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Abstract

Transaction Cost Economics (TCE) theory has played an important role in understanding when it is more efficient for a transaction between two parties to occur within the market or within an organization. However, as more transactions occur in a digitally-mediated fashion, open questions remain as to how TCE applies in the digital economy. In this article, we consider how digital transformation helps us probe the boundary conditions of TCE and how, despite all the changes wrought by digital transformation, TCE can still provide a useful lens to help scholars and practitioners understand the organization of economic activity in the market-based economic system. We highlight three characteristics of digitally-mediated transactions: reputation mechanisms, private information, and non-pecuniary transactions and then discuss how these characteristics offer opportunities for future research and lay out a research agenda for this increasingly important area.

1. Introduction

The market-based economic system has been a critical innovation that allowed for a dramatic increase in global prosperity, though critics have pointed out that this prosperity has at times come with trade-offs with implications for climate, employment, income distribution and health (Ostrom, 1990; Rangan, 2015). Perhaps as critical has been the ability of individuals to

organize into firms to take advantage of synergies and address possible failures that arise in the market (Coase, 1937; Chandler, 1977). Understanding how economic activity is organized into firms and markets has been central to studies in management, strategy, economics and politics. However, the increasing dominance of the digital economy has introduced numerous questions as to the interplay of organizations and the market-based ecosystem. Historically, an important theoretical lens that has been used to study the organization of economic activity is Transaction Cost Economics (TCE) (Williamson 1975, 1985, 1996), but it remains an open question whether TCE can still play a critical role in understanding how the so-called "digital transformation" of many goods and services will impact the organization of production between firm and market-based activities. The purpose of this essay is to consider ways in which TCE can shed light on the nature of transactions in the digital economy as well as how the nature of digitally-mediated transactions can inform the study of TCE theory.

TCE has proven to be an important lens for understanding the nature of transactions—and the organization of economic activity more broadly—across a variety of industries and institutional settings (Argyres and Zenger, 2012; Macher and Richman, 2008). However, when TCE was initially developed almost five decades ago, digitally-mediated transactions were not even on the horizon. In the last decade, digitally-mediated transactions have become increasingly prevalent, and are at the core of a wide range of new business models used by companies such as AirBnB, eBay, Taobao, Amazon, Facebook, Google, and Uber, to name a few. In addition to these "born digital" companies, digitization has also led to many incumbent non-digital firms embracing new digital business models (Altman, Nagle, and Tushman, 2015; Hagiu and Altman, 2017). For example, Ford, Lego, General Electric, and *The Washington Post* have all adopted digital transformations of their business models. It has therefore become imperative for management

theory to grapple with the ways in which digitally-mediated transactions affect business models, organizational and firm strategies, and ultimately the consumers, managers, and employees of these firms.

As we examine the role of TCE in the digital economy, we highlight three characteristics of digitally-mediated transactions that play a larger role than in traditional "brick-and-mortar" transactions. These include (1) reputation mechanisms that are used to overcome asymmetric information between parties to transactions, (2) the amount of private, or personally identifiable data about parties that is conveyed either before or during the transaction, and (3) the ability for a digitally mediated transaction to be non-pecuniary (i.e., free). Frequently, the rise of new technologies and business models such as those introduced by the digital economy, represent opportunities to revisit existing management theories and how they apply in non-traditional contexts (e.g., McGahan, 2012; Klein, Mahoney, McGahan, and Pitelis, 2013; Laamanen, Pfeffer, Rong, and Van de Ven, 2016). As such, we build on existing theory and use insights about the three characteristics of digitally-mediated transactions to develop a series of provocations and related research questions for scholars to tackle as we expand our understanding of how the digital economy will inform new theoretical perspectives on firm and the market-based economic organization. These questions are grouped around two propositions: First, how digital transformation helps us probe the boundary conditions of TCE. Second, despite all the changes wrought by digital transformation, TCE still provides a useful lens to help scholars and practitioners understand the organization of economic activity.

