4	60.3
		15 EUR	3	1.3	61.5
		20 EUR	15	6.3	67.8
		25 EUR	2	.8	68.6

	Frequency	Percent	Cumulative Percent
30 EUR	1	.4	69.0
35 EUR	1	.4	69.5
40 EUR	1	.4	69.9
49 EUR	1	.4	70.3
50 EUR	23	9.6	79.9
70 EUR	1	.4	80.3
75 EUR	1	.4	80.8
99 EUR	1	.4	81.2
100 EUR	20	8.4	89.5
130 EUR	1	.4	90.0
150 EUR	1	.4	90.4
200 EUR	1	.4	90.8
250 EUR	3	1.3	92.1
300 EUR	4	1.7	93.7
500 EUR	5	2.1	95.8
1000 EUR	4	1.7	97.5
1500 EUR	1	.4	97.9
2000 EUR	1	.4	98.3
Outliers (outlier threshold = 4006 EUR):			
8000 EUR	1	.4	98.7
10000 EUR	1	.4	99.2
1000000 EUR	1	.4	99.6
1000000000000000 EUR	1	.4	100.0
Total	239	100.0	

	WTA	Frequency	Percent	Cumulative Percent
5. TRANSFER + MARKET CONSCIOUSNESS	0 EUR	142	52.0	52.0
	1 EUR	2	.7	52.7
	5 EUR	1	.4	53.1
	10 EUR	1	.4	53.5
	15 EUR	1	.4	53.8
	20 EUR	1	.4	54.2
	30 EUR	1	.4	54.6
	50 EUR	1	.4	54.9
	51 EUR	1	.4	55.3
	60 EUR	1	.4	55.7
	100 EUR	5	1.8	57.5
	120 EUR	3	1.1	58.6
	150 EUR	2	.7	59.3
	200 EUR	4	1.5	60.8
	250 EUR	2	.7	61.5
	300 EUR	1	.4	61.9
	500 EUR	12	4.4	66.3
	750 EUR	1	.4	66.7
	1000 EUR	12	4.4	71.1

1300 EUR	1	.4	71.4
1500 EUR	3	1.1	72.5
2500 EUR	1	.4	72.9
5000 EUR	14	5.1	78.0
5400 EUR	1	.4	78.4
6000 EUR	1	.4	78.8
7200 EUR	1	.4	79.1
10000 EUR	18	6.6	85.7
15000 EUR	2	.7	86.4
20000 EUR	1	.4	86.8
30000 EUR	2	.7	87.5
50000 EUR	5	1.8	89.4
75000 EUR	1	.4	89.7
100000 EUR	7	2.6	92.3
150000 EUR	1	.4	92.7
200000 EUR	1	.4	93.0
500000 EUR	1	.4	93.4
1000000 EUR	7	2.6	96.0
3000000 EUR	1	.4	96.3
10000000 EUR	1	.4	96.7
20000000 EUR	1	.4	97.1
Outliers (outlier threshold = 25150642 EUR):			
47110815 EUR	1	.4	97.4
100000000 EUR	1	.4	97.8
1000000000 EUR	1	.4	98.2
5000000000 EUR	1	.4	98.5
100000000000 EUR	1	.4	98.9
9999999999999 EUR	1	.4	99.3
1000000000000000000000000 EUR	1	.4	99.6
1000000000000000000000000000000000 EUR	1	.4	100.0
Total	273	100.0	

Note: *The differences in stated price distributions led us to conduct separate outlier analyses for all conditions. In line with (Hubert and Van der Veeken 2007), we used the outlier labeling rule for maximally skewed distributions (MC =1) and excluded 29 outliers.

TABLE B-3

Main statistics for WTP and WTA for personal data, Psychological Ownership, Privacy concerns, Data valuation, Reactance and top 3 reasons for WTP/WTA across the 5 Conditions

Transferring personal data- with OSN service utility	Downloading personal data- no OSNservice utility

Facebook deletes personal data- without Market Awareness prime – WTP to download or transfer

Condition 1 (net N=287; 13 outliers; outlier threshold* = 64 EUR)

Median WTP = € 0
75th Percentile = € 1
67 % WTP = €0

xPrivacy concerns M (SD)
Organizational threats = 6.1 (2.2)
Accessibility = 3.5 (1.8)
Social threats = 3.9 (2.2)
xPsychological ownership M (SD)
Feelings of home = 4.5 (1.7)
Engagement = 5.2 (2.3)
Efficacy = 3.6 (1.8)
Identity construction = 4.2 (2.1)
x Data valuation= 4.6 (2.6)

