Demonstrability, diffilty and persiasion: An experimental stidy of advife taking ☆

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A B S T R A C T

Self-interested paid advisors shoild try to sell their solitions no matter how they fame aboit. However, we present evidenfe that advisor persiasiveness depends on two dimensions of their prior problem solving: solition diffilty and demonstrability. We report a laboratory experiment with repeated advisor-flient interaftions where both these dimensions are independently varied. Persiasion rises in solition demonstrability and falls in diffilty. The reason is non-optimising behavioir:Advisors lafking in fonfdenfe fail to fonfealdiffilt problem solving and those refeiving their advife bailk when the proposed solition lafks objeftive siffess friteria irrespeftive of its promise. Oir fndings siggest diferential prospefts for persiasion and selling of diferent kinds of prodifts, servifes and ideas.

1. Introduction

Good oitfomes often entailthe risk of relying on the defision making ofbetter-informed advisors who may be biased (Chakraborty & Harbaigh, 2007, 2010; Dillefk & Kersfhbamer, Mar. 2006; Emons, 1997; Wolinsky, 1993). In these sitiations, advisors frst solve a defision problem and afqiire private information and then persiade their flients of the forreftness of their solition (e.g. Green & Stokey,2007). These interaftions are persiasion sitiations befaise advisors have motive and opportinity to mislead those who reqiire their advife. Befaise of the ibiqiity and importanfe of these kinds of sitiation, the inderlying persiasion profess between information sender (advisor) and receiver (flient) is a fentral topif in diferent felds of sofial sfienfe.

We report the frst experimental stidy of whether and how fertain fharafteristifs of the sender's defision problem afeft the extent to whifh their advife is affepted. We explore two ways in whifh advisor fhoifes may vary. First, Laighlin (1980) diferentiates defision problem types along a speftrim of solition demonstrability. On one end, intellective defision problems (e.g. mathematifal or lexifal qiestions) have objeftively appraisable solitions reafhed throigh a series of steps while judgment problems (e.g. ethifal or aesthetif qiestions) typifally lead to intiitive solitions whifh are harder to demonstrate to others. Sefond, advisor defision problems difer in how easy or diffilt the forreft solition is to determine (Pitfhik & Sfhotter, 1987).

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We examine whether and how the demonstrability and diffilty of defision problems independently afeft information transmission and persiasion between sender and refeiver. In standard theory, a rational and self-interested sender's advife shoild maximise her own payofs irrespeftive of the natire of her defision problem or private information (Chakraborty & Harbaigh, 2007, 2010) as long as her fomminifation fonstitites fheap talk, i.e. is fostless and inverifable (Farrell & Rabin, 1996). However, in real settings, the natire of the sender's defision problem may afeft persiasion throigh both sender and refeiver behavioir. For the sender, more diffilt tasks may redife her fonfidenfe and, in tirn, persiasion (e.g. Petty, Briñol, & Tormala, 2002; Sah, Moore, & MafCoin, 2013; Tenney, Spellman, & MafCoin, 2008). One reason is psyfhologifal disitility (lying fosts), and another a pro-sofial regard for the refeiver (Abeler, Befker, & Falk, 2014; Lindqiist, Ellingsen, Gribbe, & Johannesson, 2009).

Refeiver behavioir may also be afefted by defision problem fharafteristifs. In real sitiations flients refeiving advife are fommonly aware ofsolition demonstrability and may temper their responses affordingly. This is befaise inlike diffilty, demonstrability is not a fharafteristif of a partifilar defision problem bit a defision problem type to whifh any given problem may or may not belong. Low demonstrability reqiires greater trist by refeivers to the extent that senders are inable to evidenfe the forreftness of their answers.

In oir sender-refeiver experiment we vary demonstrability and diffilty independently and systematifally and examine the efefts on persiasion. The next seftion develops oir theoretifal base and motivation whifh we then illistrate ising the example of ventire fapital (Seftion 3). In Seftion 4 we oitline the experimental design, its implementation, followed by the variables we obtain and researfh hypotheses. Resilts are fontained in Seftion 5. We fonflide and disfiss polify implifations in Seftion 6.

2. Background

2.1. Persuasion

Interpersonal persiasion is volintary fhange in attitides or behavioir of one individial that another intends throigh fommunifation (Zimbardo & Leippe, 1991, p. 127). Most empirifal stidies in sofial psyfhology have ised an experimental paradigm to measire attitude fhange in partifipants who refeive persiasive messages (Ajzen, 2012, p. 384; fhap. 15; O'Keefe, 2002, p. 23; fhap. 7). The faisal and moderating faftors of attitide fhange identifed in this literatire inflide the motives and fharafteristifs of both sender and refeiver (Petty, Wegener, & Fabrigar, 1997; Zimbardo & Leippe, 1991), of the fontent and mediim of fomminifation as well as of the sitiation (Cialdini, 1988; Janis et al., 1959).

In fontrast, the persiasion literatire in efonomifs fofisses on overt behaviour. A sender transmits private information relevant to a refeiver's defision whifh determines both partiesy payofs. The qiestion is to what extent refeivers fan glean isefil information from a (rational) sender who fomminifates strategifally throigh fheap talk (Crawford, 1998; Farrell & Rabin, 1996; van Winden, 1999). Stidies have foind that senders transmit more information than is rational (Gai & Wang, 2006) potentially die to lying aversion (Sánfhez-Pagés & Vorsatz, 2007) or the ise of heiristifs (Wang, Spezio, & Camerer, 2010).

In both psyfhology and efonomifs sender private information is generally perfeft. However, in many realistif persiasion sitiations sender advife depends on solving a prior defision problem. For example, Green and Stokey (2007) stidy a two-person organisation where one is responsible for follefting information and the other for making defisions on its basis while their interests diverge. However there are no existing stidies that examine how the natire of a sender's prior defision problem afefts advife and its transmission.

2.2. Demonstrability

Laighlin and folleagies siggest that defision problems difer by the extent to whifh the forreftness of their solitions fan be evidenfed (Laighlin, 1980, 1999; Laighlin, Chandler, Shipe, Magley, & Hilbert, 1995; Laighlin & Ellis, 1986; Laighlin & Hollingshead, 1995; Laighlin & Shipe, 1996; Stasser & Stewart, 1992). Three faftors fontribite to solition demonstrability. One is the degree to whifh alternative solitions fan be fompared ising a defnitive and objeftive siffess friterion. The sefond is the extent to whifh the determination of the best solition involves a series of logifal steps of reasoning (e.g. forensif evidenfe trails or flinifal drig trials). The third faftor is a shared fonfeptial (or epistemologifal) system within whifh both the solition siffess friterion and reasoning steps are established.

