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Economic Implications of the Use of Personal Information: Potential Impact of the Digital Platform Companies on Payment Services

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Personal information is actively collected, processed, and transmitted against the backdrop of the digitalization of people's social activities and the rapid improvement of data analysis methods, including artificial intelligence and machine learning. In order for individuals and society to benefit from the effective use of personal information, it is important that a broad range of entities are able to have proper opportunities to use personal information with due consideration to privacy protection. To achieve this goal, self-management of private information is crucial, but not sufficient – there might remain considerable inefficiencies associated with "market failure" and "negative externalities." This article will provide an overview of international discussion of academics and policy makers regarding these issues. In particular, we will illustrate the mechanism, which might generate monopoly power of the digital platform companies, and potential implications of public digital payment instruments in light of eliminating inefficiencies arising from the less competitive market.

Introduction

In recent years, the digitalization of daily life has been advanced substantially as the digital devices such as PCs and smartphones have been widely adopted, and the Internet of Things (IoT) for home appliances and automobiles have grown rapidly. In this situation, personal information is actively collected, processed, and transmitted for a variety of purposes. The use of personal information not only improves the quality of services received by individuals, but also contributes to the economic growth and the social welfare through enhancing innovations and creation of new digital services. This trend has been reinforced by the rapid development of data processing and analysis methods such as machine learning and artificial intelligence.

Against this background, a variety of data-driven business models have been emerged. In particular, the "digital platform companies" has gained much attention in recent years. The platform companies design and operate internet-based platforms for the purpose of fostering trades and information exchanges among participants. Major social networks and online market places are regarded as prime examples of platform companies.

The core feature of the platform business is to establish a mutually reinforcing mechanism where the more activities happen at the platform, the more data the platform company can collect, and then take advantage of the "increasing returns to scale" properties in networking and use of data (further details will be discussed later). In this respect, academics and policy makers have actively discussed a wide range of issues regarding potential side effects of the huge platforms on the competition and the proper use of personal information.

This article is intended to provide an overview of the economic implications of the use of personal information by reviewing recent international discussion. In particular, we will illustrate the mechanism, which might generate monopoly power of the platform companies, and potential implications of public digital payment instruments in light of eliminating inefficiencies arising from the less competitive market.

While this paper will focus on the economic consequences of the use of personal information, needless to say, a multi-faceted approach is necessary when we consider appropriate privacy protection and competition policy. Especially, we acknowledge that privacy is recognized as a right to individual's personality, protecting his or her intrinsic value, in many jurisdiction including Japan. On the other hand, to derive the economic implications, this concept is not applied to the economic literature, generally assuming that privacy has instrumental value, which can be evaluated and measured in terms of utility and then can be comparable with the value of goods and even pecuniary gains.[1]

Benefits and Limitations of Self-Management of Personal Information

In general, information is non-rival while most economic goods are rival. That is, information can be used repeatedly, broadly, and simultaneously as it is not lost when given to others. If it is digitalized, it can be easily duplicated and transmitted. Also, information can be encrypted to allow only specified parties to use. If these properties are jointly leveraged in a well-balanced manner, both individuals and society would benefit greatly from the effective use of personal information.

If individuals enjoy large net benefits through the use of their private information, they will be willing to provide their own personal information with firms at low price or even for free, and it will be possible to reach an equilibrium where personal information is shared broadly and utilized effectively at a society level.[2] Also, if people are not eager to provide their information, firms can offer compensation to offset this resistance. In this case, individuals can decide whether to provide information by weighing the disutility of providing their private information against the price that firms offer, and as a result, an appropriate supply of personal information can be realized for a society as a whole (Chart 1).[3]

However, a number of conditions should be satisfied to ensure that personal information is adequately supplied to a society and that individuals are rightly compensated for providing their information. In this regard, the most important condition which we should consider first is to what extent individuals are able to manage their own personal information by handling whether, how, and who to utilize their information. Additionally, it is also important to consider to what extent an appropriate self-management of personal information is conducted by individuals.

