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DIGITAL IDENTITY AS A PLATFORM OF PLATFORMS: INVESTIGATING BANKID'S EFFECT ON SWEDISH ORGANIZATIONS

Research in Progress

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Abstract

Digital Identity Management Platforms (DIMPs) hold considerable promise for organizations to digitalize processes and in so doing reduce costs and increase efficiency. However, while there is considerable computer science and practitioner literature on DIMPs' design and use, we know little about how (and if) they live up to this promise. We thus examine the performance effects of Sweden's BankID on adopting organizations, using data from 2012-2018 from BankID and the Swedish Companies Registration Office. We understand BankID as a platform of platforms that confers benefits by making third-party platforms interoperable with the state identity system and banks, but expect that benefits accrue only when a sufficiently large number of individuals and organizations adopt the platform (network effects). We find support for the hypotheses that organizations with more liquid assets and higher spending on innovation were positively affected by adopting BankID, while organizations with more fixed assets were negatively affected.

Keywords: Digital Identity, Platform of Platforms, Platform Ecosystems, BankID, Sweden

1 Introduction

Digital identity management platforms (hereafter DIMPs) have long been of interest for researchers—in issues as diverse as the different forms of digital identity (Buell and Sandhu 2003; Ingram Bogusz 2018), the security weaknesses associated with them (Alpár et al. 2013; Camp 2004), and optimal methods for identity data storage and verification (Dunphy and Petitcolas 2018; Yang and Li 2020). Examples of DIMPs include national DIMPs, for instance Aadhaar in India and the National Integrated Identity Management System (NIIMS) in Kenya, and BankID in Sweden and Norway, and self-sovereign DIMPs like Civic and Datacoup. Their importance has already been underlined in the information systems literature, as scholars have suggested that digital identity should enable the “*digitization of customer processes, internal efficiency gains and reduced costs*” (e.g. Eaton et al., 2014, p. 223). However, and despite the significant scholarly attention to the *design* of DIMPs and the expectation that they will confer benefits, it is striking that we do not know either the extent or the mechanisms by which organizations can benefit from them (although see Eaton et al. 2014; Masiero and Arvidsson 2021). Indeed, the existing accounts of the value and benefits of DIMPs in the countries where they operate at scale (largely in the Nordics, see e.g. in Finland, Bazarhanova et al. 2020 and Norway, Eaton et al. 2014) do not make use of data from the DIMP provider themselves.

From the perspective of individual users, DIMPs allow these individuals to not only create and maintain a unique identity online, but also to verify that they are who they say they are, when, for instance, they execute a transaction or sign a contract (Ingram Bogusz 2018; White et al. 2019). From the perspective of organizations that integrate user-facing DIMPs into their platforms, they can better identify and contract with customers and employees alike (Lumineau 2014). In so doing, transaction costs are reduced for both individuals and organizations (de Reuver et al. 2018). However, the mechanism that reduces transaction costs differs from extant studies of transaction

platforms. While some DIMPs may serve as boundary objects for other platforms, for instance a two-step-identification to log into Facebook or LinkedIn (Buell and Sandhu 2003), others DIMPs might more accurately be thought of as being *platforms of platforms*, rather than stand-alone transaction platforms. A platform of platforms does not merely mediate interactions between multiple actors — including both individuals and organizations (see de Reuver et al. 2018) — but rather enables interactions across multiple platform ecosystems, making them interoperable (Zhang and Williamson 2021). While a platform relies upon attracting many users to realize network effects (and thus their effects can only be realized once this platform operates at sufficient scale, see also Gregory et al. 2020 and Paquin and Howard-Grenville 2013), a platform of platforms can reduce transaction costs by integrating a sufficiently large number of platforms.

This need for scale measured in terms of number of platforms, rather than number of users (e.g., Huang et al. 2017) explains why, empirically, we know so little about DIMPs that have achieved the scale required to operate as platform of platforms: there simply aren't many of them to study, and those that there are (e.g. in Finland, see Bazarhanova et al. 2020 and Norway, see Eaton et al. 2014) have not made their data available for analysis by external researchers. This paper, however, focuses upon and investigates the economic effects of one platform of platforms that has achieved this scale: BankID in Sweden. To quote one interviewee: *"BankID is the key for everything [in Sweden] ... the whole society relies on BankID, regardless if it's just state agencies or if it's a private company..."* (Interview, 02.2022). Of the 8.4 million adults in Sweden, approximately 8 million of them have an active BankID profile, allowing them to identify themselves, as well as authorize interactions associated with the exchange of data and funds on platforms. In our data, we identified 117,884 organization-year observations who actively used BankID from 2012 to 2018. This case therefore serves as an extreme case that is illustrative for others interested in platform of platforms, and digital identity (Flyvbjerg 2006).