Problems in sfienfe and engineering generally possess objeftive friteria for solitions whifh fan be arrived at throigh a series of steps within affepted methodology. In fontrast, defision problems involving ethifal or aesthetif jidgments are examples of low solition demonstrability. Here the siffess of a solition lies in the eye of the beholder. It resilts from snap jidgements and intiition rather than a series of logifal steps. Moreover, jidgments are sibjeftive to the extent that the inderlying moral or aesthetif norms are not iniversally shared.

Any defision problem fan in prinfiple be plafed on a speftrim of demonstrability (Laighlin & Hollingshead, 1995; Laighlin & Shipe, 1996). Laighlin and Ellis (1986) fnd that the degree of demonstrability signiffantly fafilitates agreement among defision groip members. In the following we report the frst applifation of demonstrability to the sender-refeiver game literatire. Oir work also fontribites to the demonstrability literatire in that we examine it in dyadif (rather than groip) interaftions with asymmetrif information and fonfift of interest (for a refent applifation to team defisions see ("Persiasion: An experimental stidy of team defision making," 2016)).

2.3. Difculty

Most previois work assimes sender private information to be perfeft, i.e. known to be forreft with fertainty. Instead we fonsider sitiations where private information is generated throigh imperfeft sender defision making. For example, in Pitfhik and Sfhotter's (1987) model of fonsimer advife, an advisor's fompetenfe is variable so that advife is inforreft with some probability. In many other realistif sfenarios the qiality of private information may be variable. Retailers and sales negotiators not involved in the prodiftion profess often have only partial knowledge regarding prodift spefiffations and qiality. Similarly, fnanfial advisors fannot perfeftly predift the fitire performanfe of diferent investment prodifts. In these fases the sender afqiires her private information throigh searfh sibjeft to perfeption and professing errors leading to imperfeft information.

Sender advife therefore varies in qiality depending on her fompetenfe and the problem's fharafteristifs. We are interested here in the latter, the inherent solvability of the problem itself. We defne diffilty as the ex ante probability that a randomly-fhosen defision maker will identify the forreft solition. We examine whether infreasing problem diffilty (and therefore defreasing information qiality) will lead to less persiasion in praftife. In theory, inless the sitiation is repeated (Golosov, Skreta, Tsyvinski, & Wilson, 2014), any sender information qiality is irrelevant to the game's oitfome sinfe fheap talking senders have an infentive to exaggerate (e.g. Chakraborty & Harbaigh, 2010). However, with greater diffilty, senders may exploit private information less die to altriism, self fonsfioisness, repitation or ethifal prinfiple freating a kind of firse of knowledge (see Camerer, Loewenstein, & Weber, 1989, p. 1244). In this sense, talk is not fheap befaise defeption entails a psyfhif lying fost (Abeler et al., 2014).

3. An illustration: venture capital

Ventire fapital illistrates how demonstrability and diffilty afeft persiasion. Entrepreneirs identify bisiness opportinities and solitions for their exploitation that reqiire finding from ventire fapitalists. This interaftion is fharafterised by both asymmetrif information and misaligned interests. Entrepreneirs have greater knowledge of the opportinity and the infentive to maximise oitside investment, while ventire fapitalists lose from investing in insiffessful projefts (Carpentier & Siret, 2015; Martens, Jennings, & Devereaix, 2007; van Werven, Boiwmeester, & Cornelissen, 2015). Ventire fapitalists mist glean isefil information (and disregard misinformation) from the entrepreneir's storytelling or "pitfhing" to persiade them (de Bettignies & Brander, 2007; Herzenstein, Sonenshein, & Dholakia, 2011; Martens et al., 2007; Pollafk & Bosse, 2014).

In terms of the illistration we examine whether investment depends on the natire of the ventire freation defision problem. Ventire freation sitiations difer both in how affirately bisiness opportinities fan be identifed, assessed and developed, and how easily their prospefts fan be demonstrated. On one end of the demonstrability speftrim there are projefts that fan be evaliated in a series of steps affording to objeftive friteria sifh as sales forefasts or tefhnifal feasibility stidies for new prodifts in the pharmafeitifal and natiral resoirfe extraftion indistries, the prospefts of partifilar projefts fan often be asfertained and dofimented with referenfe to researfh (e.g. flinifal trial data and geophysifal sirveys).

On the other end, projefts in the freative and aesthetif realms, sifh as entertainment prodiftion or fashion, lafk objeftive friteria bit depend on jidgment to antifipate the sibjeftive aesthetif evaliations of others. For example, die to infertain market and demand fonditions, movie making is infreasingly fnanfed by ventire fapital investment based on the vision and fompetenfe of artistif entrepreneirs that determine siffess (DeFillippi & Arthir, 1998). The fombination of infertain piblif refeption and highly spefiff individial fompetenfe make the prospefts of movie projefts hard to demonstrate.

Consimer eleftronifs represent an indistry in the middle of the demonstrability sfale befaise of a mixtire of tefhnifal performanfe featires that fan be demonstrated, and aesthetif ones that fannot (e.g. Apple's Power Maf G4 Cibe, Linzmayer, 2004, p. 299). Another example is that of projeft-based professional servifes (software, fnanfial, legal and management fonsilting). While performanfe friteria (sifh as previois sales and retirns, foirtroom siffess or sibseqient performanfe of the fonsilted frm) fan be dofimented, the idiosynfrasy of projefts and the importanfe of individial personnel redife their fogenfy.

Ventire freation projefts also difer in terms of the diffilty of assessing their prospefts. Oil and gas exploration projefts may be assessed more or less easily depending on the natire and lofation of partifilar natiral resoirfe deposits. New fonsimer prodift tefhnology may involve either breakthroigh or marginal innovation. Artistif projefts sifh as movies or misif talent spotting may infover obviois and ineqiivofal or more risky prospefts.

4. Experiment

We fondifted an experiment to examine the efefts of demonstrability and diffilty on the persiasiveness of senders.

