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market-based definition**

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# **Unintended consequences of fair value's market-based definition**

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## **Abstract**

This study examines the impact of fair value's market-based definition on the valuation process of non-financial assets by a pre-registered online experiment (N = 1417). After comparing the valuation process among three conditions (entity-specific definition, market-based definition, or no-definition), we find that the different definitions affect the estimation process and that the valuation in the market-based condition differs in quality from that under other conditions. If financial reporting that faithfully represents individuals' natural estimation process observed under no-definition condition is useful for investors' decision-making, the entity-specific definition consistent with the process is appropriate. By contrast, valuation under the market-based definition is biased and deviates from individuals' natural estimation process. This result suggests that the market-based definition does not improve

decision usefulness, contrary to the intent of standard setters. Our findings can contribute to the standard-setting debate on fair value.

**Keywords:** fair value, non-financial assets, entity-specific, market-based, business combinations, online experiment

## 1. Introduction

The International Accounting Standards Board (IASB) issued IFRS 13 following SFAS 157, which clarifies fair value's definition. Fair value is relevant, highly comparable, and possesses qualitative characteristics useful for investors' decision-making. Prior studies have often analyzed fair value accounting for financial instruments; however, reference to the fair value of non-financial assets is minimal. Non-financial assets are generally valued at cost; only a limited number of situations value such assets at fair value. However, the fair value of non-financial assets significantly impacts impairment loss and goodwill in a business combination. Unlike financial instruments, non-financial assets are not marketable, and their fair value is not uniquely determined. Fair value varies depending on the attributes of the market (entry or exit market), use of the asset, and inputs used in the valuation, and management has a great deal of discretion in determining fair value. Although the standard clarifies fair value's definition, non-financial assets' fair value is unclear and open to various interpretations.

Traditionally, non-financial assets' fair value comprises the following three measurement bases: replacement cost, net realizable value, and value in use. These are

estimated from an entity-specific perspective, and business combination accounting specified that fair value should be determined by considering the intention of the acquiring entity. By contrast, current fair value is defined as “the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date” (IFRS13, par.9). By definition, the fair value of an asset represents the market price at which it is sold. Additionally, the fair value of non-financial assets is based on the assumptions used by market participants and should not consider entity-specific perspectives. It also clearly states that the intent of the acquiring entity in a business combination is not reflected in the fair value assessment, and the fair value appears to have changed significantly. However, the three valuation techniques used to assess fair value remain the same—namely, cost, market, and income approaches; these approaches are consistent with past measurement standards. Non-financial assets’ marketability is limited, and the assumptions of reasonable market participants may be unclear. Consequently, management is forced to value non-financial assets from an entity-specific perspective. In other words, whether fair value’s definition essentially changed non-financial assets’ fair value is unclear.

How do individuals estimate non-financial assets’ fair value? Is the change in the definition of fair value and measurement objectives (from entity-specific to market-based) consistent with individuals’ decision-making, or does it distort the individuals’ natural estimation process? If accounting standards are useful to investors’ decision-making, fair value definitions and valuation techniques should faithfully represent management’s valuation process. Our interest is particularly in clarifying the impact of changes in the definition of fair value on individuals’ fair value estimation process, aiming to contribute to

standard-setting. To answer these questions, we assume a business combination and identify the individual fair value estimation process for acquired non-financial assets. Specifically, we adopt an experimental approach to examine the fair value estimation process for non-financial assets with different prices calculated using the three valuation techniques. In the experiment, we control for other factors related to fair value assessment to observe the impact of the definition change on the fair value estimation process. Collecting fair value data for non-financial assets recognized in the financial statements on the acquisition-date does not allow us to know why and how the value was calculated. Previous archival studies have examined value-relevance and earnings management by taking fair value as a given without focusing on the content of fair value. It seems appropriate to rely on experimentation to answer the question of how the change in fair value's definition has changed valuation practice and whether it is consistent with the standard-setters intention of increasing usefulness. We conducted a pre-registered online experiment to verify our research question using Mechanical Turk (MTurk, N = 1417). In the experiment, participants in the role of the Chief Executive Officer (CEO) at a hypothetical company assessed the fair value of a non-financial asset in the mergers and acquisitions (M&A) situation. We manipulated the definition of fair value (entity-specific definition, market-based definition, or no-definition) proposed to the participants. The experimental results exhibited unintended consequences, predominantly under the market-based definition. We find that the different definitions affect the estimation process and that the valuation in the market-based condition differs in quality from that under other conditions. This study's contribution lies in examining individuals' natural fair value estimation process and the impact of fair value's definition on that process for non-financial assets.

The remainder of this paper is organized as follows: Section 2 describes the concept of fair value, explains standard rules, and clarifies the issues and discussion points addressed in this study. Additionally, we summarize the accumulated academic debate on fair value to help build hypotheses and interpret the experimental results. Section 3 describes the experimental design and builds the hypotheses. Section 4 summarizes the results. Section 5 provides robustness checks. Section 6 discusses the empirical results. Section 7 presents the conclusions and future tasks.

## **2. Theoretical background on fair value**

### **2-1. Market-based fair value**

The concept of fair value has existed for many years and has been defined by individual accounting standards. For example, in IAS (IAS16, 17, 18, etc.), the “fair value is the amount for which an asset could be exchanged or a liability settled between knowledgeable, willing parties in an arm’s length transaction.” However, its interpretation varied among standard-setters and accounting information preparers, and there was discretion in determining fair value. Following the FASB’s issuance of SFAS 157 “Fair Value Measurements” in 2006, the IASB issued IFRS 13 “Fair Value Measurement,” which established a uniform definition of fair value. Fair value is “the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date” (IFRS13, par.9). An important characteristic of fair

value is that it is a market-based measurement and not an entity-specific measurement<sup>1</sup>. As the objective of fair value measurement is estimating the exchange price for the asset or liability being measured in the absence of an actual transaction (FASB, 2004, par.5), fair value is measured using the assumptions that market participants would use when pricing the asset or liability. An entity's intention to hold an asset or to settle or otherwise fulfill a liability is not relevant when measuring fair value (IFRS 13, pars.2-3). Another notable feature is that fair value is the exit price. An exit price objective is embodying current expectations regarding future inflows associated with the asset and future outflows associated with the liability from the perspective of market participants, consistent with the definitions of assets and liabilities (SFAS 157, par.C26). Even if an entity generates cash flows from the use rather than the sale of an asset, the exit price embodies the expected value of the cash flows from the sale of the asset to market participants who would use it in the same way. Therefore, the exit price is always considered an appropriate definition of fair value, irrespective of whether the entity uses or sells the asset (IASB, 2009, par.BC23). To measure fair value on a market basis, it is preferable to directly reference market prices or use highly marketable inputs; however, this may be difficult in some cases. Fair value can be divided into three levels, depending on the marketability of the inputs used for measurement. The standard also indicates that fair value, which is by definition an exit price, is measured using the following multiple valuation techniques: the cost, market, and income approaches (IFRS

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<sup>1</sup> A market value measurement objectives reflect market risk preferences and market expectations about the amount, timing, and uncertainty of future cash flows. On the contrary, an entity-specific measurement objectives focus on the expectations and risk preferences of the reporting entity's management (IASB, 2005, par. 99).

13, par.62). If there is no potential buyer, the exit price will be significantly lower because of the higher cost of disposing of the asset. The amount that a buyer of the asset would pay could be the exit price for the seller, and as that amount depends on the value in use for the buyer, it is reasonable to consider the cost or income method to measure fair value (Benston, 2008).

Market-based fair value has predictive and feedback value and is considered superior to entity-specific objectives, especially in terms of comparability (IASB, 2005, Chapter 4). Although several studies have examined the value-relevance and economic consequences of fair value, most have focused on financial instruments and financial institutions<sup>2</sup>. However, numerous financial instruments are marketable and have been measured using quoted market prices—irrespective of fair value’s definition. Entity-specific usage is not anticipated, and a difference in the prices measured using the three valuation techniques is unlikely. Therefore, a change in the definition of fair value exhibits minimal impact on financial instruments.

