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Sludge and Transaction Costs

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Abstract

Behavioural scientists have begun to research “sludge”, excessive frictions that make it harder for people to do what they want to do. Friction is also an important concept in transaction-cost economics. Nevertheless, sludge has been discussed without explicit referral to transaction costs. Several questions arise from this observation. Is the analogy to friction used differently in both literatures? If so, what are the key differences? If not, should we develop the concept of sludge when the well-established literature on transaction costs already exists? This conceptual paper shows that sludge and transaction costs are related, but distinct concepts, and that the literature on sludge can benefit from incorporating elements from transaction-cost research. For example, we suggest defining sludge as aspects of the choice architecture that lead to the experience of costs, organise sludges using a typology inspired by the transaction-cost literature, highlight specificity, uncertainty and frequency as important determinants of the “sludginess” of choice architecture and show that sludge audits can be conducted using methods developed in the transaction-cost literature.

Keywords: Sludge, Transaction costs, Behavioural Economics, New Institutional Economics, Frictions.

Introduction

Behavioural insights can be used to help people achieve their long-term goals without limiting their freedom of choice. Thaler and Sunstein (2008) call this nudging. But behavioural insights can also be used to make it more difficult for people to achieve their long-term goals. The phrase for this “dark cousin” of nudging has recently been termed as “sludge” (Sunstein, 2019b, Thaler, 2018). Early definitions of sludge view it as nudging for evil (Thaler, 2018),¹ or as excessive or unjustified friction that makes it harder for people to do what they wish (Sunstein, 2020). Sludge impedes decision making by making it more difficult for people to navigate through their everyday lives (Sunstein, 2019a).²

Examples of sludge in the private and the public sector include unnecessarily complicated and cumbersome paperwork and form-filling requirements, hidden add-on fees, long and confusing fine print, unfavourable default settings, inconvenient cashback and refund conditions, messages that induce psychological costs in the form of negative emotions, subscription traps and bureaucratic red tape (Soman et al., 2019, Akerlof and Shiller, 2015, Sunstein, 2020).

As a result of sludge, take-up of government programmes can be low, profits of firms high at the expense of consumer welfare, people can become frustrated, stressed and sometimes humiliated and exercising some basic human rights can be more difficult (Soman et al., 2019,

¹ We can differentiate sludge from dark nudging. The former makes good decisions more difficult (mainly by increasing friction) and the latter makes bad decisions easier to enact (for example, by reducing frictions) (Thaler, 2018; Sunstein 2020; Soman et al., 2019). Sludging can also be related to ethically unacceptable goals (Lades and Delaney, 2020).

² The words “excessive” and “unjustified” are relevant in this definition. It suggests that there are many valid reasons for friction, including programme integrity, self-control problems, privacy, security issues, the acquisition of useful data (Sunstein, 2019b) and the creation of decision points (Soman et al., 2010). But these frictions are not sludge under this definition, as they are essential or beneficial and not excessive and harmful. Whether sludge is always and by definition welfare-reducing is subject to a current debate (e.g., Mills, 2020), and we will have something to say about that debate in this paper’s sub-section *A definition of sludge*.

Sunstein, 2019b, Thaler, 2018). Sludge can influence everybody's decisions, but it is particularly powerful when humans are present-biased, overoptimistic or show other deviations from rationality identified in the behavioural sciences.

While examples of sludge are abundant in the emerging discussions on the dark side of behavioural science, the conceptual work on sludge is in its nascent stage.³ To make progress, we need to define what sludge is and what it is not. We also need to identify different types of sludge and to establish the main factors that determine whether a process is "sludgy" or not. Having established such details will allow us to conduct more systematic "sludge audits" (Sunstein, 2020) in which different types of sludge can be identified in private and public institutions. In this paper, we suggest advancing the conceptual literature on sludge by integrating the literature on sludge (mainly discussed in the behavioural science literature) with the literature on "transaction costs" (mainly discussed in the new institutional economics literature).

Transaction costs are typically defined as all costs involved in a transaction, other than the costs of physical production (Nilsson and Sundqvist, 2007, Webster and Lai, 2003).⁴ More substantially, transaction costs are the sum of the direct and indirect costs of making economic transactions on a market. They describe all costs that make a transaction happen but that do not create value (Shahab et al., 2018a, Coggan et al., 2015). They include the costs of finding appropriate opportunities for market transactions, exchanging and trading in the market and the

³ For example, Sunstein (2020) defines sludge as excessive friction and Sunstein and Gosset (2020) investigate the optimal level of sludge. But if sludge is excessive (by definition), optimal sludge should be zero. In this paper, we understand sludge as excessive so that the optimal level of sludge is, by definition, zero.

⁴ The concept of "transaction costs" was conceptually introduced by Coase (1937) to explain why firms exist. The concept was then further developed mainly by new institutional economics scholars (Williamson 1985, North 1992, Cheung, 1987).

costs of creating and enforcing property rights (Allen, 1999). Williamson (1985) uses the analogy between mechanical frictions and transaction costs. He argues that if engineers look for frictions in mechanical systems, economists need to take account of transaction costs. Three types of transaction costs are often distinguished: search and information costs, bargaining costs and policing/enforcement costs. Additionally, transactions costs are often linked to the creation and enforcement of property rights (Dahlman, 1979, Allen, 1999).⁵

Both the literature on sludge and the literature on transaction costs rely on the analogy to friction in mechanical systems.⁶ However, the concept of sludge has been introduced without reference to transaction costs. Several questions arise from this observation: Do transaction costs and sludge theories analyse and explain the effects of friction on economic or policy outcomes in the same way? If yes, is there any need for developing a new concept such as sludge? If no, what are the key differences in their approaches or rationales and how can the sludge literature learn from over 50 years of transaction-cost research? This paper aims to answer these questions with the aim of developing the growing conceptual literature on sludge.

We start by bringing together and synthesising the literature on transaction costs and the literature on sludge with two main objectives: (i) to identify similarities and differences across both areas; and (ii) to show whether/how the work on sludge can benefit from insights generated in transaction-cost economics. To this end, the next section shows that there is considerable

⁵ It is worth noting that while term “transaction costs” suggests that it only applies to costs arising from a transaction, it is sometimes used more broadly (Buitelaar, 2004; Wang, 2003) to also include actions, as opposed to “trans-actions” (Commons, 1931).

⁶ Friction, in the mechanical context, is the force resisting the relative motion of surfaces and material elements sliding against each other (Atkins and Escudier, 2013). Soman (2020) makes the analogy to friction very explicit when he introduces sludge by describing a metaphorical city in which some houses do not receive water from the water grid due to (actual) sludge that leads to blocked pipes.

overlap in the concepts and their approaches, but also highlights some key differences. We then describe how the literature on sludge can benefit from insights gained in transaction-cost research, first suggesting to define sludge as *aspects of the choice architecture that lead to the experience of costs* and discussing this definition. Second, we borrow from transaction-cost typologies to develop a typology of sludge that differentiates between different choice architectures that lead to search costs, evaluation costs, implementation costs and psychological costs. Third, we discuss the extent to which the main determinants of transaction costs (specificity, uncertainty and frequency) are also determinants of sludge. Finally, we show how approaches to measuring transaction costs as well as the other insights gained from the transaction-cost literature can inform “sludge audits”. We conclude the paper by suggesting avenues for future research as well as thoughts on sludge reduction in private and public contexts.

Sludge and transaction costs: Similarities and differences

This section compares the concepts of sludge and transaction costs as defined above in the introduction, highlighting some similarities and differences across both concepts. A complete description of all similarities and difference is beyond the scope of this paper. Instead, we hope to provide a useful synthesis to spark some discussion across the two literatures. We focus on similarities and differences with potential for transaction-cost research to inform the discussions of sludge, as described in the following section on *Informing discussions on sludge with insights from transaction-cost economics*.