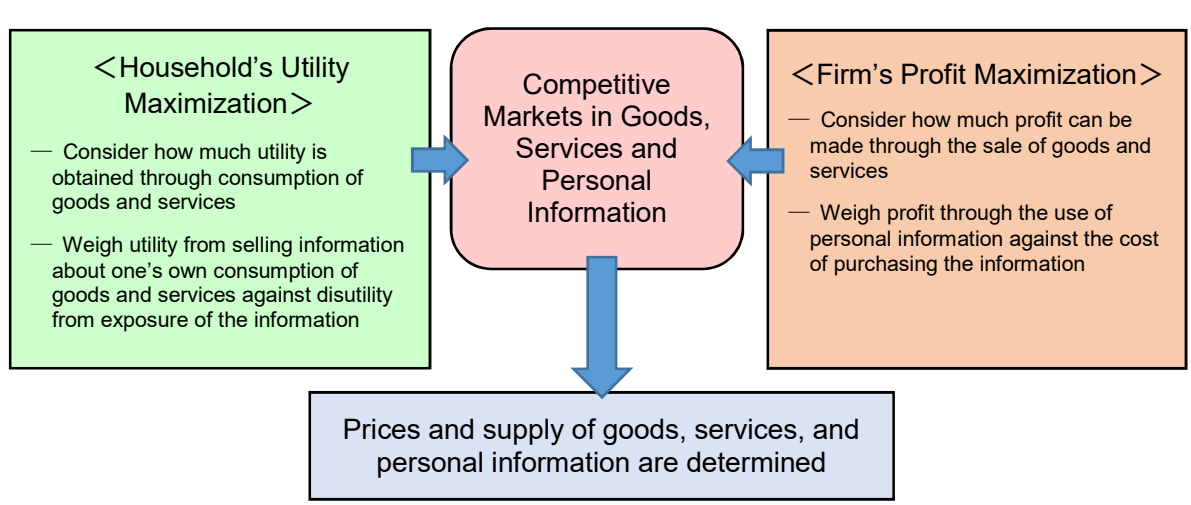
For instance, if all personal information was managed by firms, they would have little incentive to share their database with other firms, and as a result, personal information would not be fully utilized in a society.

Moreover, an efficient self-management of personal information is not easy in practice. Individuals are often unaware of the value of their personal information or, to enjoy attractive services, they tend to share their information easily with the service providers without thinking seriously about the price of their personal data. In such cases, the compensation for the provision of information received by the individual is underpaid.

Furthermore, in fact, appropriate compensation to the individual and an efficient supply of personal information to a society are not achieved only by the efficient self-management.

For example, if a market for trading personal information is not in place, the appropriate compensation cannot be realized due to a limited price competition among firms.[4] In addition, depending on the type of personal information, effective data analysis can be done only after a certain amount of personal information is put together. While one customer's data can only be used to analyze the preferences of that customer, by combining data from many customers, it is possible to analyze demand trends representing the entire market, greatly expanding the scope of its

[Chart 1] Supply and Demand of Personal Information under a Competitive Market Mechanism



Note: Prepared by the authors based on Jones, C. I., and Tonetti, C., [2020].

utilization. As a result, the large part of the revenue obtained from the utilization of the information often belongs to the company that collects and integrates the information, not to each individual who is the fundamental source of the information. In this case, the compensation to the individual is limited.[5]

Besides, in order to obstruct the collection of information by its rivals, a firm can add a premium to the price of the personal information on the condition that the individual restricts the supply of information to other firms. Under this strategy, an optimal transaction is achieved between the parties involved, but personal information is under-supplied with a society as a whole.[6]

Also, if a core service is operated by a monopolistic firm, individuals may feel virtually forced to provide a large amount of personal information at a low cost in exchange for use of the service, even when data subject's consent is officially required. In this case, there will be oversupply of personal information.

In the next section, we will focus on this case and explain the mechanism of monopoly by platform companies and its implications for the use of personal information.