Consistent with this framing, we therefore ask two questions: (1) *How does the adoption of a digital identity management platform affect the performance of an organization?*, and subsequently (2) *Which organizations benefit more from the adoption of a digital identity management platform?*

These research questions form the first part of a research project that examines, first, the extent to which a DIMP, in this case BankID, positively affects organizations—and which ones. However, it also informs the second part of our project—around the mechanisms whereby this occurs. Our initial interviews and examination of extant literature on DIMPs suggests that the mechanism(s) whereby value is created derive from a DIMP's scale, measured in terms of number of platforms and extent of reliance. However, questions remain around whether adoption timing by an individual platform makes a difference (e.g. Paquin and Howard-Grenville 2013), whether industries are affected differently (e.g. McIntyre and Srinivasan 2017), and whether there are gains—for instance ones of work quality or convenience—that are not captured in organizations' financial results but might be captured in qualitative data instead. Moreover, we do not know what happens once all organizations adopt a DIMP—does it become a hygiene factor, or something else?

We use a novel dataset of organizations who actively use BankID in Sweden, a DIMP that has largely solved the issues that past literature has largely focused upon including trust-building, user acceptance, and scaling (Dhamija and Dusseault 2008). In addition, we combine that with a dataset from the Swedish Companies Registration Office from 2012-2018. This enabled us to hypothesize, test, and determine how the use of BankID's services affected the performance of the adopting organizations, comparing them against comparable organizations that had not adopted BankID. We subsequently develop our hypotheses, present our results, discuss their implications and limitations, as well present opportunities for future research.

2 Background: From Platforms to Platform of Platforms

That platforms are of significant economic advantage to their owners is well-established in the literature (Evans 2003; Rochet and Tirole 2003). They do this by occupying an intermediary role that facilitates either innovation or transactions between actors on either side of the platform (Bonina et al. 2021; Cusumano et al. 2019), while also reducing transaction costs. While innovation platforms provide, and charge for, functionalities that can be recombined to create innovative new products and services, transaction platforms reduce the friction between transacting parties, and charge a fee for this service (de Reuver et al. 2018). Of particular relevance for a digital identity platform is that friction is reduced by allowing both parties the ability to verify the other's identity.

However, a digital identity management platform (DIMP) — unlike e.g. Alibaba or Amazon—does not orchestrate the transaction itself. While extant understandings of transaction platforms focus on transfers of information (Cusumano et al. 2019) and financial transfers (Eaton et al. 2015; Gawer 2020), a DIMP does not make any direct transfer, but rather orchestrates the verification process in order to facilitate a transfer in which it is not involved, to which it serves as an intermediary. A DIMP acts as a transaction cost-reducing meta-artefact that allows that platform to exchange data with other platforms, in this case between organisations and both banks

and state agencies. The benefit of signing up for BankID, from both the individual and organizational point of view, increases as others sign up for it, and all parties derive network effects (Gawer 2014). Elsewhere these network effects have led to platform dominance, and even monopoly (Bonina et al. 2021).

2.1 Digital Identity in Practice

There are two crucial features that allow us to identify multiple kinds of DIMPs: interoperability and verification scope. On the interoperability front, some allow an individual to identify themselves only on one platform (e.g. to log into only Netflix), while others can be used to identify oneself across multiple platforms (e.g. using a Google identity to identify oneself on multiple platforms) (Dhamija and Dusseault 2008). On the verification scope front, one can distinguish between two extremes around the identity being verified: on the one end one can identify oneself as the owner of an account, for instance by using two-step verification or a password (as is the case with both Google and Netflix). On the other end, a DIMP can be used to confirm not just that one is an account holder, but one's identity as an individual, linking that to a national identity document or similar (e.g. Aadhaar in India and the National Integrated Identity Management System (NIIMS) in Kenya, see Ingram Bogusz 2018 for further examples).