By contrast, few studies have focused on the fair value of non-financial assets. Logically, the fair value provides the most relevant information for financial instruments that produce cash flows directly, whereas historical cost is likely to provide relevant information

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<sup>2</sup> Barth (1996) provided evidence that fair value estimates of loans, securities, and long-term debt in banks are more value relevant than book value. Wang (2005) also examined the value-relevance of fair value in banks and found statistically significant results for disaggregated notional value disclosure of derivatives under SFAS 119. Hodder (2006) found that the incremental volatility in full fair value income for commercial banks was positively correlated with stock-market-based risk measures. Dechow (2010) noted that management uses flexibility available in fair value to manage earnings when securitizing. Song (2010) presented evidence that Level 1 and Level 2 fair value disclosed by banks in accordance with SFAS 157 has stronger value-relevance than Level 3 fair value.



for non-financial assets that produce cash flows indirectly by being used in combination with an entity's other economic resources (IASB, 2018b, pars.5.55–56). Therefore, there are limited situations wherein non-financial assets are valued at fair value. However, material transactions in terms of both quality and value, such as business combinations and impairments, require re-evaluating non-financial assets. The marketability of non-financial assets is poor, and there is likely to be an opening gap between the three valuation approaches. In a business combination, consideration is allocated to the acquiree's identifiable assets and liabilities, and the remainder is goodwill (Purchase Price Allocation: PPA). PPA involves the process of measuring identifiable assets and liabilities at fair value. As non-financial assets are not marketable and are likely to be priced differently depending on valuation techniques, management has the discretion to determine the fair value of the identifiable assets and could manipulate the amount of goodwill. Shalev (2013) found that the percentage of consideration allocated to goodwill increases in proportion to the percentage of profit-based bonuses in the CEO's salary package. Paugam (2015) noted that clarifying the goodwill calculation process would make it easier to ascertain the appropriateness of the goodwill amount and the quality of the acquisition. Both studies indicate that the fair value calculation process is opaque and may lead to earnings management. This problem stems from weak conceptual support for the fair value of non-financial assets. Hitz (2007) pointed out that there are significant reliability concerns with the fair value calculated using less marketable inputs and that no sound theory exists for applying the fair value paradigm to non-financial assets.

To assess the usefulness of defined fair value, it is necessary to first identify how valuation practices have changed owing to the definition of fair value. If a change in

definition increases usefulness, it is natural to assume that the valuation practice has changed. In this study, we examine the impact of fair value's definition on the estimation process for non-financial assets, which has a weak theoretical foundation. Specifically, we examine how management values the non-financial assets acquired in a business combination. Although detailed valuation guidance exists for impairment and the "lower of cost or market" method, these are transaction-specific valuations, not general fair value measurements. By contrast, the accounting standard for business combinations requires non-financial assets to be valued uniformly at fair value in accordance with IFRS 13, and there are no transaction-specific arrangements. Additionally, the accounting standard for business combinations had valuation provisions for non-financial assets based on an entity-specific perspective. The advantage of assuming a business combination is that it is possible to assess the impact of changes in the definition of fair value that occur in reality on the valuation process. This can provide useful input for the standard-setting.

## **2-2. Fair value of non-financial assets in business combinations**

In a business combination, the acquirer measures the identifiable assets acquired and the liabilities assumed at their acquisition-date fair values (IFRS3, par.18). As noted above, the fair value of non-financial assets is unclear, and accounting standards have a history of prescribing valuation techniques. The valuation techniques for plant and equipment are listed in Table 1. Prior to IFRS3 (2008), accounting standards selected fair value from replacement cost (RC), net realizable value (NRV), and value in use (VIU), depending on the purpose for

which the asset was held (use or sale)<sup>3</sup>. By contrast, the current standard removes detailed guidance and requires valuation in accordance with the fair value accounting standard. The disappearance of the traditional measurement bases from the standard was caused by the issuance of the fair value accounting standard, but the change in measurement objectives was behind this disappearance. That is, RC, NRV, and VIU are measurement bases estimated from an entity-specific perspective, whereas current fair value is a measurement bases estimated from the perspective of market participants. While IAS 22 (1983; 1993) defined fair value as the amount obtained from an exchange between market participants, it also specified that fair value is determined by the acquirer's intent (Table 1). However, IAS 22 (1998), using the same definition of fair value, declared that fair value does not depend on the acquirer's intent. The change from an entity-specific perspective to a market-based perspective can be clearly observed<sup>4</sup>. IFRS 3 (2008) measures the fair value of non-financial assets using market-based inputs according to the most efficient use assumed by market participants—the highest and best use (HBU)—irrespective of the acquirer's intentions (BC262).

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<sup>3</sup> RC is defined as “The most economic current cost of replacing an existing asset with an asset of equivalent productive capacity or service potential,” NRV as “The estimated selling price in the ordinary course of business less the estimated costs of completion and the estimated costs necessary to make the sale,” and VIU as “The present value of estimated future cash flows expected to arise from the continuing use of an asset and from its disposal at the end of its useful life” (IASB 2005).

<sup>4</sup> Although FASB did not mention the measurement objectives, since the release of SFAS 141 (2007), it has been clearly stated that the valuation should be made from the perspective of market participants.

*(Insert Table 1 about here)*

At first glance, the market-based fair value appears to be a significant change in valuation practices. However, the difficulty of using market-based inputs for non-financial assets results in Level 3 fair value being measured. If market-based estimates are difficult to obtain, the difference between the traditional measurement bases and fair value is not apparent for non-financial assets.

Past accounting standards are provided for the valuation of non-financial assets using the entity-specific measurement bases RC, NRV, and VIU, whereas the current standard uses three market-based approaches (cost, market, and income) to determine fair value. However, for unmarketable non-financial assets, there may not be a substantial difference between the traditional measurement bases and the three approaches to determining current fair value. It is possible to interpret RC as fair value plus transaction costs and NRV as fair value minus transaction costs (Alexander, 2007). If transaction costs are ignored, RC and NRV can be considered equal to the fair value determined by cost and market approaches. As RC and NRV are based on market exchange prices, they are unlikely to deviate significantly from market-based fair values. By contrast, VIU may not approximate the fair value determined by the income approach because it does not refer to market prices as direct inputs. VIU and fair value differ when management's intended use of the asset differs from that expected by market participants. Although IFRS 13 states that non-financial assets are measured at fair value based on the use assumed by market participants (the most effective use that maximizes the utility of the asset), management may assume a specific use. The fair value measurement of non-financial assets considers the ability of market

participants to generate economic benefits from the HBU, but management may assume specific use (IFRS13, par.27). Different uses of an asset result in different expected cash flows, and the VIU and fair value determined by the income approach will not approximate each other. However, rational managers are expected to practice the most efficient use, and it is common to view current usage as the most efficient (IFRS13, par.29)<sup>5</sup>. For non-financial assets, it is unclear whether management or market expectations are used (Abdel-Khalik, 2011), and some studies have found that entity-specific estimates are made. In the absence of a market, distinguishing between value in use and market-based fair value is difficult because one cannot pretend to be a typical market participant (Barker & Schulte, 2017). In the Post-implementation Review of fair value accounting standards, many responses were critical of the concept of HBU, not considering the entity's business model and management's intent (IASB, 2018c, par.133). Standard setters also acknowledge that the starting point for Level 3 inputs is estimates developed by the reporting entity, which may necessarily be subjective (FASB, 2004, parC56; IASB, 2009, par.BC91). Based on these considerations, this study views the traditional measurement bases as substantially equivalent to the three approaches for determining fair value. By assuming that the measurement bases used for fair value estimation remain unchanged regardless of the change in the definition of fair value, the impact of the change in the definition on the fair value estimation process can be examined. Our primary concern is how management estimates fair value from these measurement bases and whether this estimation process is affected by the definition change. The primary

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<sup>5</sup> Indubitably, cases exist wherein the management of an entity uses an asset in a manner different from that of the HBU. For example, an entity operates a factory on a parcel of land even though the HBU of the land is to demolish the factory and build residential properties (IASB 2009, par. 20).

research question is “How does a definition of fair value with a change in measurement objectives affect an individual’s fair value estimation process?” First, we assume that accounting standards that faithfully represent the natural fair value estimation process of individuals are highly useful. Therefore, in this experiment, we examine the natural fair value estimation process in the absence of a definition and consider this the norm. Thereafter, we check whether the definition of fair value in the standard is consistent with the natural estimation process or distorts it. Although the subject matter differs, Cade et al. (2019) reported that the definitions of assets and liabilities in the conceptual framework (IASB, 2018b) are consistent with individuals’ natural judgments regarding the existence of assets and liabilities and that the previous definitions distorted individuals’ natural judgments. Our experiments are also conducted using the actual definitions in accounting standards for business combinations, which can provide useful input for standard-setting.

### **2-3. The classic argument for fair value**

Assets are commonly valued using the purchase, sale, and use perspectives, and valuation techniques that address all three perspectives are well-established in practice (IVSC, 2022). However, no clear guidance exists on determining a fair value when the three measurement bases have different values. The weighting of multiple divergent estimated values is highly dependent on the judgment of the valuers (IVS105. par.10.6). Sterling (1969) asked for fair value for a specific asset (a 10-key Monroe printing calculator) and found that

the variance in estimated fair value was large, with some respondents interpreting the fair value as RC and others interpreting it as exit price on the used market<sup>6</sup>.