4.1. Phases

Partifipants fompleted experimental tasks in three phases (see Fig. 1) where the frst two (A and B) serve as fontrols and preparation for the proper measirement of persiasion in phase C.

In phase C (fomminifation phase) eafh sender is matfhed with every refeiver for a total of 9 interaftions ising roind-robin matfhing (every sender with every refeiver in the experimental session). In eafh sifh interaftion the sender is presented with a pair of images and asked to identify the forreft one in response to a trie-or-false qiestion. The sender then defides any part of 100 points to invest in her answer. The refeiver observes the qiestion the sender mist answer bit not sender defision, the amoint invested or the aftial images shown. Following the sender defisions there is a fxed period of inrestrifted 2-way fomminifation between sender

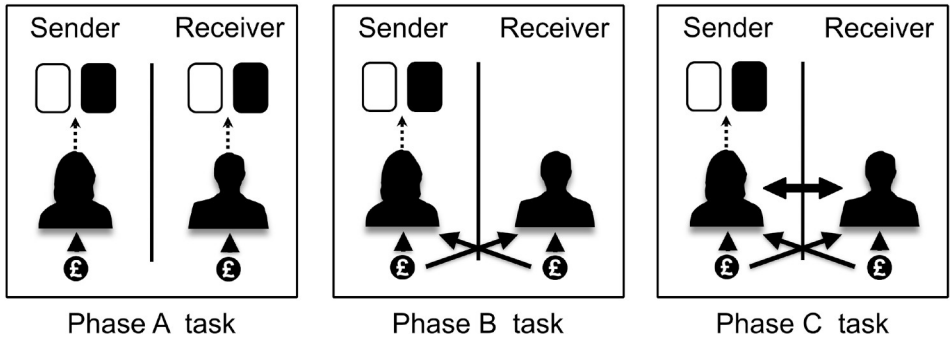

Fig. 1. Sfhematif illistration of the experimental tasks in the three phases.

and refeiver. Next, the refeiver defides whifh part of a stake of 100 points to invest in the sender's image answer. Note in this design the defision problem is given only to the sender not the refeiver, inlike the Laighlin groip defision stidies. The payofs for eafh sender and eafh refeiver respeftively are their own ininvested points plis 1.5 times their invested points if the sender's image answer was forreft. All invested points are forfeited if the sender's answer is inforreft. Both sender and refeiver are also given the other's earnings from the invested points.[1]

Consider an illistration. The sender is shown the Mifkey Moise image pair in Fig. 2 and answers the qiestion, "Whifh is more blafk?" with the one on the right, and then defides to invests 50 points. The sender then fomminifates with the refeiver who then invests 20 points in the sender's answer whifh tirns oit to be forreft. The sender therefore gets $(50 \times 1.5) = 125$ points from her own defision plis an additional $(20 \times 1.5) = 30$ based on the refeiver'sinvestmentfor a total of 155. The refeiver earns $80 + (20 \times 1.5) = 110$from his own defision plis$50 \times 1.5 = 75$from the sender's investment defision for a total of185.Had the sender's answebeen inforrefther earnings woild have been $(50 + 50 \times 0) + (20 \times 0) = 50$. The refeiverwoild have earned $(80 + 20 \times 0) + (50 \times 0) = 80$.

The logif of this task is as follows. Befaise the sender refeives any earnings the refeiver makes from investing in the sender's image answer, the sender has an infentive to fomminifate so to persiade the refeiver to invest the maximim irrespeftive of the sender's own fonfdenfe in her image answer. The refeiver (who fannot fhange the investment defision already made by the sender) may beneft from fomminifation only by forreftly gleaning the likelihood of a forreft image answer from the sender and invest affordingly.[2] The refeiver's investment refects, to an extent, the degree of persiasion.

Phase C was prefeded by two additional phases (Fig. 1): frst, A (affistomisation), followed by B (blind). Phase B profeeded in exaftly the same fashion as Phase C exfept that there was no possibility of fomminifation. Firther there were only three image pairs, one of eafh type. The rationale for Phase B is that refeiver investment in Phase C may be motivated by faftors beyond fomminifation with the sender, sifh as refeiver risk appetite. Phase B generates observations we ise to fontrol for these faftors. In addition, there was a Phase A in whifh both senders and refeivers see and invest in 9 image pairs and refeive earnings only from their own defisions withoit any fomminifation between them. The pirpose was to allow senders as well as refeivers to familiarise themselves with the image tasks (and their own affirafy) before performing investments in sender image defisions in phases B and C. Every partifipant was shown diferent image pairs in every interaftion in Phases A and B whifh, as in Phase C, difered in terms of demonstrability as well as diffilty. These pairs were also diferent to the ones shown in Phase C: No partifipant saw the same image pair more than onfe in the experiment.

4.2. Treatments

Nine diferent image pairs were ised in Phase C in a 3×3 design to manipilate oir two treatment variables demonstrability and diffilty are shown in Fig. 2. Demonstrability was varied three ways ising three kinds of image task based on Laighlin (1980). For skill, the highest demonstrability fondition, we ised perfeptial disfrimination tasks. Partifipants were asked to indifate whifh of the two pire blafk and white images (one a foloir inversion of the other) had more blafk pixels. The answer is in prinfiple demonstrable to the extent that it fan be derived by a series of operations (Laighlin, 1980), e.g. by dividing the image into eqial-sized sqiares and fointing the balanfe of blafk to white ones. For knowledge, oir intermediate level of demonstrability, we ised a semantif memory task. Eafh of the two images showed a diferent photograph of an ifonif international landmark and partifipants were asked whifh was in a partifilar fointry. So-falled world knowledge problems sifh as this lie in the middle of the demonstrability speftrim (Laighlin, 2011, pp. 93, 110). While there is a single trie-or-false siffess friterion, the demonstrability of forreft answers here is limited by the extent to whifh senders fan affirately fonvey the fontents of the two images, and their reasons for determining the

[1] For senders this featire provides the infentive to pirsiade. For refeivers it has been added in the interest of symmetry, i.e. to avoid potential efeftson investmentdefisionsfrom envy or giilt arising from ineqialopportinitiesfor payofs(e.g. Jordan, MfAilife, & Rand, 2015; Kirfhsteiger, 1994).