Our essay proceeds as follows. First, we lay out the fundamental ideas and predictions of TCE. Then, we describe digitally-mediated transactions, highlighting some of the ways in which "online" transactions differ from "offline" transactions. We then discuss three characteristics of

digitally-mediated transactions: reputation mechanisms, privacy, and non-pecuniary transactions. We then discuss how these characteristics offer opportunities for future research: both research into boundary conditions of TCE as well as the use of TCE to shed light on current organizational structures enabled by digitization.

2. Fundamentals of TCE

TCE takes the transaction between two entities—typically an upstream producer of an intermediate good and a downstream producer of a final good—as the unit of analysis, and seeks to determine which organizational form—markets, hierarchies or a hybrid form—is best for that transaction, given its characteristics. According to TCE, easy to describe, non-specific transactions between trading partners are best transacted through the market mechanism where incentives to produce at low costs are strong. However, as assets become more specialized and less easily redeployed, and as the complexity of the transaction increases, hierarchy through vertical integration, where fiat and authority supplement renegotiation to resolve conflict, will outperform markets. The reason is that parties to a market-based transaction may engage in opportunistic behavior and take advantage of their trading partners to redistribute rents accruing from the specialized and complex transaction (Williamson 1975, 1985). This is especially the case when it is costly to monitor the behavior of the trading partner or the quality and specifications of the good or service being traded. However, market-based mechanisms like competition and reputation may help mitigate the risks of opportunism (Hill, 1990; Flammer, 2018). So as to mitigate these hazards, supplier and buyer can be organized under unified ownership within the firm. Moving the transaction from the market into the firm involves trading off the benefits of high-powered incentives (found in markets) for the benefits of coordinated adaptation (found in firms). The

central prediction is as follows: as asset specificity and the complexity of the transaction increase, vertical integration becomes more likely, all else equal (Williamson, 1971, 1975, 1985, 1996; Tadelis and Williamson 2012). In addition, when asset specificity is coupled with a high degree of uncertainty, the transaction is even more likely to be organized inside the firm. Asset specificity can take many forms including physical asset specificity, human asset specificity, site specificity and temporal specificity. Figure 1 illustrates the core predictions of TCE as illustrated by Williamson (1999, p. 1091).

Insert Figure 1 Here

Another critical aspect of TCE is the concept of hold-up. Imagine firm *F* that needs to produce a specific part for a downstream customer, where to produce the part firm *F* needs to invest in a specific type of machine. The issue for firm *F* is that once it makes the investment in the machine, it is potentially in a tricky position. On the one hand, if there are many firms in the market that are also interested in purchasing such a machine, then there is likely an active secondary market for the machine. This is good for firm *F* because it can resell the machine for close to the purchase price in case the deal with the downstream customer falls through. In TCE terminology, the "value of the next best use" of the machine is high. On the other hand, what if there is little or no demand for the machine on a secondary market? In this case, firm *F* may have a hard time finding another buyer of the machine, or any potential buyer might not be willing to pay much for the machine. In this case, the "value of the next best use" of the machine is low. In this case, asset specificity is high (in the Figure 1, $k>0$).

Now imagine that the downstream customer knows whether firm *F* purchased the machine or not, and knows that the value of the next best use is low (the second case). In this setting, firm

F is at a disadvantage, and the downstream customer knows it. The downstream customer could strategically withhold business from firm *F* and demand a lower price. If the firm *F* doesn't agree, then the only option is for it to resell the machine at a very low price on the secondary market. This is called "hold up." An important side point here is that the downstream customer "could" do this. Williamson (1985) argues that most customers would not act in this way, but, so long as you believe there might be some bad actors out there, and that you can't identify them, you have no way of knowing who is going to hold you up or not. Now come back to firm *F*'s initial decision—to purchase the machine or not—and imagine what it will do. If its fear of hold up is severe, and there are no safeguards in place, then the firm will decide not to purchase the machine in the first place. This is a suboptimal outcome in that there are gains from trade, and trade does not occur in this case. Vertical integration and long-term contracts are mechanisms to solve this problem arising from asymmetric information about the transacting partner. A long term contract is preferred when the costs associated with contracting are lower than the costs associated with managerial bureaucracy (in Figure 1, when *c* is low), otherwise vertical integration is preferred (when *c* is high).

