

A Review of Bias Research in Auditing: Opportunities for Combining Psychological and Economic Research

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1.0 Introduction

Accounting research borrows its methodology mainly from economics and psychology. It shares with these disciplines the fundamental goal of understanding human behavior. Accounting applies the methodologies of these disciplines to investigate how managers prepare financial information, how auditors evaluate it, how financial analysts process it and how investors use it [Libby et al., 2002]. Traditionally, research in accounting has been based on either economics or psychology, with only limited attempts to integrate the two approaches [Haynes and Kachelmeier, 1998]. Choice of methodology is mainly determined by the research approach used: Archival and analytical research employs the framework of economics, while behavioral experimental research often draws from psychology.

In economics, a successful integration of psychology has taken place over the last decade, forming what is called behavioral economics. The approach of behavioral economics is to 1) identify anomalies and clear violations of the normative assumptions in economics; 2) use the anomalies as inspiration for creating alternative theories that generalize existing models, and 3) construct models of economic behavior using the revised assumptions, test them, and derive new implications [Camerer and Loewenstein, 2004, p. 7]. A valuable source of inspiration for identifying anomalies is the heuristics-and-bias approach of psychology. This approach fits well with economics because it investigates how and why behavior deviates from the standard assumption of rationality used in economics [Tversky and Kahneman, 1974; Kahneman, 1991]. Behavioral economics is distinct from the heuristics-and-bias approach as it upholds the fundamental assumption of rational behavior and integrates only selected biases into each model [Sunder, 2006], while the heuristics-and-bias approach dispenses fully with the rationality

assumption and aims to built descriptive models of behavior solely on the heuristics discovered [Kahneman, 1991]. Behavioral economics is already well received in some fields of applied economics such as finance [Barberis and Thaler, 2003; Glaser et al., 2004] and organizational behavior [Camerer and Malmendier, 2007].

The general goal of this paper is to facilitate the reception of behavioral economics in accounting. This shall be achieved by (1) uncovering the rich resource of psychology-based bias research, (2) showing how prior accounting research has started to combine economics and psychology, and (3) suggesting opportunities for combining both approaches in future research. We concentrate on experimental research in auditing, where the heuristics-and-bias approach has been frequently used.

First of all, to make psychology-based research more accessible, we review the extensive literature with a focus on features that are important for integrating findings from the heuristics-and-bias approach into economic theory. These features are the general proneness of auditors to biases, the role of experience and the motivational effects of the auditing environment. We also describe the origin and causes of the biases based on seminal experiments and complement this with recent findings in psychology.

Second, to show how the approaches of economics and psychology have been successfully combined in prior research, studies in the tradition of experimental economics are reviewed. We compare those biases that have been investigated by both behavioral and economic experiments to make potential gaps in the literature apparent. The findings are also summarized by auditing topic in order to provide suggestions on how prior analytical models might be extended or how hypotheses in archival research could be enriched.

Third, suggestions for future research follow the idea of combining the approaches of psychology- and economics-based research. Regarding experimental research, both approaches complement each other well, as the weaknesses of one approach are the strengths of the other: Economics-based research can draw from the psychology-based approach in order to strengthen external validity, while psychology-based bias research can adopt the focus on structure prominent in economics-based research to strengthen internal validity. Such a focus on structure could also help formulate a benchmark of normative behavior that is often difficult to construct in psychology-based bias research in auditing [Johnson et al., 1989; Hogarth, 1993]. Combining both approaches might also offer opportunities to examine the interaction between financial and social incentives [Lerner and Tetlock, 1999].

Our contribution, with respect to earlier reviews, is that we collectively review both psychology-based and economics-based research in auditing with a focus on how these two approaches complement each other. In the past, both approaches have mostly been reviewed separately from each other. Most closely related to our review of the psychology-based bias research in auditing is the review of Smith and Kida [1991], who also concentrate on research following the heuristics-and-bias approach in auditing. Like Smith and Kida [1991], we focus on the potentially mitigating effects of auditors' experience and the audit environment. We extend their review by considering a wider range of biases and by being able to include the more recent studies. This allows us to reevaluate the preliminary findings of Kida and Smith [1991] that biases would have a weaker influence on judgment when experienced auditors perform familiar tasks and that auditors would employ a functional heuristic of conservatism.

Other reviews do not focus on the heuristics-and-bias approach, but review the findings of audit judgment research in general. These reviews include, for example, Solomon and Shields [1995], who categorize the research by evaluation criteria and audit task; Trotman [1998], who

focuses especially on the effects of information order; Kotchetova and Salterio [2004], who also summarize the findings for hindsight bias, confirmation bias and accountability; and Nelson and Tan [2005], who structure their review around the factors of task, person and interaction. An early review of economics-based bias research and its methodology is Smith et al. [1987], which reviews the literature on the value of audits and audit pricing. Later reviews have contrasted the economics-based approach with the psychology-based approach [Waller, 2002] or have emphasized the linkage between both approaches [Callahan et al., 2006]. One of the few reviews to synthesize both approaches is Haynes and Kachelmeier [1998].

2.0 Psychology-based bias research in auditing

2.1 Characteristics

2.1.1 Methodology: Auditors performing realistic audit tasks

In a typical auditing experiment based on the heuristics-and-bias approach, individual auditors are confronted with hypothetical audit scenarios and are asked to conduct audit procedures. Only rarely is the decision-making of groups of auditors examined [e.g. Reckers and Schultz, 1993; Ahlawat, 1999]. In order to derive variance in the auditors' responses, the hypothetical scenario often involves a certain amount of ambiguity. Oft-selected topics include the evaluation of an internal control system, the solution of an accounting problem, or judgments about the going-concern of the audited company.

The focus of these experiments is often on external validity. Auditors should act as they would in a real situation. This aim should be achieved by reconstructing a realistic audit scenario that implicitly incorporates the incentives and circumstances that auditors face in reality. Using a realistic setting also enables auditors to make use of their experience.

2.1.2. Development: From a theory to an issue focus

The heuristic-and-bias approach of psychology has been adopted rapidly by auditing research [Birnberg and Shields, 1989]. In the beginning, auditing research borrowed theory from psychology and transferred it to a general auditing setting. Students were used as subjects [e.g. Swieringa et al., 1976]. Later, the approach was contrasted with the special features of the audit environment, and auditors familiar with such a setting were used as subjects [Solomon and Shields, 1995]. Finally, after establishing that auditors frequently employ heuristics in their judgment and decision-making, researchers examined factors that could mitigate the effects of biases and tested decision aids for improving judgment [Ashton and Ashton, 1995; Messier, 1995].

The focus of psychology-based audit bias research has shifted over time. The first wave of research replicated the experiments of Tversky and Kahneman [1974], which examined anchoring bias and the representativeness heuristic in an audit context. The second wave started with the introduction of the belief-adjustment model by Hogarth and Einhorn [1992]. This model provides a framework for investigating a setting in which a series of pieces of evidence is sequentially presented. It allows for measuring the amount of weight the decision-maker attaches to each piece of evidence and predicts overall judgment. Biases that can be examined with this model include those derived from order effects or confirmatory processes [Trotman, 1998]. In a third wave, beginning at the end of the 1990s, bias research became more issue-oriented. For example, researchers examined how hindsight bias affects auditor liability risk or how acceptability heuristics affect auditor independence.

The adoption of the heuristics-and-bias approach by the auditing literature can be explained by its salience for auditing: Judgment and decision-making is inherent in nearly every phase of the audit process [Solomon and Shields, 1995]. The heuristic-and-bias approach provides a valuable framework for generating hypotheses and integrating findings from various experiments [Hogarth, 1993]. Such a framework has often been missing in the experimental auditing literature, which has been criticized for lacking a basis in theory and being too descriptive [Chow et al., 1988]. The audit setting also has some particular features that make the application of the heuristic-and-bias approach interesting from the viewpoint of general psychology research. These particular features include the judgment of experts, the variety of audit tasks of different complexity and ambiguity, the potentially massive financial consequences of erroneous judgments, and the institutional mechanisms [Hogarth, 1991; Ashton and Ashton, 1995].