Significant debate exists as to which measurement bases is appropriate as a fair value. VIU, the present value of future cash flows, is considered useful in investors' decisions to forecast corporate value, but only in the ideal situation of a perfectly competitive market (Bromwich, 1977). Real markets are not perfectly competitive, and objective projections of future cash flows and discount rates are difficult, making VIU unreliable. By contrast, Revsine (1970) supported RC as an indirect measure of economic income, and Edwards and Bell (1961) supported RC from the perspective of maintaining an entity's productive capacity and emphasize the division of management profit into operating profit and holding gains. Chambers (1970) noted that NRV, representing cash equivalents, is necessary to determine any present position, assess past performance, and estimate expected betterment from future actions. They attempted to identify the most appropriate measurement bases as fair value, but the "value to the owner" is a concept that selects different measurement bases as fair values, depending on the circumstances (Baxter, 1967). This valuation technique, also known as "deprival value," takes the smaller of the recoverable amount (the higher of NRV and VIU) and RC as the fair value. The value of the asset is the recoverable amount, but if the RC is less than that, he would only spend up to the RC in the transaction. Conversely, if the recoverable amount is less than the RC, the amount spent to acquire the asset is capped at the recoverable amount. Six permutations can be assumed for the amounts of the three

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<sup>6</sup> Respondents were provided information to estimate book value ((1) depreciation method, (2) capitalized cost, (3) salvage value, and (4) years of life for an asset), but not a definition of fair value or information to estimate fair value.

measurement bases, and the RC is chosen in four of these patterns; hence, the “value to the owner” is sometimes equated with the RC. For example, APB 16 stated that plant and equipment held for use should be valued at the current replacement cost for similar capacity unless the expected future use of the assets indicates a lower value to the acquirer (par.88). The fact that an entity holds an asset for use means that the VIU is higher than the NRV and that the VIU is the recoverable amount. In this context, APB 16, which directs a lower value for VIU and RC, is consistent with the “value to the owner.” In addition, impairment accounting reduces the carrying amount to a higher of VIU or NRV. The RC of an asset whose profitability has declined and for which replacement is no longer reasonable is, assumedly, higher than the recoverable amount. Valuation at recoverable amount is consistent with the “value to the owner” (Weetman, 2007). Although the conceptual framework of the IASB removed the “deprival value” from the measurement bases because of its complexity (IASB, 2018b, par.BC6.28), its implicit introduction into accounting standards can be confirmed. In fact, the Accounting Standards Board (ASB) explicitly stated that current value is most relevant when it reflects “deprival value” (ASB, 1999, par6.7). Furthermore, the “value to the owner” is referred to as “(t)he principal rational management behavioural framework” (IASB, 2005, par.342). However, the relevance of “value to the owner” has not yet been verified. Examining the individual fair value estimation process—considering the information on the three measurement bases—also involves assessing the decision usefulness of the “value to the owner.”



### 3. Experimental design and hypotheses

#### 3-1. Experimental task

In the experimental task, participants—in the role of the Chief Executive Officer (CEO) at a hypothetical company named *ABC company*—read a scenario and assess the fair value of a non-financial asset under the M&A situation. This scenario is based on Illustrative Example 4 (*Machine held and used*, IE11–14) of IFRS No.13. The scenario is as follows (see supplementary file S1 for details): ABC company would like to acquire another company, *Master Miner Co.*, which belongs to the same industry. As part of the acquisition, ABC company intends to acquire the machinery used by Master Miner Co. in their primary business.

Participants are presented with three pieces of pricing information for the machinery: information regarding the replacement cost (RC), the quoted price (QP) equivalent to the net realizable value (NRV), and the value in use (VIU). This study assumes only one pattern:  $VIU > RC > NRV$ .  $RC > NRV$  is realistic (Baxter, 1967; Wolk et al., 2017; Zijl, 2006) for non-financial assets, and  $VIU > RC$  indicates that the use of the asset is efficient (HBU). Conversely,  $RC > VIU$  indicates that the asset is inefficiently used, which calls for the asset's impairment. Therefore, we assume the normal case of  $VIU > RC > NRV$  to clarify the fair value estimation process. We presented the participants with the following price information based on the Illustrative example 4 of IFRS 13: "*Replacement cost: You asked the machine supplier to estimate the amount of money needed to produce a substitute (customized)*

*machine of comparable utility. The estimate provided was \$46,000<sup>7</sup>. This estimate considers the condition of the machine and the environment in which it will be used (e.g., installation costs),” “Quoted price: The estimated value of the machine based on quoted prices for similar machines adjusted for differences between the machine (as customized) and similar machines was \$44,000<sup>8</sup>. The measurement reflects the price that would be received for the machine in its current condition and location (installed and configured for use),” and “Value in use: The estimated present value of the future gross revenue that ABC company could earn by using the machine in its business after acquiring Master Miner Co. was \$54,000<sup>9</sup>.”* The order presented was randomized for each participant to avoid order effects during the experiment.

After reading the scenario, participants assess the “fair value” of the machinery using additional information regarding the pricing of the machinery described above and answer some questionnaires regarding the decision process of the assessment (see supplementary file 2 for details). After completing the responses, they answered the operation check questions and the post-demographic questionnaire. Figure 1 presents an overview of the experimental task.

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<sup>7</sup> This price was based on the median value of the prices that were proposed in IE12 (b) of the Illustrative example 4 of IFRS No.13.

<sup>8</sup> This price was based on the median value of the prices that were proposed in IE12 (a) of the Illustrative example 4 of IFRS No.13.

<sup>9</sup> That amount is not directly presented in example 4 of IFRS 13. Therefore, using the relationship between RC and NPV as a reference, we selected a value that could clarify the relationship that  $VIU > RC > NPV$ .

*(Insert Figure 1 about here)*

### **3-2. Experimental design**

We examined a  $3 \times 1$  between-participants design. We manipulated the definition of fair value (entity-specific definition, market-based definition, or no-definition) proposed to the participants. Participants were randomly assigned to one of the following three conditions: (1) market-based definition condition, wherein participants were presented with the market-based definition of fair value; (2) entity-specific definition condition, wherein participants were presented with the entity-specific definition of fair value; and (3) no-definition condition, wherein participants did not present a definition of fair value.

In the market-based and entity-specific definition conditions, participants were provided with the definition of fair value before reading the scenario. Under the market-based definition condition, participants were informed regarding the definition of fair value based on paragraphs 2 and 9 of IFRS 13 (2011) as follows: *“The fair values are defined as the price that would be received to sell an asset in an orderly transaction between market participants at the measurement date. Fair value is a market-based measurement, not an entity-specific measurement. An entity shall measure the fair value of an asset using the assumptions that market participants would use. Assets should be measured at their fair values regardless of how or whether the acquirer intends to use them.”* Under the entity-specific definition condition, on the contrary, participants were informed regarding the definition of fair value based on paragraph 38 of IAS 22 (1993) as follows: *“The fair values of identifiable assets acquired in an acquisition are determined by reference to their intended use by the acquirer. The buyer may have a specialized use for an asset, which is not available to other potential*

*buyers.*” In the no-definition condition, the participants did not propose a definition of fair value. Instead of a definition, participants read a business document<sup>10</sup> as a placebo (e.g., Price et al. 2008) before reading the scenario.

The dependent variable was the assessed fair value of the machinery under an M&A situation, measured by participants’ pricing process in dollars. Independent variables are dummy variables (a) definition dummy, which is 1 if the definitions are presented to the participants; and (b) market-based dummy, which is 1 if participants are presented with the market-based definition and other control variables.

### **3-3. Experimental procedures**

After receiving approval by the Institutional Review Board (IRB), we pre-registered for the experiment on the AsPredicted website (<https://aspredicted.org/>, Pre-registered No.113615). We used Mechanical Turk and recruited 1417 participants (entity definition condition, 472; market definition condition, 475; no-definition condition, 470). We performed a power analysis beforehand using the R package “pwr” and calculated this sample size using the failure rates of the manipulation checks in the pilot experiments conducted before the implementation<sup>11</sup>.

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<sup>10</sup> The context of this document was based on the part of the Introduction of an academic paper on M&A by Berger et al. (1998), which is one of the most famous papers on M&A researches. This document was not related to the definition of the assets’ fair value.