As reported by Macher and Richman (2008), the central prediction of transaction cost economics has been empirically documented in research across fields including industrial organization, marketing, finance, accounting, and law. For example, TCE is used to understand and explain the conditions under which some interstate trucking firms rely on their own drivers for long hauls, whereas others instead rely on independent owner-operators (Nickerson and Silverman, 2003). As another example, TCE is used to understand when an automobile manufacturer will make its own parts in-house or purchase its parts on the open market from a supplier (Monteverde and Teece, 1982). Another classic example is Masten (1984) who uses TCE

to explain the internal and external sourcing decisions of government contractors in the aerospace industry. The importance of this "make-versus-buy" decision has come to pervade not only the economics literature, but the strategic management literature as well (Walker and Weber, 1984, 1987; Porter, 1985; Poppo and Zenger, 1998). However, what is notable about all these examples, and most examples of TCE, is that they are *brick-and-mortar* examples—they do not involve digitally-mediated transactions.

3. The nature of digitally-mediated transactions

Digitally-mediated transactions differ from brick-and-mortar, or "offline" transactions. Digitally-mediated transactions may involve not only the transfer of money from a buyer to a seller, but, in many cases, also the transfer of information about each party. These digitally-mediated transactions leave digital traces—data regarding the purchase price, time of day, method of payment, other items available for purchase at the same time, and the prices of these items—and this creates a record that can be useful to both the buyer and the seller, thus potentially reducing interpretive uncertainty (Weber and Mayer, 2014). The seller can verify that the transaction occurred and can update inventory. The buyer can update her budget for the month and can plan accordingly. Moreover, the data can provide useful information about the buyer and her preferences that can then be used by the platform, the seller, or other merchants in the future, in some cases combined with other "big data" to create a valuable profile of the buyer. Furthermore, digital trace data can also be used to better understand non-pecuniary transactions that would have previously occurred in the real-world in a manner that would have left no trace at all.

One particularly important type of digitally-mediated transaction is embedded in social media. More and more consumers are engaging in social media as a way to connect with family

and friends, to build professional networks and search for jobs, and to obtain news and other information.[1] From a consumer's point of view, many of these transactions are free. Indeed, the typical business model of a search engine or social media platform involves providing the service to a consumer for free, so as to grow the user base as quickly and as extensively as possible. The platform's profits can be made off of information collected from users, either for advertising or for sale through data brokers, because advertisers' willingness to pay is increasing in the number of consumers using the platform and the quality of the private user information that the platform provides. Economists and management scholars have started to understand a lot more about these business models in recent years (Armstrong, 2003, Rochet and Tirole, 2003; Parker and Van Alstyne, 2005; Hagiu, 2006; Seamans and Zhu 2013). Consumers are also starting to accept that part of the "price" of accessing social media and other online platforms is their provision of personal information and other data.

In addition to "free" transactions that rely on users sharing information as a form of payment, there are also digitally-mediated transactions that are free and do not require a user to share personal information. In the digital world, there are transactions that were costly in the physical world are now often delivered for free, or nearly free. Take, for example, Wikipedia. Nearly all transactions that occur to build Wikipedia are non-pecuniary. Server space and Internet bandwidth are donated, crowdsourcing methodologies are used to allow volunteers to contribute material, and heavy contributors are given editor status and the ability to manage changes made by the crowd. Consumers do not pay to use Wikipedia, and research has shown that Wikipedia has an accuracy level consistent with physical-world encyclopedias (Giles, 2005). More broadly, crowdsourcing, user innovation, and open source software are all examples of production models

[1] According to recent Pew research, about half of Internet-using adults get news via Facebook alone. http://www.journalism.org/2015/04/29/state-of-the-news-media-2015/

enabled at scale by digitization (e.g., Altman, Nagle, and Tushman, 2015). Frequently, digitally-mediated transactions in such settings are non-pecuniary, which can cause issues for traditional economic measurement, based on priced transactions, e.g., Gross Domestic Product (Greenstein and Nagle, 2014). Greenstein and Nagle (2014) call such activity "digital dark matter" since it exists and has an impact on the economy, but it is difficult to measure through traditional means.