BankID in Sweden is unusual in that it has largely overcome early teething problems and is not only a DIMP with a state-verified identity, but also interoperable as a significant platform of platforms. Based on exploratory interviews, the reasons for this are related to, first, their timing—they came to market as the both the Swedish financial and public sector were digitalizing in the early 2000s—and, second, related to the manner of its development and later delivery. In particular, BankID was developed through encouragement by the Swedish state, although it was not sponsored or owned by them. The resulting service was then sold and made available to both business and private customers via Swedish banks. The result was that banks began to offer it early, although not all at the same time, and Swedish state agencies were among the very first users of the services—providing an incentive for private users to use BankID while accessing public services. This made non-organizational users of BankID comfortable with, and accustomed to, the service—paving the way for wider adoption when BankID was made available to non-public actors from 2009 onwards (see Grönlund 2010).

While extant literature points to pre-adoption concerns around trust building and user experience (Dhamija and Dusseault 2008) to post-adoption concerns around DIMPs' security in the face of data leaks (Alpárr et al. 2013), these are largely non-issues in the Swedish context in which this paper is set. Instead, there is not just speculation that DIMPs might be a boon for businesses and users insofar as they reduce transaction costs online, but there are actually data on what the economic effects of using BankID are for other organizations' platforms, here captured through the performance of the organizations that own those platforms.

3 Hypothesis Development

Transaction cost economics suggests that cooperation not only reduces transaction costs (Gulati 1995), but also allows organizations to focus on their relative advantages (Parkhe 1993). However, when it comes to IT, and specifically where IT adoption is part of a bandwagon, and thus its benefits also available to competitors, that the effects might be negligible or even counter-productive (Salancik and Pfeffer 1978). What is crucial, therefore, to understand is to whom benefits do and do not accrue, and why.

The first step in making sense of this lies in examining whether organizations that made use of BankID, irrespective of the purpose for which they make use of it, perform better than their non-BankID-using counterparts. To capture this relationship, we can compare organizations that adopt BankID against those who do not, allowing us to capture the extent to which BankID offers a “relative advantage”, defined as “the extent to which an innovation is perceived as being better than its precursor” (Moore and Benbasat 1991, p. 195). Both the reduction in transaction costs for an organization, and the possibility of added benefits due to network effects generated by an organization's association with BankID can make it easier for a customer to initiate and execute a transaction with the focal organization, and serves as a backdrop for our hypothesis development.

3.1 Fixed and Liquid Assets

In general, organizations invest in fixed assets, for instance machinery or buildings, as a way to expand their capacity and fortify their position in relation to rivals (Dixit and Pindyck, 1994). However, fixed assets are typically not liquid: they limit an organization's flexibility, and its ability to maneuver in the face of technological changes. In the absence of significant technological shifts, we expect organizations who invest in fixed assets to perform better than organizations with more liquid assets. This is because organizations with more liquid assets

have not invested their capital in production or market-expanding capabilities, but rather held on to their financial capital.

Therefore, we hypothesize that:

H1A: Organizations will derive higher operating profit when they have high fixed assets.

H1B: Organizations will derive lower operating profit when they have high liquid assets.

3.2 Innovative Organizations

Investment in research and development is generally considered to be a good proxy for innovation activities (Kleinknecht et al. 2002), and generally captures both product/service innovation, and process innovation. In general, innovation is linked to improved firm performance because of a firm's ability to develop new products and processes, and with them both revenue and profit margins (Camisón and Villar-López 2014; Piening and Salge 2015). Therefore, we hypothesize that:

H2: More innovative organizations will derive higher operating profit.

3.3 Digital Identity Management Platform and Assets

Organizations with more liquid assets typically have more operational flexibility (Ortiz-Molina and Phillips 2014), which means that they should be better able to re-organize their operations when a significant innovation, in this case BankID, significantly changes their business conditions (Maksimovic and Phillips 2001). In contrast, organizations with more fixed assets are less able to change their business models or rearrange resources in their operations (for instance, machinery or other assets), including when business conditions change.

In contrast, organizations with more fixed assets are less flexible. While they are able to adopt BankID, they might not be able to make the necessary changes in their business model, or adapt their products or internal processes to fully benefit from BankID. Moreover, BankID is (mostly) open to all: where one firm in an industry can adopt it, so too can others. The usefulness of BankID therefore lies in their ability to translate that adoption into a relative advantage through product and/or process innovation. Organizations with more liquid assets are typically better placed to act more flexibly.