Bounded rationality

A key similarity across the literatures on transaction costs and sludge is that both literatures share the view that human behaviour is not always best described by the rational agents that maximise their utility under constraints as depicted in many economics textbooks. Transaction-cost economists often cite the influence of Herbert Simon's research on satisficing and highlight that people are "intendedly rational, but only limitedly so" (Simon, 1997, p.xxiv). They argue that bounded rationality can contribute to increased transaction costs; if people were fully rational, less time and effort would need to be spent to allow transactions to happen.⁷

The behavioural economic literature goes a step further and argues that people are not only boundedly rational, but also that these deviations from rational behaviour can be predicted in directional hypotheses (Thaler, 2015). Predictable deviations from rationality are called biases, and behavioural economists have identified many of these biases over the last 3 decades (including inertia, present bias, optimism bias, overconfidence, biased expectations, loss aversion and inattention to name just a few) (Dhimi, 2016). It is helpful to have this view of human behaviour in mind when discussing the origins and consequences of transaction costs and sludge in the next sub-sections.

Origins: Institutions and choice architecture

The concept of transaction costs originates from the literature on institutions. Institutions are sometimes described as the "rules of the game" (North, 1990) and can lead to more or less

⁷ However, the transaction-cost literature does not view bounded rationality as a sufficient condition for the existence of transaction costs. For example, if all the agents involved in a transaction were fully trustworthy, bounded rationality would not necessarily lead to higher transaction costs (Williamson, 1993).

frictions in economically relevant transactions. On the macro level, institutional environments are composed of political, social and legal ground rules and these rules can slow down or speed up economic activities depending on their design. On the micro level, institutional arrangements can lead to frictions when cooperation or competition between different economic actors is hindered by, for example, complicated rules (Williamson, 1993).

The term sludge originates from a literature in behavioural science that highlights the importance of the choice architecture as a main determinant of human behaviour. Choice architecture describes the contexts in which individuals make decisions (Thaler and Sunstein, 2008). These contexts can make it easy for people to make welfare-promoting decisions, for example when information is described in simple terms. Thaler and Sunstein (2008) call modifications of the choice architecture that facilitate welfare-promoting choices “nudging”. But choice architecture can also complicate decisions, for example when the completion of unnecessary forms is required or when prices of consumer products are hidden and communicated without much transparency. In these situations, the choice architecture can be called “sludgy” as it creates unnecessary frictions that make it more difficult for people to make decisions that increase their welfare.

Nudges that rely on changes of the choice architecture do not restrict people’s freedom to make decisions or change incentives significantly. Instead, these changes use psychological levers to make it more likely that one option is chosen over another. The importance of the choice architecture has been overlooked in traditional economic thinking where supposedly minor situational factors have been deemed irrelevant for the behaviour of the rational agents in economics textbooks and hence for economic analysis. But findings from behavioural

economics and psychology about bounded rationality and predictable biases suggest that these “supposedly irrelevant factors” do matter a lot (Thaler, 2015).

Institutions and choice architecture are not identical concepts. For example, nobody would deem institutions, such as property rights, marriage and religion as (supposedly) irrelevant. Moreover, institutions are often designed centrally, and the choice architecture is typically designed by street level bureaucrats or lower-level workers in organisations. However, the two concepts are related. When institutions are defined as the “rules of the game”, we can define the choice architecture as the “design of the game”.

Consider chess as an example. The rules of the game dictate that the board is organised in 8x8 squares, that the bishop can move diagonally and that the game is over when the king is taken. Within the limits provided by these rules, the game can happen in loud or quiet environments, different pieces can look differently, and the material of the board and the pieces can vary. While these design aspects might not influence the game of grandmasters, beginners might very well be affected, and some designs can make it harder to follow the rules than other designs.

As such, the design, or the choice architecture, can either make it easier or more difficult to make decisions. Accordingly, both institutions and choice architecture influence our decisions. But while institutions necessarily influence everybody’s decisions, including those decisions of the rational agents from economics textbooks and sometimes limit freedom of choice, changes of the choice architecture (often in the form of changes of supposedly irrelevant factors) have particularly strong effects on boundedly rational individuals and never reduce freedom of choice.

Both institutions and the choice architecture may originate from deliberate decisions. For example, government officials may make it excessively difficult for people to receive welfare benefits and companies may make it difficult to redeem mail-in rebates to gain financial benefits in a somewhat opaque way. Moreover, financial adviser lobbies have an incentive to keep the tax system complicated to guarantee demand for their services. On the other hand, institutions with transaction costs as well as sludgy choice architecture can also result from unintentional processes where, for example, paperwork requirements accumulate over time, potentially because the designers of the institutions and the choice architects themselves are boundedly rational and not aware of the frictions they create for end-users. Public officials and industry representatives might not be able to see these frictions emerging as there might be an “empathy gap” where experts are blind to problems that non-experts might encounter (Soman et al., 2019).

Consequences: Effectiveness, efficiency and equity

Transaction costs can have many consequences. The transaction-cost literature often distinguishes between consequences related to reduced levels of effectiveness, efficiency and equity (Coggan et al., 2015, Shahab et al., 2019b, Rørstad et al., 2007, Jaraite et al., 2010, Kuperan et al., 2008, Shahab and Viallon, 2019, Mack et al., 2019). Transaction costs influence the effectiveness of market transactions when, for example, contracts are too complicated to be set up so that sales are not agreed upon. Thus, fewer transactions happen than it would be optimal. They can influence the effectiveness of government programmes when take-up rates of welfare benefits are low due to paperwork burdens. Transaction costs reduce efficiency when, for example, they lead to dead weight losses due to too little trade on a market or when citizens need to spend too much time and effort to receive welfare benefits. High levels of transaction costs in a market mean that a lot of resources are needed to complete transactions.

And transaction costs can influence how equitable outcomes of market transactions are when they make it easier or less costly for some than for others to make transactions. For example, the transaction costs of the EU Emissions Trading Scheme are lower for participants with larger allocations than for those with smaller allocations. While the average transaction costs for smaller firm is around €2.02 per tonne, larger firms pay only about €0.05 per tonne (Jaraite et al., 2010).

The sludge literature has also begun to discuss consequences of sludge and we can organise these consequences according to their effects on effectiveness, efficiency and equity, as well. In terms of effectiveness in the public sector, sludge can reduce the take-up rates of government programmes, reduce acquisitions of permits or licenses (Herd and Moynihan, 2019) and reduce the ability to enjoy individual rights such as the right to vote and the right for free speech (Sunstein, 2020). In the private sector, sludge can reduce the number of rebates that consumers claim (Bar-Gill, 2012) and generally reduce people's freedom understood as the ability to do what they want to do (Sunstein, 2019a). Moreover, when firms compete to design the most deceiving and sludgy choice architecture (rather than competing over price or quality), lower social welfare can be the result (Akerlof and Shiller, 2015).

In terms of efficiency, sludge in the public sector can increase the time and money spent to achieve given outcomes, for example when administrative requirements lead to an increased need for administrative capacity and person-time. In the private sector, sludge can reduce efficiency when goods are purchased for more than the market price.