2.2. Examined heuristics and biases

Arkes [1991] categorizes biases into three underlying general causes of biases, distinguishing between those which are psychophysically-, association-, and strategy-based. In our outline, we follow this categorization and distinguish between biases caused by the association-based overweighting of irrelevant information and by a strategy-based neglect of relevant information. We do not address psychophysically-based biases which comprise e. g. reference point effects as they have not been examined in psychology-based bias research. Additionally, we consider biases connected to self-serving judgment, and further biases as availability and ambiguity aversion. Classifications of biases by underlying heuristics always remain somewhat arbitrary, because it often not fully clear what the underlying heuristics for the biases are [Pohl, 2004].

2.2.1. Focusing on irrelevant information due to anchoring effects

2.2.1.1. Anchoring

Studies have shown that people use externally provided initial values as anchors even when they are irrelevant [Tversky and Kahneman, 1974]. The anchoring heuristic can be explained by two factors. First, externally provided anchors trigger the accessibility of conforming information [Chapman and Johnson, 1999], even when presented subliminally [Mussweiler and Englich, 2005]. Second, the anchor is used internally as a starting point and, during the judgment process, adjustments made away from it are too small [Epley and Gilovich, 2006]. Only the latter process is effort-related [Epley and Gilovich, 2001, 2005].

Almost all experiments suggest that auditors use the anchoring heuristic, e.g., by judging fraud frequencies [Joyce and Biddle, 1981a]. Auditors also rely too much on the previous year's working papers in audit planning [Wright, 1988; Bedard, 1989] or on unaudited book values in analytical review tasks [Kinney Jr and Uecker, 1982]. This is problematic, as Wild and Biggs [1990] showed that anchoring on unaudited book values usually has negative effects on audit effectiveness. The prevalence of anchoring has also been shown for tax asset judgments under SFAS 109: Auditors starting with the full amount of the potential asset value and adjusting downwards derived higher asset values than auditors starting at zero and adjusting upwards [Heiman-Hoffman and Patton, 1994].

Experience has turned out to have some positive effects. Auditors seem to rely not only on externally provided anchor values, but also on internal, experiential values [Butler, 1986]. This can be helpful, as experienced auditors have good knowledge about, for example, error frequency rates [Solomon et al., 1999]. Experienced auditors also seem to anchor less on already budgeted audit hours by giving more consideration to internal control effectiveness and analytical

review results [Cohen and Kida, 1989]; they also appear to be better at limiting the use of the anchoring heuristic to situations in which it is efficient [Shields et al., 1988].

The evidence on interaction effects between anchoring and motivational factors is mixed. Some experiments suggest that an auditor's tendency to employ an anchoring heuristic is reduced in critical situations, such as when analytical testing suggests a problem [Cohen and Kida, 1989] or when the client is unreliable [Heintz et al., 1999]. On the contrary, Heintz and White [1989] found an even stronger reliance on anchor values in the critical setting of trend reversals.

A useful strategy for debiasing anchoring effects is to ask auditors to imagine alternative scenarios [McDaniel and Kinney, 1995] or provide a richer set of audit information to the auditors [Biggs and Wild, 1985].

2.2.1.2. Hindsight bias

Hindsight bias describes the phenomenon of outcome knowledge altering the ex-ante judgment of the occurrence of an event [Fischhoff, 1975]. A meta-analysis of over 100 studies confirmed the robustness of this bias [Christensen-Szalanski and William, 1991]. It occurs mainly because knowledge about the outcome makes information consistent with that outcome more easily accessible [Hawkins and Hastie, 1990], and because people attempt to show competence by signaling that they would have foreseen the event [Campbell and Tesser, 1983; Hölzl and Kirchier, 2005; Musch and Wagner, 2007]. Connected to the hindsight bias is the outcome effect; outcome knowledge influences not only judgments about ex-ante probabilities, but also about the evaluation of the quality of the ex-ante judgment that, in hindsight, turned out to be wrong [Tan and Lipe, 1997]. Peecher and Piercey [2008] investigated the conditions under which the outcome effect resulted in a biased judgment

Auditors are prone to hindsight bias and the outcome effect. King et al. [1994] and Emby et al. [2002] showed that auditors informed about the subsequent failure of a company judged the ex-ante likelihood of bankruptcy to be higher, which also influenced the auditors' evaluation of the audit quality in a peer review. Studies that compared the judgments of auditors to those of students [Kennedy, 1995] or investigators [Kinney and Nelson, 1996] found no evidence that auditors' experience mitigated hindsight bias; this is line with findings in psychology [Guilbault et al., 2004]. Some experiments tested whether hindsight bias would be mediated by surprising outcomes, but these did not detect strong effects [Buchman, 1985; Reimers and Butler, 1992; Anderson and Lowe, 1993].

Eliminating the hindsight bias has proved to be difficult. Motivating the auditor by making he or she more accountable has no effect [Kennedy, 1995]. Hindsight bias was somewhat reduced when subjects were asked to also consider alternative outcomes [Reimers and Butler, 1992; Kennedy, 1995]. Due to the robustness of hindsight bias, Lowe and Reckers [2000] suggested that auditors should try to ameliorate the litigation risk by trying to approach the biased judgment of juries evaluating the audit in hindsight in their own ex-ante judgment. The effect of hindsight bias on juries' judgments has been demonstrated in an auditing context in several experiments [e.g., Anderson and Lowe, 1993; Lowe and Reckers, 1994; Anderson et al., 1997a; Kadous, 2001; Clarkson et al., 2002; Brandon and Mueller, 2006; Peecher and Piercey, 2008].

2.2.1.3. Information order

According to the belief-adjustment model of Hogarth and Einhorn [1992], processing information sequentially can trigger order effects because prior beliefs serve as anchor values and are adjusted in the light of new evidence. The model predicts a contrast effect, which means that new

evidence has the strongest impact when it contradicts prior beliefs. This explains recency bias, in which people put too much weight on information received last in a series of inconsistent evidence.

In a review article, Trotman and Wright [2000] discussed fourteen studies on order effects in an auditing context. These studies confirmed the occurrence of recency bias for judgments on internal controls [Ashton and Ashton, 1988], accounting issues [Tubbs et al., 1990], going-concern opinions [Asare, 1992; Guiral and Esteo, 2006] and performance evaluations [Pei et al., 1992]. A weaker effect was observed for action tasks [Messier Jr, 1992]. Overall, experimental research suggests that experience mitigates recency bias. While one study found that experience accentuates the overweighting of evidence received last [Krull Jr et al., 1993], two other studies show that experienced auditors are less prone to this behavior [Kennedy, 1993; Messier Jr and Tubbs, 1994]. Furthermore; Trotman and Wright [1996] demonstrated positive effects for task-specific experience. The positive effects of experience are weaker for a long sequence of evidence [Arnold et al. 2000]. Motivational factors that increase effort decrease recency bias. For example, recency bias was less distinct in the presence of high fraud [Reckers and Schultz, 1993] or litigation [Monroe and Ng, 2000] risk.

Several techniques for debiasing have been tested successfully. Review pressure is one of these techniques; recency bias was reduced when auditors were held accountable to their audit partner [Kennedy, 1993], required to conduct a self-review [Ashton and Kennedy, 2002] or had to document their findings in writing [Cushing and Ahlawat, 1996]. Further mitigating factors include strong prior beliefs on the part of the decision-maker [Butt and Campbell, 1989], presentation format [Tubbs et al., 1990], and the chronological order of evidence [Favere-Marchesi, 2006]. Mixed results were observed for group decision-making [Reckers and Schultz, 1993; Johnson, 1995; Ahlawat, 1999].

2.2.1.4. Confirmatory processes

People tend to direct their information search towards evidence that confirms their beliefs, thereby following a positive test strategy [Klayman and Ha, 1987, 1989], where this can also affect their judgment. This confirmation bias may occur because people have a preference for supporting their initial beliefs [Church, 1990; Jonas et al., 2001] or because information consistent with prior beliefs is more accessible [Schwarz, 1998].