Therefore, we hypothesize that:

H3A: The adoption of BankID will reduce the operating profit of organizations with more fixed assets.

H3B: The adoption of BankID will increase the operating profit of organizations with more liquid assets.

3.4 Digital Identity Management Platform and Innovation

Innovation has been shown to improve organization performance by facilitating product and process innovation (Camisón and Villar-López 2014; Piening and Salge 2015). Innovations that are open to everyone reduce any relative advantage that accrues just by adopting an innovation (so, in this case, just by adopting BankID), so the ability for an organization to turn BankID adoption into a relative advantage rests on other factors (Koellinger 2008). In this case, we hypothesize that:

H4: The adoption of BankID will increase the operating profit of innovative organizations.

4 Setting and Study Design

Our framework and hypotheses are summarized in Figure 1. To test our hypotheses, we used data from the first, and dominant, DIMP in Sweden, BankID. Started in 2003, BankID offers a digital identity service that allows individuals to verify their identity and authorize financial transactions. The limited liability company behind the service, Finansiell ID-Teknik BID, was started by a consortium of Nordic banks, in response to a request from the Swedish state. Although BankID does identity authorization, it does not sell services directly to end-users (whether individuals or organizations). Instead, a Swedish bank both verifies the identity of a would-be customer and facilitates access to BankID. BankID, in turn, has operating agreements in place with all Swedish banks. At first, some banks offered their own, competing, digital identity services. However, by 2022, BankID had become the *de facto* standard. Individual users can use BankID to verify themselves, while organizations can obtain BankID to integrate into their own platforms for users (both individuals and employees) to identify themselves. Our data focuses on the latter, the organizations who make use of BankID as part of their own platform—whether

to verify identity or to execute a financial transaction, or both. We then compare these organizations against comparable organizations who did not make use of BankID, identified from the Swedish Companies Registration Office data.

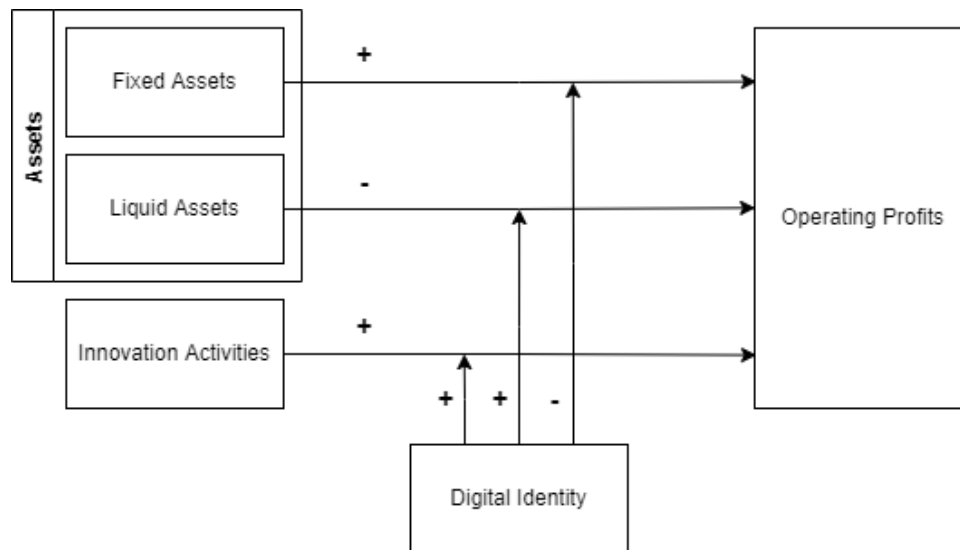


Figure. 1. The Effect of a Digital Identity Management Platform on Organization Performance

Exploratory interviews pointed to the fact that this federated set-up meant that BankID could focus on providing the technical service, while banks could make use of their already-established processes for vetting customers: including when it comes to complying with Know Your Customer and Anti-Money Laundering regulations in Sweden and the European Union.