Finally, sludge can have uneven effects on different people, and inequality can increase when sludges have stronger effects on some segments in the population, such as the poor, the elderly,

the sick or those with young children (Christensen et al., 2020). Those most in need of welfare support might also be those who have most difficulties overcoming sludge to obtain the welfare benefits due to low mental bandwidth and being pre-occupied with financial and other worries (Shafir and Mullainathan, 2013). While also fully rational people are likely to be adversely affected by sludge, behavioural biases make sludge especially harmful and sometimes devastating (Sunstein, 2019b).⁸

Measurement: Direct and indirect costs

To quantify transaction costs and consequences of sludge (also in terms of effectiveness, efficiency and equity), we need to identify the units in which transaction costs and the consequences of sludge can be measured. The transaction-cost literature quantifies transaction costs by measuring the direct and indirect costs incurred by involved parties to complete transactions (Coggan et al., 2015, Falconer and Saunders, 2002, Fang et al., 2005, Kuperan et al., 2008, McCann and Easter, 1999, Shahab et al., 2018a).⁹ The direct costs refer to all direct financial (or monetary) costs involved in the transactions. These costs include, for example, administration fees, brokerage fees, the costs of hiring consultants and intermediaries, the costs of transportation and accommodation and the costs of conducting surveys. The indirect costs often refer to the costs of time spent on each transaction. To monetise time-related costs, reported time inputs are multiplied by standard hourly rates.¹⁰

⁸ Madsen, Mikkelsen, and Moynihan (2020) discuss more distributional issues related to the effects of friction as dealt with in the literatures on sludge, administrative burden, red tape, and ordeals.

⁹ The magnitude of transaction costs varies widely from as low as 1% of the payment (Falconer and Whitby, 1999) to as high as 110% of the payment (Falconer and Saunders, 2002) depending on the context, the way transaction costs are measured and the definition of the baseline payment that defines the 100%.

¹⁰ For example, Shahab et al (2018a) assessed the standard value of time for Maryland farmers as \$22.80 per hour. They calculated this rate based on the average net income per farm in 2015, i.e. \$40,797 (Maryland State Archives,

The effects of sludge can also be measured in terms of direct costs (i.e., monetary costs in terms of how much money consumers/citizens lose) and indirect costs (i.e., time-related costs in terms of how much time consumers/citizens lose).¹¹ Sunstein (2019b) for example suggests that about 9.78 billion hours have been lost in the US in 2015 due to paperwork. Additionally, behavioural scientists highlight hedonic psychological costs (another form of indirect costs) related to sludge (Thunström, 2019). First studies are emerging that quantify these psychological costs of sludge for example using face recognition techniques (e.g., Hattke et al., 2020). While much more attention has been devoted to quantifying transaction costs than to the quantification of sludge, only few transaction costs scholars have attempted to take account of psychological costs when discussing transaction costs (see Hart and Moore, 2008; Hart and Holmstrom, 2010; Fehr et al., 2009, 2011; Bartling et al., 2017).

Types: Search, bargaining and enforcement costs

The transaction-cost literature has identified several types of transaction costs (Dahlman, 1979, McCann et al., 2005, McCann and Easter, 1999, Shahab et al., 2019a, Thompson, 1999, Bruce and Fabozzi, 1991). These typologies have helped transaction-cost researchers over the years to think systematically about transaction costs. The typologies have been instrumental particularly in empirical studies that aim to identify and measure transaction costs in different economic contexts. The literature on sludge has not yet agreed upon a typology.¹² Maybe the

2017), divided by the average annual hours actually worked per worker in the US in 2015, i.e. 1790 hours (OECD, 2017).

¹¹ The “effects of sludge” in this sentence refer to the welfare consequences of changing the choice architecture. Sludges can have economic consequences in form of direct monetary costs just like nudges can make people financially better off. These economic costs can arise although sludges and nudges do not change economic incentives significantly.

¹² The first sludge typology we could identify is by Soman et al (2019) who differentiate between process sludge, communication sludge and emotional exclusion sludge. In the literature on administrative burdens, Moynihan,

most popular typology of transaction costs was suggested by Dahlman (1979). He differentiates between (i) search and information costs, (ii) bargaining and decision costs and (iii) policing and enforcement costs. We briefly summarise this typology here because it has inspired our thoughts on a sludge-typology that is presented in the sub-section *Toward a typology of sludge*.

Dahlman (1979) suggests that people incur search and information costs when searching and collecting information before carrying out transactions. For example, consumers need to spend time and resources to obtain information about potential purchases (e.g., the quality of products and services and the trustworthiness of transaction partners), and companies need to invest time and resources to identify the prices they can sell their products for on the target market. Bargaining costs become relevant once potential transaction partners have been identified. They arise, for example, when interested parties attempt to assess the desire of other agents to participate in the transaction and to obtain information about their willingness to pay or sell. Such bargaining costs can arise in firm-to-firm transactions but are also relevant for transactions within firms and between firms and consumers. Finally, policing and enforcement costs become relevant when parties have come to an agreement and when this agreement needs to be enforced. The parties need to make sure that everybody sticks to the agreements and complies with formal or informal contracts. These costs can include the monitoring of outcomes and the level of compliance with the agreed terms and conditions, as well as the development of monitoring technologies.

Herd, and Harvey (2015) suggest that burdens come in the form of three types of costs: learning costs describe the time and effort that needs to be spent to identify public services; compliance costs describe the effort and money that has to be spent to complete administrative requirements; and psychological costs are related to negative emotions such as stigma, stress and loss of autonomy that arise when people interact with the government (see also Herd and Moynihan, 2019).

Influencing factors: Specificity, uncertainty and frequency

What are the factors that influence whether transaction costs and sludge are high or low? While the literature on sludge has not yet identified a systematic answer to this question, the transaction-cost literature describes various factors that influence transaction costs (Coggan et al., 2013, Shahab et al., 2018c, McCann, 2013). The literature has mainly focused on three interrelated factors influencing transaction costs: specificity, uncertainty and frequency (Williamson, 1985, 1996). Specificity (often referred to as asset specificity) is a “specialised investment that cannot be redeployed to alternative uses or by alternative users without a loss in productive value” (Williamson, 1996, p.377). Specificity, which has various types,¹³ concerns the degree to which resources are specific to particular transactions. Some resources can be used in many domains (e.g., money, general computer hardware or math skills) and other resources are not easily re-deployable to other transactions (e.g., specific software and hardware or tacit knowledge about how an organisation works). The more specific resources are, the higher are the transaction costs when these resources need to be employed in another area.

Uncertainty can increase transaction costs when transaction partners have limited and/or asymmetric information about cost structures, prices and potential profits of the transactions. In such cases, contracts are more difficult, expensive and risky to establish (Dixit, 1996, Williamson, 1975, Saussier, 2000). Different aspects of uncertainty can be distinguished, for example in terms of volatility and ambiguity (Carson et al., 2006). Volatility concerns uncertain future conditions and ambiguity is about the uncertainty in present and past experiences.

¹³ There are different types of specificity, such as the site of production, physical and dedicated assets, human capacity (Williamson, 1981), brand name (Williamson, 1985), time of production (Malone et al., 1987) and procedural specificity (Zaheer and Venkatraman, 1995).

Transaction costs arise because of both forms of uncertainty and as a result of the actions that transactors must take to manage for these uncertainties.

Finally, frequency is discussed in the transaction-cost literature as an influencing factor of transaction costs. Transaction costs are higher when transactions are infrequent than when they are frequent because agents become more efficient over time through a “learning by doing” effect (Arrow, 1962).¹⁴ Frequent transactions reduce marginal transaction costs due to the ability to re-deploy the collated information and capitalise on standardised processes and contracts. More frequent transactions of the same good or service also enable transactors to capitalise on economies of scale, and individuals’ past experiences with an activity can help them to accomplish their tasks in a more efficient way.

Informing discussions on sludge with insights from transaction-cost economics

A definition of sludge

Viewing sludge through the lens of transaction-cost economics, we suggest the following working definition of sludge: *sludge describes aspects of the choice architecture that lead to the experience costs.*

The *costs* in this definition refer to costs that need to be paid to make an action happen, but that might not create any value for the person who bears the costs; just like transaction costs are the costs that make a transaction happen, but do not create value. This definition highlights the

¹⁴ There are interrelations between the three factors of specificity, uncertainty and frequency. Frequent transactions can reduce uncertainty over the transaction, whilst creating trust between parties involved. Likewise, asset specificity might impact the frequency of a transaction (Rørstad et al., 2007); a high degree of asset specificity might lead to low frequency.

connection between the literatures on sludge and transaction costs and clarifies how both terms are related, i.e., that sludge can *lead* to costs, such as transaction costs. We use the word “*lead*” intentionally here to highlight that sludge and transaction costs are not the same thing, but that one can lead to the other.