24 % Reactant participants
Top 3 WTP reasons:
(1) have a back up (25%)
(2) data has no value (19%)
(3) wish to delete (7%)

Condition 2 (net N= 273; 4 outliers; outlier threshold* = 176 EUR)

Median WTP = € 0
75th Percentile = € 5
60% WTP = €0

xPrivacy concerns M (SD)
Organizational threats = 6.1 (2.2)
Accessibility = 3.6 (1.9)
Social threats = 4.0 (2.2)
xPsychological ownership M (SD)
Feelings of home = 4.6 (1.7)
Engagement = 5.3 (2.3)
Efficacy = 3.8 (1.9)
Identity construction = 4.2 (2.1)
x Data valuation = 4.3 (2.4)

26% Reactant participants
Top 3 WTP reasons:
(1) have a back up (32%)
(2) data has no value (22%)
(3) data has no value, privacy (9%)

Facebook sells personal data- with Market Awareness prime – WTP to download or transfer – choice to avoid personal data sale

Condition 3 (net N = 226; 0 outliers; outlier threshold* = 4006 EUR)

Median WTP = € 5
75th Percentile = € 50
40 % WTP = €0

xPrivacy concerns M (SD)
Organizational threats = 5.6 (2.2)
Accessibility = 3.5 (1.8)
Social threats = 3.9 (2.2)
xPsychological ownership M (SD)
Feelings of Home = 4.6 (1.6)
Engagement = 5.3 (2.3)
Efficacy = 3.7 (1.9)
Identity construction = 4,3 (2.2)
x Data valuation = 4.7 (2.3)

25% Reactant participants
Top 3 WTP reasons:
(1) data has no value, privacy (30%)
(2) data has no value (11%)
(3) have a back up (7%)

Condition 4 (net N = 239; 4 outliers; outlier threshold* = 4006 EUR)

Median WTP = € 5
75th Percentile = € 50
39% WTP = €0

xPrivacy Concerns M (SD)
Organizational threats = 5.5 (2.2)
Accessibility = 3.3 (1.9)
Social threats = 3.8 (2.3)
xPsychological ownership M (SD)
Feelings of Home = 4.6 (1.7)
Engagement = 5.3 (2.3)
Efficacy = 3.7 (1.9)
Identity construction = 4.3 (2.2)
x Data valuation = 4.6 (2.3)

27% Reactant participants
Top 3 WTP reasons:
(1) data has no value, privacy (30%)
(2) data has no value (19%)
(3) have a back up (7%)

Facebook sells personal data- with Market Awareness prime – WTA money for transfer – no choice to avoid personal data sale

Condition 5 (net N=273; 8 outliers; outlier threshold= 25150642 EUR)

Median WTA = € 0
75th Percentile = € 3750
54 % WTP = €0

xPrivacy concerns M (SD)
Organizational threats = 6.0 (2.3)
Accessibility = 3.7 (1.9)
Social threats = 3.8 (2.3)
xPsychological ownership M (SD)
Feelings of Home = 4.7 (1.6)
Engagement = 5.3 (2.2)
Efficacy = 3.7 (2.0)
Identity construction = 4,3 (2.1)
x Data valuation = 5.3 (2.6)

49 % Reactant participants
Top 3 WTA reasons:
(1) claim of ownership (13%)
(2) data has value (11%)
(3) data protection (10%)

Note: All the scales range from 1 – completely disagree to 9 completely agree except for PO Engagement items 2 and 3, which were measured on an 11-point scale ranging from 1 – never to 11 – always; WTP = Willingness to pay, WTA = Willingness to accept, OSN = Online Social Network.