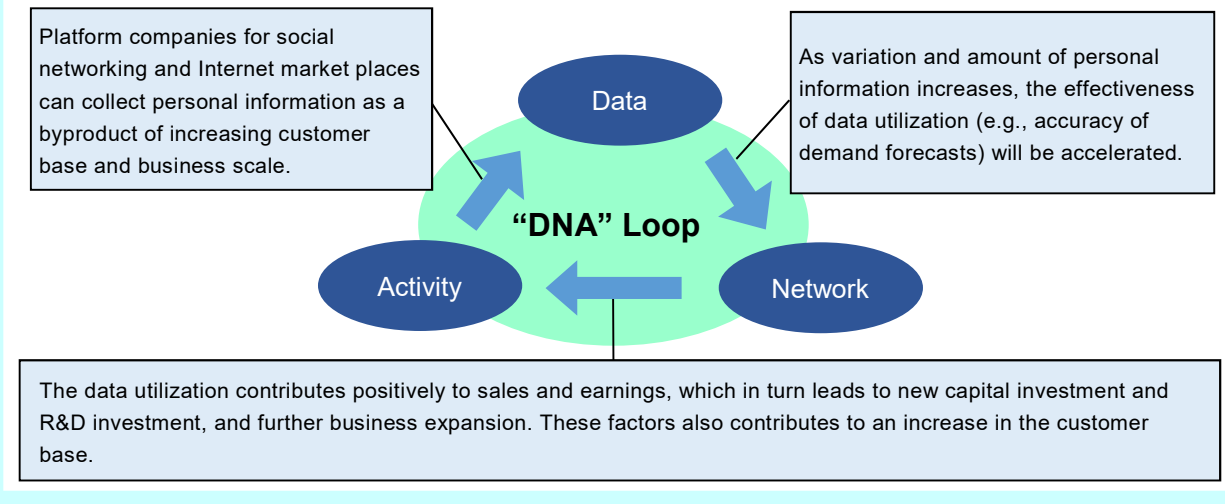
Mechanisms behind a Monopoly by Platform Companies and Oversupply of Personal Information: the DNA (Data-Network-Activity) Loop

Discussions in academia and among policy makers point to the collective "economies of scale" as a key driver for the monopoly or oligopoly of the large platform companies such as the major social networks and the internet shopping sites. That is, from the standpoint of the infrastructure business that manages the platform, the operating cost per customer decreases as the number of customers increases. In terms of data collection and utilization, the integration of a large amount of personal information can lead to more efficient utilization. In addition, the more customers there are, the more active interactions will take place between them, making the platform more attractive, which in turn will contribute to further customer growth. These "economies of scale" are interconnected starting from the platform's business model, which allows for the acquisition of large amounts of customer data as a byproduct of business scale expansion.

In other words, by collecting and integrating a large amount of personal information, platform companies accelerate the effectiveness of data utilization, which leads to improved service quality, business efficiency, and business expansion, raising the attractiveness of the platform and increasing the number of customers. This finally generates a loop that leads to further accumulation of personal information and business efficiency. This mechanism is often referred to as the "DNA loop," an acronym for Data, Network, and Activity (Chart 2).[7]

In markets where "economies of scale" are at play, it is likely to result in monopolization. If a monopolistic platform company simply tries to maximize its profits, (1) the supply of services will be under-supplied due to the monopolistic pricing of service, and the exclusive access to the user information with strong customer retention strategies will be a major barrier to entry, which will hinder the efficiency of resource allocation. In addition, (2) consumers' bargaining power will be reduced, and they may be forced to provide a large amount of personal information at a low price to the platform company in order to use the service.

[Chart 2] "Data-Network-Activity" Loop



Monopolistic Platform Company in the Digital Payment Services and Public Digital Payment Instrument

We can also see a discussion assuming the situation where the "DNA loop" occurs and a monopolistic platform company emerges in the digital payment services. In this case, the payment services available to individuals will be a combination of the private payment service provided by the monopolistic firm and cash as a public payment instrument. At this point, the less attractive cash is, the more serious the inefficiencies in resource allocation and underpayment for personal information will become. The reason is as follows.

The monopolistic platform company raises the fees for its services to the level at which people would stop using the payment service and shift to cash. In this case, the payment service is under-supplied due to the higher service fees, resulting in the inefficiencies in resource allocation.

At the same time, the monopolistic firm will reduce the compensation for payment information provided from customers to the lower limit (Chart 3(i)). Furthermore, a wide range of services based on the payment service infrastructure (e.g., targeted advertising) will either be operated exclusively by the monopolistic platform company or outsourced to affiliated companies in the same group.