The definition also captures that sludge is concerned with specific costs, namely those arising from *aspects of the choice architecture*. Other types of costs, such as brokerage fees/commissions, legal fees and administrative charges, do not arise due to sludge because they do not directly link to aspects of the choice architecture. Linking sludge to the choice architecture highlights the close connection between sludge and the behavioural science literature which suggests that human behaviour is strongly influenced by the contexts in which we make decisions.

The definition suggests that sludge leads to the *experience* of costs. Since it is this subjective experience of costs that determines whether sludge is present, it is not sufficient to analyse a particular choice architecture to determine whether sludge is present or not (e.g., by observing whether there is a default, a social norm, or a lot of information presented). Additionally, one must observe how individuals interact with this choice architecture. This is in line with the literature on transaction costs that emphasises the importance of perceived, rather than objective, transaction costs (Mack et al., 2019, Miharia and Woltier, 2010) and the behavioural public administration literature which defines administrative burden (a sub-set of sludge) as the

experience of cost (e.g., Burden et al., 2012; Christensen et al. 2020; Herd and Moynihan, 2018).¹⁵

The focus on subjective experience highlights that the same sludge can lead to different costs for different people. For example, requiring some additional paperwork to be completed can lead to the subjective experience of high costs for people who are currently pre-occupied with financial and other worries and thus are low on mental bandwidth (Shafir and Mullainathan, 2013). Other people, who do not perceive these worries, might not experience the same high costs of filling out the same forms.¹⁶ Highlighting that sludge leads to experienced costs also suggests that sludge includes aspects of the choice architecture that create psychological costs such as frustration, anxiety, stigma and humiliation. Note, however, that in many situations the subjective experience of costs will align with objective costs, for example in terms of time, effort and money spent.

Our definition of sludge also speaks to the debate on whether sludge should be defined normatively (sludge is always “bad”) or non-normatively (sludge can be both “good” and “bad”) (see Mills, 2020 arguing for a non-normative definition of nudge and sludge). Our definition suggests that sludge always leads to the experience of costs, and costs are always

¹⁵ There are more links between the literature on sludge and the literature on public administration as reviewed by Madsen, Mikkelsen, and Moynihan (2020). This paper compares sludge with three other forms of friction: administrative burden (e.g., Burden et al, 2012), red tape (e.g., Bozeman, 2000 and Bozeman, 2012) and ordeals (e.g., Nichols and Zeckhauser, 1982). It highlights, for example, that administrative burden is defined as a subjective experience (although one can use objective measures of experience to quantify it) and that sludge is described as objective changes in friction. We deviate from this perspective on sludge and suggest that sludge must lead to experienced costs to be defined as sludge. The paper by Madsen, Mikkelsen, and Moynihan (2020) additionally discusses distributiveness, the object and the domain of frictions, and intentionality as other dimensions on which sludge can be compared with administrative burden, red tape and ordeals.

¹⁶ The subjective element of costs experienced by the decision maker in our definition links to the “as judged by themselves” criterion that Thaler and Sunstein (2008) use to determine whether nudges are libertarian paternalistic or not.

welfare-reducing. However, it might very well be the case that the same sludge also leads to benefits for the individual, for the choice architect or for society as a whole (for example as discussed in the context of self-control problems by Soman (2010) and program integrity by Sunstein and Gosset, 2020). But whether sludge leads to net-benefits or net-costs all aspects considered is irrelevant for our definition of sludge. Observing that a person experiences costs that are due to the choice architecture the person navigates in is enough for us to claim that we have identified sludge, independent of whether the sludge also leads to benefits. As such, we suggest that sludge always leads to costs, but determining whether sludge is welfare-reducing (i.e., unjustified and excessive) or welfare-enhancing requires a broader cost-benefit analysis that also integrates benefits to all involved parties (see also Linos et al., 2020).¹⁷

Toward a typology of sludge

The universe of sludging is large and there are many types of sludges (e.g., unnecessary paperwork, difficulties to opt out of newspaper subscriptions and unnecessary waiting periods). A systematic classification of these types of sludge would be beneficial. For example, it would help to develop scorecards that individuals and institutions can use to identify sludge (Soman et al., 2019).¹⁸ It would also assist in bridging the gap between theoretical and empirical studies

¹⁷ As discussed in Madsen, Mikkelsen, and Moynihan (2020), some sub-fields in the public administration literature suggest that frictions can be overall welfare-enhancing (e.g., when administration is onerous but also useful to identify whether somebody is eligible for a service). Other sub-literatures in that field suggest that frictions are always welfare-reducing (e.g., some definitions of red tape assume that there are no benefits to red tape).

¹⁸ Soman et al. (2019) argue that a given choice architecture can be sludgy for some individuals but not for others. They argue that it can be difficult for choice architects (who are experts in their area) to empathise with non-experts who experience sludge with detrimental outcomes. Experts can easily navigate through even complex choice architectures and thus might have difficulties identifying the effect of sludge on non-experts' behaviour. A typology will help overcome this empathy gap.

on sludge, particularly regarding sludge audits, and prevent overlooking important types of sludge in these audits. Hence, we suggest a sludge typology in this sub-section.

Since our definition of sludge connects sludge to the transaction-cost literature, relying on Dahlman's (1979) typology for transaction costs (described in the sub-section *Types*) is a good starting point to develop a sludge typology. However, Dahlman's typology is most adequate to describe transaction costs that arise in market transactions, and sludge is also present in other situations, for example within organisations and institutions and when citizens interact with the government. Hence, we modify the typology by using broader terms that can describe most examples of sludge currently discussed in the literature. More precisely, and in line with Dahlman's three types of transaction costs, we differentiate between sludge as aspects of the choice architecture that lead to the experience of (i) search costs, (ii) evaluation costs and (iii) implementation costs.¹⁹ We also add a fourth type of cost to account for the emotional consequences of sludge: (iv) the experience of psychological costs. Below and in Table 1, we explain this typology and use it to organise some of the emerging behavioural science literature on sludge, also from behavioural industrial organisation (Akerlof and Shiller, 2015, Heidhues and Kőszegi, 2018, Bar-Gill, 2012, Grubb, 2015a). We thus demonstrate that, while there is overlap between the types, many sludges can indeed be organised into one of these four types.

¹⁹ Sludge is particularly relevant when individuals interact with non-human systems such as websites, booking systems and generally in online environments (Costa and Halpern, 2019). Since the term bargaining does not capture all these transactions as it implies active participation of both bargaining partners, we use the term *evaluation costs* to describe costs arising from choice architecture that makes it more difficult for people to evaluate the costs and benefits of an action. Evaluation costs include bargaining costs (or the evaluation of the willingness of the potential transaction partners to pay or sell products), but evaluation costs are not limited to bargaining costs. Similarly, *implementation costs*, as we use the term, are broader than policing and enforcement costs. They include the implementation of agreements between different parties, but also include the costs of sticking to plans people have made before and when people attempt to behave according to their intentions.