<sup>11</sup> In further detail, we conducted the pre-survey using M Turk beforehand, wherein we used the same scenario and similar questionnaires in October 2022. In our pre-survey, the percentage of the sample excluded because they could not answer the check question was 32%. Subsequently, we conducted a

We conducted an online experiment in November 2022. All conditions were programmed using the o-Tree software (Chen et al., 2016), and participants were recruited from the Mechanical Turk platform to compensate for two dollars. As the average task time of effective respondents in the pilot experiment was approximately 11 min, we set the participation fee at two dollars, in line with the minimum wage in the United States. We set the following conditions for participation in the experiment: (1) participants had to be U.S. residents; (2) they had completed at least 100 Human Intelligence Tasks (HITs, MTurk’s task unit); (3) their HIT approval rate had to be at least 95%; and (4) they had to be current, full-time workers. The participants provided basic demographic information (e.g., age, gender, and income) under all conditions. We did not have access to information that could identify individual participants during or after the data collection. We excluded participants who failed the attention and manipulation checks (typically 23% of the sample) from the subsequent analyses. As the attention and manipulation check primarily asked for the content of the proposed definitions and scenarios, participants who passed these checks would have responded to the experiments with a clear understanding of our proposed definitions and scenarios. Our final sample size for the analyzed data was 1092 (Entity definition condition, 344; Market definition condition, 364; No-definition condition, 384. See Supplementary File S3 for details). We assigned more than 300 participants per condition, exceeding the required sample size ( $n = 323$  per condition) calculated beforehand.

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power analysis (significant level = 0.05, power = 0.8, the number of groups = 3, effect size = 0.1 [small]) using the R package “pwr.” According to the power analysis calculations, the required sample size is 323 per treatment. Therefore, our sample size per treatment for collected data is calculated as follows:  $323/(1 - 0.32) = 475$ .

The participants for the analyzed data were 35.31 years old on average (SD =11.51). The maximum and minimum ages of the participants were 72 and 21 years, respectively, and 48.16% of them were female. The average years of work experience of participants were 9.86 years (SD = 9.56). The rate of the management experience was 87.6 %, the rate of the M&A experience, 70.6 %, the rate of major in finance and accounting, 80.8%, respectively. The average task time of effective respondents in the experiment was 574.68 seconds (SD = 491.33).

The participants were randomly allocated to each treatment. As we adopted a between-participant design, no participant participated in more than one experimental session. To prevent retakes between sessions, we used *UniqueTurker* (<http://uniqueturker.myleott.com>), a third-party software, to prevent workers who had already participated in a specific Human Intelligence Task from being invited for future sessions. This method uses a unique MTurk identification number linked to each worker, and Amazon constantly monitors it to avoid duplicate participation (e.g., Arechar et al., 2018).

### **3-4. Participants' decision-making process expected in the experiment and hypotheses**

In this subsection, we propose the following hypotheses based on the theoretical analysis in Section 2 and experimental scenario setting described in the previous subsection.

Referring to the dual process theories of thinking and reasoning discussed mainly in cognitive science and psychology<sup>12</sup> (e.g., Evans, 2003, Evans & Stanovich, 2013;

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<sup>12</sup> Dual-process theories of thinking and reasoning quite literally propose the presence of two minds in one brain: 'System 1' is a fast decision-making system responsible for intuitive decision-making

Kahneman, 2003a, 2003b, 2011; Sloman, 1996), we hypothesize the participants' decision-making process as follows (Figure 2): There are two pathways in the decision-making process. The first pathway is the process of shaping attitudes toward fair value based on the definitions that are (or are not) offered (the left side of Figure 2). This pathway draws on the idea of 'System 2' of the dual process theory, which is a slow system that observes System 1's intuitive outputs and provides the basis for a higher level of rationality in their reasoning and decision-making (Evans 2003; Kahneman 2003a). The second pathway is the process of weighting the price information within a specific M&A scenario (right side of Figure 2). This pathway requires judgment in a specific context and draws on the idea of 'System 1' of the dual process theory, which is a fast decision-making system responsible for intuitive decision-making based on emotions, vivid imagery, and associative memory (Evans 2003; Kahneman 2003a). Using these two paths, participants were expected to assess the fair value of the assets in the scenario (bottom of Figure 2).

*[Insert Figure 2 about here]*

First, using this decision process, we hypothesize the participants' assessments of the fair value of the assets in the scenario (bottom of Figure 2). In our setting, the value in use of the machine is the highest (\$54,000) of all the price information presented to the participants,

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based on emotions, vivid imagery, and associative memory. 'System 2' is a slow system that observes System 1's outputs, and intervenes when "intuition" is insufficient. System 2 provides the basis for hypothetical thinking that endows modern humans with the unique potential for a higher level of rationality in their reasoning and decision-making (e.g., Evans 2003; Kahneman2003a).

and the participant under the entity-specific condition is primarily expected to emphasize this pricing information because the definition presented to participants under the entity-specific condition states that fair value is determined by referring to their intended use by the acquirer. Therefore, the assessment under the entity-specific condition is expected to be the highest among all the conditions.

***H1: Comparison of the assessment of the fair value.*** The assessment of the fair value under the entity-specific condition is the highest of all the conditions.

Second, we hypothesize pathway A—participants' attitudes toward fair value with or without the definition (the first pathway on the left side of Figure 2), which is based on the idea of 'system 2' (the basis for a higher level of rationality) of the dual process theory. Owing to the different definitions given (or not given), it is expected that participants will exhibit different attitudes toward fair value, and under the entity-specific condition, the participants are expected to assume fair value based on the value in use because the definition presented to participants under the entity-specific condition states that fair value is determined by referring to their intended use by the acquirer.

***H2a: The attitude to the fair value under the entity-specific condition.*** The participants are expected to assume a fair value based on the value in use under the entity-specific condition.



On the contrary, under the market-based conditions, participants are expected to assume fair value based on replacement cost or quoted price derived from market transaction prices because the definition presented to participants under the market-based condition states that fair value is a market-based measurement, not an entity-specific measurement.

***H2b: The attitude to the fair value under the market-based condition.*** Participants are expected to assume a fair value based on the replacement cost or quoted price under the market-based conditions.

Under the no-definition condition, there are two hypotheses regarding the attitude to the fair value: Firstly, if participants tend to make judgments based on little information and follow the simple additive rule (Martin et al. 2006), they are expected to think that all pricing information should be simply averaged to evaluate the fair value (namely, “simple average attitude”). Second, based on the “value to the owner,” as discussed in Section 2, participants are expected to assume a fair value based on the replacement cost. Following the accounting theory of the “value to the owner,” we would expect an individual as a manager to choose RC. Management can realize VIU using the asset, but the reasonable amount to spend on the asset would be RC.

***H2c-1: The attitude to the fair value under the no-definition condition (simple average).*** The participants are expected to assume that all pricing information should be simply averaged to evaluate the fair value under the no-definition condition.

***H2c-2(alternative): The attitude to the fair value under the no-definition condition***

***(value to the owner)***. Participants are expected to assume a fair value based on the replacement cost under the no-definition condition.

Third, we hypothesize pathway B—participants' awareness and weighting of the price information given within a specific context of the M&A scenario (the second pathway on the right side of Figure 2), which is based on the idea of 'system 1' (the basis for intuitive decision-making) of the dual process theory. Many studies have revealed that in certain situations, such as pricing, the intuitive decisions of System 1 produce the anchoring effect (Ariely et al., 2003; Bergman et al., 2010; Bucchianeri & Minson, 2013; Furnham & Boo, 2011; Scott & Lizieri, 2012; Soule & Madrigal, 2015; Tversky & Kahneman, 1974; Zong & Guo, 2022). Ariely et al. (2003) experimentally showed, for example, that even an irrelevant "anchor" (sometimes derived from a person's social security number) strongly affects the participant's subsequent willingness to pay for a variety of goods. In the valuation of non-financial assets such as real estate, several previous studies have reported that valuation bias occurs (e.g., Black et al., 2003; Born & Pyhrr, 1994; Crosby et al., 2010; Crosby, 2000; Geltner, 1993; Hansz & Diaz II, 2001; Lin & Vandell, 2007; Northcraft & Neale, 1987; Quan & Quigley, 1991; Salzman & Zwinkels, 2017). We focus on participants' attention to price information regarding the value in use. As the assets to be assessed are non-financial assets that will be used after the acquisition, their value in use acts as the "anchor" for evaluation, and participants would pay particular attention to their value using non-financial asset. Therefore, participants under all conditions are expected to pay the highest attention to price information regarding the value in use.

***H3: The anchoring effect specific to non-financial assets.*** In all conditions, irrespective of the content or presence of the definition of fair value, attention to information regarding the value in use is the highest among other attention to price information.

## **4. Results**

### **4-1. Summary statistics**

Table 2 reports the descriptive statistics for each experimental condition.

*[Insert Table 2 about here]*

Panel A of Table 2 presents that the average assessment of the fair value under the market-based condition (46,886.80) is the highest of all three conditions and that under the no-definition condition (44,950.78) is the lowest. Panel A of Table 2 also reveals that, under all conditions, information regarding the value in use is the most important information of all pricing information, and the level of attention to the information regarding the value in use under the no-definition condition (5.90) is the highest of all conditions.