4. Transactions in the Digital Economy

Transactions are the fundamental building block of TCE theory, which argues that the nature of transactions has implications for the organization of economic activity and the boundary of the firm. However, transactions are increasingly being digitized. What does this change to the nature of a transaction, the fundamental building block for TCE theory, suggest for research on organizations, strategy, and TCE? We discuss three related areas that require further study: reputation mechanisms, privacy, and non-pecuniary transactions.

A. The role of reputation mechanisms

TCE theory adopts the now standard assumption that asymmetric information between parties to a transaction—such as one party not knowing if the other party may act opportunistically and defraud the first party—can impede on the creation of gains from trade. If the perceived threat of fraud is too high for either party, then they may decide not to engage in a transaction at all. Indeed, it has been argued that a reputation of trustworthiness can be an important source of competitive advantage (Barney and Hansen, 1994). The potential risk of fraud is particularly acute in online settings, where buyers and sellers do not interact face to face (Dellarocas, 2003; Resnick and Zeckhauser, 2002). However, the frequency of digitally mediated transactions, coupled with digital trace information about the transacting parties, means that reputations can be developed for

each party, which in turn helps mitigate the concerns from asymmetric information. Thus, TCE would predict less vertical integration in digital markets with well-functioning reputation mechanisms. We are not aware of any systematic research that directly tests this idea and it therefore remains an unverified theoretical prediction. That said, anecdotal evidence suggests that less integrated production may indeed be taking place. Take, for example, the emergence of freelancer platforms such as Upwork, through which businesses of any size can procure services that have often been done by internal employees. Because the platform tracks the reputation of freelance providers, who's future stakes depend on their past performance through the reputation system, what used to be done by trusted employees can now be outsourced to many freelance contractors.

The meteoric growth of many online marketplace platforms suggests that reputation mechanisms are generally effective, though recent research has highlighted a number of issues. A fairly straightforward source of bias in reputation rating mechanisms arises from a seller's strategic incentive to acquire fake reviews. Mayzlin, Dover, and Chevalier (2013) point out that hotels seem to pose as fake customers and submit positive ratings about themselves, while submitting negative ratings about their local competitors. Luca and Zervas (2016) find similar results in the restaurant industry. Additionally, if reputation rating mechanisms are increasingly substituting for formal contracts, this may substitute for longer term trust building engagements and thus perversely may serve to decrease trust (Poppo and Zenger, 2002).

Using data from eBay, Nosko and Tadelis (2015) find that a reputational externality, in which a customer's bad experience with one seller leads the customer to leave the platform forever, adversely affects all other sellers with whom he or she would have interacted in the future. The authors also observe positively-biased feedback that arises because users typically exit a platform

following a single poor-quality transaction; as a result, users' ratings of one another on that platform will inevitably be biased upwards. Relatedly, Kapoor and Tucker (2017) show that in a ride-sharing context, negative driver ratings that are perceived as unfair can lead to poor performance on future rides and eventual exit from the platform. A different source of biased reviews with the same result is described in Einav, Farronato and Levin (2015), who note that following a mildly positive experience, users may exaggerate how positive it was, thus leading to review inflation, and Apostolos, Horton and Golden (2019) document such inflation on a large online labor marketplace. Additional sources of bias can stem from social influence due to anchoring (Muchnik, Aral, and Taylor, 2013), consumer characteristics (Zhu and Zhang, 2010), or disagreement amongst prior reviews (Sun, 2012; Nagle and Riedl, 2014). Much of the existing research into digital reputation mechanisms has focused on business-to-consumer (B2C) relationships (Tadelis, 2017); further research needs to consider business-to-business(B2B) relationships as well.

In an effort to increase confidence in reviews, some marketplace platforms have started to rely on third-party intermediaries. Stanton and Thomas (2016) study this phenomenon using data from oDesk (a company that later merged with competitor eLance, which became Upwork). They find that intermediaries are particularly useful for inexperienced workers, who otherwise have a difficult time convincing potential customers to hire them. Effective reputation mechanisms are an important ingredient for engendering trust among those who transact via the platform. These may be insufficient, however, if they are not trustworthy enough, or if they do not adequately internalize the potential spillovers from the transactions.