Early experiments provided only weak evidence that auditors process information in a confirmatory manner [Kida, 1984; Ashton and Ashton, 1988; Butt and Campbell, 1989; Trotman and Sng, 1989; Pei et al., 1992; Ayers and Kaplan, 1993]. This might be due to methodological deficiencies, because later studies that controlled for individual rating of evidence and intermediate belief did find evidence of confirmation bias [Bamber et al., 1997; Peterson and Wong-On-Wing, 2000]. Psychological research suggests that level of confirmation bias does not depend on level of expertise [Jonas et al., 2001; Jones and Sugden, 2001]. This is consistent with the finding of Bamber et al. [1997], who did not detect positive effects for auditors' experience. On the other hand, an earlier study by Kaplan and Reckers [1989] found that experience had a mitigating effect. Other studies showed that experience can improve efficient use of confirmatory test strategies [Brown et al., 1999; Peterson and Wong-On-Wing, 2000]. Some studies have provided evidence that particular features of the audit environment cause auditors to focus more on negative evidence [Ashton and Ashton, 1988; Trotman and Sng, 1989; Church, 1991; McMillan and White, 1993], a finding not confirmed in a later study by Bamber [1997].

Confirmation bias can be reduced effectively with techniques that motivate the auditor to expend extra effort, such as introducing documentation requirements [Emby and Finley, 1997].

This is supported by a recent experiment with tax professionals that demonstrated a debiasing effect of justification requirements [Wheeler and Arunachalam, 2008]. Confirmation bias was smaller when all pieces of evidence were presented simultaneously [Emby, 1994].

2.2.2. Neglecting relevant information due to judgment by representativeness

2.2.2.1. Sample size neglect

Judging by representativeness occurs when the decision-maker focuses on highly representative and salient factors while neglecting other less salient, but important, clues. With regard to the evaluation of randomly drawn samples of data, this means that people rely too much on sample distribution while neglecting sample size [Tversky and Kahneman, 1974; Grether, 1982; Pitre, 2007]. Similarly, people tend to believe that very small sample sizes are highly representative of the underlying population [Tversky and Kahneman, 1971; Rapoport and Budescu, 1992, 1997]. This belief in the law of small numbers has been formalized into an economic model by Rabin [2002].

Auditors often rely on non-random methods for sampling and employ non-statistical methods for evaluating these samples [Hall et al., 2000, 2002]. This brings with it the danger that auditors overestimate the power of small samples when employing the representativeness heuristic in their judgment. In accordance with this theory, Kachelmeier and Messier [1990] found that auditors draw sample sizes that are smaller than the size required by audit standards., This effect disappeared after a change in auditing standards [Messier Jr et al., 2001]. Weak evidence for the positive effects of experience was provided by two early studies: Swieringa et al. [1976] found that higher familiarity with the task reduced the neglect of sample size, and Uecker

and Kinney [1977] observed that auditors require at least a minimum sample size in sampling audit tasks.

2.2.2.2. Base rate neglect

Decision-makers often tend to focus only on the individual meaning of each piece of evidence without considering it in light of prior knowledge of base rates. For example, they only consider the match between presented character traits and stereotypes of professions, without considering the proportion of each profession in a population [Kahneman and Tversky, 1973; Bar-Hillel, 1980]. Additionally, the level of base rate neglect depends on the context [Birnbbaum, 2004].

While Joyce and Biddle [1981] argued that base rates are less often neglected by auditors performing familiar tasks, Holt [1987] demonstrated that the apparent decrease in the neglect of base rates is due to the wording used in the task description and that auditors do neglect base rates. The findings of Tuttle [1996] suggest that experience has at least the positive effect of improving the choice of the relevant subsample, which would improve the decision quality of auditors even when they are prone to base rate neglect.

The context-dependency of base rate neglect was also demonstrated by Kida [1984], who showed that auditors use base rates more often when they are presented in a way that highlights the causal link between the base rate and the relevant population [Ajzen, 1977].

2.2.2.3. Conjunction fallacy

Basic statistical theory tells us that the probability of a certain event "x" must be higher than the probability that "x" happens in conjunction with another event "y" ($p(x) > p(x \cap y)$). However, when the combination of two conjunctive events is highly representative for a certain scenario,

people tend to estimate the likelihood of this combination higher than the likelihood of both single events [Tversky and Kahneman, 1983; Kahneman and Tversky, 1996; Fisk, 2004]. The conjunction fallacy is moderated when probabilities are presented in the form of frequencies [Gigerenzer, 1996; Hertwig and Gigerenzer, 1999; Mellers et al., 2001] and precise terms are used to describe the conjunction, e.g., “x who are y” instead of “x and y” [Tversky and Kahneman, 1983; Mellers et al., 2001; Sides et al., 2002].

In auditing, an early study by Joyce and Biddle [1981] indicated that the experience of auditors eliminates the conjunction fallacy. However, this non-finding might have occurred due to experimental design issues, because the conjunctive event used in their study lacked similarity to a highly representative event. Later studies suggest that, to the contrary, experience might increase the impact of the conjunction fallacy because gaining experience would go along with forming an image about the representativeness of events. For example, auditors were more prone to the conjunction fallacy when estimating the likelihood of possible error combinations regarding an accounting issue because they were familiar with the principle of double bookkeeping [Frederick and Libby, 1986] or connected audit implication [Ho and May, 1993]. Requiring auditors to state the individual likelihoods for each single event reduced the effects of the conjunction fallacy [Ho and Keller, 1994].

2.2.2.4. Source credibility neglect

When judgment is based mainly on the representativeness of the message, the credibility of the source is neglected [Tversky and Kahneman, 1974; Pornpitakpan, 2004].

While Joyce and Biddle [1981] found some evidence that auditors neglect the credibility of a source, later research came to the conclusion that auditors consider various forms of source

reliability in their judgment: for example, source objectivity [Bamber, 1983; Rebele et al., 1988; Hirst, 1994; Anderson et al., 2004], source competence [Anderson and Koonce, 1994; Hirst, 1994; Goodwin and Trotman, 1996] and source integrity [Goodwin, 1999]. Auditors considered source reliability not only in their judgment, but also directed their information search towards more reliable sources [Knechel and Messier Jr, 1990]. As in Bamber [1983], auditors sometimes even excessively discounted evidence from unreliable sources. One driver of the high sensitivity of auditors to find reliable sources seems to be experience. Both Haynes [1999] and Kaplan et al. [2008] found that highly experienced auditors were more likely to discount non-credible information than students or novice auditors. Auditors showed a slight focus on negative evidence. For example, changes in source reliability were given special consideration when that change was negative [Cohen and Kida, 1989], or when the source content was associated with negative consequences [Knechel and Messier Jr, 1990].

One potential technique that heightens awareness of source reliability is to put auditors in the role of reviewers instead of preparers [Reimers and Fennema, 1999].

2.2.3. Self-serving judgment

2.2.3.1. Overconfidence

Overconfidence describes the tendency of people to believe that their judgment is more accurate than it really is [Lichtenstein et al., 1982], that they have superior abilities [Svenson, 1981; Taylor and Brown, 1988], and that they have a brighter future than the average person [Weinstein, 1982]. Overconfidence has been used to explain a variety of economic phenomena, including overtrading in financial markets [Glaser et al., 2004] and excess entry into markets by entrepreneurs [Camerer and Lovallo, 1999].

In auditing, the focus of overconfidence research has been on the potential mismatch between auditors' confidence in their own judgments and their judgment accuracy, since such a mismatch would negatively affect audit efficiency [Beck et al., 1985]. In a first study with auditors, Tomassini et al. [1982] unexpectedly observed underconfidence. One explanation for this might be the task-dependency of this bias; while overconfidence appears in difficult tasks, underconfidence is present in easy tasks. This happens because the level of task difficulty affects judgment accuracy strongly, but judgment confidence weakly [Lichtenstein et al., 1982]. This task-dependency has been further investigated and confirmed in subsequent studies examining auditors' confidence in a going-concern judgment [Mladenovic and Simnett, 1994], an internal control audit [Simnett, 1996], a work paper recall task [Moeckel and Plumlee, 1989], and in a comparison of a simple error frequency task with a difficult interest-rate swap task [Han et al., 2007]. Overconfidence in auditors' judgment was observed in their evaluations of their own technical knowledge [Kennedy and Peecher, 1997], competence in auditing software risks [Hunton et al., 2004], ability to complete general knowledge tasks [Solomon et al., 1985], and in their evaluation of chance of winning a court ruling [McCracken, 2003]. Furthermore, superordinate auditors were overconfident in the competence of subordinates [Kennedy and Peecher, 1997], at least for complex tasks [Han et al., 2007], and subordinates were overconfident in the competence of superordinates, at least for easy tasks [Kennedy and Peecher, 1997].