Panel B of Table 2 presents that related to items to focus on when considering fair value. The weighted average item was higher than the simple average item under all conditions. Therefore, numerous participants tended to think that fair value should reflect the weighted value of each piece of pricing information according to its content.

Panel B of Table 2 also indicates the type of prices that fair value should reflect and reports the following: under the entity-specific definition condition, the item of emphasis on

the value in use was the highest [emphasis on the value in use (5.56) > emphasis on the quoted price (5.44) > emphasis on the replacement cost (5.41)]. Under the market-based condition, the emphasis on the replacement cost (5.58) was highest [emphasis on the replacement cost (5.58), emphasis on the quoted price (5.56), and emphasis on value in use (5.49)]. Therefore, in these two definition conditions, the proposed definitions properly affected the participants' thinking regarding fair value (Pathway A based on the 'System 2' thinking of the dual process theory). This result also indicates that the manipulation in our experiment was successful. Under the no-definition condition, the item of emphasis on the replacement cost (5.45) was the highest [emphasis on the replacement cost (5.45) > emphasis on value in use (5.43) > emphasis on quoted price (5.37)]. This result is consistent with the theoretical prediction of the "value to the owner" described in section 2.

#### **4-2. Testing H1: comparing fair value's assessment**

First, we analyzed the assessment of the fair value under all conditions. To test H1, we conducted an ANOVA and the Kruskal-Wallis test of the assessment between conditions. Figure 3 and Table 3 present the results.

*[Insert Figure 3 and Table 3 here]*

Figure 3 presents the ANOVA results. Panel A and C of Table 3 indicate a significant difference in the levels of assessment between the conditions [the ANOVA,  $F(2) = 9.32, p = 0.000$ . the *Kruskal-Wallis test*;  $\chi^2 = 18.472, df = 2, p = 0.000$ ]. Panel B and D report the results of multiple comparisons, wherein there are significant differences in the

levels of assessment between the entity-specific and market-based conditions [Turkey,  $p = 0.003$ ; Dunn's test,  $Z(1) = -2.853$ ,  $p = 0.000$ ], and between the market-based and no-definition conditions [Turkey,  $p = 0.000$ ; Dunn's test,  $Z(1) = 4.209$ ,  $p = 0.000$ ]. Panel B and D also indicate, on the contrary, no significant difference in the levels of assessment between the entity-specific and the no-definition conditions [Turkey,  $p = 0.73$ ; Dunn's test,  $Z(1) = 1.257$ ,  $p = 0.209$ ].

In summary, there was a statistical difference between all conditions, and the assessment under the market-based condition (46,886.80) was the highest. This result was unintended, and our results did not support H1. Furthermore, the results of multiple comparisons indicated that the assessment under the entity-specific condition was similar to the assessment under the no-definition condition as humans' natural assessments.

#### **4-3. Testing H2 (Pathway A): analyzing the items to focus on when considering fair value**

In this subsection, we analyze the items to focus on when considering fair value for each condition (pathway A based on the 'System 2' thinking of the dual process theory, the left side of Figure 2). To capture participants' attitudes toward fair value, we performed several regression analyses wherein the dependent variable was the assessment of fair value.

We assume the following basic relationship for each condition:

$$Assess_i = F [Simple_i; Weighted_i; EmphasisRC_i; EmphasisQP_i; EmphasisVIU_i; X_i],$$

where  $Assess_i$  represents the participants' assessment of fair value. The independent variables are the items to focus on when considering fair value: (1)  $Simple_i$  is the participants' agreement levels on a scale of 7 points to the question that fair value should incorporate each price information equally; (2)  $Weighted_i$  is the participants' agreement levels on a scale of 7 points to the question that fair value should reflect the weighted value of each pricing information according to its content; (3)  $EmphasisRC_i$  is the participants' agreement levels on a scale of 7 points to the question that fair value should reflect a replacement cost-oriented valuation; (4)  $EmphasisQP_i$  is the participants' agreement levels on a scale of 7 points to the question that fair value should reflect a quoted price-oriented valuation; and (5)  $EmphasisVIU_i$  is the participants' agreement levels on a scale of 7 points to the question that fair value should reflect a value-in-use-oriented valuation. We controlled for several factors  $X_i$ , including individual demographic characteristics identified in the literature, such as gender ( $Gen$ , dummy for women) and age ( $Age$ ). Table 4 contains our regression results. Panel A presents the result of the subsample under the entity-specific definition condition. Panel B presents the subsample under the market-based definition condition. Panel C presents the subsample under the no-definition condition.<sup>13</sup>

*[Insert Table 4 about here.]*

The difference between regressions (1) and (2) and regressions (4) and (5) lies in whether they include items that emphasize RC, QP, and VIU. First, under the entity-specific condition, H2a indicates a significantly positive relationship with the item of emphasis on

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<sup>13</sup> Supplementary file 4 provides the correlation coefficients between these variables.

VIU. Panel A of Table 4 indicates that the coefficient of  $EmphasisVIU_i$  is significantly positive at  $p < 0.01$ , indicating participants' agreement that fair value should reflect a value-in-use-oriented valuation. This result supports hypothesis H2a.

Second, under the market-based condition, H2b indicates a significant positive relationship between emphasis on RC and QP. Panel B of Table 4 presents that the coefficient of  $EmphasisRC_i$  is significantly positive ( $p < 0.05$  or  $0.10$ ), revealing that participants' agreement that fair value should reflect a replacement cost-oriented valuation. This result supports hypothesis H2b.

Third, under the no-definition condition, H2c-1 indicates a significant positive relationship with the simple average item. H2c-2, which is the alternative hypothesis of H2c-1, indicates a significant relationship between emphasis on RC. Panel C of Table 4 presents that for regression models 2 and 3, the coefficient of the item of the emphasis on QP ( $EmphasisQP_i$ ) is significantly negative at  $p < 0.05$ , or  $0.10$ , though the coefficient of the item of the simple average ( $Simple_i$ ) and that of the emphasis on RC ( $EmphasisRC_i$ ) is not significant. This result does not support H2c-1 or H2c-2.

#### **4-4. Testing H3 (Pathway B): valuation bias specific to non-financial assets**

In this subsection, we analyze the attention levels of each price information by condition (pathway B based on the 'System 1' intuition of the dual process theory, right side of Figure 2). To capture participants' decision process in pathway B in Figure 2 and assess H3, we performed several regression analyses, with the dependent variable representing the assessment of fair value. We assume the following basic relationship:

$$Assess_i = F [DED_i; MAD_i; InfoRC_i; InfoQP_i; InfoVIU_i; MAD_i \times InfoVIU_i; X_i],$$

where  $Assess_i$  represents the participants' assessment of the fair value,  $DED_i$  is a dummy variable that takes the value of 1 if the experiment is under the with-definition (the entity-specific and the market-based) condition (0 if under the no-definition condition),  $MAD_i$  is a dummy variable that takes the value of 1 if the experiment is under the market-based definition condition (0 if under the entity-specific definition or the no-definition condition). We controlled for the levels of the participants' attention to price information about the replacement cost ( $InfoRC_i$ ), the quoted price ( $InfoQP_i$ ), and the value in use ( $InfoVIU_i$ ) related to pathway B in Figure 2. H3 predicts a significant positive relationship between the coefficient of  $InfoVIU_i$  and the cross term.

Additionally, we controlled for several factors  $X_i$ , including individual demographic characteristics. Table 5 contains our regression results. Panel A presents the results under all conditions (full sample). Panel B presents the results under the definition condition (both the entity-specific and the market-based definition condition). Panel C presents the results by conditions.<sup>14</sup>

[Insert Table 5 about here.]

First, in panel A of Table 5, the difference between regression models lies in (1) whether they include  $DED$  or  $MAD$ ; (2) whether they include the cross-term  $DED \times$

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<sup>14</sup> Supplementary file 5 presents the correlation coefficients between these variables.



$InfoVIU_i$  or  $MAD \times InfoVIU_i$ ; and (3) whether they include factors  $X_i$ , including individual demographic characteristics. H3 indicates a significant relationship between the coefficient of  $InfoVIU_i$  and cross-term  $DED \times InfoVIU_i$  or  $MAD \times InfoVIU_i$ . Panel A of Table 5 reveals that the coefficient of  $InfoVIU_i$  is significantly positive at the 10 percent level in Models 5 and 6, and the coefficient of the cross-term,  $MAD \times InfoVIU_i$  is significantly positive at the 1 and 5 percent levels in Models 4 and 8. This result supports H3: Panel A of Table 5 also reveals that the coefficient of  $MAD$  is significantly positive ( $p < 0.01$  in models 2, 4, 6, and 8), revealing that participants' assessment under the market-based condition is the highest even when controlling for various variables. This result is also consistent with the results of the test of H1.