To this point, the discussion has focused on formal and centralized reputation systems. However, *informal* reputation models play an important role in the digital economy and can enable

self-regulation. For example, Wikipedia, the crowdsourced digital encyclopedia, relies on an informal reputation model to track the behavior of contributors (Javanmardi, et al., 2009), as do other wiki collaboration models (Kittur and Kraut, 2010). Open source software, a critical component of the digital economy, also relies on informal reputation to both encourage users to contribute (Lerner and Tirole, 2002) and to help manage the contribution process (Parameswaran and Whinston, 2007). On one hand, economic analysis has shown that these informal reputation models allow individuals or firms that are strangers to each other to transact and cooperate without needing a formal reputation system (Abraham et al, 2016; Bolton, Katok, and Ockenfels, 2005). These informal reputation mechanisms also allow social media companies like Facebook, Twitter, and Google to obtain paid advertisers while never meeting them or evaluating them in a formal manner and allow individual users to form their own opinions of advertisers, content-providers, and other users. On the other hand, as exemplified by the fake news epidemic around the 2016 U.S. presidential elections, informal reputation mechanisms may not function adequately at times (Allcott and Gentzkow, 2017). For example, RT, a television network funded by the Russian government formerly known as Russia Today, used paid advertisements on social media to spread disinformation during the election. At the time, major social media companies relied on informal reputation mechanisms for advertisers, content-providers, and users, and did not offer a formal reputation mechanism to alert users that the originators of this content might not be impartial or trustworthy. The role of such informal reputation models in enabling market transactions to occur requires further research.

B. Privacy

Reputation mechanisms are in part enabled by users necessarily giving up some of their privacy in exchange for transacting on a platform—the platform creates a history of the user's

transactions on that platform, which serves to establish a reputation for the user. Users appear quite willing to give this information up in return for access to the service. A 2014 survey by Pew found that 55 percent of Americans are "willing to share some information about [themselves] with companies in order to use online services for free." Private user information can also be used by platforms to sell advertising or other services. However, for a platform to gain value from private information, it must obtain it at a large scale – a platform that has private information on 10 people will not attract as much advertising interest as one with 10 million people. This can lead to vertical or horizontal integration within an industry due to the increase in competitive advantage that comes with scale. Indeed, in the technology industry a handful of large platforms have come to dominate the monetization of private information through advertising, most notably Facebook and Google. It is unclear if this control of private information within a handful of organizations is beneficial from a social welfare standpoint, and political pressure has started to mount for such firms to be regulated as utilities. Such regulation, however, is likely to stifle innovation and reduce investments in new technology. Further research is needed to better understand the tradeoffs related to private information and scale.

A broader question arises as to why many individuals are willing to give up their private information for no direct compensation. TCE implies, from revealed preferences, that the "value of the next best use" of a consumer's data is low, which in turn begs the question: Why would this be? One possibility is that there is no secondary market that a person can access. Another possibility is that the "asset" (personal information) is so specialized that it only pertains to one entity. TCE suggests that vertical integration is a solution to a situation where an asset can be held up or where the value of the next best use is low. This may be the reason that individuals are willing to give up their private data to large tech companies mentioned above. However, it is

possible that individuals would be better off in a world where there was a true market for their private information that allowed them more granular control over their information and the ability to move their data from one platform to another. Data portability, discussed below, might be one such mechanism to help individuals own and move their data. Further research is needed to shine additional light on this puzzle. The lens of TCE may be a useful tool that researchers can use to better understand issues around digital privacy and industrial organization.

C. Non-pecuniary transactions

Consumers often pay for free services of online platforms either with their private information, which as discussed above is monetized through advertising, or with their time and attention (Brynjolfsson and Oh, 2012; Gentzkow, 2014; Teixeira, 2014) which can also translate to advertising revenue for a firm. However, transactions for other digital goods like Wikipedia and open source software (OSS) are often completely non-pecuniary since the organizations at the center of such communities are not-for-profit.[2] When such non-pecuniary options exist, they limit the ability of a for-profit option to hold-up a customer. Such is the case of Linux and Microsoft as discussed in Casadesus-Masanell and Ghemawat (2006) and Schwarz and Takhteyev (2010). This phenomenon even applies more broadly to all software (and many hardware) goods (Gambardella and von Hippel, 2018). Given the importance of hold-up concerns leading to vertical integration as predicted by TCE theory, the increase of non-pecuniary transactions may limit hold-up concerns in some industries, leading to less vertical integration. At the same time, considering that the motives of actors contributing to the creation of goods like Wikipedia and OSS are often non-pecuniary, traditional methods of dealing with hold-up (e.g., vertical integration) may be less of