In two experiments, experience increased auditors' propensity to be overconfident: While judgment accuracy improved very little with experience, judgment confidence did increase with experience [Pincus, 1991; Chung and Monroe, 2000].

2.2.3.2. Acceptability heuristic

Tetlock [1985] argues that people tend to employ an acceptability heuristic in judgment and decision-making when they are accountable to someone whose preferences are known. This can lead to an attitude shift in which people unconsciously gravitate toward the preferences of the other party and adopt a "socially acceptable" compliant position [Tetlock et al., 1989; Lerner and Tetlock, 1999]. This affects both information search and information-processing [Kunda, 1990, 1999; Brownstein, 2003]. Accountability has a different effect when the views of the other relevant party are unknown. In this case, subjects try to anticipate potential objections to their own views by switching over to more complex and effortful reasoning [Tetlock et al., 1989]. In auditing, studies have focused widely on this positive accountability effect in the context of internal reviews by superordinates [DeZoort and Lord, 1997].

Auditors are accountable to various groups (e.g., the management and audit committee, team members, superordinates, reviewers, regulators, investors, and the general public) [Gibbins and Newton, 1994; Emby and Gibbins, 1988]. Buchman et al. [1996] and Koch et al. [Koch et al., 2008] conducted two of the few experiments that investigated the acceptability heuristic by explicitly manipulating the accountability pressure felt by the auditors towards the client by announcing a prospective meeting with the client. These studies observed a weak tendency to favor the client. Support for the acceptability heuristic can also be derived from other studies that showed that auditors favored their client when evaluating ambiguous accounting issues [Hackenbrack and Nelson, 1996] and when planning the audit [Gramling, 1999]. Related to this, auditing research also found that auditors reacted similarly to known preferences of the internal reviewer, e.g., on issues affecting auditor independence [DeZoort and Lord, 1994; Lord and DeZoort, 2001], analytical tasks [Peecher, 1996], or client acceptance decisions [Cohen and Trompeter, 1998]. Interestingly, the reviewing party did not expect that the behavior of the

reviewed party was biased by the review [Wilks, 2002]. No significant effects for experience have been detected [Buchman et al., 1996; Chang and Hwang, 2003]. Motivational factors that mitigate the effects of the accountability heuristic include counteracting financial incentives like litigation risk [Farmer et al., 1987; Hackenbrack and Nelson, 1996; Chang and Hwang, 2003; Koch et al., 2008], additional accountability towards an audit partner who had preferences for a high audit quality [Gramling, 1999], low commitment to keeping the client [Kadous et al., 2003] or high commitment to professional values [Lord and DeZoort, 2001].

Factors that mediate the effects of the acceptability heuristic include the necessity of conducting a quality assessment [Kadous et al., 2003], high salience of the other party's preferences [Haynes et al., 1998], knowledge of the preferences of the relevant other prior to decision-making [Wilks, 2002; Jenkins and Haynes, 2003], and high ambiguity in the audit task [Salterio and Koonce, 1997].

2.2.4. Availability

The availability heuristic describes a judgment in which the estimate of likelihoods of events is based on the ease of its retrieval [Tversky and Kahneman, 1973; MacLeod and Campbell, 1992], or on the amount of content associated with it [Schwarz, 1998]. This strategy can be error-prone when the availability of the event is related not to the actual frequency of occurrence, but rather to factors like vividness, familiarity, similarity or information order [Dubé-Rioux and Russo, 1988; Fischhoff et al., 1978; Hoch, 1984].

Libby [1985] demonstrated in an experiment that auditors rely on the availability of error causes when generating hypothesis about potential errors in analytical tasks. Further experiments have shown that having a specific error-cause as hypothesis in mind can interfere with the

generation of alternative error causes [Anderson et al., 1992; Green, 2004]. Evidence is mixed as to whether the type of hypothesis generated affects the final audit judgment [Moser, 1989; Anderson et al., 1997b] or not [Anderson et al., 1992; Green, 2004].

Availability will not result in biased judgments when it is well-associated with actual error frequencies. Such an association was observed for experienced [Libby and Frederick, 1990; Ashton, 1991] or specialized auditors [Solomon et al., 1999]. Furthermore, experienced auditors seem to be better at ignoring irrelevant information even if it is highly available; for example, they were able to ignore last year's audit findings when these findings were unimportant to the task at hand [Bedard and Wright, 1994].

Consistent with auditors' tendency to focus on negative factors, having a non-error explanation at hand did not interfere with generation of error causes [Anderson et al., 1992, 1997b; Green, 2004].

General research in psychology suggests that the availability heuristic can be mitigated when people are made aware that ease of retrieval is not due to actual frequency, but to other external factors [Schwarz et al., 1991].

2.2.5. Ambiguity

Uncertainty about exact probability is called ambiguity. Investigation of behavior in the presence of ambiguity seems important since exact probabilities are often unknown in real-world auditing tasks [Zebda, 1991]. Ellsberg [1961] demonstrated in a thought experiment that people have a tendency to be ambiguity-averse and showed how ambiguity aversion contradicted the concept of subjective expected utility maximizing. Experiments that tested the Ellsberg hypothesis showed the general robustness of ambiguity aversion, but also some limitations [Camerer and Weber,

1992; Keren and Gerritsen, 1999]. For example, ambiguity aversion increased with the probability level in the gain-domain [Einhorn and Hogarth, 1986], while it decreased with the probability level in the loss-domain [Hogarth and Kunreuther, 1989; Di Mauro and Maffioletti, 2004].

Research has found that ambiguity influences auditors' probability judgments about the disclosure of contingent losses [Nelson and Kinney Jr, 1997], and the number of planned audit hours [Guess et al., 2000]. In both tasks, the effects of ambiguity interacted with the motivational effects of the audit environment. In the accounting task, auditors became less ambiguity-averse when this behavior would be in favor of the client [Nelson et al., 1988]. Similarly, the risk of impaired auditors' independence increased with the ambiguity of the scenario [Salterio and Koonce, 1997; Kennedy et al., 1997; Johnstone et al., 2002]. In the audit task, ambiguity aversion decreased when audit risk increased [Guess et al., 2000].

2.3. Implications

2.3.1. Effects of biases in auditing

Overall, the findings of the auditing literature imply that auditors do employ heuristics and are prone to the resultant biases when conducting audit tasks. Auditors were unable to ignore irrelevant evidence (anchoring, hindsight), depended on irrelevant factors when weighting evidence in sequential decision-making (recency, confirmation), were influenced by the representativeness of the scenario (sample size, base rate, conjunction, dilution), displayed self-serving tendencies (overconfidence, acceptability), relied on the availability of error causes to set up hypotheses in analytical tasks, and were ambiguity-averse.

This conclusion differs somewhat from that of Smith and Kida [1991, p. 485], who concluded that “(i)mportant differences in the findings of studies using experts in the performance of familiar, job-related tasks and those using students subjects or less realistic tasks are apparent.” Smith and Kida [1991, p. 486] emphasize that their findings are preliminary. Our conclusion that auditors employ heuristics when conducting audit tasks is based on the studies that have been published since the review of Smith and Kida [1991]. These studies suggest that the reduced bias found by earlier studies was probably not driven by the familiarity of experience auditors with the task, but by other confounding factors. For example, auditors showed behavior consistent with confirmation bias in later studies that controlled for individual ratings of the evidence [Bamber et al., 1997] or for the intermediate hypotheses of each individual [Peterson and Wong-On-Wing, 2000]. Also, Smith and Kida [1991] relied partly on the finding that auditors were not prone to source reliability neglect. However, later research in psychology showed that source reliability neglect is not a robust bias as credibility of the source is a salient factor in many contexts [Chaiken and Maheswaran, 1994].