Search costs:

Sludge can increase search costs when aspects of the choice architecture make it more difficult for people to find the relevant information needed for good decision making. For example, presenting too much information can decrease the motivation to choose or the satisfaction with the finally chosen option (Grubb, 2015b, Scheibehenne et al., 2010). The order in which information is presented can also increase search costs, for example when initially low prices increase throughout the purchasing process (Gabaix et al., 2006). A product might be listed at a very low price but additional shipping and handling costs or essential “extras” can increase this price above that of competitors, a characteristic sometimes referred to as “shrouded attributes” (Ellison and Ellison, 2009, Gabaix et al., 2006). Generally, the choice architecture can determine whether prices and other product attributes are immediately visible and salient or hidden from sight, which influences how easy or difficult it is to find the relevant information. Moreover, the choice architecture can orient people’s attention to one area of the product over another potentially more important dimension (Bar-Gill, 2019, Ubel et al., 2015). In the context of interactions between the government and citizens, sludge can lead to search costs when websites are so complicated that it is difficult for citizens to become aware of their eligibility for welfare benefits, tax reductions or other government benefits (Herd and Moynihan, 2019).

Evaluation costs:

Sludge can increase evaluation costs when the choice architecture makes it more difficult to evaluate advantages and disadvantages of different options. In many cases, this creates deviations of *perceived* attributes from *actual* attributes of options. For example, the way firms

communicate product features, contract terms and prices can make consumers overestimate benefits and underestimate prices of products such as credit cards, mobile phone contracts and mortgages (Bar-Gill, 2012). Moreover, predicting how consumers will use products in the future is inherently difficult, and firms can make use of this by hiding overdraft fees and credit limits in the fine print. For example, mobile phone and credit card contracts are often designed to make the evaluation of their actual prices difficult: Salient up-front costs are reduced and the less salient, hidden costs such as overdraft fees, are increased. Shrouded attributes do not only increase search costs as described in the previous sub-section; they can also make it more difficult to evaluate the costs and benefits of different options.

Implementation costs:

Sludge can lead to higher implementation costs when the choice architecture makes it more difficult for people to get what they want and avoid what they do not want. For example, after people have evaluated the costs and benefits of receiving a monthly service and decided to cancel the service, they must implement that decision. Sludge can make this implementation very difficult when the cancellation process is made complicated and long (Norwegian Consumer Council, 2021). Similarly, excessive paperwork and form filing requirements can make it more difficult for people to participate in government programs, for example when information needs to be provided multiple times, when one's status needs to be certified although the government is the certifying institution, when submissions are required to be sent by postal mail rather than digitally or when people are required to actively renew their participation in welfare programmes (Herd and Moynihan, 2019). As many researchers will know, applying for third-party funding can be easy or difficult depending on the administrative

requirements in one's institution and these differences can be described as implementation costs.

Psychological costs:

The literature on sludge frequently refers to psychological costs (Sunstein, 2020).²⁰ For example, Hattke et al. (2020) show in a laboratory experiment that bureaucratic red tape creates negative emotional responses as measured using facial recognition technology. Other examples of psychological costs of sludge include the stress in dealing with unnecessary frictions with the underlying worry of the risk of losing important benefits, embarrassment that might arise when people need to apply for welfare benefits, self-image concerns related to the requirement to tell others how miserable one is to get welfare benefits, the stigma of participating in programmes, loss of personal autonomy, a sense of unfairness and animosity among public servants who administer programs (Herd and Moynihan, 2019). For choice architects it can be difficult to anticipate these psychological effects of sludge because the designers of the choice architecture may not have experienced these emotions first-hand. Hence, the empathy gap between the choice architect and the end user is likely strongest when it comes to psychological costs (Soman et al., 2019).

²⁰ Here (and in other instances) the literature on sludge cites insights from the administrative burden literature which places emphasis on citizen experiences with welfare administration (Herd and Moynihan, 2018).

Table 1 A typology of four different types of sludges leading to different experienced costs

| Type of cost | Definition | Examples |
|----------------------|---|--|
| Search costs | Aspects of the choice architecture that lead to the experience of search costs by making it more difficult to acquire relevant information about different options. | Offering too many options; Confusopolies; Ordering of search results by profit margins rather than price. |
| Evaluation costs | Aspects of the choice architecture that lead to the experience of evaluation costs by making it more difficult to evaluate advantages and disadvantages of different options. | Hidden add-on costs and drip pricing; Hidden extra fees; Untrue discount claims and moon pricing; Long and confusing fine print. |
| Implementation costs | Aspects of the choice architecture that lead to the experience of implementation costs by making it more difficult to get what you want and avoid what you do not want. | Hidden subscriptions; Automatically renewing subscription; Unnecessarily complex paperwork; Difficult return policies; Complicated tax filing. |
| Psychological costs | Aspects of the choice architecture that lead to the experience of psychological costs by creating negative experiences such as stress, stigma, disempowerment and loss of autonomy. | Misleading messages that put psychological pressure on buyers to purchase; Misleadingly highlighting the popularity of a product; False scarcity messages; Pressure selling. |

Factors influencing sludge

As summarised in section *Influencing factors*, the transaction-cost literature suggests that, *inter alia*, specificity, uncertainty and frequency influence how low or high transaction costs are. These three factors are also important determinants of whether a choice architecture is sludgy or not. First, a highly specific choice architecture can make a change of setting more costly. For example, people may have developed the skills to navigate through the choice architecture of a specific software in their organisation. This skill is of limited use in other organisations where

people need to navigate through a different choice architecture that can be complex to navigate in at the start. If that is the case, specificity of the choice architecture can be a form of sludge as it creates implementation costs related to the move from one organisation to another.

Second, when a person experiences costs due to a choice architecture that creates uncertainty, sludge can be present. For example, some firms seem to try to reduce cancellations of their services by warning users of the consequences of unsubscribing without clarifying what these consequences are. Similarly, users willing to cancel subscriptions are sometimes asked multiple times to affirm their choice using different words which can create uncertainty about one's motivation to cancel (Norwegian Consumer Council, 2021). Uncertainty can also make the choice architecture sludgy when multiple steps are required in administrative or other processes and when individuals are not made aware of these steps at the beginning of the process. People may also experience costs when the timing of a service, such as the arrival of a taxi or the delivery of a postal parcel, is uncertain. These are examples where the choice architecture creates uncertainty in individuals and thus makes them experience search, evaluation, implementation and psychological costs.

Finally, the extent of sludge in a choice architecture can also be influenced by the frequency of navigation in this choice architecture. When people first encounter a new choice architecture, they often experience high costs. However, once people have learned to navigate in this choice architecture, it becomes less sludgy for them as they experience less search, evaluation, implementation and psychological costs over time. A choice architecture can be particularly sludgy when people encounter the choice architecture only infrequently (for example, once a year for the tax returns). Such infrequent requirements to navigate through a largely unchanging choice architecture provide business opportunities for third parties to become experts in these

choice architectures by re-using collected information and re-deploying resources again and again. This allows them to become helpful guides in choice architectures that appear complex and alien to most people.

Sludge audits

Arguably the main reasons to better understand sludge are to be able to identify it, to conjecture about its welfare consequences and to develop ways to reduce sludge if deemed necessary (Soman et al., 2019, Sunstein, 2019b). To identify sludge as a first step in this process, Sunstein (2020) suggests using “sludge audits.” He argues that private and public organisations can engage in annual sludge audits to identify where and when sludge exists and whether it needs to be reduced. Periodic lookbacks at existing sludge can be conducted to identify the current stock of unnecessary requirements posed to employees and civil servants as well as customers and citizens. To measure sludge, he differentiates between time-related costs, financial costs and psychological costs (see also sub-section *Measurement: Direct and indirect costs*). When conducting sludge audits, Sunstein argues, cost-effectiveness and cost-benefit analyses should be considered,²¹ and a mix of quantitative and qualitative approaches should be used to look at sludge on a case-by-case basis (Sunstein, 2020).