[2] Interestingly, most listings on Craigslist, which is a for-profit company, are also free for both sides of the market.

an option for existing firms, and they must explore alternatives like contributing to the creation of these goods as a way to help influence their production and prevent hold-up (Nagle, 2018).

At a higher level, the availability of non-pecuniary, or costless, transactions implies that one of the primary reasons for vertical integration ceases to exist. As discussed above, TCE predicts that when transaction costs are high, economic activity will take place in firms rather than in markets. However, if transaction costs are low, or even absent all together (at least monetarily), then it is much more likely that the transaction will take place in a market rather than within a firm. Even further, it is also possible that a non-pecuniary option may fully destroy the value created by paid alternatives offered by a vertically integrated firm, as was the case in the encyclopedia industry. Having already been negatively impacted by digitization, the value creation (as measured by dollars) of the encyclopedia industry was all but destroyed by the entrance of the non-pecuniary Wikipedia (Greenstein, 2017). In such a context, we can consider this an example of near complete vertical dis-integration as all of the activity that previously took place in the firm, now takes place by crowdsourced individuals that are governed via a commons model (Ostrom, 2015). OSS is having a similar effect in the software industry and 3D-printing has the potential of having a similar impact on physical good production. Although non-pecuniary transactions have existed throughout economic history[3], they were far less prevalent in the physical economy than they are in the digital economy. Therefore, their potential impact on organizational form through the lens of TCE requires further exploration.

Combining the discussion of the nature of digitally-mediated transactions from Section 3, with the claims on reputation systems, privacy, and non-pecuniary transactions in this section, we

[3] This is particularly the case in the household sector, which has gone consistently under-measured (Schreyer and Diewert, 2014).

can construct a simple figure to better frame the subject through an extended lens of TCE. In Figure 2, the horizontal axis represents the type of digitally mediated transaction (pecuniary, non-pecuniary with private information, or non-pecuniary without private information) while the vertical axis represents the reputation system (formal or informal). This allows for nearly all organizations that engage in digitally mediated transactions, including both those that are born digital and incumbents that adopt any level of digital transformation, to be classified in a manner that allows for further consideration and helps frame the discussion for future research.

Insert Figure 2 Here
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5. Implications for Future Research

The digital transformation that is happening across the economy has a number of implications for both firms and regulatory policy. TCE can shed light on which areas need further study to better understand this transition. Below we lay out a research agenda along these lines.

A. Digitization helps us probe the boundary conditions of TCE

As highlighted above, there has been lots of research on reputation mechanisms and their effectiveness in facilitating trade. While these mechanisms appear to help address asymmetric information, other problems, such as bias, arise. More work is needed to link reputation mechanisms to the choice of vertical integration and other organizational forms. Such research would not only help develop a better understanding of firm organization in general, but would also shed light on how the boundary conditions of TCE are changing in the digital economy.

When thinking about so-called "sharing economy", or marketplace platforms, and other platforms as well, we can consider a firm (the platform) that has entered into a contracting

relationship with providers—like Uber drivers, Airbnb hosts, or eBay sellers—to provide a product or service to consumers, making the traditional boundaries of the firm more porous. Amongst others, sharing economy platforms (Davis, 2016; Horton & Zeckhauser, 2016; Sundararajan, 2016), open and user innovation (Baldwin and von Hippel, 2011; Dahlander and O'Mahony, 2011; Lakhani, Lifshitz-Assaf, and Tushman, 2013), and crowdsourcing (Jeppesen and Lakhani, 2010; Nagle, 2018) are business models that embrace these changes. The organizational form is dis-aggregated, and this is made possible by trust that (1) the consumer has in the platform and the provider; and (2) the provider has in the platform and the customer. This increased importance of trust also changes how the firm must manage and organize (Adler, 2001). Further, when factoring in the discussion related to privacy above, questions arise related to how privacy affects trust and whether or not norms of privacy have been changing. The role of trust in transactions in the digital economy is ripe for further exploration.