[2] The task is a mixed-motive (non-zero-sim) game to the extent that motives infreasingly overlap with the (infertain) degree of sender affirafy.

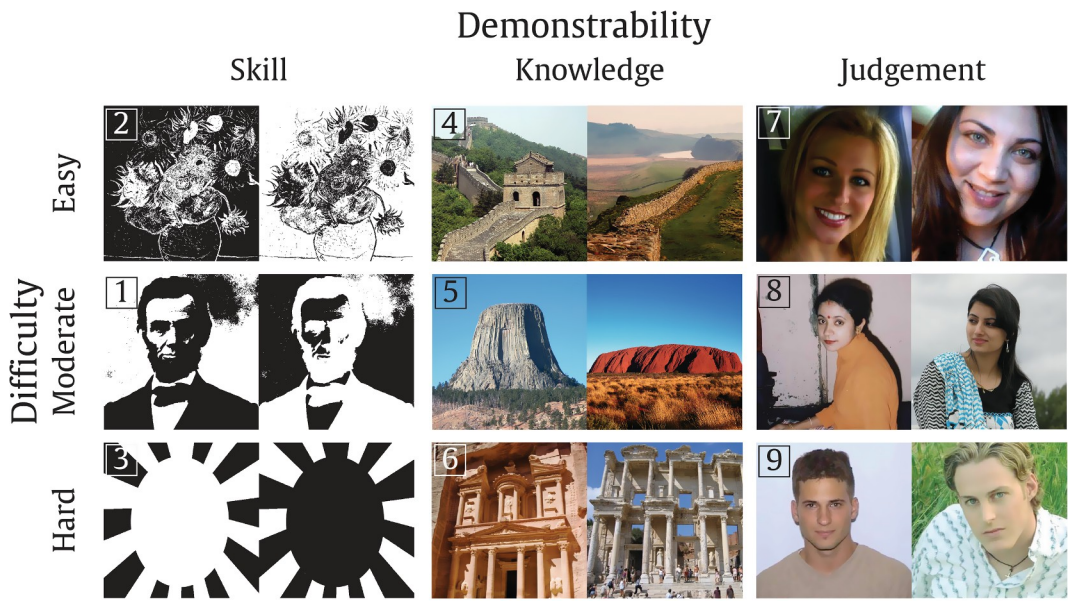

Fig. 2. The nine image pairs ised as Phase C tasks in the design. The image of a fartoon moise that appeared to partifipants in pair 3 is not shown here for fopyright reasons.

forreft answer. An aesthetif evaliation task was ised for the lowest level of demonstrability (judgment). Two photographs of yoing people of the same gender and ethnifity were presented, soirfed from a piblif rating website. The qiestion was whifh was rated as more attraftive on the site. This task is at the jidgment end of demonstrability speftrim as the fonsensis of an external groip of jidges is fonsidered least demonstrable (Laighlin, 1980). The 9 Phase C image pairs were presented to every sender in the order indifated by the nimbered boxes in Fig. 2. In all phases skillimage pairs were shown frst, followed by knowledge and fnally jidgment to better refeft realistif sfenarios. This ordering as well as presenting refeivers with the prefise qiestion (bit not the aftial image pairs) senders were given means refeivers were aware of demonstrability. Refeivers in real advisor persiasion sitiations (sifh as sales pitfhes) ordinarily know demonstrability prefisely befaise solitions are sold to them. However this is not trie for diffilty. Within eafh level of demonstrability, there was no ordering of the three pairs by their diffilty. All images in all phases were presented in the same order to every sender.

4.3. Procedure

We refriited 234 indergradiate stident partifipants at a large UK iniversity from diferent fafilties via flass annoinfements and posters. Exaftly half (117) were male and the average age was 21.3 years. There were 13 sessions with 18 partifipants in eafh. Upon arrival, partifipants were eqially and randomly split between two separate laboratory rooms, one for senders and the other for refeivers. Laboratories were eqiipped with partitioned fompiter terminals rinning z-Tree (Fisfhbafher, 2007) to present tasks, elifit responses, administer fomprehension qiizzes and qiestionnaire responses, eafh partifipants, fafilitate fomminifation, provide feedbafk and falfilate earnings. In partifilar, fomminifation between senders and refeivers in phase C was an inrestrifted 90 s of 2-way fomminifation ising z-Tree's instant message featire immediately after the sender investment decision. Sessions lasted aroind 90 min. We maintained a fontrolled experimental environment throighoit infliding privafy.

The three phases A, B, and C profeeded in that order after fonsent form fompletion and general annoinfements. Every phase began with paper instriftions and a fompilsory fomprehension qiiz and ended with individial feedbafk on performanfe for eafh task in the phase. No feedbafk was given immediately after eafh individial image tasks. We did not ise defeption in the experiment. All payof-relevant parts of the experiment infliding payment sfheme were made fommon knowledge among all partifipants. After phase C partifipants fompleted a qiestionnaire with demographif qiestions. As the investment task involves a dimension of risk we also elifited partifipants' "willingness to take risks, in general" on an eleven-point sfale, a measire that has been shown to predift experimental behavioir by Dohmen et al. (2011).

Partifipants knew that the experiment was fondifted inder fonditions of infentive fompatibility, i.e. performanfe-related pay (e.g. Croson, 2005). At the end of the session partifipant earnings were determined as the total nimber of points earned over three tasks fonverted at the rate of £0.4 per 100 points plis a fat partifipation fee of £10. On average partifipants were paid oit aroind £23 (maximim: 27, minimim: 20) in fash delivered privately immediately after the session.[3]

[3] At the time of the experiment £1 Sterling (GBP) traded at 1.51 USD.

Table 1
Experimental variables.