The insights from the transaction-cost literature, some of them presented in the previous sections of this paper, may provide additional guidance on how to design sludge audits. Transaction-cost economics has developed a large body of literature that addresses questions on how to measure transaction costs in theoretical, empirical and methodological contributions

²¹ Cost-benefit analyses may often be impossible in the context of the quantification of sludge. Sunstein (2020) suggests that an alternative to the cost benefit analysis is to make assessments of proportionality, asking whether there are significant costs from the sludge and whether these serve significant purposes.

(Shahab et al., 2018a, McCann and Easter, 1999, Coggan et al., 2015, McCann et al., 2005, Jaraite et al., 2010). Referring to this literature and the previous insights presented in this paper, in what follows we present five crucial aspects to be considered when conducting sludge audits: (i) breaking up the processes into required actions, (ii) choosing the appropriate methods, (iii) recruiting the relevant participants, (iv) asking the right questions and (v) communicating the benefits of sludge audits.

Breaking up the processes into required actions:

Most sludge audits will proceed in at least two steps. The first step is to break up more complicated processes into smaller sub-processes. This is essential to keep the audit manageable and to identify the specific interventions that can reduce sludge in certain situations. A potential problem arises in this process as, theoretically, each sub-process could be further divided into more and more sub-sub-processes (Shahab et al., 2018b, Tan et al., 2012). To avoid endless divisions into smaller processes, a basic unit of analysis needs to be identified. In the transaction-cost literature, the basic unit of analysis is the transaction (Williamson, 1998), defined as the transfer of property rights regarding goods, services, information, knowledge or ideas (Williamson, 1996). For sludge audits, we suggest using the “required action” as the basic unit of analysis. The required action would be defined as each step that has to be taken in a decision-making process to achieve one’s goal as subjectively defined by the individual. The concept of the required action is somewhat broader than the concept of the “trans-action”, because sludge can also be present when only a single individual makes a decision and no other people are involved who could be the receiver of a transaction. Practically, sludge auditors can ask relevant interview/survey participants to describe the process of, for example, applying for a visa, filing a tax return or completing a form by breaking

down the process into the different actions required. In the second step, a sludge auditor would then analyse each required action using methods/questions as presented in the next sub-sections.

Choosing the appropriate method:

The transaction-cost literature uses various approaches to measure transaction costs. For example, McCann et al. (2005) identify five different sources of information for measuring transaction costs: (i) interviews or surveys of people and parties involved in transactions, (ii) secondary data from other studies, (iii) government reports, (iv) financial reports and (v) proposed budgets. However, the most common way to collect data about the size of transaction costs is to use surveys and/or interviews (see for example Falconer and Saunders, 2002, Shahab et al., 2018a, Fang et al., 2005, Kuperan et al., 2008, Ofei-Mensah and Bennett, 2013). The main reason for the use of interviews and surveys is that other methods and data sources are not always available to obtain information regarding both *ex-ante* and *ex-post* transaction costs (McCann et al., 2005). As such, the most common methods to conduct sludge audits will likely be interviews and surveys as well. Moreover, to start the sludge audit, it is advisable for auditors to go through the process themselves, if possible, attempting to gain a first-hand experience. To bridge the “empathy gap” (Soman et al., 2019), auditors can alternatively ask a non-expert to go through the process. Additional methods, such as face recognition experiments to measure psychological costs (Hattke et al., 2020), are likely to become more common over time.

Recruiting the relevant participants:

If sludge auditors decide to use interviews and/or surveys to collect data regarding each of the required actions, the next step will be to recruit the relevant participants. Some studies in the transaction-cost literature separate this process into three steps (Shahab et al., 2018a): (i)

defining the population of interest, (ii) deciding on a sample size and (iii) selecting a sampling strategy. The population of interest would be a set of all people who are eligible to be interviewed/surveyed in a sludge audit. To define the population of interest, either inclusion (i.e., everyone who has a specific characteristic) or exclusion (i.e., everyone who does not have the specific characteristic) criteria can be used. It is important to include individuals who do navigate in the respective choice architecture to gain insights into experienced costs from those who experience these costs in real life as well. Deciding on the size of the sample of participants depends on the chosen method. In quantitative surveys, the sample size needs to allow for statistical generalisability and power analyses can be helpful. In qualitative interviews, the aim is to reach data saturation, which describes the point at which no new additional data or no further insights are generated from data collection (Guest et al., 2006). Finally, regarding the sampling strategy, the auditors can choose between different types of purposive and/or random sampling strategies, depending on the main objectives of the audit and the chosen method.

Asking the right questions:

The second step in most sludge audits will aim to identify sludge related to each of the required actions. To identify valid topics to discuss and questions to ask, it can be helpful to refer to the definition of sludge, the sludge typology and the influencing factors that we have described above. For example, a good start is to ask participants to indicate whether they experienced costs in the process of enacting the required action. It is worth noting that these costs can be financial (direct costs) or related to lost time or psychological burden (indirect costs). Follow-up questions can then ask whether participants experienced specific types of costs (i.e., search costs, evaluation costs, implementation costs and psychological costs). For example, questions about what made it difficult for participants to acquire relevant information, to evaluate

advantages and disadvantages of options and to get what they wanted and avoid what they did not want can be asked. Similarly, sludge auditors can directly ask about negative experiences such as stress, stigma, disempowerment and loss of autonomy.

Once these different costs have been identified, sludge auditors can ask participants to reflect on the sources of these costs, highlighting supposedly irrelevant factors related to the choice architecture. In particular, sludge auditors can invite participants to reflect on the specificity, uncertainty and frequency of the choice situation. It may be helpful, for example, to ask participants whether they are able to transfer knowledge from one experience to the next, whether they experience uncertainty and are not sure about the right steps in the process and whether the process would get less costly each time they go repeat it.

Communicating the benefits of sludge audits:

For sludge audits to happen, it is essential to get some buy-in from the relevant actors in industry or policy. To obtain this buy-in, it is important to clearly demonstrate the relevance of thinking about the choice architecture and design aspects, rather than thinking only about institutional rules. It can be helpful to communicate some key insights from the behavioural sciences about predictable decision-making biases and the related importance of context effects to highlight why it is important to also consider the choice architecture. Moreover, potential auditors might be experts in the choice architecture that might benefit from a sludge audit. This can lead to an empathy gap, making it difficult for the experts to “see sludge” (Soman et al., 2019). Hence it is important to highlight the subjective nature of sludge; that what is sludge for one person is not sludge for another person. It can also be helpful to stress that sludge can grow through unintentional processes over time to highlight that no single individual might be to blame for

the existing sludge. Finally, it might be better to avoid using negative language. Both the words “sludge” and “audit” may be perceived as threatening and public officials as well as industry representative may be more open to “behavioural process reviews”, “tests for regulatory load” or “transaction costs measurement” than for “sludge audits”.

Summary and Conclusion

This conceptual paper shows that sludge and transaction costs are related, but distinct concepts. The two concepts are related because sludge can lead to the experience of costs. The two concepts are distinct because sludge can lead to the experience of various types of costs and not only transaction costs. The paper suggests that the behavioural science literature on sludge can benefit from incorporating concepts and methods developed in the new institutional economics literature on transaction costs. First, it suggests defining sludge as aspects of the choice architecture that lead to experienced costs. Second, it presents a new typology of sludge that differentiates between aspects of the choice architecture that lead to the experience of (i) search costs, (ii) evaluation costs, (iii) implementation costs and (iv) psychological costs. Third, the paper shows that specificity, uncertainty and frequency are factors that influence transaction costs as well as how sludgy a choice architecture is. Finally, building on the discussed contributions, the paper presents some pragmatic considerations for conducting sludge audits.