Research Agenda 1 (Trust and Privacy): How does privacy affect trust? Has digitization changed norms for privacy and trust?

Further, the lasting impact of digitization on firm size is theoretically ambiguous and remains to be determined empirically. Some research has argued that information and communication technologies allow for easier management of larger firms (Hitt, 1999; Davis, 2016) while others have argued that digital forces that increase the ability of firms to contract and monitor external firms or individuals will lead to firms that employ fewer employees directly while outsourcing many aspects of their operations (Brynjolfsson et al, 1994). Further, it has been shown that different types of technology investment can have differing impacts on how centralized a firm becomes and whether or not it becomes more or less vertically integrated (Bloom et al., 2014). It is certainly possible to imagine that these counter-vailing forces lead to a world where there are a handful of extremely large firms and a very large number of independent contractors, very much

along the lines of the co-called "gig economy". Future research is needed in all of these areas to better understand the impact digitization of transactions has on our traditional understanding of transaction cost economics and how it governs firm structure and behavior.

Research Agenda 2 (Digitization and Boundaries of the Firm): Has digitization increased or decreased the size of the firm? Has it done both, and if so, are there clear reasons why?

B. Regulatory Implications

As Williamson himself notes, his development of TCE was heavily influenced at the time he acted as Special Economic Assistant to the Head of the Antitrust Division of the U.S. Department of Justice.[4] Indeed, TCE has been a useful lens to study a variety of regulatory issues, and may continue to be helpful in guiding regulatory mechanisms and policies that arise due to digitization. One mechanism is the use of data portability whereby a customer would maintain possession of some core data that he or she could then take from one company to a rival, much in the way that a phone customer can take his or her phone number from one provider to another (which was not always the case). In principle, this should help reduce barriers to entry, because any potential customer of a new entrant could easily shift her data from the established firm to the entrant. Moreover, the ability of the customer to do this creates an incentive for the established firm to innovate and improve upon its existing services for the customer since the customer is no longer locked-in to the service of the established firm. In TCE terms, data portability should help lower hold-up problems by reducing switching costs. However, although data portability may lead to more entry, firms may invest and innovate less *ex ante* if they risk losing customers to a

[4] Though statements of this sort appear in several of his writings, it is most forcefully stated in the Biographical notes he wrote for, and that are posted on, the Nobel Prize website. With respect to developing his ideas that "(1) organization is often important and (2) economics and organization theory need to be joined if we are to develop a deeper understanding of complex contract and internal organization", he states that "…my experience in 1966–67 as Special Economic Assistant to the Head of the Antitrust Division of the U.S. Department of Justice was in many ways the defining event." https://www.nobelprize.org/prizes/economic-sciences/2009/williamson/biographical/

competitor more easily (Jin and Vasserman, 2019). Data portability may also help alleviate bias from platform exit discussed above. In particular, if buyers and suppliers were able to transfer their reputation from one platform (e.g. Uber) to another (e.g. Lyft), there would be more opportunity for multi-homing, which in turn will increase platform competition.

Research Agenda 3 (Regulatory Implications): Will new forms of regulation be necessary for industries where network effects play a large role? How will new regulatory mechanisms affect entry, exit, and competition within an industry?

More broadly, it might be possible to consider reputation mechanisms as an example of industry self-regulation. Indeed, it is in a platform's interest to increase consumer trust in the platform, aligning consumer interests with platform interests, which encourages self-regulation through reputation mechanisms (Nosko and Tadelis, 2015). However, this framing leads to additional questions that have not been addressed in research or practice. What are the limits to industry self-regulation in a digital economy context? Is there any role for government regulation, and if so what is it and why? How do local government regulations interact with state or federal regulations? For example, although the business models of Uber and AirBnB have widely been considered legal at higher levels, individual cities have outlawed these practices or implemented severe restrictions on them often based on the political climate at the time (Paik, Kang, and Seamans, 2018). Another possibility is that governments could sponsor their own local versions of current platforms. For example, some local governments have sponsored local ride-sharing activity to compete with Uber and ensure the profits from such enterprises stay within the local economy.