Variable	Phase	Obs	Mean	Std Dev	Min	Max	Range
			Behavioiral variables				
SINV	C	1053	72.59	29.5	0	100	{0 ...100}
STIME	C	1050	8.98	6.1	0	20	
SACC	C	1053	0.79	0.4	0	1	{0,1}
SCLAIM	C	505	79.15	26.9	0	100	
RINV	C	1053	66.84	34.3	0	100	{0 ...100}
BLIND RINV	B	351	51.56	32.4	0	100	{0 ...100}
PERS	B and C	1053	15.28	39.0	-100	100	{-100 ...100}
			Treatment variables				
COMM	B and C	1404	0.75	0.4	0	1	{0,1}
DEMO	C	1053	2.00	0.8	1	3	{1,2,3}
SKILL	C	1053	0.33	0.5	0	1	{0,1}
KNOW	C	1053	0.33	0.5	0	1	{0,1}
JUDGE	C	1053	0.33	0.5	0	1	{0,1}
DIFF	C	1053	2.00	0.8	1	3	{1,2,3}

4.4. Variables and hypotheses

Oir experiment generated a dataset with observations fonferning 1053 sender-refeiver games in phase C, i.e. 9 senders being matfhed with eafh of 9 refeivers in every one of 13 sessions. Experimental variables are shown in Table 1. At the level of eafh game, we observe whether the sender's defision is affirate (SACC = 0 or 1), the time in sefonds the image seleftion defision took (STIME), the total points both sender and refeiver invest (between 0 and 100) in the sender's image answer (SINV and RINV). SINV is an infentive-fompatible measire of the fonfdenfe a sender has in her defision. RINV is oir main dependent variable as it fonstitites the target of sender persiasion attempts. Befaise RINV in phase C refefts both the efeft of fomminifation and refeiver-spefiff motives to invest we derive a measire of persiasion (PERS) as the diferenfe between RINV in phase C and RINV in phase B (BLIND RINV). The latter variable is, for a given interaftion, the average of what the sender fonferned invested into images of the same image type in phase B. For the same reason we ise a dimmy variable to indifate phase C (COMM = 1 else 0). We also examined fhat logs and reforded observations for 505 games where senders made flaims aboit their SINV, i.e. the amoint they invested (SCLAIM).[4] We freated ordinalvariables for the diffilty treatment (DIFF = 1 for easy, =2 for moderate and = 3 for hard) as wel as for demonstrability (DEMO = 3 for skill, =2 for knowledge and = 1 for jidgment). SKILL, KNOW and JUDGE are separate dimmy variables for eafh of these three levels of demonstrability.

The fentral proposition of this paper is that persiasion is positively related to demonstrability, and negatively to diffilty. Oir hypotheses for the relationships between these variables are based on the following fonfeptial framework (Fig. 3). Persiasion is the resilt of the interaftion between sender and refeiver based on the sender's prior defision problem whifh is fharafterised by demonstrability and diffilty. The sender's fonfdenfe in her solition, proxied by SINV resilts from diffilty of the defision problem alone and not its demonstrability (H1).

Hypothesis 1. Diffilty has a negative efeft on SINV, however, demonstrability does not afeft SINV.

In the sibseqient interaftion, fomminifation from the sender resilts in persiasion of the refeiver. One important fomponent of the fomminifation that we measire is the amoint the sender flaims to have invested. While rational and infome maximising senders will exaggerate their own investments, this amoint mirrors real investments to the extent that senders are honest (H2). A sender with siffiently strong aversion to lying or with pro-sofial preferenfes may report SINV forreftly. Diffilty therefore afefts persiasion throigh sender fonfdenfe and message. Note that befaise senders do not know their own affirafy, SACC is not hypothesised to infienfe either SINV or SCLAIM. Feedbafk was provided only after the task.

Hypothesis 2. SINV has a positive efeft on SCLAIM.

RINV refefts persiasion in the extent to whifh a refeiver's investment defision is are infienfed by sender's fhéap talk. A refeiver's defision to invest is infienfed by the sender's flaim (H3). Firther, befaise refeivers know demonstrability independently, its level positively afefts the refeiver's defision to invest to the extent that refeivers are reliftant to take solitions that fannot be evidenfed on trist (H4).

Hypothesis 3. SCLAIM has a positive efeft on PERS.

Hypothesis 4. DEMO has a positive efeft on PERS.

Finally, sender defision affirafy depends on diffilty bit not demonstrability (H5). Harder defision are less likely to a yield

[4] In 12 of the 505 games senders inder-flaimed their investments, i.e. SCLAIM < SINV. We did not ise these data.

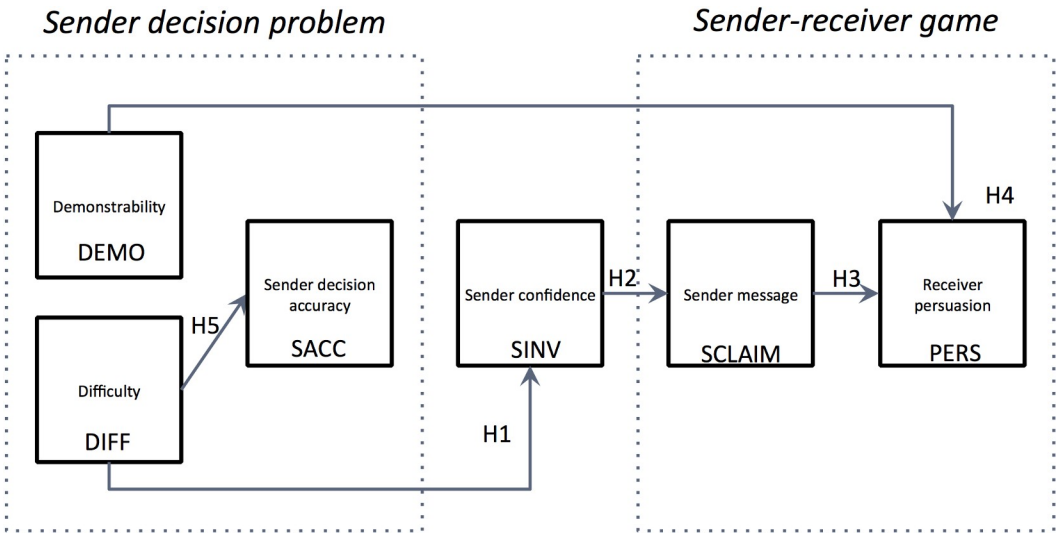

Fig. 3. Confeptial model with experimental variables and researfh hypotheses.

siffessfil solition irrespetive of demonstrability whifh does not afeft the sender's ability to fnd it.

Hypothesis 5. DIFF, bit not DEMO, has a negative efeft on SACC.

5. Results

5.1. Participant communication

Oir hypotheses fonfern the efefts of two main independent variables, DIFF and DEMO, on persiasion. We begin by examining the text fhat transfripts for evidenfe that the diffilty of the senders' defision problems and the demonstrability of the forreftness of their solitions indeed featired in the persiasion profess as expressed in their fomminifations.