Against this mechanism, it is argued that a public digital payment instrument that offers the convenience of digital payments, low usage fees, and privacy protection would be effective in reducing the inefficiencies and raising the compensation for individuals.[8]

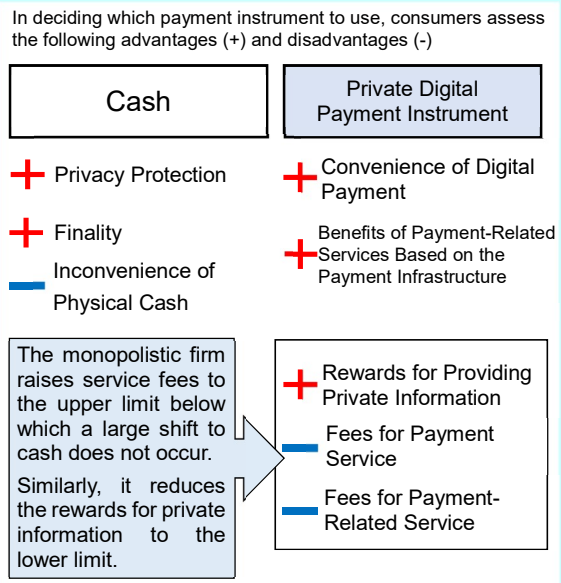
With a public digital payment instrument, the monopolistic platform company would need to lower usage fees and raise the price for providing personal information in order to prevent a large shift to the public digital payment instrument. In addition, by widely opening up the public digital payment infrastructure, a level playing field can be achieved for services leveraging that infrastructure.[9] It is also expected to contribute to easing barriers to entry, since there is no need to operate a settlement service infrastructure as a foundation for such payment related services.[10] In this case, the supply of services will increase and usage fees for the service will decrease, thus improving the efficiency of resource allocation (Chart 3(ii)).

Needless to say, the implications of public digital payment instruments must include a variety of factors not considered in the simple framework above, and conclusions are likely to vary from jurisdiction to jurisdiction.[11]

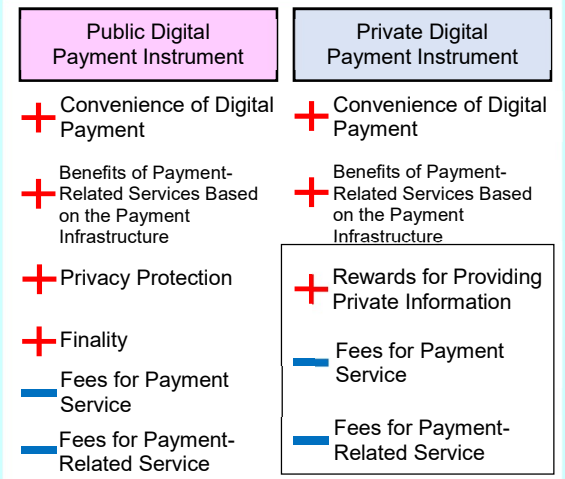
In addition, the actual ecosystem of the payment services market is considerably more complex and multi-layered than assumed in the above discussion. In Japan, for example, in addition to the large amount of cash in circulation, many private digital payment services coexist, and bank transfers are also widely used. Consumers choose which payment service they use depending on the purposes, and so far, it does not appear that a platform company is rapidly monopolizing private payment services with the "DNA loop."

[Chart 3] Monopolistic Private Digital Payment Service and Public Payment Instrument

(i) Cash and Private Digital Payment Instrument



(ii) Public and Private Digital Payment Instruments



Note: Prepared by the authors based on Garratt, R., and Lee, M., [2021].

However, looking to the future, it should be noted that this may become an important policy issue depending on the development of structural changes in the payment services market, including business strategies of the global platform companies.

