THE LAW AND ECONOMICS OF PRIVACY, PERSONAL DATA, ARTIFICIAL INTELLIGENCE, AND INCOMPLETE MONITORING

Edited by James Langenfeld, Frank Fagan and Samuel Clark

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THE LAW AND ECONOMICS OF PRIVACY, PERSONAL DATA, ARTIFICIAL INTELLIGENCE, AND INCOMPLETE MONITORING

Frank Fagan[a] and James Langenfeld[b]

ABSTRACT

This issue of Research in Law and Economics *covers several areas of important research by a variety of international scholars. It contains theoretical papers on privacy, the protection of personal data, the use of regulatory monitoring under legal standards vs. rules, a study of the properties of market efficiency in securities fraud litigation, as well as an analysis of nonexclusionary price floors. It also contains an empirical paper on the relationship between uncertainty of patent approval of artificial intelligence applications and the Supreme Court's decision in* Alice Corp. v. CLS Bank International. *Finally, Volume 30 contains a law-and-economics assessment of the Chinese financial system within the context of the trade-off between centralized control and rapid growth.*

Keywords: Privacy; GDPR; data protection; *Alice Corp*; artificial intelligence; patents; regulatory monitoring; securities fraud; Chinese banking

There are seven refereed papers in this issue of *Research in Law and Economics*. Two address key technical economic issues in privacy and data protection. The

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first, by Carlo Capuano, Iacopo Grassi, and Giacomo Valletta, is entitled *The Right to Be Informed and the Right to Be Forgotten: Welfare Implications in the Presence of Myopic Consumers*. This paper consists of a model of a monopolist who purchases consumer information in order to price discriminate. The model shows that data protection regulation can benefit sophisticated consumers while simultaneously harming low-income consumers. The second paper, by Björn Fasterling and entitled *Privacy as Vulnerability Protection*, considers privacy rights as protection from vulnerability. Under this expanded definition of privacy, the paper shows that regulators can avail themselves of greater opportunities for increasing welfare.

Ryan Whalen and Raphael Zingg contribute *Innovating under Uncertainty: The Patent-Eligibility of Artificial Intelligence after* Alice Corp. v. CLS Bank International. The paper presents empirical analysis of the uncertainty of patent approval for inventions that use artificial intelligence, and whether the Supreme Court's decision in *Alice Corp. v. CLS Bank International* increases that uncertainty. It finds that it does not. There are three additional theoretical papers. The first, entitled *Market Efficiency and Securities Fraud Litigation*, and authored by Roland Eisenhuth and David Marshall, considers the properties of market efficiency within the context of securities fraud litigation. The paper formally sets forth the necessary assumptions regarding capital markets in order for various efficiency properties to hold within the context of Rule 10b-5 litigation. The second, entitled *Legal Standards and Incomplete Monitoring*, and authored by David Hasen, develops a model that quantifies some of the specific tradeoffs that regulators face in designing standards regimes under incomplete monitoring. Interestingly, the model permits estimation of the extent to which suboptimal compliance due to incomplete monitoring is likely to result in deadweight loss. The third, entitled *A Note on the Law and Economics of Non-Exclusionary Price Floors*, and authored by Dennis L. Weisman, analyzes nonexclusionary price floors, and in particular, the two-sided risk of market exclusion by a VIP that possesses both upstream and downstream market power. Finally, Frank Fagan provides a paper entitled *Lending in China*, which serves as an informal law-and-economics analysis of the Chinese financial system within the context of trading off control and growth.

Each of these papers provides important insights into various aspects of the intersection of law and economics.

THE RIGHT TO BE INFORMED AND THE RIGHT TO BE FORGOTTEN. WELFARE IMPLICATIONS IN PRESENCE OF MYOPIC CONSUMERS

Carlo Capuano,[a] Iacopo Grassi,[b] and Giacomo Valletta[c]

ABSTRACT

We propose a simple model consisting of two separated markets: the market for good y *and the market for good* x*. Purchasing information about consumer behavior in the former market helps the monopolist firm, in the latter market, to price-discriminate. Consumers differ in their income and in their level of myopia. Personal data market regulation could both increase consumers' awareness about the treatment of their data and allow them to have their data erased from the data holder. We find that the former aspect of the policy reduces the number of transactions, and hence tends to reduce total surplus, while the second typically boosts willingness to pay of consumers and has positive effects on surplus, provided that the share of high-income consumers is not too high. The overall effect of regulation on total welfare depends on the share of high-income and myopic consumers.*