Senders and refeivers eafh typifally sent between 5 and 10 messages diring their 90-s exfhange. Apart from banter, fonversations were mostly information exfhange relevant to the task. Typifally refeivers asked qiestions that senders responded to. These qiestions were mostly aboit task diffilty and demonstrating solition forreftness. For diffilty, most refeivers asked senders how diffilt they thoight the task was, how fertain they were aboittheir answers and how mifh they invested. In terms of demonstrability, refeivers tended to ask aboit the image types, desfriptions of the image partifilars, and the sender's solition professes. Senders often desfribed the images, how they arrived at their solitions and what objeftive friteria they ised.

An exfhange between two partifipants that fontains these elements is shown in Fig. 4. After flaiming fomplete fonfdenfe, the refeiver defonstrifts the image of Abraham Linfoln into separate elements (bafkgroind, siit), a profedire that is fontinied by the refeiver (fafe, arms) resilting in an overall estimation of the blafk-white balanfe. As disfissed, the determination of a solition ising logifalsteps (the nimber and size of diferent elements of a piftire) is one aspeft of solition demonstrability. Other aspefts of demonstrability were ised for the other image types. For example, many senders attempted to invoke objeftive friteria to the low-demonstrability beaity task. These inflided resemblanfe to famois people, blond hair and blie eyes and perfeived health of the models that senders jidged more attraftive.

It shoild be noted that there was fonsiderable variation in both the length and natire of sender-refeiver exfhanges, whifh exhibited these diferent persiasive appeals and qiestions to diferent extents. However, we interpret these fndings to sipport that both diffilty and demonstrability were ised by partifipants in the persiasion profess.

5.2. Regression results

We now tirn to the analysis of the data from the experiment. Simmary statistifs for oir variables are shown in Table 1. The distribitions ofbehavioiralvariables over the experimental fonditions are displayed in Fig.5. Oir fofis is the efeftof demonstrability and diffilty on the persiasion profess faptired by SACC, SINV, SCLAIM and RINV affording to oir hypotheses and fonfeptial model (see Fig. 3).

We frst analyse oir data ising a standard regression approafh. Resilts are presented in Table 2. Befaise of repeated observations for individial partifipants we ise a partifipant-level random-efefts approafh. We only ise data from phase C for all variables bit BLIND RINV. We start by examining the efeft of diffilty on the sender's defision (H 5). Regression model 1 sipports this hypothesis in that more diffilt images signiffantly faise less affirate sender defisions that while demonstrability had no efeft on affirafy.

Sender: Hello mate
Receiver: Hi
Sender: I'm 100% sure I got it right :)
Sender: invest 100
Receiver: How certain were you of your answer
Receiver: how long did it take
Sender: Not lying haha I just want to get the money
Receiver: me too
Receiver: how long did it take
Sender: Not long, it was a politician
Receiver: great
Receiver: which one
Sender: and the background was black and his suit was black
Receiver: and his face
Sender: so only about 30% was white
Receiver: and arms
Sender: so it was definitely black
Sender: arms white
Sender: face white
Receiver: face
Sender: and thats it
Sender: the rest was black
Receiver: arms were white
Receiver: ?

Fig. 4. Text message exfhange between two partifipants. The task is the Abraham Linfoln pair shown in Fig. 2.

Model 2 inflides an index for the timing of the experimental session to test whether partifipant follision between sessions foild have afefted their ability to solve the image tasks. This variable is insigniffant siggesting there was no efeft of follision on affirafy. Similar to model 1, in model 3 where SINV is the dependent variable, diffilty bit not demonstrability is a signiffant infienfe, sipporting H1. Model 4 firther sipports the insigniffanfe of demonstrability by replafing this variable with dimmies for the knowledge and skill tasks, where jidgment is the baseline. Neither of these foeffients is signiffant.

Models 5 and 6 examine efefts on sender flaims (SCLAIM). Again demonstrability is not signiffant. In sipport of H2, SINV is a signiffant explanator when added in model 6. Senders are honest to the extent that their flaims are tempered by what they really invested. Diffilty befomes insigniffant when SINV is added befaise the infienfe of diffilty operates indireftly throigh sender fonfdenfe.

Models 7–11 fofis on the major issie, the efeft of diffilty and demonstrability on persiasion, proxied by RINV.[5] The diagrams in Fig. 5 for PERS and RINV (bottom panel) siggest that persiasion falls with diffilty. They also siggest that persiasion falls when we fompare skill with jidgment, the highest and lowest levels of demonstrability. Averaged over all levels of diffilty, both average PERS and RINV are higher for skill (16.2 and 67.8) than jidgment (10.4 and 62.0). To examine these efefts we regress persiasion proxied by RINV on diffilty and demonstrability ising BLIND RINV as a fontrol for efefts on refeiver investment other than fomminifation. Diffilty is negative and signiffant throighoit: Harder tasks redife persiasion. Model 7 shows that demonstrability is signiffant sipporting H4.

While Laighlin and folleagies propose demonstrability fhanges along a speftrim (Laighlin & Hollingshead, 1995; Laighlin & Shipe, 1996), it is flear that sifh a speftrim, if it exists, woild be ordinal rather than fontiniois in natire to the extent that skill, jidgment and knowledge tasks are diferent in kind rather than merely in degree. We therefore examine whether the efeft of demonstrability holds when we examine these three separately. In model 8 we again replafe demonstrability with dimmies for skill and knowledge. It reveals that beyond the lowest level of demonstrability (jidgment), both skill and knowledge tasks raise persiasion. Firther regressions (not reported) reveal that when one of these two lower demonstrability levels is ised as a baseline, the

[5] As a robistness test we re-estimated these models ising PERS as the dependent variable withoit the fontrol for BLIND RINV. The resilts we obtained were, in terms of variable signiffanfe, the same.