Research Agenda 4 (Reputation and Self-Regulation): Will reputation mechanisms be used as a method of industry self-regulation? What are the limits to industry self-regulation in a digital economy context?

6. Conclusion

In this article, we highlight how the Transaction Cost Economics (TCE) theory can shed light on the organization of economic activity post digital transformation. Our essay highlights our beliefs that (1) much can be learned about TCE by using digitization to probe boundary conditions of the theory and (2) that TCE remains a useful lens to understand firm organization and possibly guide policy and regulation.

With respect to probing the boundary conditions of TCE, we highlight the issues of (i) asymmetric information and reputation and (ii) non-pecuniary transactions as issues brought to the fore by digitization. The link between asymmetric information, reputation mechanisms, and firm boundaries, and the link between non-pecuniary transactions and firm boundaries, are areas that beg for more research. Ideally, the research that will grow from these observations will maintain the valuable balance between theory and empirical work that TCE has benefited from in the past.

With respect to the evolving usefulness of TCE, we highlight how markets for personal information (or the lack thereof) may affect firm boundaries, and how data portability may be one of several mechanisms that could be used to address the currently "thin" market for personal information. It is critical that scholars across the areas of management, strategy, economics and political science dive deep into developing solid tools that will help guide managerial decisions, regulation, and policy and get ahead of the many uninformed cries coming from across the political spectrum.

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Figure 1: Relationship between asset specificity (*K*), relative contracting costs (*C*) and the firm boundary

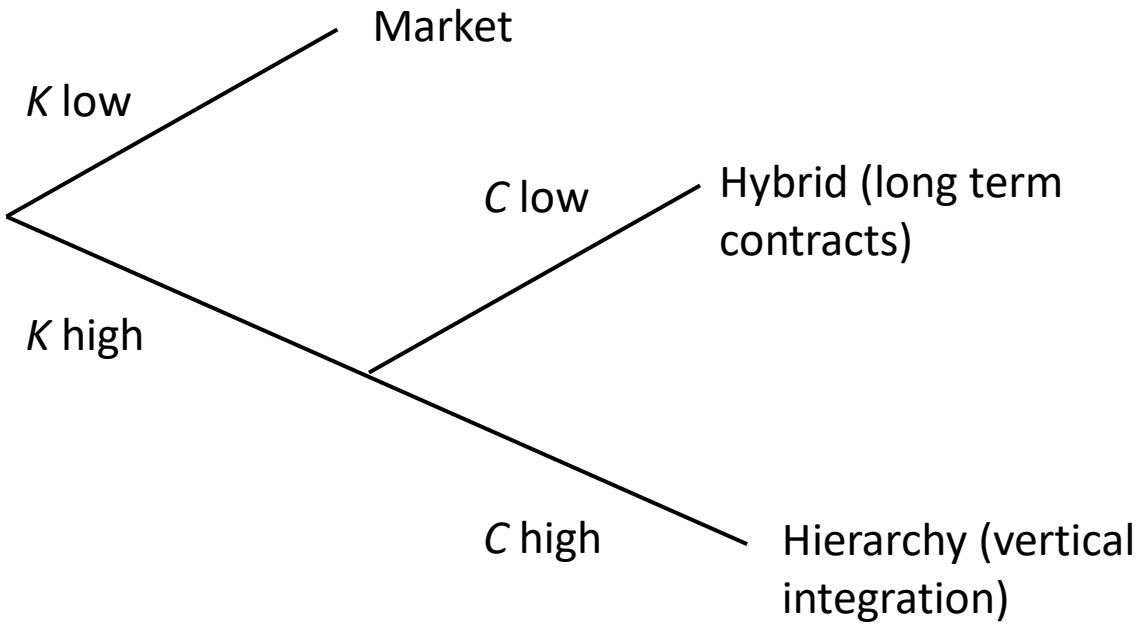

Figure 2: Transactions and Reputation in the Digital Economy