A general limitation of bias research is the difficulty of constructing a normative benchmark for rational behavior. This is especially true in the case of auditing due to the complexity of the setting [Hogarth, 1981; Johnson et al., 1989]. This complexity makes it difficult to determine whether the use of heuristics really induces bad judgment or whether it instead induces highly efficient judgment due to the lower costs of information search and information processing [Gigerenzer and Todd, 1999]. Furthermore, it is unclear what constitutes good judgment in auditing, as this can be evaluated according to such diverse criteria as accuracy, unbiasedness and justifiability [Joyce and Biddle, 1981a; Emby and Gibbins, 1988].

2.3.2. Effects of biases for experienced auditors

The auditing setting provides an interesting opportunity to test controversial issues surrounding the effects of experience on biases. While Kahneman [1991] is skeptical that experience affects the use of heuristics, Smith and Kida [1991] conclude that experience reduces the use of heuristics.

Our review of the auditing literature suggests that auditors make use of heuristics as laymen, and consequently, are also prone to biases. For example, no effects for experience were observed for hindsight bias [Kennedy, 1995], the acceptability heuristic [Buchman et al., 1996], or ambiguity [Nelson and Kinney Jr, 1997]. Only effort-related biases [recency, e.g., Trotman and Wright, 1996, or, dilution, e.g.,] and task-sensitive biases [overconfidence, e.g., Mladenovic and Simnett, 1994; Chung and Monroe, 2000] were less pronounced.

Meanwhile, experience often influenced the effects of the use of heuristics on the quality of the decisions. Knowledge gained from experience helped auditors make use of accurate internal anchor values [Butler, 1986], access the most common error causes in auditing [Bedard and Wright, 1994], have realistic base rates in mind [Tuttle, 1996], and use confirmatory strategies, especially in those circumstances in which they are efficient [Brown et al., 1999]. In certain circumstances, experience exacerbates biases for auditors. For example, having a better knowledge of which events are representative induced higher sensitivity to the conjunction fallacy [Ho and May, 1993; Ho and Keller, 1994].

Heuristics-and-bias research in auditing has rarely detected significant effects of experience on the use of heuristics; this might be because the effects are indeed non-existent or because these effects are difficult to measure with the methodology used. Support for the conjecture that experience does not affect the use of heuristics comes from the difficulty of

improving judgments and decision-making with experience without valuable feedback [Einhorn, 1982]. In the audit context, like in many other areas, feedback on the quality of the decision is often missing.

Methodological reasons for the limited effects of experience derive from the construction of the experimental setting. First of all, it is difficult to construct a setting that is suitable for addressing this research question. While it is essential to construct a rich and realistic setting in order to give auditors the opportunity to make use of their experience [Smith and Kida, 1991], this carries the risk of limited control of potentially confounding factors, reducing the statistical power. Second, using a realistic case study in an experiment makes it difficult to have a reliable control group of subjects who are sufficiently inexperienced enough to serve as a control group, yet sufficiently experienced enough to understand the case study. Without a reliable control group, it becomes difficult to discern whether the results are really driven by experience or by confounding context effects. Third, experiments investigating these phenomena are often highly pre-structured [Johnson et al., 1989], which makes it difficult to isolate the potentially positive effects of experience [Bédard, 1989; Trotman, 1998]. The reason for this is that experience plays a less prominent role in such settings, as experience has the biggest impact in settings that involve structuring, planning and coordinating complex tasks [Abdolmohammadi and Wright, 1987; Hogarth, 1991; Bonner and Lewis, 1990].

2.3.3. Mitigating motivational effects of the audit environment on biases

Experiments in auditing have shown that the use of heuristics is often mitigated by the conservative behavior of auditors. For example, auditors anchored less on previous year's audit findings when the prospects of the audited firm deteriorated [Cohen and Kida, 1989], paid more

attention to error causes regardless of their hypothesis frame [McMillan and White, 1993], and were more able to access error causes than non-error causes in analytical tasks [Anderson et al., 1992, 1997b].

Ashton and Ashton [1990, p. 16] speculated that auditors' stronger focus on negative evidence is "likely to be driven by characteristics of professional auditors". Similarly, Smith and Kida [1991, p. 485] conclude that it appears as if auditors have adopted the "functional heuristic" of conservatism in order to minimize potential economic losses, e.g. litigation costs. Ashton and Ashton [1990] and Smith and Kida [1991] derive their conclusion mainly from psychology-based experiments. These experiments are constructed in such a way that the setting mimics a realistic scenario. Auditors participating in these experiments should act as they would in a real situation, which means that they should also consider the incentives they face in reality. This makes it impossible to determine whether conservative behavior is driven by the personal characteristics of the auditor or by the implicitly incorporated incentives of the setting. One way to distinguish between these two potential underlying causes would be to manipulate the motivation factors. Such a manipulation was done by later studies which found that auditors showed less conservatism in situations of low risk. For example, risk mitigated the recency bias [Reckers and Schultz, 1993], the acceptability heuristic [Hackenbrack and Nelson, 1996], and ambiguity [Guess et al., 2000]. These findings are in line with the psychological theory of dual processing, which predicts less heuristic-driven judgments and decision-making in high-risk situations [Chen and Chaiken 1999]. Based on experiments that explicitly manipulated the incentives auditors face, we conclude that the conservative behavior of auditors observed in the experiments cannot be traced back to a general characteristic of auditors, but, rather, can be purely explained by motivational incentive effects of the audit environment.

Further evidence for our conclusion is provided by experiments that demonstrated that auditors sometimes even display behavior contrary to conservatism. Experiments have shown that auditors sometimes support overly aggressive accounting when under client pressure [Hackenbrack and Nelson, 1996]. They even make use of the ambiguity surrounding an accounting issue in order to justify the position of a client who manages earnings [Nelson and Kinney Jr, 1997]. Furthermore, auditors rely too heavily on their own evidence indicating no going-concern problems, even when the findings of other team members indicate otherwise [Rau and Moser, 1999]; additionally, auditors are overconfident about their own audit knowledge [Kennedy and Peecher, 1997; Hunton et al., 2004].

2.3.4. Debiasing

The heuristic-and-bias approach is useful for providing ideas for debiasing techniques since it offers theories about the underlying causes of biases.

Redirecting attention to decision-relevant pieces of information can reduce overreliance on irrelevant information [Arkes, 1991]. One specific technique employed in an auditing experiment was the introduction of the requirement to also consider alternative outcomes, which reduced the hindsight bias [Reimers and Butler, 1992; McDaniel and Kinney, 1995].

Effort-enhancing techniques have proved to be successful in moderating effort-related biases. For example, the recency bias was mitigated by an announcement that work would be reviewed by an audit partner with unknown preferences [Kennedy, 1993], by asking auditors to document their procedures [Cushing and Ahlawat, 1996], or by requiring them to self-review their work [Ashton and Kennedy, 2002]. Similarly, documentation requirements also helped to

debias confirmatory processes [Emby and Finley, 1997]. These techniques were not successful in debiasing non-effort related biases, such as hindsight bias [Kennedy, 1995].

Statistical tools can be employed to reduce errors in probability judgments (base rate, sample size, conjunction fallacy). Furthermore, requiring auditors to deconstruct the decision problem helped: for example, rating the individual probabilities of events separately when judging the probability of a conjunctive event [Ho and Keller, 1994]. It also helps to enhance the salience of the logical connections between provided items by, for example, drawing a causal connection between the judgment task and the underlying base rate [Kida, 1984].

While decision aids can be helpful in improving judgment, they also have potential shortcomings. First of all, the mitigation of heuristics by decision aids can sometimes reduce the quality of decision-making. This can be the case when the use of the addressed heuristic is actually efficient in many scenarios in the field. Another danger is that the effects of the decision aids may overshoot, as it is often difficult to correctly calibrate them. Additionally, auditors tend to game with decision aids [Kachelmeier and Messier Jr, 1990; Messier Jr et al., 2001]. For example, they form initial opinions about sample size, then use decision aids primarily as devices for justifying those same judgments by manipulating them. Finally, decision aids often involve a higher level of structure and thus eliminate opportunities for exercising professional judgment. This could lower auditors' general level of motivation and their incentives to engage in further training [Glover, 1997].