A precondition for BankID is that Sweden operates a full population registry. That is, everyone who is resident in Sweden receives an identity number from the Swedish Tax Authority either on birth or at the registration of their immigration to Sweden. This identity number is needed for everything from obtaining health care to registering children for schooling and adults for social benefits—and, of course, for paying taxes. It is on the basis of this identity number, and an associated Swedish-issued identity document (e.g. a passport, citizen’s identity card or non-citizen’s identity card), that a bank will issue an individual login details to BankID.

Although BankID was initially set up by a subset of Swedish banks, it was initially used primarily by state agencies, including the Swedish Tax Agency and the Swedish Social Insurance Agency, for access to social benefits and to digitally authorize and sign tax returns. This was possible from as early as 2005, and it is thought that in 2021 the majority of adult Swedes signed their tax return using BankID. In 2010, it became possible for private organizations to sign up to allow their users (and employees) to use BankID to authorize their services. While the first version of BankID was a desktop-only version, in 2011, a mobile version was released, and in 2012 a peer-to-peer payment service called Swish, also started by a consortium of banks, is released, reliant on BankID.

In sum, this constituted an ideal site to examine the economic effects of adopting this platform of platforms for other platform operators, as 95 percent of adults in Sweden, or around 8 million individuals, had obtained access to BankID through a bank. As a result, BankID is today close to ubiquitous among Swedish private organizations, meaning that BankID has established the scale, and network effects, needed for it to operate as a platform of platforms.

4.1 Data and analysis

To understand the effect of platform of platforms, in this case BankID, we combined two sources of data. The first source was a list of 117,884 organization-year observations who actively use BankID, from 2012 to 2018. Our data from BankID were aggregated at the organization level to preserve the privacy of individual users. The second source of data was the Swedish Companies Registration Office, containing 1,299,323 Swedish organizations, which were aggregated at the year level. We constructed a panel dataset containing yearly indicators for each of the organizations of interest. We undertook 6 exploratory interviews with both BankID and organizations which used it to understand the implications of our quantitative data. Two of the interviews were

with BankID employees, one of whom worked at the organization in the early 2000s. Three interviews were with banks who offer BankID, and one was with a Swedish state agency that was one of the earliest adopters of BankID. Interestingly, the individual responsible for the agency’s adoption in 2003 was still working for the agency and available for interview. The interviews were 40-60 minutes long, and in either English or Swedish. Notes were taken during the interviews and we will in future transcribe them fully, together with planned future interviews.

We used the annual *operating profit* of each organization as our dependent variable and as a proxy for the organization’s performance. For our independent variables, we examined the annual i) fixed assets, ii) liquid assets, and iii) R&D expenditures of each company. Similar to past work, R&D expenditures was used as a proxy for the innovativeness of a focal organization (Kleinknecht et al. 2002). To ensure that our results were not due to other factors, we used Propensity Score Matching (PSM). PSM is a statistical matching technique that attempts to estimate the effect of an intervention, attempting to reduce plausible biases in estimations (Rosenbaum and Rubin 1983)

PSM used three variables that enabled us to create a more balanced dataset were each of the organizations that had adopted BankID’s services was matched with organizations that were as similar to them as possible. First, the Swedish Companies Registration Office classifies organizations into 11 branch sectors including IT & Electronics, Telecom & Media, as well as Industrial Goods. Second, we differentiated between organizations of different size, where organizations were classified in 9 different categories depending on their overall *number of employees* (where size has previously been observed to affect the likelihood of digital technology adoption, see e.g. Chan and Ngai 2007). For instance, organizations that had less than 5 employees were separated from organizations that have at least 5 but less than 10 employees. Third, we also accounted for the number of years that an organization had been operating.

Finally, in our analysis, we employed linear fixed effects models to account for potential heterogeneity within the organizations examined due to their location and years in business. To achieve this, we used data on the County in which an organization was based, and the year in which an organization was first registered.