APPENDIX C. QUALITATIVE ANALYSIS

TABLE C-1

Qualitative reasons for stated WTP and WTA amounts

Category for WTP or WTA	Description of Reason	Examples	Total sample		Market unaware		Market aware	
			Freq.	Valid %	Freq.	%	Freq.	%
1. Data has no value	The participant feels that their data on FB has simply no or little value.	"Data is superficial" "This data is not important to me" "I don't need this data"	184	15.8	107	20.8	77	11.8
2. Data has no value, privacy (is not privacy sensitive)	The participant feels that their data on FB has little value because they state to not post sensitive information there.	"No sensitive/private data" "I don't share anything that could not be known by anyone"	182	15.6	38	7.4	144	22.1
3. Backup/ data abundance	The participant has a copy of the information posted on FB.	"Have the data elsewhere" "Have a copy on my computer" "Can easily reproduce the data"	175	15.0	144	28.0	31	4.8
4. Claim of data ownership	The participant makes an ownership claim.	"This is my data" "My intellectual property" "I have the rights"	60	5.2	12	2.3	48	7.4
5. Market or price calculations, opportunity cost	The participant reflects on the amount that FB can afford to pay or how the market estimates prices for PD, compares the offered amount to other purchases, calculates the time invested or other price rationalizations	"Stock market value divided by number of users" "10 EUR is a symbolic amount that I would otherwise spend without thinking on food, drinks or something similar" "50 EUR is my opportunity cost, it's for the time I would save for not saving the data manually"	56	4.8	23	4.5	33	5.1
6. Economic injustice	Participant does not see why he should pay to protect their own data; especially since FB has already earned money from the data. The comment may mention legal prohibition of the scenario. It is critical of FB.	"Why should I pay for my data if it helped to make profit before?" "social networks earn enough money with advertisements" "I would sue FB"	54	4.6	23	4.5	31	4.8
7. Data protection	For privacy reasons, the participant wants to avoid that their data is passed on to a third party.	"I would pay a bit so that a totally unknown company would not get my data", "The amount would be fine already to impede that my email address and name is shared with a totally unknown company"	44	3.8	2	0.4	42	6.6
8. Data has value	The participant perceives their data as valuable.	"Private information are worth a lot" "So much personal information is expensive"	42	3.6	6	1.2	36	5.5

		Description	Example quotes						
9.	Gut feeling	The value of the information was spontaneously guessed by the participant	"Gut feeling" "I did not think much" "I spontaneously came up with it"	38	3.3	11	2.1	27	4.1
10.	Friends	The value of the information is related to the friends and the possibility to have a network or the absence thereof.	"I know all my friends and don't need to pay to find them again", "I don't need a social network", "I am only with FB to stay in touch with friends from abroad"	37	3.2	23	4.5	14	2.2
11.	Replaceability of FB	The value of the information is derived from the valuation of FB	"I only use FB to chat with friends" "Because FB is not an important part of my free time"	33	2.8	25	4.9	8	1.2
12.	Resignation toward data markets	The participant thinks that he/she has no control over her data anyways since it may have already been widely distributed or even sold by FB. Therefore it makes no sense to try to save it.	"The data will be sold anyways", "No matter how much money I offer, my data is already on the Net.", "I think a lot of the data has been sold by FB already now to companies"	28	2.4	6	1.1	22	3.4
13.	Affordable budget	Participant reflects the amount they could pay for their data to save it	"This amount would be fine within my budget" "I can't afford more"	26	2.2	5	1.0	21	3.2
14.	Wish to delete	The participant would like to delete their data on FB anyways and would not care if it was deleted.	"I want my data to be deleted anyways" "I would not care if it was deleted" "I would welcome this step to get rid of my data"	25	2.1	22	4.3	3	0.5
15.	Life logging	The participant associates an ideational value with their data that is the data is valuable because of memories	"Mainly because of the photos", "Quite nice as a memory of what one has done over the past years" "My pictures are important to me"	23	2.0	13	2.5	10	2.5
16.	Attitudes towards the experiment	The participants talks about the survey and how it is unrealistic or improbable. It is clear that the reasons for the amount has nothing to do with the WTP, but more towards the experiment	"Abstract question" "it would never happen, this is a stupid question"	19	1.6	4	.8	15	2.3
17.	Fake account	The participant uses fake name or false identity and the information on the platform has no value	"I do not have a single true private information about me on FB"	9	.8	2	.4	7	1.1
18.	Open source stand	Participant thinks all information on the Internet should be free for all	"Information on the Internet is free" "Open source" "Anyone can use the data"	6	.5	0	0	6	.9
19.	Loss of identity	The participant thinks that the data are priceless or invaluable. Selling it would be like selling the identity	"If they want my data they will have to bleed"	1	.1	0	0	1	.2

20. Ambiguous statement/cant categorize

	The statement was ambiguous It cannot be clearly categorized					
	123	10.6	48	9.3	75	11.5
Total	1165	100.0	514	100.0	651	100.0
Missing Did not give a reason	104		29	(5.3)	75	(10.3)
	8.2 % (from total sample)					
Total	1269					