3.0. Economics-based bias research in auditing

3.1. Characteristics

3.1.1. Methodology: Students interacting in abstract tasks

The methodology of experimental economics was first developed to test the predictive power of economic models for market behavior [Chamberlin, 1948; Smith, 1962]. Today, it is also used to research strategic interactions and the effects of various institutional settings and financial incentives [Smith et al., 1987]. This methodology tool is employed to provide insight into the behavior of individuals and markets as well as to derive policy implications [Smith, 1994; Kachelmeier and King, 2002].

The focus of this approach is on internal validity, presumably ensured through the construction of an abstract design without potentially confounding context effects [Friedman and Sunder, 1994], and the use of financial incentives to decrease the noise in the data deriving from unmotivated answers [Smith, 1991]. When financial incentives are salient and dominant, they can also provide a benchmark for rational, payout-maximizing, behavior [Smith et al., 1987]. Researchers attempt to ensure external validity by incorporating the underlying task structure into the design of the experiment, including interactions with other parties and monetary consequences.

In auditing, a typical experimental market setting comprises investors (called buyers), managers (called sellers), and auditors (called verifiers). The manager determines the effort expended for producing a good and the level of quality announced, the auditor chooses the effort for verifying the quality of the good and the audit opinion, and the investor chooses the bid prices for the good and for the audit service. Sometimes, all tasks are conducted by human subjects [e.g., Dopuch et al., 1989; Schatzberg, 1990; Calegari et al., 1998]; and sometimes a portion of the tasks and roles are played by robot subjects or are fixed [Schatzberg, 1994; Dopuch et al.,

2003]. Recently, the focus has shifted to examining the behavior of individuals, not only aggregated market behavior [Sunder, 2006]. For example, experiments have investigated the strategic interaction between the individual auditor and manager [e.g., Zimbelman and Waller, 1999; Fischbacher and Stefani, 2007].

3.1.2. Development: From confirming rationality to confirming biases

The first wave of experimental economics research in auditing (1985-1995) concentrated on confirming the predictive power of analytical models on topics like the demand for voluntary audits [e.g., Dejong et al., 1985], auditor liability [e.g. Dopuch, 1992] and auditor independence [e.g., Schatzberg, 1990]. The validity of the economic predictions was often confirmed, as subjects often showed a high degree of “unconscious rationality” [Smith, 1994].

The second wave addressed Kachelmeier’s criticism [1994, 1995, 1996] that the previous experiments were simply “a demonstration that students prefer more money to less” [Kachelmeier, 1995, p. 28]. The focus shifted towards investigating the limits of economic models by testing for deviations from rationality. For example, Schatzberg et al. [1996] explored whether the necessary preconditions for an impairment of auditor independence, as posited by economic theory [Magee and Tseng, 1990], are sufficient and essential. The research that took place during this wave identified several instances of deviation from rationality, thereby demonstrating that experimental economics is not simply about showing that more money is preferred to less. However, the ex post explanations for these deviations remained explorative because potential biases had not been incorporated ex-ante into the hypotheses.

During a third wave starting at the end of the 1990s, research began to incorporate findings from psychology and behavioral economics in order to derive ex-ante hypotheses of deviations from rationality.

3.2. Examined heuristics and biases

3.2.1. Effects of biases examined by both psychology- and economics-based research

While psychology-based and economics-based research has examined the same biases, both approaches differ with respect to the general design and the research questions asked.

Psychology-based bias research investigates the behavior of professional auditors in a realistic context, whereas economics-based bias research usually uses students to examine individual decision-making in an abstract context with financial incentives. Accordingly, psychology-based bias research can be used to investigate whether auditors are prone to biases and whether biases are mitigated by experience, motivational factors or debiasing techniques. Economics-based research cannot address these questions, but focuses instead on investigating optimizing behavior, strategic behavior, behavior in interactions, and experimental markets.

Only a few experiments have explicitly examined the effects of biases in an audit context. King [2002] provided support for the acceptability heuristic by showing that auditors can have unwarranted trust in the *cheap talk* of managers, but he also showed that social group pressure can counteract this effect. Dopuch et al. examined the effects of anchoring of prior beliefs on investors' reactions to the disclosure of the auditors' fees. They found that investors persisted in their prior belief that the joint provision of audit and non-audit services impairs auditor independence, even after they have received feedback indicating otherwise. Zimelman and Wallner [1999] confirmed that auditors reacted to ambiguity by increasing audit effort even in abstract settings with financial incentives. Preferences for resolution of ambiguity also seemed to

be an important driver of investors' demand for independent audits [Mayhew and Pike, 2004]. Koch and Schunk [2008] demonstrated that ambiguity aversion increased with stake size, which can cause overauditing in settings of unlimited liability.

Other experiments have also resulted in the observation of unexpected deviations from the benchmark of rational behavior that might have been caused by bias. A prevalent finding is that subjects focus excessively on the often-highly salient price level and neglect other important factors, which can be traced back to the representative heuristic. This behavior affects the efficiency of different liability regimes [Dopuch and King, 1992; Dopuch et al., 1994; Zhang et al., 2001] and the demand for high audit quality [Brozovsky and Richardson, 1998; Mayhew et al., 2004]. Overconfidence in one's ability to win a case in court might explain why auditors choose to litigate rather than settle more often than expected [Dopuch et al., 1997]. Auditors might also be overconfident in their ability to recover costs, which would explain why underpricing is observed regularly in competitive experimental markets [e.g., Dopuch and King, 1991; Schatzberg, 1994; Schatzberg and Sevcik, 1994; Gramling et al., 1998]. The availability heuristic might explain, in part, King and Schwartz's [1999] finding that auditors react to the imposing of sanctions with a change in audit effort.

Other biases, such as recency bias and confirmation bias, have not been investigated by experimental economics research in auditing. This might be partly because economics-based bias research is focused more on outcomes and less on the process of decision-making.

3.2.2. Biases examined only in economics-based research

Biases that are easiest to observe by considering that interactions with financial incentives can be best examined with studies using the experimental economics approach, where one of those

biases is fairness. While economic theory generally assumes that people selfishly maximize their own utilities [Camerer and Fehr, 2006], it has been observed in experiments that people are willing to share their payoff with others in dictator games [e.g., Forsythe et al., 1994], that they are willing to bear costs in order to punish unfair behavior in ultimatum games [e.g., Hoffman et al., 1996], and that they show trust that they will be treated fairly by the others and show positive reciprocity towards those who trust them in gift-exchange games [Fehr et al., 1993; Berg et al., 1995]. In an audit context, fairness effects can explain why auditors regularly send unbiased information to investors even when they have incentives to do otherwise [Schatzberg et al., 1996; Falk et al., 1999], especially when those investors would have to bear high costs for auditors' misreporting [King, 1996]. One potentially mitigating factor is whether the incentives of auditors are disclosed to investors or not [Koch and Schmidt, 2008]. Theories of fairness can also explain why auditors are willing to bear costs in order to retaliate against the unfair behavior of other auditors who engage in lowballing [Calegari et al., 1998]. In the experiment of Kachelmeier [1991], auditors demonstrated reciprocal behavior by putting forth a higher audit effort when they received higher fees. Similarly, auditors who received low fees [Coller et al., 2002] due to, for example, excessive lowballing [Dopuch and King, 1996], reduced their audit effort. Managers expected this behavior and committed more fraud when the auditors received lower fees [Matsumura and Tucker, 1992]. Cooperative behavior that is fostered by mutual trust can negatively affect auditor independence. Auditors cooperate with managers, signaling their willingness to act with impaired independence by demanding high fees, and then actually do so despite having incentive to do the opposite after being hired [e.g., Calegari et al., 1998; Dopuch et al., 2003]. Cooperative behavior can also improve audit effectiveness, for example, in a setting in which the overall welfare is highest when both managers and auditors exert high levels of effort [Fisher et al., 1996].

Auditing can be characterized as a strategically complex setting in which many actors interact (e.g., auditors, managers, regulators, reviewers, investors). Deviations from equilibrium conditions identified by game theory can occur in such a setting, since people have limited strategic reasoning ability. In auditing, such deviations from the outcome predicted for rational behavior were observed in a strategically complex fraud setting [Bloomfield, 1999], for complex liability regimes [Dopuch et al., 1997], and for the interaction between forecast accuracy and self-fulfilling prophecy in a going-concern task [Tucker et al., 2003]. Fischbacher and Stefani [2007] showed that for a fraud detection task, the quantal response equilibrium (which considers the bounded rationality of actors) yields better predictions than the Nash equilibrium.