Once sludge audits have been conducted, the next step is to reduce the previously identified sludge where adequate. While “sludge reduction” is beyond the scope of the current paper (see Sunstein 2019 for a discussion on sludge-reduction), we do provide an outlook on future work on this topic. First, our definition of sludge suggests that sludge reduction refers to changes in the choice architecture that remove those aspects that create experienced search costs,

evaluation costs, implementation costs and psychological costs. Sludge reduction policies might well differ depending on the type of sludge. Second, while we have focussed on changing the choice architecture in this paper, our definition of sludge also allows an alternative avenue of sludge reduction: It is possible to educate people to be aware of sludge in its different facets and to help them navigate through the choice architecture efficiently. Such educational strategies could be considered a specific form of “boosting” (e.g., Grüne-Yanoff and Hertwig, 2016). In fact, merely providing a language to describe the hassle related of administrative burdens and other frictions of everyday life might already be enough for self-reflective individuals to experience less costs when navigating through complex choice architecture. Third, sludge is often reduced by private agents when intermediaries (for example, consultants, lawyers and the tax preparation industry) take care of our paperwork for us. Finally, when sludge is intentional, governments may also consider mandating sludge reductions and thus engage in specific forms of “budging”, i.e. the governments’ uses of behavioural economic findings to inform where and how to regulate the private sector (Oliver, 2013).

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References

- Akerlof, G. A. & Shiller, R. J. 2015. *Phishing for Phools: The Economics of Manipulation and Deception*, Princeton, Princeton University Press.
- Allen, D. W. 1999. Transaction Costs. In: Bouckaert, B. & De Geest, G. (eds.) *Encyclopedia of Law and Economics*. Cheltenham: Edward Elgar.
- Arrow, K. J. 1962. The Economic Implications of Learning by Doing. *The Review of Economic Studies*, 29, 155-173.
- Atkins, T. & Escudier, M. 2013. *A Dictionary of Mechanical Engineering*, Oxford, Oxford University Press.
- Bar-Gill, O. 2012. *Seduction by Contract: Law, Economics, and Psychology in Consumer Markets*, Oxford, Oxford University Press.
- Bar-Gill, O. 2019. Smart disclosure: promise and perils. *Behavioural Public Policy*, 1-14.
- Bar-Gill, O. & Ben-Shahar, O. 2020. Rethinking Nudge: An Information-Costs Theory of Default Rules. *University of Chicago Law Review*, Harvard John M. Olin Discussion Paper.
- Bozeman, B. 2000. *Bureaucracy and red tape*, Upper Saddle River, NJ, Prentice Hall.
- Bozeman, B. 2012. Multidimensional Red Tape: A Theory Coda. *International Public Management Journal*, 15, 245-265.
- Bruce, M. C. & Fabozzi, F. J. 1991. A Methodology for Measuring Transaction Costs. *Financial Analysts Journal*, 47, 27-44.
- Burden, B. C., Canon, D. T., Mayer, K. R. & Moynihan, D. P. 2012. The Effect of Administrative Burden on Bureaucratic Perception of Policies: Evidence from Election Administration. *Public Administration Review*, 72, 741-751.
- Carson, S. J., Madhok, A. & Wu, T. 2006. Uncertainty, Opportunism, and Governance: The Effects of Volatility and Ambiguity on Formal and Relational Contracting. *Academy of Management Journal*, 49, 1058-1077.
- Cheung, S. N. S. 1987. Economic organization and transaction costs. In: EATWELL, J., MILGATE, M. & NEWMAN, P. (eds.) *The New Palgrave: A Dictionary of Economics*. London: Palgrave Macmillan.
- Christensen, J., Aarøe, L., Baekgaard, M., Herd, P. & Moynihan, D. P. 2020. Human Capital and Administrative Burden: The Role of Cognitive Resources in Citizen-State Interactions. *Public Administration Review*, 80, 127-136.
- Coggan, A., Buitelaar, E., Whitten, S. M. & Bennett, J. 2013. Intermediaries in Environmental Offset Markets: Actions and Incentives. *Land Use Policy*, 32, 145-154.
- Coggan, A., Van Grieken, M., Boullier, A. & Jardi, X. 2015. Private Transaction Costs of Participation in Water Quality Improvement Programs for Australia's Great Barrier Reef: Extent, Causes and Policy Implications. *Australian Journal of Agricultural and Resource Economics*, 59, 499-517.
- Commons, J. R. 1931. Institutional Economics. *American Economic Review*, 21, 648-657.
- Costa, E. & Halpern, D. 2019. The behavioural science of online harm and manipulation, and what to do about it. *The Behavioural Insights Team*.
- Dahlman, C. J. 1979. The Problem of Externality. *The Journal of Law and Economics*, 22, 141-162.
- Dhami, S. 2016. *The Foundations of Behavioral Economic Analysis*, Oxford, Oxford University Press.
- Dixit, A. K. 1996. *The Making of Economic Policy: A Transaction-Cost Politics Perspective*, Cambridge, MA, MIT Press.
- Ellison, G. & Ellison, S. F. 2009. Search, Obfuscation, and Price Elasticities on the Internet. *Econometrica*, 77, 427-452.
- Falconer, K. & Saunders, C. 2002. Transaction Costs for SSSIs and Policy Design. *Land Use Policy*, 19, 157-166.

- Fang, F., Easter, K. W. & Brezonik, P. L. 2005. Point-nonpoint source water quality trading: A case study in the Minnesota River basin. *JAWRA Journal of the American Water Resources Association*, 41, 645-657.
- Gabaix, X., Laibson, D., Moloche, G. & Weinberg, S. 2006. Costly Information Acquisition: Experimental Analysis of a Boundedly Rational Model. *American Economic Review*, 96, 1043-1068.
- Grubb, M. D. 2015a. Behavioral Consumers in Industrial Organization: An Overview. *Review of Industrial Organization*, 47, 247-258.
- Grubb, M. D. 2015b. Failing to Choose the Best Price: Theory, Evidence, and Policy. *Review of Industrial Organization*, 47, 303-340.
- Grüne-Yanoff, T. & Hertwig, R. 2016. Nudge Versus Boost: How Coherent are Policy and Theory? *Minds and Machines*, 26, 149-183.
- Guest, G., Bunce, A. & Johnson, L. 2006. How Many Interviews Are Enough? *Field Methods*, 18, 59-82.
- Hatke, F., Hensel, D. & Kalucza, J. 2020. Emotional Responses to Bureaucratic Red Tape. *Public Administration Review*, 80, 53-63.
- Heidhues, P. & Köszegi, B. 2018. Behavioral Industrial Organization. In: Bernheim, B. D., Dellavigna, S. & Laibson, D. (eds.) *Handbook of Behavioral Economics: Applications and Foundations 1*. North-Holland.
- Herd, P. & Moynihan, D. P. 2019. *Administrative Burden: Policymaking by Other Means*, New York, Russell Sage Foundation.
- Jaraite, J., Convery, F. & Di Maria, C. 2010. Transaction costs for firms in the EU ETS: lessons from Ireland. *Climate Policy*, 10, 190-215.
- Kuperan, K., Abdullah, N. M. R., Pomeroy, R. S., Genio, E. L. & Salamanca, A. M. 2008. Measuring Transaction Costs of Fisheries Co-Management. *Coastal Management*, 36, 225-240.
- Lades, L. K. & Delaney, L. 2020. Nudge FORGOOD. *Behavioural Public Policy*, 1-20.
- Letzler, R. & Tasoff, J. 2014. Everyone Believes in Redemption: Nudges and Overoptimism in Costly Task Completion. *SSRN*.
- Linos, E., Quan, L. T. & Kirkman, E. 2020. Nudging Early Reduces Administrative Burden: Three Field Experiments to Improve Code Enforcement. *Journal of Policy Analysis and Management*, 39, 243-265.
- Mack, G., Kohler, A., Heitkämper, K. & El-Benni, N. 2019. Determinants of the perceived administrative transaction costs caused by the uptake of an agri-environmental program. *Journal of Environmental Planning and Management*, 62, 1802-1819.
- Malone, T. W., Yates, J. & Benjamin, R. I. 1987. Electronic Markets and Electronic Hierarchies. *Communications of the ACM*, 30, 484-497.
- Maryland State Archives. 2017. *Maryland Manual On-Line* [Online]. Annapolis, MD. [Accessed 29/04/2017 2017].
- McCann, L. 2013. Transaction Costs and Environmental Policy Design. *Ecological Economics*, 88, 253-262.
- McCann, L., Colby, B., Easter, K. W., Kasterine, A. & Kuperan, K. V. 2005. Transaction Cost Measurement for Evaluating Environmental Policies. *Ecological Economics*, 52, 527-542.
- McCann, L. & Easter, K. W. 1999. Transaction Costs of Policies to Reduce Agricultural Phosphorous Pollution in the Minnesota River. *Land Economics*, 75, 402-414.
- Miharia, M. & Woltier, J. 2010. Interlocal government collaboration and perceived transaction costs in Indonesian metropolitan transport planning. *International Development Planning Review*, 32, 167-189.
- Nichols, A. L. & Zeckhauser, R. J. 1982. Targeting Transfers through Restrictions on Recipients. *The American Economic Review*, 72, 372-377.