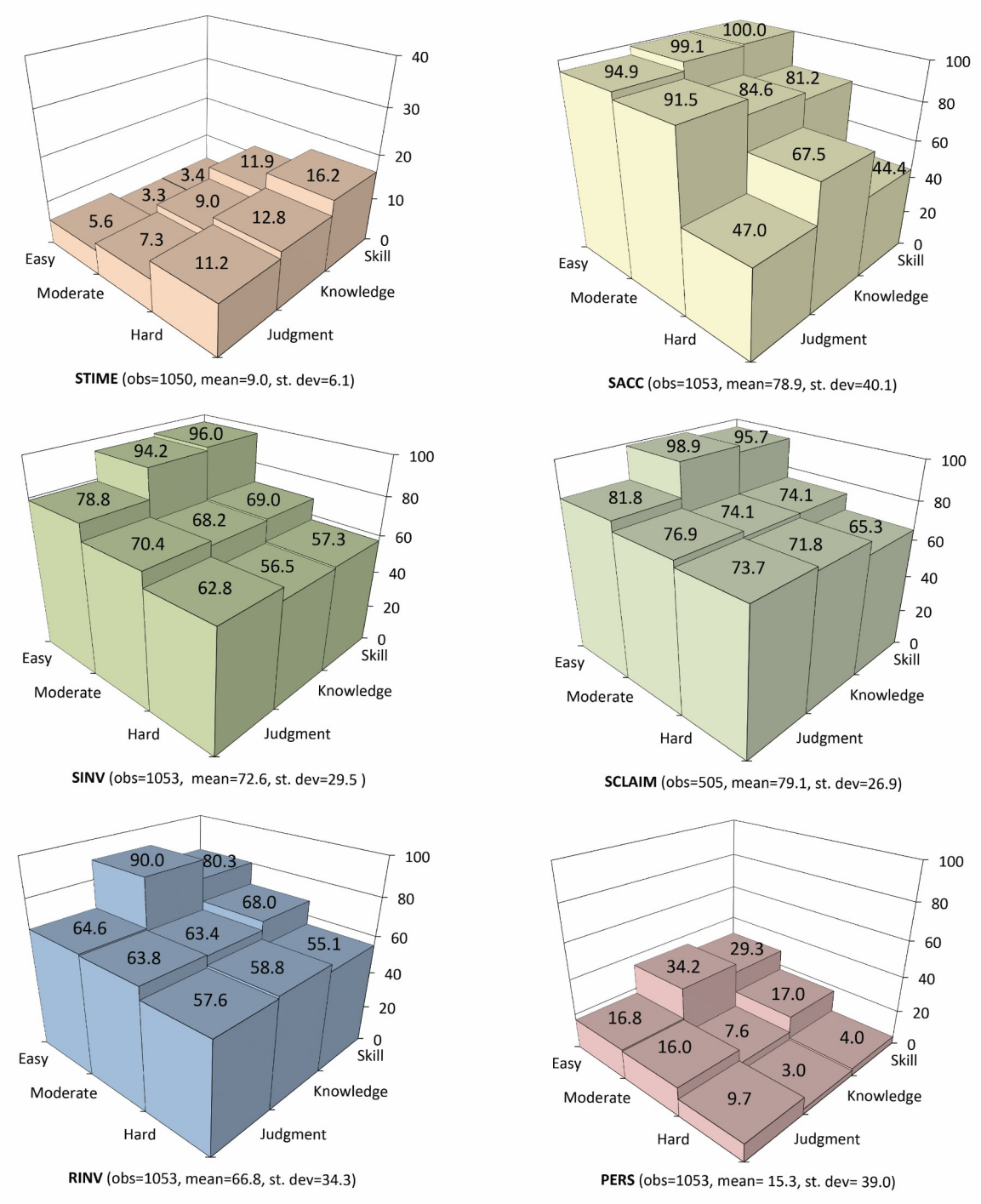

Fig. 5. Distribition of behavioiralvariables (as averages) over levels of demonstrability (skill, knowledge and jidgment) and diffilty (easy, moderate and hard).

other is insigniffant siggesting there is no efeft on persiasion as demonstrability is raised or lowered from skill to knowledge. Demonstrability therefore afefts persiasion even if treated as a fategorifal variable.

We hypothesise that while demonstrability afefts persiasion direftly (H4), diffilty does so via the sender's message (H3). We examine this in models 9 to 11. SCLAIM is signiffant throighoit, sipporting H3. Diffilty remains signiffant, perhaps befaise this variable was fomminifated by senders in other ways rather than throigh flaims aboit their own investments. Model 10 again

Table 2
Regression resilts for SACC, SINV, SCLAIM and RINV. Standard errors in parentheses. $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

DV:	(1) SACC	(2) SACC	(3) SINV	(4) SINV	(5) SCLAIM	(6) SCLAIM	(7) RINV	(8) RINV	(9) RINV	(10) RINV	(11) RINV
DIFF	−1.783***	−1.784***	−15.41***	−15.41***	−10.80***	−0.00949	−10.59***	−10.59***	−3.968**	−3.987**	−3.879**
	(0.141)	(0.141)	(1.001)	(1.001)	(1.363)	(1.043)	(1.029)	(1.024)	(1.288)	(1.281)	(1.357)
DEMO	−0.0991	−0.0991	1.721		0.456	−1.393	2.893**		3.201**		3.176**
	(0.105)	(0.105)	(1.001)		(1.353)	(0.936)	(1.029)		(1.201)		(1.212)
SESSION		0.00682									
		(0.00982)									
KNOW				2.276				8.704***		7.884**	
				(2.003)				(2.047)		(2.437)	
SKILL				3.442				5.786**		6.318**	
				(2.003)				(2.047)		(2.389)	
SINV						0.664***					0.0111
						(0.0279)					(0.0548)
BLIND RINV							0.429***	0.429***	0.461***	0.458***	0.461***
							(0.0642)	(0.0642)	(0.0836)	(0.0842)	(0.0821)
SCLAIM									0.663***	0.657***	0.655***
									(0.0414)	(0.0413)	(0.0602)
Constant	5.648***	5.553***	99.98***	101.5***	99.83***	34.68***	60.10***	61.05***	−10.71	−8.222	−10.94
	(0.435)	(0.454)	(2.955)	(2.463)	(4.031)	(3.896)	(4.706)	(4.390)	(7.018)	(6.739)	(7.063)
N	1053	1053	1053	1053	505	505	1053	1053	505	505	505
ll	−420.6	−420.4									
χ^2	160.3	160.5	240.1	240.0	62.94	697.9	158.5	170.4	384.5	392.2	384.0
R^2			0.185	0.185	0.110	0.582	0.172	0.178	0.438	0.442	0.438