3.3. Implications

3.3.1. Independence: Lowballing and ethical behavior

Economic models of auditor independence have been a major source of inspiration for economics-based bias research in auditing. The basic idea is that the financial bond between the auditor and the audited company can put auditors' independence at risk [DeAngelo, 1981].

First, researchers examined whether and how such an economic bond emerges. DeAngelo [1981] argues in his economic model that the inherent transaction costs of switching the auditor provide the incumbent auditor with an economic advantage. In competitive markets, this advantage drives audit fees below costs in the first period, which is called lowballing. Schatzberg [1990] confirmed this effect experimentally and also showed that quasi-rents can arise when it is assumed that auditors are heterogeneous. Calegari et al. [1998] observed cooperative behavior between auditors and managers in a similar experimental setting; auditors signaled their willingness to impair independence by demanding higher audit fees, and then actually did so after

receiving the mandate, without being bound to do so. This finding that cooperative behavior can have negative effects on auditor independence might also explain why Schatzberg et al. [2005] found that high ethical development was associated with low auditor independence. Dopuch et al. [2001] showed that rotation requirements can break up such cooperative behavior.

Second, researchers examined whether and how economic bonds affect auditor independence. Schatzberg and Sevcik [1994] showed experimentally that prospective quasi-rents could impair auditor independence. In an economic model, Magee and Tseng [1990] identified conditions that must be present for future quasi-rents to negatively influence auditor independence. For example, the audited company would have to have incentives to threaten the incumbent auditor with the deprivation of future quasi-rents and be able to credibly do so. Schatzberg et al. [1996] explored whether these conditions were really necessary and found them to be neither sufficient nor essential. They speculated that "behavioral factors" [Schatzberg et al. 1996, p. 47) like moral reasoning might be responsible for these irrational deviations.

Third, a potential direct link between lowballing and auditor independence was observed. Economic theory predicts that lowballing will not affect auditor independence because it constitutes a sunk cost. Meanwhile, Dopuch and King [1996] observed that auditors are less objective in periods in which fees are below costs. Collier et al. [2002] also found evidence that lower fees reduced audit quality, especially under low litigation risk.

Economics-based research also investigated the effectiveness of proposed or enacted auditor independence regulations. Tucker and Matsumura [1997] found a second-partner review to be generally helpful in improving auditor independence, but observed that it is sometimes ineffective due to the reluctance of the second-partner to punish the partner in charge. Making investors responsible for appointing the auditor improved audit quality in Mayhew and Pike's

[2004] experiment because investors showed a higher demand for high quality audits than expected. Dopuch and King [1991] showed that potential impairment of auditor independence arising from the joint provision of audit and nonaudit services did not necessarily reduce audit quality, because auditors providing also nonaudit services were better informed about the client's financial condition.

3.3.2. Liability regimes: Framing and complexity

Experimental economics research has compared the efficiency of different liability regimes. The main differences between liability regimes are the damage-sharing rule between auditor and manager (joint and several vs. proportionate liability), measurement of the damages (out-of-pocket vs. independent of investment), required level of due care (negligence vs. strict liability), and liability amount (limited vs. unlimited liability). Theoretically, different liability regimes can be structured in such a way that they are economically equivalent. For example, a stricter liability regime provides a higher level of assurance for investors, but is also more costly. In experiments, welfare was observed to be lower in stricter liability regimes as investors were unwilling to bear the higher audit costs, which decreased the demand for audits more dramatically than expected [Dopuch, 1992]. Furthermore, high-risk clients found it difficult to hire an auditor for a reasonable fee [Dopuch et al., 1994; Gramling et al., 1998]. Meanwhile, a very lenient liability regime can also be problematic when investors lose their faith in the accuracy of financial reports and lower their bids [Dopuch et al., 1994]. Koch and Schunk [2008] contribute to the current discussion of limiting liability by showing that unlimited liability can be inefficient as it triggers high levels of risk aversion and ambiguity aversion.

Level of complexity can also affect the efficiency of liability regimes. King and Schwartz [1999] showed that the behavior of the relevant actors in a complex liability regime characterized by a vague standard of negligence and an out-of-pocket damage measurement can deviate from the predicted equilibrium, which can cause inefficiencies. King and Schwartz [2000] investigated whether this deviation from the benchmark of rational behavior is driven by errors in anticipating the other's behavior or by faulty responses to accurate anticipations. Further complexity can arise from opportunities for settlement. The settlement process can be considered a strategic game between plaintiff and auditor in which both parties choose how much to offer and whether to accept the other party's offer. In the experiment by Dopuch et al. [1997], deviations from the predicted offer acceptance rate occurred especially in the setting of joint-and-several liability, which had the highest strategic complexity.

Liability primarily protects investors, but a sanctioning mechanism may also benefit auditors. The audit setting can be compared to a prisoners' dilemma game in which all auditors are best off when all of them provide a high audit quality, but each individual auditor has incentives to shirk. In this scenario, it is in the auditors' own interest to voluntarily join a regime in which the provision of low audit quality is sanctioned, which helps them to coordinate their behavior by, for example, setting up a professional self-regulating body [Grant and Bricker, 1996].

The reaction of auditors to imposed sanctions was studied by King and Schwartz [1999]. While audit effort increased only slightly in the period following the sanctions, the amount variation in effort level widened: some auditors responded to the sanction by increasing their efforts, while others responded by decreasing their efforts. This effect leveled out over time.

3.4. Limitations

3.4.1. Limited psychological background of the early research

In the beginning, experimental economics research in auditing was concerned primarily with the validity of economic models. Psychological explanations for observed deviations were rarely provided or addressed only briefly. This literature has only slowly begun to acknowledge that “cognitive limitations and other behavioral exceptions” might have an influence on their results and that there is “more eccentricity in the world than typically admitted” [Dopuch et al., 1994, p. 123 seq.]. One of the first papers attempting to explain observed deviations from rationality by referring to a specific bias is Dopuch and King [1996], who speculated that the unexpected negative effect of lowballing on auditor independence might be due to hyperbolic discounting.

In the mid-1990s, some researchers started to incorporate potential biases into their hypotheses. Meanwhile, references to psychological literature remained limited, and references to psychology-based bias auditing research in particular were virtually nonexistent. While both economic and behavioral hypotheses were provided regularly, the psychological theory behind behavioral hypotheses often remained vague as no psychological literature was cited [e.g. Dopuch et al., 2001]. Other experiments referred to psychological findings, but often reduced them to “simple platitudes” [Bazerman et al., 2006, p. 45].

3.4.2. Richness of the design: Tractability vs. external validity

In experimental economics, setting up an experimental design involves the tradeoff between a context-rich design to ensure external validity and an abstract design to ensure internal validity.

A context-rich setting is sometimes necessary in order to incorporate features that constitute antecedents of bias. Context-rich settings are prone to becoming complex settings in which subjects have difficulties understanding the task and begin to make random choices [Bloomfield, 1999]. This often makes it difficult to disentangle the effects of the treatment variable from unintended effects arising from the complexity of the setting [DeJong and Forsythe, 1992; Libby, 1992]. This problem is further amplified by the difficulty of deriving a benchmark of normative behavior for rich and complex settings. The current trend in experimental economics of examining individual decisions instead of market outcomes [Sunder, 2006] is arguably due to attempts by researchers to reduce setting complexity. This trend also holds true in auditing. While early experiments took into account the audit market in its entirety, with investors, managers and auditors interacting [Dopuch and King, 1992; Dopuch et al., 1994], today, the main experimental focus is on the interaction of two individuals [King and Schwartz, 2000; Dopuch et al., 2001; King, 2002] or the behavior of one individual [Choy and King, 2005].