JEL Classification: C73; D82; D83

Keywords: Privacy; regulation; data; myopic consumers; sophisticated consumers; price discrimination; surplus

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1. INTRODUCTION

The considerable progress in digital communication technologies has dramatically increased firms' ability to collect their customers' personal data and information about their consumption choices (Acquisti, Taylor, & Wagman, 2016; Bergemann & Bonatti, 2015; Tucker, 2012). Individuals leave a thicker and thicker trail of data behind them (e-commerce, social media and networks, mobile computing, sensor technologies) while increasingly sophisticated tools allow to assemble, harness, and analyze large and complex data-sets (so-called "Big data"). Consequently, firms are now able to target their customers with an unprecedented precision. Moreover, relying on more information enhances the capacity of firms to price-discriminate, and this could, in principle, reduce consumer surplus (Belleflamme & Vergote, 2016) while the impact on total surplus would typically be ambiguous.

Apart from *direct* surplus considerations, the increased capacity of collecting and using large amounts of data has raised concerns about the protection of privacy. Such concerns are partly justified by the fact that internet giants like Facebook and Google, as well as less known data brokers and data intermediaries, have created a very lucrative market based on the collection and the commercial use of personal data. Some of these firms have managed to attain, very quickly, a considerable market power. However, regulatory concerns go well beyond antitrust considerations.

Many consumers may not be aware of the fact that sensible information about their behavior and their tastes is systematically collected, when they simply use the internet (often through free services such as social networks or e-mails), or in other situations. What is more, they may not be aware that this information could be used, without their consent, and against their interest, for commercial or political purposes. Beyond incomplete information, consumers are also afflicted by cognitive and behavioral biases, concerning the protection of their privacy, which may also be detrimental for consumer and aggregate welfare (Acquisti & Grossklags, 2007) providing further ground for privacy regulation.

In light of these considerations, the support for an ex ante and holistic regulation of personal data markets is growing bigger and bigger. This has induced the European Union to approve the General Data Protection Regulation (GDPR) (EU 2016/679) in 2016, having for object data protection and privacy protection for all individuals within the European Union and the European Economic Area.[1]

The main purpose of this regulation is to provide individuals with a greater control over their personal data, while creating a lawful, fair, and transparent process of data collection and processing (Article 5). One of the salient aspects of the GDPR is to provide data subjects with the *right to be informed* (Article 12) from the data holder about the collection, the processing and the use of their personal data. Moreover, the GDPR introduces the so-called *right to be forgotten* (Article 17), also known as right to erasure, that entitles the data subject to have the data holder erase her personal data, ceasing further dissemination of the data, and potentially having third parties halt processing of the data.

In what follows, we build a simple model that helps exposing some of the possible welfare effects, especially in distributional terms, of these two features of

personal data market regulation. We consider two possible markets. In the first one, the monopolist Y produces the *luxury* good y that is exclusively affordable for high-income consumers. In the second market, the monopolist X produces the good x, that is affordable both for low-income and high-income consumers. Moreover, the willingness to pay for x, of high-income consumers, is higher than the willingness to pay of low-income consumers while they are both not observable by firm X. We assume that some consumers are myopic, while the rest of them are sophisticated. A consumer is myopic (or "naive," see Pollak (1976) and Pashardes (1986)) if, unlike a sophisticated or "rational" consumer, she does not recognize the impact of her present consumption decisions on her future ones.[2]

In our framework, a myopic consumer does not understand that revealing information about her preferences, on the market for good y, may have an impact on her surplus when she buys on the other market, provided that the information about her preferences has been transmitted (or sold) by firm Y to firm X.

We first consider the situation where the two firms cannot exchange data about their consumers since a market for consumer data is absent. Then, we consider the situation where firm Y can sell personal data about its customers to X. Obtaining such information, firm X is able to discriminate, at least to some extent, between consumers with a high and a low willingness to pay. More precisely, through direct marketing, firm X can charge a higher price to all the consumers that, buying good y, indirectly revealed their high willingness to pay for good x and charge a lower price to all the other consumers.