Second, Panel B of Table 5, which uses the subsample restricted to the with-definition condition, also presents the same result. Panel B presents that the coefficient of  $InfoVIU_i$  and the coefficient of the cross-term,  $MAD \times InfoVIU_i$  is significantly positive at the 5 or 10 percent level in all models. This result also supports H3.

Third, Panel C of Table 5, which uses the subsample by conditions: Models 1 and 2, the entity-specific condition: Models 3 and 4, the market-based condition: Models 5 and 6, no-definition condition), reveals that only under the market-based condition, the coefficient of  $InfoVIU_i$  is significantly positive at the 10 percent level in Models 3 and 4. This result partially supports H3, particularly under market-based definition conditions.

In sum, our results partially support H3 and reveal that the anchoring effect occurs only under the market-based definition condition. In particular, as presented in panels A and B of Table 5, the significantly positive coefficient of the cross-term,  $MAD \times InfoVIU_i$  indicates that, only in the market-based definition condition, participants' over-attention to

the price information regarding the value in use caused the unanchoring effect and affected over-assessments of the fair value. Therefore, the results also indicate that the assessment under market-based conditions differs in quality from that under other conditions.

## **5. Robustness check: Effect of the change of price information on the assessment levels**

In this section, we examine the effect of the change in price information on participants' assessment levels.<sup>15</sup> Our additional research question is as follows: How will the assessment of the fair value of assets change if the pricing information provided to participants is changed, as presented in Figure 4? In the experiment, we asked additional questions to all participants: When the value in use of the asset increased from \$54,000 to \$60,000 (sub-setting 1 [sub1]: + 6,000) and to 74,000 (sub-setting 2 [sub2]: +20,000), and when the quoted price of the asset decreased from \$44,000 to \$24,000 (sub-setting 3 [sub3]: - 20,000), how did the assessment levels of the fair value of the assets change?

*[Insert Figure 4 about here]*

Table 6 reports the descriptive statistics for each experimental condition.

*[Insert Table 6 about here]*

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<sup>15</sup> We designed this additional experiment referring to the factorial survey experiment in Auspurg and Hinz (2014) and Wallander (2009).

We focus on changes in market-based conditions. Table 6 presents that the slope of the change in the levels of the assessment in market-based conditions when the value in use changed from the main setting (\$54,000) to sub1 (\$60,000) is greater than the slope of the change in other conditions. However, Table 6 also presents that the slope of the change in the levels of the assessment in market-based conditions when the VIU changed from sub1 (\$60,000) to sub2 (\$74,000) is smaller than the slope of the change in other conditions. Additionally, Table 6 presents that the slope of the change in the levels of the assessment in market-based conditions when the quoted price changed from the main setting (\$44,000) to sub3 (\$24,000) is smaller than the slope of the change in other conditions. In summary, changes in assessment under market-based conditions differed from those under other conditions.

We conducted a two-way ANOVA with a mixed design. Table 7 and Figure 5 present the results.

*[Insert Table 7 and Figure 5 about here]*

First, regarding the ANOVA when the value in use changed (Panel A and B), the results revealed a significant difference in the condition factor ( $F[1, 2] = 10.123, p = 0.000$ , partial  $\eta^2 = 0.012$ ) and setting factor ( $F[1, 2] = 10.123, p = 0.000$ , partial  $\eta^2 = 0.012$ ). No significant differences were found in the interaction effects ( $F[1, 2] = 1.370, p = 0.246$ , partial  $\eta^2 = 0.000$ ). Second, regarding the ANOVA when the quoted price changed (Panel C and D), the result indicated a significant difference in the condition factor ( $F[1, 2] = 15.684, p = 0.000$ , partial  $\eta^2 = 0.0194$ ), setting factor ( $F[1, 2] = 147.077, p = 0.000$ , partial  $\eta^2 = 0.040$ ),

and interaction effects ( $F[1, 2] = 3.067, p = 0.046, \text{partial } \eta^2 = 0.001$ ). Third, regarding the multiple comparisons when the value in use and the quoted price changed (panels B and D), there was no statistical difference between the change in the assessment under the entity-specific and no-definition conditions. Panels B and D of Table 7 also indicate, on the contrary, that changes in the assessment under the market-based condition differ from that in the assessment under other conditions. In summary, even when we captured changes in the assessments, the entity-specific condition was similar to the no-definition condition as humans' natural judgment.

## **6. Discussion**

We experimentally examined how the definition of fair value changed the estimation process of fair value for non-financial assets. In the experiment, the fair value estimation process was divided into a process of shaping attitudes toward fair value based on definitions that are (or are not) offered (Pathway A) and a process of weighting price information provided within a specific M&A scenario (Pathway B). In Pathway A, participants in the no-definition condition focused on RC and VIU consistent with the “value to the owner,” but no statistically significant relationship was identified between the assessment of the fair value and these two measurement bases. By contrast, participants in the entity-specific condition emphasized VIU, which reflected the intended use of the acquirer and was positively correlated with the assessment of fair value. Participants in the market-based condition emphasized RC and QP, which are based on market exchange prices, and exhibited a positive correlation between the assessment of fair value and RC. These results indicate that participants' fair value estimation process is influenced by the definition of fair value. On the

contrary, in Pathway B, the greatest emphasis was placed on value-in-use information under all conditions. In other words, although the measurement bases to be emphasized differs depending on the definition of fair value, when machinery in continuous use is specifically given as an asset to be evaluated, value-in-use information as the recoverable amount has to be emphasized, which is reflected in the assessment. The logic of RC being the upper limit, like the “value to the owner,” is not practiced, and the assessment value is pulled to the recoverable amount. It is possible that the concept of fair value is different from fair value assessment in practice. In this regard, IAS 22 (1993), which distinguished the valuation of plant and equipment according to the purpose for which it was held (use or sale), may have had a certain rationale. Notably, the degree to which value-in-use information was emphasized in Pathway B was particularly significant in the market-based condition, which can be interpreted as leading to the highest assessment. Why was value-in-use information the most important in market-based conditions? This may be the result of participants expecting that fair value would converge with VIU as the recoverable amount in a hypothetical market because value-in-use information is important with respect to machines that are used continuously and furthermore, that other market participants would think similarly. Considering a market-based definition that emphasizes the market participant’s perspective, attention to VIU may have been magnified because it considers other participants’ expectations.

Once again, the estimation process in Pathway B and the comparison of fair value assessment and robustness checks suggest that the assessment in the market-based condition may differ in quality from that of other conditions. In other words, the fair value assessment under the no-definition condition was similar to the assessment provided by the entity-

specific definition. Under the assumption that accounting rules that faithfully represent an individual's natural fair value estimation process provide useful information, the entity-specific definition consistent with the process is appropriate. That is, an entity-specific fair value may provide more decision-useful information than a market-based fair value. The interpretation is that market-based fair value is inappropriate as a norm in the first place and that a change in definition would not lead to an increase in usefulness, contrary to the intent of standard setters. However, the other view is that the aggregate result of an individual's natural fair value estimation process under the no-definition condition is the inherent market-based fair value. People in market exchange transactions do not consider the definition of fair value when valuing assets. If so, the norm of market-based fair value itself is not incorrect. The fact that the entity-specific definition did not distort the natural estimation process of individuals and resulted in a assessment closer to the fair value of the no-definition condition may mean that inherent market-based and entity-specific assessments are approximately equal with respect to Level 3 fair value. However, the finding that a definitional emphasis on market-based measurement leads to deviations from inherent market-based fair value has implications for accounting standard-setting<sup>16</sup>.

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<sup>16</sup> In Cade et al. (2019), individuals' conservative attitudes were observed with respect to the threshold for the existence of assets and liabilities. While it is conceivable that conservatism could be explicitly introduced in accounting standards with respect to the recognition of assets and liabilities, there is also concern that an explicit introduction could encourage conservative accounting practices.

## 7. Conclusion

This study's contribution is examining the natural fair value estimation process of individuals and impact of fair value's definition on that process for non-financial assets. Even if the inputs and measurement bases used in fair value estimation remain constant, explicit changes to the measurement objectives in the definition can affect the estimation process. If entity-specific fair values consistent with individuals' estimation processes enhance usefulness, the market-based definition is inconsistent with the purpose of financial reporting. On the other hand, if the aggregation of an individual's natural estimation process leads to the inherent market-based fair value, which is also close to the entity-specific fair value, then it would not be wrong to use market-based fair value as the measurement objective. However, if the definition includes market-based measurement objectives, deviation from the original market-based fair value is possible.