5 Initial Results

Pertinent to Hypothesis 1, our results show that organizations with high fixed assets will derive higher operating profit, while organizations that have high liquid assets will derive lower operating profit, thus supporting H1A and H1B. The positive and significant coefficient of the effect of R&D Expenditures on Operating profit suggests that innovative Organizations will derive higher operating profit (H2). In relation to our third Hypothesis, we found that the adoption of a digital identity service by organizations with high fixed assets reduced their operating profit, while increasing the operating profit of organizations with more liquid assets. Finally, we found that the adoption of a digital identity service amplified the operating profit of innovative organizations. We next discuss the implications of our work and findings, its limitations, and opportunities for future research. Our results are summarized in Table 1.

| Operating Profit | | Estimate |
|--|-----------------------------------|--------------|
| | Constant | 15986.027 |
| | Digital Identity | 21090.470*** |
| H1A | Fixed Assets | 0.011*** |
| H1B | Liquid Assets | -0.0322*** |
| H2 | R&D Expenditures | 0.433*** |
| H3A | Digital Identity*Fixed Assets | -0.033*** |
| H3B | Digital Identity*Liquid Assets | 0.349*** |
| H4 | Digital Identity*R&D Expenditures | 0.434*** |
| Fixed Effects | Branch Sector | ✓ |
| | Registration Year | ✓ |
| | County | ✓ |
| | DF | 68 646 |
| | F-stat | 835.3 |
| | Adjusted R² | 0.55 |
| N=117,884; ***p<0.001; **p<0.01; *p<0.05 | | |

Table 1. Panel Regression Results

6 Discussion and Avenues for Future Research

The results in Table 1 indicate that while firms with Fixed Assets generally outperform their counterparts with more liquid assets (H1A and H1B), the opposite was true when the organizations began to use Bank ID. Controlling for branch sector, organization registration year, and location (County), we found the opposite relationship: That organizations with more liquid assets who used BankID performed better (H3B), while organizations with more fixed assets performed worse (H3A). The reasons for this are deserving of further investigation, but at first glance it would seem that explanations around operational flexibility (e.g. Ortiz-Molina and Phillips 2014), are likely to apply. This is because BankID is available to (almost) all organizations in Sweden, which suggests that adoption alone is not likely to confer significant relative advantage—but must be coupled with other kinds of innovation, whether product or process innovation (Koellinger 2008).

The view of BankID as complementary, or innovation-enhancing, is supported by the observation that while innovative organizations, those who spent more on research and development, generally performed better than comparable firms (H2), this performance improves, although modestly, with BankID adoption (H4).

6.1 Limitations and Future Research

The emerging picture of a DIMP as a platform of platforms suggests that BankID adoption improved organizational performance for those organizations who are more flexible or innovative. We suggest that this is because a DIMP 1) becomes more useful the more ubiquitous it is and the larger its network effects, meaning that 2) once it is ubiquitous it should be seen as a complement or enhancer of other forms of innovation. This lends support for our initial suggestion that DIMPs can be thought of as platform of platforms. Although this exploratory study provides some initial support for this idea, more work is needed—especially to understand the exact mechanisms through which platform of platforms operate, and how and if they differ from existing transaction and innovation platforms.

Moreover, in this study we did not account for relative timing of BankID adoption by organizations, and have not distinguished effects by industry. In particular, we are interested in what happens when nearly all organizations have already begun to use BankID and it becomes a “hygiene factor”, rather than a competitive advantage (e.g. Rietveld et al. 2020). These possibilities for future examination that would enrich our picture of the effect of DIMP as a platform of platforms.

We also want to ensure the robustness of the results—so future work will also include considering alternative measures of value, as well as ensuring that our work is not susceptible to data sampling bias (e.g. King and Nielsen 2019).

More broadly, this paper’s results suggest that BankID and DIMPS are one of many important contributors to digital transformation, defined as a transformative process which includes changes to business models, performance management, workplace processes, employee and customer mindsets, and underlying IT artefacts (Vial 2019), leading to performance improvements for the organization (Sebastian et al. 2017). However, the exact role of digital identity specifically, and platform of platforms more generally is deserving of further research, including inductive analysis to uncover the processes whereby this occurs. This paper in the first step in this direction—in which we examine if DIMPs do indeed deliver on the promise of economic benefits, and to whom those benefits accrue. Our next steps include deeper analysis of the existing quantitative data and complementing it with an inductive or abductive study to understand the mechanisms whereby platform of platforms generate value—and how, if at all, they differ from innovation and transaction platforms (Bonina et al. 2021; Cusumano et al. 2019).

Future steps in this research include 1) unpacking further the mechanisms whereby platform of platforms, in this case DIMPs, lead to economic benefits for adopters; 2) examining if there are temporal affects—the difference between early and late adoption; and 3) theorizing the role and effects of platforms of platforms in more detail.

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