In presence of a market for data we find that, in the case of a contraction of the fraction of myopic consumers, both markets X and Y shrink: the volume of transactions is smaller, and this ultimately leads to a reduction in total welfare. This fact has an immediate implication for the situation where the market for data is regulated. Indeed, if one interprets data regulation as a means to increase consumer's awareness (hence reducing the amount of myopic consumers) by fulfilling their *right to be informed*, then regulation leads to a reduction of the size of both markets and has a negative effect on total welfare. Nonetheless, consumer surplus increases in the market for good x, as more consumers are able to buy this good at a lower price since they can avoid price discrimination.

We then focus on another possible aspect of privacy regulation: the *right to be forgotten*. In our framework this amounts to enabling sophisticated consumers to prevent firm Y from selling data concerning them to firm X. We find that, on the one hand, this may increase the demand for good y, with positive effects on Y's profit and consumer surplus. Also in the market for good x total surplus increases, provided that the share of high-income consumers is sufficiently low. Moreover, while consumers benefit from the introduction of the right to be forgotten, as some of them can avoid to be price-discriminated, firm X's profit decreases. Finally, regulation also makes firm X more prone to serve only high-income consumers, since fewer consumers reveal their type. In such a case, the effect of the right to be forgotten on total welfare is unambiguously negative.

In general, the combined effect of both aspects of regulation on total welfare (the sum of consumer and producer surplus across the two markets) is

ambiguous, depending on the share of high- and low-income consumers, the initial share of myopic consumers and how this changes because of the reform.

The closest contribution to our work is the paper by Taylor (2004). He relies, like us, on a model where two companies exchange data about their customers who could be naive or sophisticated (actually in his model either all consumers are sophisticated or all consumers are myopic).[3] However, he does not consider a nuanced regulatory regime like we do: the information exchange between the two firms is either allowed or not. He shows that the consequences of regulation in terms of welfare change sharply if *all* consumers are sophisticated or *all* consumers are myopic. In the former case in particular, regulation is actually not necessary in the sense that it would be against the firm's interest to trade consumer data. Pavan and Calzolari (2009) also consider a similar information-exchange setting but their model only features sophisticated consumers, and they rather focus on the structure of the information transmission mechanism.

Acquisti and Varian (2005) consider a two-period model where sellers are able to track buyers and buyers are able to rely on some technology that allows them to avoid identification. They show that tracking consumers can be beneficial for firms as long as they use the information they have to enhance quality and provide better services. Conitzer, Taylor, and Wagman (2012) also rely on a model where consumers can use a costly anonymizing technology to conceal their reservation price. They show that total welfare is increasing in the cost of the anonymizing technology up to a certain point, then it starts decreasing.

Our chapter also shares some similarities with Taylor and Wagman (2014). Like us they focus of the effects of regulation on the distribution of welfare. However, they rely on a broader definition of privacy regulation (either consumer types are known by firms or they are not) and instead of focusing on the effects of the exchange on welfare of information among firms, they look at how the distributive effects of privacy regulation are shaped by different types of oligopolistic markets.

The chapter is organized as follows. Section 2 introduces the model. Section 3 presents the benchmark scenario where a market for personal data is absent. Section 4 focuses on the welfare effects of the introduction of a market for personal data and the impact of myopia on its functioning. Section 5 focuses on the welfare implications of personal data market regulation. Section 6 concludes. The proofs are relegated to the Appendix.

2. THE MODEL

We consider a population of potential consumers whose size is normalized to 1 (without loss of generality). Such a population is split into two subgroups: a share λ of high-income consumers and a share $1-\lambda$ of low-income consumers. The size of the two subgroups is common knowledge while the consumer type (low or high income) is not observable by firms.