A limitation of our experiment was that we only observed the estimation process for the pattern  $VIU > RC > NRV$ . For example, in a situation wherein the profitability of a machine has declined, and a sale is reasonable ( $RC > NRV > VIU$ ), would QP information as the recoverable amount be more important, and would this be reflected in the assessment? Different results may arise when the order of the measurement bases is changed, e.g., Pathway A works better than Pathway B. By accumulating these empirical results, we aim to strengthen the conceptual support for the fair value of non-financial assets and question the validity of the accounting rules. Non-financial assets' fair value assessment also affects post-M&A profits through the allocation of consideration to amortizable or non-amortizable assets (including goodwill). Clarifying non-financial assets' fair value estimation process could

explain management behavior with respect to PPA and provide useful interpretations of how goodwill should be measured post-acquisition.



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## Supplementary file S1. Experimental scenario & Screenshot of the experiment

The following are the instructions that were presented to the participants in our experiments.

Participants are randomly assigned to only one of the three conditions and read only one scenario. The different parts of each scenario are underlined and italicized according to the conditions of the experiment. Footnotes are also underlined and italicized.

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### Page 1 Introduction

## Introduction

Thank you for agreeing to participate in this task.

**Please enter your MTurk worker ID into the text box.**

**Before we begin, do you swear upon your honor to answer the following questions truthfully?** (You will be allowed to continue with this survey regardless of your answer to this question)

Yes.

No.

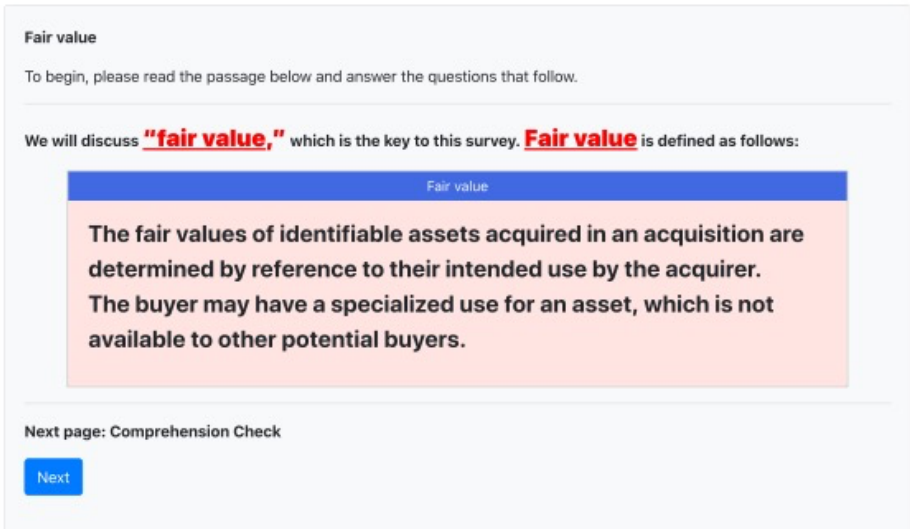
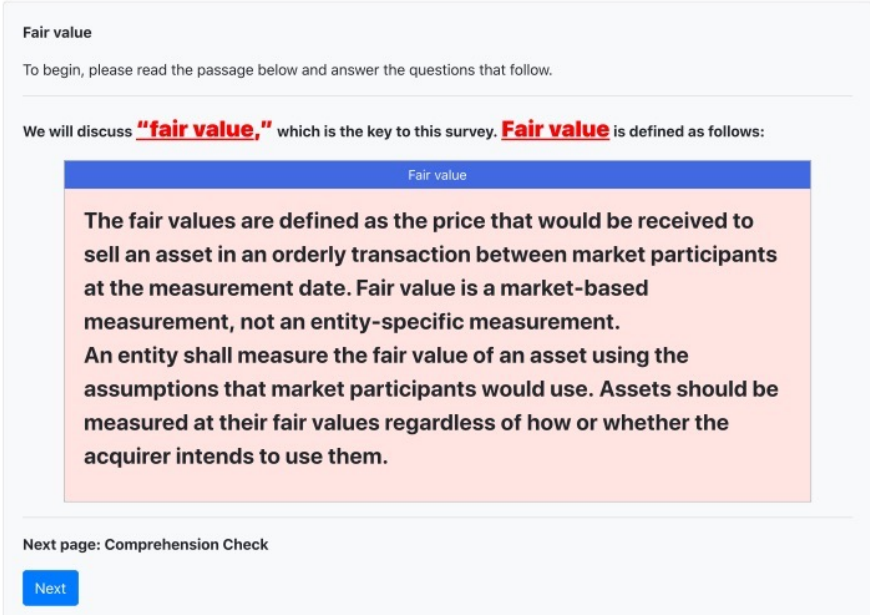
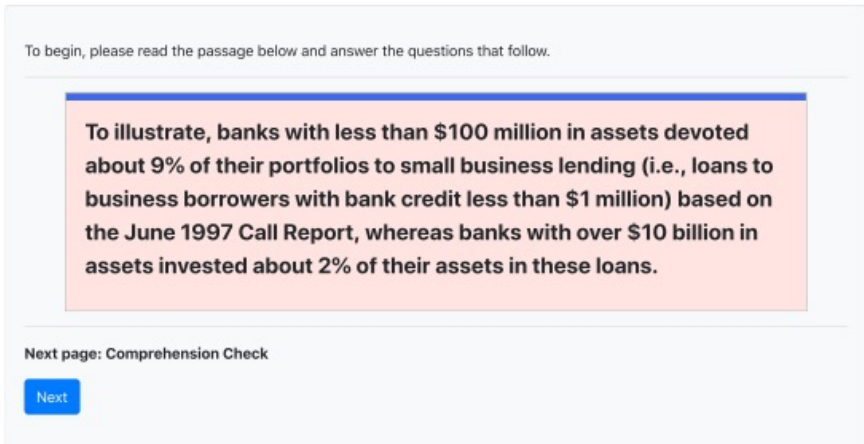
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In today's task, you will be playing **the role of a CEO of a firm**. You will read the following scenario and answer some questions about it.

**Next page**

[Next](#)

Page 2 Definition (or not)

<p><u>Entity-specific</u> <u>definition condition</u></p>	 <p>Fair value</p> <p>To begin, please read the passage below and answer the questions that follow.</p> <p>We will discuss <b>"fair value,"</b> which is the key to this survey. <b>Fair value</b> is defined as follows:</p> <p><b>Fair value</b></p> <p><b>The fair values of identifiable assets acquired in an acquisition are determined by reference to their intended use by the acquirer. The buyer may have a specialized use for an asset, which is not available to other potential buyers.</b></p> <p>Next page: Comprehension Check</p> <p>Next</p>
<p><u>Market-based</u> <u>definition condition</u></p>	 <p>Fair value</p> <p>To begin, please read the passage below and answer the questions that follow.</p> <p>We will discuss <b>"fair value,"</b> which is the key to this survey. <b>Fair value</b> is defined as follows:</p> <p><b>Fair value</b></p> <p><b>The fair values are defined as the price that would be received to sell an asset in an orderly transaction between market participants at the measurement date. Fair value is a market-based measurement, not an entity-specific measurement. An entity shall measure the fair value of an asset using the assumptions that market participants would use. Assets should be measured at their fair values regardless of how or whether the acquirer intends to use them.</b></p> <p>Next page: Comprehension Check</p> <p>Next</p>
<p><u>No-definition</u> <u>condition</u></p>	 <p>To begin, please read the passage below and answer the questions that follow.</p> <p><b>To illustrate, banks with less than \$100 million in assets devoted about 9% of their portfolios to small business lending (i.e., loans to business borrowers with bank credit less than \$1 million) based on the June 1997 Call Report, whereas banks with over \$10 billion in assets invested about 2% of their assets in these loans.</b></p> <p>Next page: Comprehension Check</p> <p>Next</p>

Page 3 Comprehension check question

<p><u>Entity-specific</u> <u>definition condition</u></p>	<p><b>Comprehension Check</b></p> <p>Please complete the following statement, identified on the previous screen. If you cannot answer this question correctly, your HIT will not be approved; therefore, please answer carefully.</p> <p>The fair values of identifiable assets acquired in an acquisition are determined by reference to their intended [__A__] by the acquirer.</p> <p>The buyer may have a specialized [__B__] for an asset, which is not available to other potential buyers.</p> <p>(1) What is the appropriate word that applies to the blank A?</p> <p><input type="radio"/> banks <input checked="" type="radio"/> use <input type="radio"/> market</p> <p>(2) What is the appropriate word that applies to the blank B?</p> <p><input type="radio"/> banks <input type="radio"/> use <input type="radio"/> market</p>
<p><u>Market-based</u> <u>definition condition</u></p>	<p><b>Comprehension Check</b></p> <p>Please complete the following statement, identified on the previous screen. If you cannot answer this question correctly, your HIT will not be approved; therefore, please answer carefully.</p> <p>The fair values are defined as the price that would be received to sell an asset in an orderly transaction between market participants at the measurement date. Fair value is a [__A__]-based measurement, not an entity-specific measurement.</p> <p>An entity shall measure the fair value of an asset using the assumptions that [__B__] participants would use. Assets should be measured at their fair values regardless of how or whether the acquirer intends to use them.</p> <p>(1) What is the appropriate word that applies to the blank A?</p> <p><input type="radio"/> banks <input type="radio"/> use <input type="radio"/> market</p> <p>(2) What is the appropriate word that applies to the blank B?</p> <p><input type="radio"/> banks <input type="radio"/> use <input type="radio"/> market</p>

No-definition  
condition

### Comprehension Check

Please complete the following statement, identified on the previous screen. If you cannot answer this question correctly, your HIT will not be approved; therefore, please answer carefully.