Oversupply of Personal Information due to Negative Externalities

In academia, it is suggested that even if the self-management of personal information and a competitive market environment are both achieved, the "negative externalities of personal information" would lead to oversupply of personal information and extremely low compensation for the provision of information.[12]

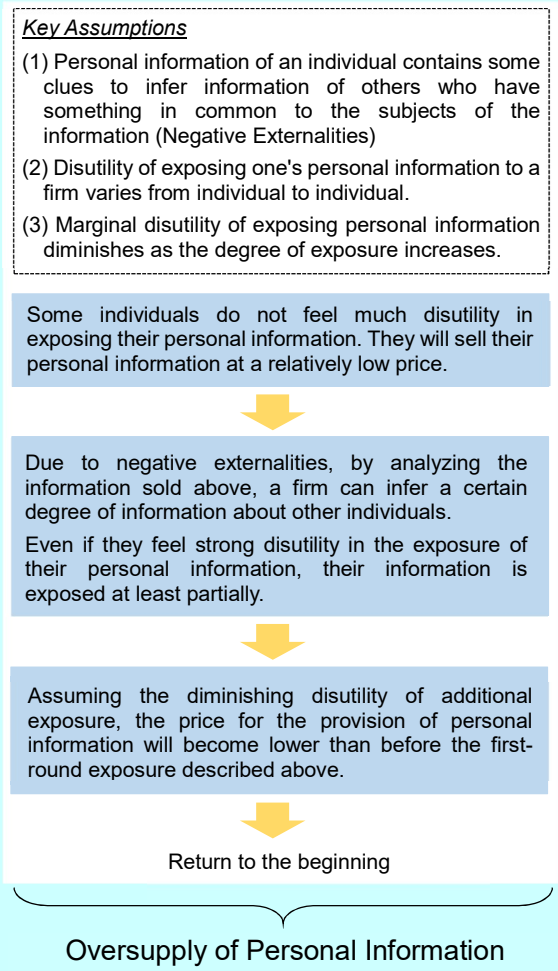
The "negative externality of personal information" refers to the property that personal information may contain not only knowledge about the subjects of the information, but also clues for information about other individuals who have similar features to the subjects in some respects. With the negative externality of personal information, once someone provides personal information to a firm, that firm could infer personal information of a group of people who have something in common to the subjects of the information.

Assuming that the marginal disutility of exposure of personal information diminishes (the more one's personal information is exposed, the lower the disutility of the exposure of additional information becomes), the group of people would provide their own personal information more easily, even at a lower price. In this way, personal information is increasingly provided in a chain reaction, and eventually all personal information of individuals who are related to others in some way is completely shared by firms (Chart 4). For individuals who are aware of this mechanism, it is rational to voluntarily provide information as soon as possible, even at a low price, before their personal information is exposed through other people.

To prevent this mechanism from occurring, it is necessary to reduce the negative externality of personal information. However, at this point, only some conceptual ideas are proposed, including imposing a person-specific tax on the individuals who are highly correlated with a wide range of others and removing hints about other people's information from the subject's personal information ("De-Correlation.")

The legal discussion about the personal data protection in various jurisdictions and the research on data anonymization seem to focus primarily on each individual's "own" personal information. These efforts include ensuring the individual's right to control the use of his or her information and the use of information on the ground of socially accepted norms, as well as developing methodologies that enable data uses without identifying the data subjects directly or even indirectly. But, the mechanism of oversupply of personal information caused by the "negative externalities of personal information" has appeared to be less focused.

[Chart 4] Mechanism of Oversupply of Personal Information due to the Negative Externalities



Conclusion

Nowadays, personal information is one of the main inputs for many companies to add value. Looking to the future, with the increasing digitalization of our lives and the development of data collection and analysis technologies, there are growing expectations for the appropriate use of personal information from the perspective of economic and social development. However, in order to achieve an effective use of personal information throughout the society and to compensate individuals for their commensurate privacy costs, it is necessary to clear various hurdles

caused by market failures and externalities.

Furthermore, the internet ecosystem, business models and information technologies are expected to change constantly. For example, rather than having a centralized structure in which personal information is aggregated by a platform company, there is a growing effort to create a decentralized framework based on the distributed ledger technology and other means to control and distribute personal information by each individual.

This trend is sometimes described as "Web3," the next stage after "Web1" at the dawn of the Internet and "Web2" at the present time where the large-scale platform companies have a prominent presence. There is a great deal of uncertainty at this point as to what the structure and business models of the digital industry will look like in the "Web 3" world, but academia and policy makers should continue to discuss appropriate policy responses in light of these structural changes.

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[1] For surveys of the economics of privacy, see the following references.