An excessively abstract setting may miss important factors pointed out by psychological research, thus failing to provide any room for the evolution of biases, and may also lack external validity. In experimental economics, however, external validity is not achieved through mundane realism, but instead through "experimental realism" [Smith et al., 1987, p. 77]. Experimental realism is sufficiently ensured when a real world task is fully incorporated into the setting, including underlying structure, and when subjects face incentives similar to those in reality. One particular limitation of experimental economics research in auditing is that there is no possible way to fully incorporate some important features of the audit environment, e.g., the large litigation risk that auditors face.

4.0. Research opportunities in bias research in auditing

4.1. Experimental bias research

Psychology-based bias research in auditing has already reached maturity. A large body of experiments has investigated whether auditors' behavior is influenced by biases, how experience and motivational factors of the audit environment mitigate or intensify this influence, and which techniques for debiasing are effective. Future psychology-based bias research can build on current research in the investigation of topical issues [Hogarth, 1993]. Topical issues can be derived from ongoing debates about regulation changes or from recent archival research. The experimental method has a competitive advantage in contributing to the present discussion, since the different suggestions can be reconstructed in the experimental setting and tested in a timely manner [Maines, 1994; Kachelmeier and King, 2002]. The heuristics-and-bias approach can be valuable in the examination of these issues because it provides a theoretical background for behavior under a wide variety of conditions. Experimental research on a recent issue that is informed by the heuristics-and-bias approach can contribute beyond the question of whether auditors are also prone to bias in a particular context by identifying potentially interacting features of the audit environment. One example of this approach is [Kadous et al., 2003]. In this experiment, they investigated the effects of the acceptability heuristic on auditor independence and identified the requirements for providing a quality assessment as prescribed by a newly introduced auditing standard (used as a potential mediating factor).

Economics-based bias research in auditing is still in the early stages. Future research can focus especially on areas in which this approach has a competitive advantage. First, it seems especially promising to use the tools of experimental economics to investigate biases that potentially interact with financial incentives. Potential research questions could address the effects of fair and ethical behavior on auditor independence or audit quality under conflicting

financial incentives [see e.g., Schatzberg et al., 2005]. Ambiguity is another important bias in auditing that is underexplored and seems especially relevant for risky decisions with financial consequences. Second, experimental economics allows for investigation of strategic interactive behavior between auditors and other relevant actors, e.g., managers, board members of the audit committee, enforcement institutions or investors. The insight that risk in auditing is endogenous, meaning that the level of risk can be influenced by other actors (e.g., managers, who react strategically to the behavior of auditors) presents another area for future research. While this issue has been addressed by prior research in a fraud context [e.g., Fischbacher and Stefani, 2007], it can be further investigated with regard to special features of internal control audits or with regard to the audit risk model. Investigating the strategic interaction between auditors and audit committee members could help to explain the mixed empirical findings on the issue of whether external and internal controls are complementary or substitutive [Hay et al., 2006]. Third, research opportunities exist in considering the effects of the competitiveness of the audit market on auditor independence, audit quality or auditor reputation. These issues could be more closely investigated by constructing experimental markets.

An interesting approach for auditing bias research in the future could be to combine the psychology- and economics-based paradigms, a strategy often recommended [King, 1992; Haynes and Kachelmeier, 1998] but hardly ever practiced, as evidenced by the lack of co-citation across the two bodies of literature [Waller, 2002]. Psychology-based bias research could try to adopt economics-based bias research approach of reducing the experimental setting as much as possible in order to enhance internal validity by avoiding potentially confounding context effects. This would move both approaches closer together, but they would remain separated, as the context in psychology-based bias research would have to maintain enough realism for the participating auditors to relate to it. Furthermore, reducing the context could enable researchers to

conduct complementary experiments with students using a similar setting. This could be especially helpful in auditing, where it is difficult to recruit professional auditors as subjects. Meanwhile, economics-based bias research could progress by attempting to integrate the more context-rich setting of psychology-based bias research into their design. This could provide insights into the robustness of biases under financial incentives, in strategic interactions and in a market context. Furthermore, it would increase the case for the external validity of experiments when a setting for which psychology-based bias research has shown that auditors are prone to a particular bias is used in the experiment.

4.2. Analytical

Analytical researchers could try to integrate findings from psychology- and economics-based bias research into their economic models. This has not yet been pursued, although such a synthesis has already been proposed by Hilton [1980]. Few papers on theoretical work cite psychology literature [Oler et al., 2008]. Integrating findings from these approaches that identify deviations from rationality seems worthwhile, as it could improve the predictive power of economic models [Kahneman and Tversky, 1979]. Consolidating the findings by integrating them into formal models can move the literature forward by providing an advanced framework that can be further tested and refined. This approach has been pursued very successfully in economics [e.g., Starmer, 2000].

4.3. Archival research

In the past, archival research built hypotheses mainly on an economic framework, without considering findings from psychology [Oler et al., 2008]. Koonce and Mercer [2005] call for a

change and illustrate the role findings from psychology can play within archival research in financial accounting. They argue that it can help to formulate more specific or even competing hypotheses on various issues, such as managers' decisions to manage earnings or to form reputations, investors' reactions to disclosure format and accounting choice and financial analysts' behavior under conflicting incentives. Similarly, psychological findings could be integrated into archival research in auditing. This would be possible for almost all audit research fields, including auditor independence, auditor liability, auditor reputation, auditor specialization, audit production, demand for audits, and fraud detection. As an example, one could employ the findings of economics-based bias research in auditing to factors that hinder the formation of auditor reputation when investigating this issue empirically.

5.0. Conclusions

The purpose of our review was to illuminate the connections between psychology-based and economics-based bias research in auditing by providing a comprehensive review of both areas. While the two approaches examine similar biases, they differ in their specific foundations and methodologies. Psychology-based bias experiments investigate the individual judgments and decision-making of experienced auditors by reconstructing the auditing environment realistically within their setting. Meanwhile, economics-based experiments focus on the underlying strategic behavior of people facing financial incentives, interacting with others and being active in markets by constructing a setting in which the basic structure is comparable to the audit environment.

In our review, we highlight that psychology-based bias research has shifted in focus over time from theory toward issue-orientation. While it started out by replicating the early findings of Tversky and Kahneman [1979], and later, making use of Einhorn and Hogarth's [1992] belief-adjustment model, it has recently become more problem-oriented, focusing on issues of auditor

independence and auditor liability. We summarize the main implications that can be drawn from this literature as follows. First, auditors are generally prone to biases. For most biases, this is also true of very experienced auditors. While experienced auditors also employ heuristics in their judgments and decision-making, experience can increase the efficiency and effectiveness of the use of heuristics. Second, motivational incentives within auditing, e.g., litigation risk or review pressure, can sometimes mitigate biases. This is consistent with theories of dual processing that assume that people are also able to process information more systematically when they have incentive to do so. Meanwhile, it must be considered that motivational factors are integrated through description, not through varying real incentives. Third, the effectiveness of debiasing techniques has been tested. These techniques try to either motivate the auditor to exert more effort or make the auditor sensitive to non-salient information. Meanwhile, it often remains unclear whether these debiasing techniques can truly be successfully implemented in auditing or whether they might have unintended effects that counteract their usefulness.

Economics-based research in auditing has only recently begun to explicitly consider biases, after concentrating previously on validating or disconfirming economic models. First of all, it has focused on the effects of biases on the efficiency of liability regimes and on the demand for audit services. Furthermore, general themes of fairness and cooperative behavior in behavioral economics have been applied to questions of auditor independence. Finally, the effect of limited strategic reasoning on the strategically complex interactions between auditor and auditee in fraud detection tasks has been examined.

We conclude that psychology- and economics-based bias research in auditing complement each other. While psychology-based research can suffer from reduced internal validity due to the richness of the design, economics-based bias research faces problems of external validity due to the abstractness of the design. Therefore, a combination of both

approaches seems to be a fruitful path for future research. While psychology-based bias research could gain internal validity by focusing more strongly on the underlying structure of the scenario under consideration, economics-based bias research could profit from drawing more strongly upon psychology for the development of the design and the derivation of the hypotheses. Combining both approaches could be accomplished by first examining the behavior of professional auditors in an abstract, but still sufficiently realistic, design in the tradition of psychology-based research; mitigating factors could then be further analyzed in experiments using a similar setting, incorporating additional financial incentives, strategic interactions or market mechanisms in the tradition of economics-based bias research.

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