- Nilsson, M. & Sundqvist, T. 2007. Using The Market at a Cost: How the Introduction of Green Certificates in Sweden Led to Market Inefficiencies. *Utilities Policy*, 15, 49-59.
- North, D. C. 1990. *Institutions, Institutional Change and Economic Performance*, Cambridge, Cambridge University Press.
- North, D. C. 1992. *Transaction costs, institutions, and economic performance*, San Francisco, CA, ICS Press.
- Norwegian Consumer Council. 2021. *You can log out, but you can never leave: How Amazon manipulates consumers to keep them subscribed to Amazon Prime* [Online]. Available: <https://www.forbrukerradet.no/news-in-english/amazon-manipulates-customers-to-stay-subscribed> [Accessed 14 January 2021].
- OECD 2017. Labour Force Statistics: Average Annual Hours Actually Worked Per Worker. 29/04/2017 ed.
- Ofei-Mensah, A. & Bennett, J. 2013. Transaction Costs of Alternative Greenhouse Gas Policies in the Australian Transport Energy Sector. *Ecological Economics*, 88, 214-221.
- Oliver, A. 2013. From Nudging to Budgeting: Using Behavioural Economics to Inform Public Sector Policy. *Journal of Social Policy*, 42, 685-700.
- Rørstad, P. K., Vatn, A. & Kvakkestad, V. 2007. Why Do Transaction Costs of Agricultural Policies Vary? *Agricultural Economics*, 36, 1-11.
- Saussier, S. 2000. Transaction costs and contractual incompleteness: the case of Électricité de France. *Journal of Economic Behavior & Organization*, 42, 189-206.
- Scheibehenne, B., Greifeneder, R. & Todd, P. M. 2010. Can there ever be too many options? A meta-analytic review of choice overload. *Journal of Consumer Research*, 37, 409-425.
- Shafir, E. & Mullainathan, S. 2013. *Scarcity: Why Having Too Little Means So Much*, New York, Henry Holt and Company.
- Shahab, S., Clinch, J. P. & O'Neill, E. 2018a. Estimates of Transaction Costs in Transfer of Development Rights Programs. *Journal of the American Planning Association*, 84, 61-75.
- Shahab, S., Clinch, J. P. & O'Neill, E. 2018b. Timing and distributional aspects of transaction costs in Transferable Development Rights programmes. *Habitat International*, 75, 131-138.
- Shahab, S., Clinch, J. P. & O'Neill, E. 2019a. An Analysis of the Factors Influencing Transaction Costs in Transferable Development Rights Programmes. *Ecological Economics*, 156, 409-419.
- Shahab, S., Clinch, J. P. & O'Neill, E. 2018c. Accounting for Transaction Costs in Planning Policy Evaluation. *Land Use Policy*, 70, 263-272.
- Shahab, S., Clinch, J. P. & O'Neill, E. 2019b. Impact-based planning evaluation: Advancing normative criteria for policy analysis. *Environment and Planning B: Urban Analytics and City Science*, 46, 534-550.
- Shahab, S. & Viallon, F.-X. 2019. A transaction-cost analysis of Swiss land improvement syndicates. *Town Planning Review*, 90, 545-565.
- Simon, H. A. 1997. *Administrative Behavior: A Study of Decision-making Processes in Administrative Organisations*, New York, Macmillan.
- Soman, D. 2020. Sludge: A Very Short Introduction. *Research Report Series Behaviourally Informed Organizations Partnership*. Toronto: University of Toronto.
- Soman, D., Cowen, D., Kannan, N. & Feng, B. 2019. Seeing Sludge: Towards a Dashboard to Help Organizations Recognize Impedance to End-User Decisions and Action. *Research Report Series Behaviourally Informed Organizations Partnership*. Rotman: Behavioural Economics in Action.
- Soman, D., Xu, J. & Cheema, A. 2010. Decision points: A theory emerges. *Rotman Magazine*, 64-68.
- Sunstein, C. R. 2019a. *On Freedom*, Princeton, Princeton University Press.
- Sunstein, C. R. 2019b. Sludge and ordeals. *Duke Law Journal*, 68, 1843-1884.
- Sunstein, C. R. 2020. Sludge Audits. *Behavioural Public Policy*, 1-20.

- Sunstein, C. R. & GOSSET, J. L. 2020. Optimal Sludge? The Price of Program Integrity. *Duke Law Journal Online*.
- Tan, R., Beckmann, V., Qu, F. & Wu, C. 2012. Governing Farmland Conversion for Urban Development from the Perspective of Transaction Cost Economics. *Urban Studies*, 49, 2265-2283.
- Thaler, R. H. 2015. *Misbehaving: The Making of Behavioral Economics*, New York, W. W. Norton & Company.
- Thaler, R. H. 2018. Nudge, not sludge. *Science*, 361, 431-431.
- Thaler, R. H. & Sunstein, C. R. 2008. *Nudge: improving decisions about health, wealth, and happiness*, New Haven, Yale University Press.
- Thompson, D. B. 1999. Beyond Benefit-Cost Analysis: Institutional Transaction Costs and Regulation of Water Quality. *Natural Resources Journal*, 39, 517-541.
- Thunström, L. 2019. Welfare effects of nudges: The emotional tax of calorie menu labeling. *Judgment and Decision Making*, 14, 11-25.
- Ubel, P. A., Comerford, D. A. & Johnson, E. 2015. Healthcare.gov 3.0--behavioral economics and insurance exchanges. *N Engl J Med*, 372, 695-8.
- Webster, C. J. & Lai, L. W.-C. 2003. *Property rights, planning and markets: managing spontaneous cities*, Edward Edgar.
- Williamson, O. E. 1975. *Markets and Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of Internal Organization*, New York, The Free Press.
- Williamson, O. E. 1981. The Economics of Organization: The Transaction Cost Approach. *American journal of sociology*, 548-577.
- Williamson, O. E. 1985. *The Economic Institutions of Capitalism*, New York, Free Press.
- Williamson, O. E. 1993. Calculativeness, trust, and economic organization. *The Journal of Law & Economics*, 36, 453-486.
- Williamson, O. E. 1996. *The Mechanisms of Governance*, Oxford University Press.
- Williamson, O. E. 1998. Transaction Cost Economics: How It Works; Where It is Headed. *De Economist*, 146, 23-58.
- Zaheer, A. & Venkatraman, N. 1995. Relational governance as an interorganizational strategy: An empirical test of the role of trust in economic exchange. *Strategic Management Journal*, 16, 373-392.