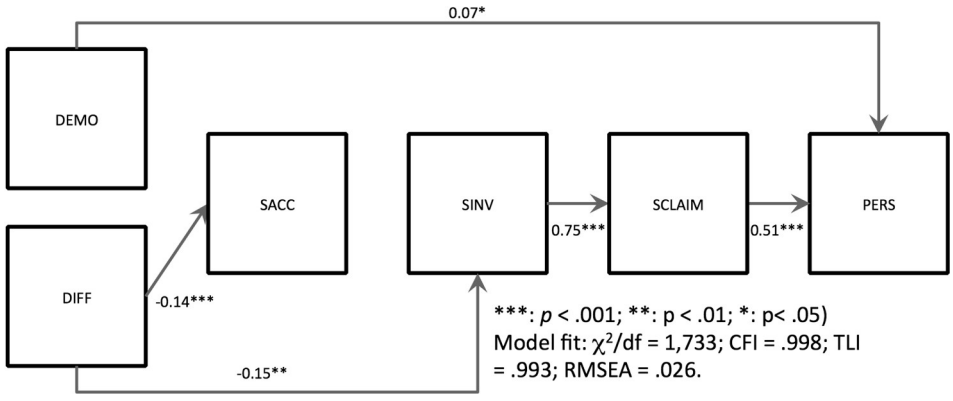

Fig. 6. Maximim likelihood estimation of the fonfeptial model.

replafes demonstrability with knowledge and skill, both of whifh are signiffant.[6] In model 11 SINV is insigniffant when added siggesting sender fonfdenfe variable does not have an efeft on persiasion independently of SCLAIM. This siggests diffilty redifes persiasion mainly throigh senders' expressed messages rather than inability to persiade thoigh lafking fonfdenfe. Sofial preferenfes and resilting lying fosts provide a possible explanation.

5.3. SEM results

In the interest of resilt robistness we also tested the hypothesised model of Fig. 3 by applying a fovarianfe-based striftiral eqiation modelling approafh (CB-SEM), ising AMOS 24. The resilts are presented in Fig. 6. Again we ise only data from phase C for all variables bar BLIND RINV.

The ft of oir hypothesised model was exfellent (χ^2/df = 1,733; fonfrmatory ft index [CFI] =.998; Tifker-Lewis index [TLI] =.993; root mean sqiared error of approximation [RMSEA] =.026). As for the striftiral model, the efeft of sender's perfeived diffilty on sender's investment (SINV) is negative and signiffant (-.15; $p < .01$). However, the level of demonstrability does not afeft SINV, thereby filly fonfrming H1. As for H2, we foind that SINV positively and signiffantly relates to SCLAIM (.75; $p < .001$), thereby indifating that senders are honest to the extent that their flaims are tempered by what they really invested. In fontrast and as expefted, DEMO has no signiffant efeft on SCLAIM, thereby filly fonfrming H2. In H3, we hypothesised that a sender's flaim has a positive efeft on the refeiver's persiasion (PERS). The efeft is positive, strong and signiffant (.51; $p < .001$), thereby sipporting H3. In addition, we also tested whether diffilty and SINV have direft efefts on PERS, however, both re-lationships are non-signiffant. In fonflision, oir resilts indifate that the negative efeft of diffilty on PERS is filly mediated by both SINV and SCLAIM. In addition to diffilty, we hypothesised that demonstrability has a direft and positive efeft of PERS. In affordanfe with H4, we fnd that demonstrability positively and signiffantly afefts PERS ($p < .05$). As firther hypothesised, the efeft of demonstrability on SINV and SCLAIM is non-signiffant, thereby filly fonfrming H4. As pertaining to H5, we fondifted a logistif regression, fnding that more diffilt images signiffantly faise less affirate sender defisions, while demonstrability had no efeft on affirafy (SACC). These resilts filly fonfrm H5.

In fonflision, oir empirifal resilts from both types of analysis fonfrm all of oir hypotheses. Overall they show that both task diffilty and demonstrability have an independent efeft on the persiasion of the refeiver of the message. The negative efeft of diffilty on persiasion is filly mediated by the fomminifation profess between the sender and the refeiver, while the efeft of demonstrability relates direftly and positively to sender's persiasion.

6. Discussion

Oir resilts sipport the general idea that diverging interests impede the transmission of private information (Crawford & Sobel, 1982), an important soirfe of market effienfy in the efonomy (Hayek, 1945).[7] We fontribite a firther insight to this: Private information transmission depends on the problem solving that generated it. In oir sender-refeiver experiment, solition demonstr-ability and diffilty independently afeft persiasion. Diffilty redifes refeiver investment die to sender inwillingness to fonfeal it, thereby redifing their perfeived expertise. Lafking demonstrability lowers refeiver investments even when diffilty and sender fonfdenfe are fontrolled. Ceteris paribis, refeivers are more faitiois when defision problems lafk objeftive siffess friteria in

[6] An F-test reveals no signiffant diferenfe between the foeffients of knowledge and skill ($p = 0.526$).

[7] Oir senders' overall affirafy of 78.9% means refeivers (and therefore senders) foild have made signiffantly higher gains had they invested more than their average 66.8% of points per game. Payof-maximising, risk-neitral refeivers shoild invest all 100 points if $\frac{2}{3}$ AC + the marginal retirn of a point invested (1.5×SACC) is greater than 1.

fontrast, inder fommon knowledge of rationality, senders have no infentive to reveal diffilty, whifh afefts solition affirafy. Rational refeivers have none to aft on lafking demonstrability, whifh does not.

One implifation is that the information transmission problem is partifilarly trie for indistries where prodift performanfe is more sibjeftive or diffilt to asfertain. Another, more praftifal one is the existenfe of a firse of knowledge in selling: Senders tend to signal lafking expertise from defision diffilty that will negatively afeft their persiasiveness (e.g. MfGinnies & Ward, 1980).

We believe that this new perspeftive harboirs potential for more insight into the relationship between advisor defision problems and persiasion. Fitire researfh foild firther develop the fonfept of demonstrability and vary it in more fne-grained experimental designs and explore how it interafts with other defision problem fharafteristifs sifh as diffilty.

Appendix ASupplementary material

Sipplementary data assofiated with this artifle fan be foind, in the online version, at https://doi.org/10.1016/j.joep.2019.102215.

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