Uno, Y., Sonoda, A., and Bessho, M., [2021] "The Economics of Privacy: A Primer Especially for Policymakers," Bank of Japan Working Paper Series No. 21-E-11

Acquisti, A., Taylor, C., and Wagman, L., [2016] "The Economics of Privacy," Journal of Economic Literature, 54(2), 442-492.

[2] For example, Ichihashi, S., [2021] "Competing Data Intermediaries," RAND Journal of Economics, RAND Corporation, 52(3), 515-537, argues that even when a consumer enjoys a positive benefit from the commercial use of his or her personal data, data intermediaries cannot offer a negative compensation due to the competitive market mechanism among intermediaries, leading to the consumer's surplus.

[3] See, for example, the discussion in Jones, C. I., and Tonetti, C., [2020] "Nonrivalry and the Economics of Data," American Economic Review, 110, 2819-2858. Note that the paper assumes that there are no negative externalities of personal information and that personal information is not used in discriminatory pricing strategies targeting the data subject.

[4] For a survey of markets for information, see the following reference.

Bergemann, D., and Bonatti, A., [2019] "Markets for Information: An Introduction," Annual Review of Economics, 11, 85-107.

[5] For example, Arrieta-Ibarra, I., Goff, L., Jiménez-Hernández, D., Lanier, J., and Weyl, E. G., [2018] "Should We Treat Data as Labor? Moving beyond 'Free'," AEA Papers and Proceedings, 108, 38-42. states that when individuals do not have bargaining power over companies that integrate their data, a "data labor union," which makes a group decision about whether to provide information of the union members, could lead to improving bargaining power of individuals and as a result, compensation for the information.

[6] Apart from the privacy costs, if individuals expect that information about their preferences will be used for discriminatory pricing strategies and an expected loss from the renewed pricing will be larger than compensation for providing their private information, individuals also have an economic incentive not to provide information. However, according to Goldfarb, A., and Tucker, C., [2019], "Digital Economics," Journal of Economic Literature, no. 1, the strategy of offering separate prices to each customer is not well implemented in the online markets, and private information is often used to display web advertisements in line with the preference of the subject.

[7] See, for example, Carstens, A., [2021], "Public Policy for Big Techs in Finance," speech at the Asia School of Business Conversations on Central Banking webinar, "Finance as Information".

[8] See the discussion in Garratt, R., and Lee, M., [2021], "Monetizing Privacy with Central Bank Digital Currencies." Available at SSRN: https://ssrn.com/abstract=3583949.

[9] Needless to say, a level playing field for payment-related services will not be immediately achieved only by introducing public digital payment instruments. In particular, we should also take account of various institutional environments, including industry-specific regulations (e.g., prohibition against banks conducting other businesses).

[10] This view has also been noted in publications by major central banks. For example, the Board of Governors of the Federal Reserve System [2022], "Money and Payments: The U.S. Dollar in the Age of Digital Transformation," Research paper, argues that one of the potential benefits of a central bank digital currency is that it could help create a level playing field in terms of allowing smaller firms to participate in payment-related services, which could lead to increased innovation in the payments sector. Also, Monetary Authority of Singapore, Economic Policy Group [2021], "A Retail Central Bank Digital Currency (CBDC): Economic Considerations in the Singapore Context," Monographs/Information Papers, also states that the platform for the central bank digital currency could help private firms to provide new payment-related services ("payment-adjacent" services). The report also points out that start-ups and small firms benefit from the opening up of the platform given that traditional payment services require the fixed cost of building payment infrastructure.

[11] For example, the impact on the financial system of a massive shift from private bank deposits to public digital payment instruments is also an important issue.

[12] For detailed discussion about the mechanisms by which negative externalities lead to oversupply of personal information, see the following references.

Acemoglu, D., Makhdoumi, A., Malekian, A., and Ozdaglar A., [2019], "Too Much Data: Prices and Inefficiencies in Data Markets," NBER Working Papers, 26296 (Forthcoming at American Economic Journal: Microeconomics).

Choi, J. P., Jeon, D., and Kim, B., [2019], "Privacy and Personal Data Collection with Information Externalities," Journal of Public Economics, 173, 113-124.

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