The monopolistic firm Y produces the luxury good y that only high-income consumers can afford. Each high-income consumer buys at most one unit of y whose price is p_y. The indirect utility of a high-income consumer i is

$$U_y^i = \theta_i - p_y, \tag{1}$$

if she buys y, otherwise is zero, with $\theta_i \sim U \in [0, 1]$ denoting i's willingness to pay for y. Obviously, the quantity demanded of y cannot be greater than the number of high-income consumers (i.e., $q_y \leq \lambda$). At the market price p_y there exists a consumer i such that $\theta_i = p_y$, such a consumer is indifferent between purchasing the luxury good or not. Since consumers' willingness to pay is uniformly distributed, the demand q_y for y can then be written as:

$$q_y = \left(1 - p_y\right)\lambda. \tag{2}$$

The monopolist X operates in the market for good x that can be afforded both by low- and high-income consumers. Each consumer buys at most one unit of x whose price is p_x. The indirect utility of a high-income consumer, if she buys x, is

$$U_x^h = h - p_x, \tag{3}$$

otherwise is zero. Similarly, the indirect utility of a low-income consumer, if she buys x, is

$$U_x^l = l - p_x, \tag{4}$$

otherwise is zero. We assume that $h > l > 0$; i.e., high-income consumers are characterized by a higher willingness to pay for x and that firm X cannot observe the willingness to pay of its customers.

The two goods are neither substitutes nor complements. Moreover, for the sake of simplicity, we assume that the marginal costs of both firms are constant and equal to zero. We also assume that neither the firms nor the consumers discount time.

In presence of a market a for data, firm Y can sell the list of its consumers (revealing the fact that they have a high income and hence a higher willingness to pay for x) to firm X at a given price w. Thus, firm Y's profit Π_y is given by:

$$\Pi_y = p_y q_y + w q_y. \tag{5}$$

By acquiring such data, firm X can rely on direct marketing and price discriminates some of the high-income consumers (those who have revealed their type buying good y) from all the other consumers. To put it differently, firm X could charge the price $p_x^D = h$ (with a take-it-or-leave-it offer) to all the high-income consumers who can be singled out thanks to the available data. Firm X could then charge the price $p_x^U = l$ to all the remaining consumers (the high-income consumers who did not buy y and all the low-income consumers). Otherwise firm X could decide not to rely on direct marketing and charge the uniform price $p_x^U = h$, selling its product only to the high-income consumers. Clearly, firm X has an incentive to buy data if and only if its unit price w is lower than the extra profit margin $h - l$ it can obtain thanks to price discrimination; i.e., $w < h - l$.

Summing up, the timing is the following:

- at $t = 1$, firm Y fixes the price p_y of good y, collecting data about its customers;
- at $t = 2$, firm X buys data (or not) from firm Y at a unit price w;
- at $t = 3$, firm X sells its good in the market. It price-discriminates (or not) across consumers relying on the available data.

In our setting, the choices of consumers are shaped by their capacity to make *time-consistent* decisions. More precisely, consumers can be either sophisticated or myopic. A sophisticated consumer correctly anticipates the impact of her current choices on the future ones. A myopic consumer simply assumes that a decision taken at a certain moment in time will not have an impact on future decisions. In our framework this amounts to say that a myopic consumer does not anticipate the fact that, by buying the luxury good y, she will reveal some information about her type so that (if there is some exchange of information between firms) she will possibly face a higher price (because of price discrimination) in the market for good x.

We assume that a share $\mu \in [0, 1]$ of the population is myopic, while a share $1 - \mu \in [0, 1]$ is sophisticated and that being myopic or sophisticated is independent of the level of income.[4]

3. NO MARKET FOR DATA

We first consider, as a benchmark, the case where a market for personal data is absent. Firm Y's profit is then simply

$$\Pi_y = p_y q_y. \tag{6}$$

Plugging Eq. (2) in Eq. (6), we obtain:

$$\Pi_y = p_y(1 - p_y)\lambda. \tag{7}$$

Maximizing the profit with respect to p_y we obtain the following equilibrium conditions:

$$p_y = \frac{1}{2},\ q_y = \frac{\lambda}{2},\ \Pi_y = \frac{\lambda}{4},\ \mathrm{CS}_y = \frac{\lambda}{8},\ W_y = \frac{3}{8}\lambda, \tag{8}$$

with CS_y and W_y denoting, respectively, consumer surplus and total surplus in the market for good y.

In the absence of a market for data, firm X cannot rely on price discrimination so it can only charge the uniform price $p_x^U = \{l, h\}$ to all of its customers. Firm X would decide to serve only high-income consumers if

$$\Pi_x(p_x^U = h) = h\lambda \geq l = \Pi_x(p_x^U = l). \tag{9}$$