To illustrate, [\_\_A\_\_] with less than \$100 million in assets devoted about 9% of their portfolios to small business lending (i.e., loans to business borrowers with bank credit less than \$1 million) based on the June 1997 Call Report, whereas [\_\_B\_\_] with over \$10 billion in assets invested about 2% of their assets in these loans.

(1) What is the appropriate word that applies to the blank A?

- banks
- use
- market

(2) What is the appropriate word that applies to the blank B?

- banks
- use
- market

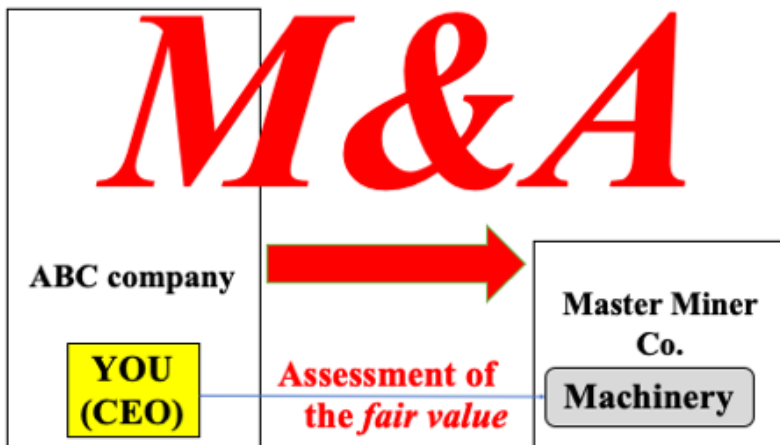
### Page 4 Scenario & Check questions of the scenario

In this scenario, you are a CEO (Chief Executive Officer) of a company, and your task is to evaluate the machine by its “fair value” as a CEO. Please read the following scenario and answer the following questions.

### Scenario

You are the CEO (Chief Executive Officer) of ABC company. You would like to acquire another company, Master Miner Co., that belongs to the same industry. As part of the acquisition, ABC company intends to acquire the machinery used by Master Miner Co. in their primary business. You will evaluate the machinery by its “**fair value,**” *which you reviewed earlier* (Note: Under the no-definition condition, this sentence is deleted). Using the following information, evaluate the fair value of the machinery.





**(1) Overview of the machinery acquired by business combination**

The machine was held and used during its operations. The machine was originally purchased by Master Miner Co. (acquired entity) from an outside vendor and, before the business combination, was customized by Master Miner Co. for use in its operations. You decide to keep using this machine after the business combination.

**(2) Pricing information for reference**

You, the CEO, have the following pricing information of the machinery.

**Information A (replacement cost)**

You asked the machine supplier to estimate the amount of money needed to produce a substitute (customized) machine of comparable utility. The estimate provided was **\$46,000**. This estimate considers the condition of the machine and the environment in which it will be used (e.g., installation costs).

**Information B (quoted price)**

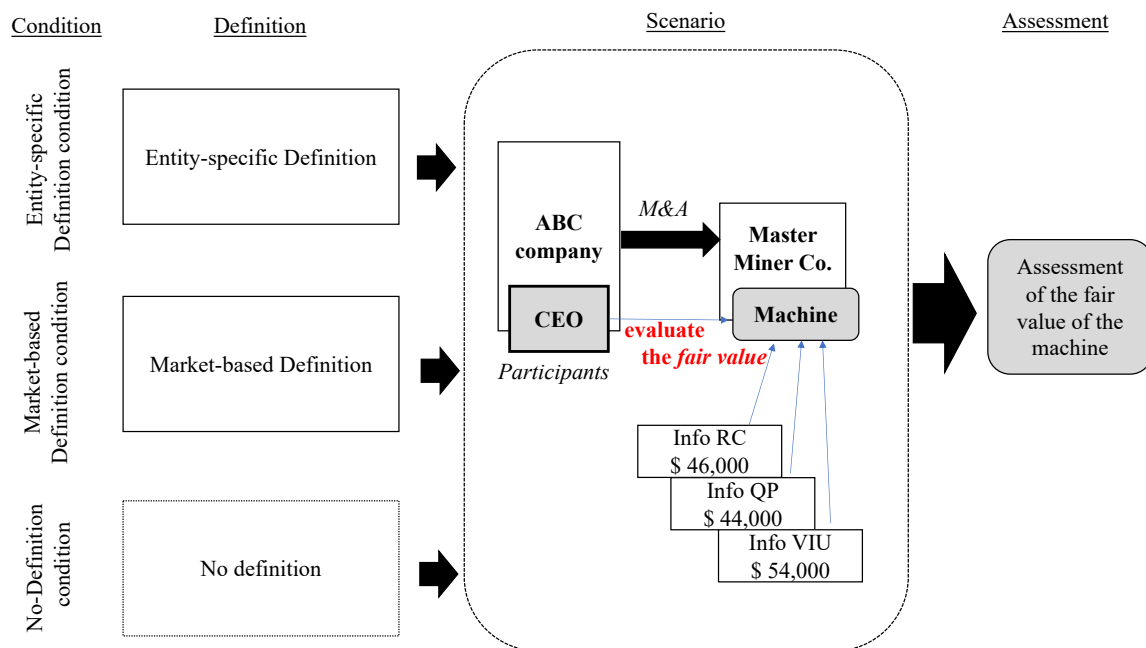
The estimated value of the machine based on quoted prices for similar machines adjusted for differences between the machine (as customized) and similar machines was **\$44,000**. The

measurement reflects the price that would be received for the machine in its current condition and location (installed and configured for use).

**Information C (value in use)**

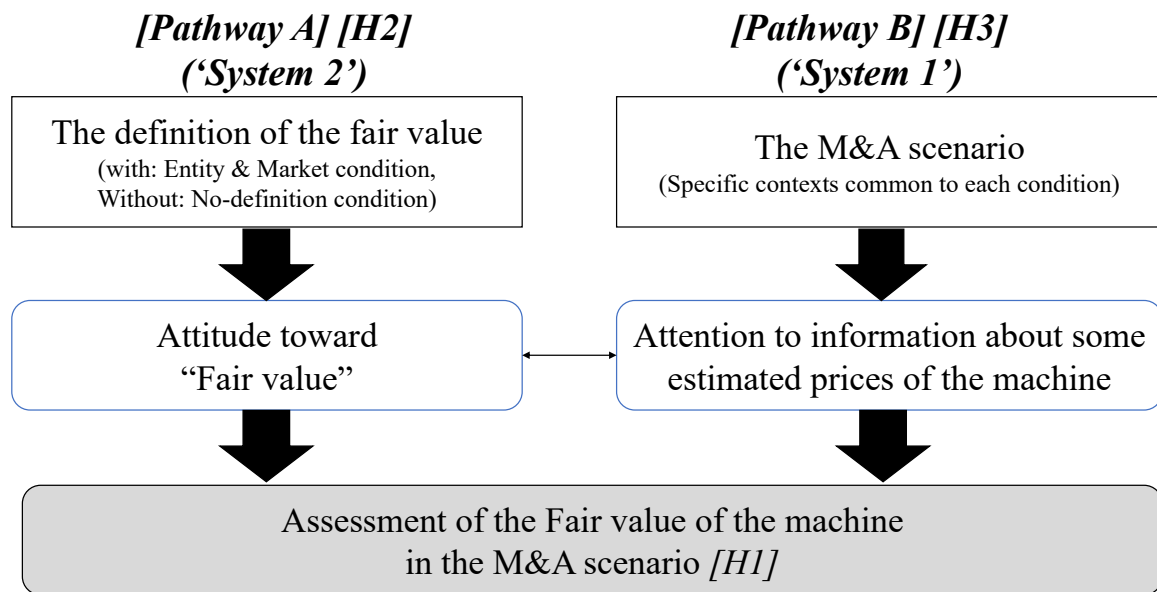
The estimated present value of the future gross revenue that ABC company could earn by using the machine in its business after acquiring Master Miner Co. was **\$54,000**.

**Figure 1 Overview of the experimental task**



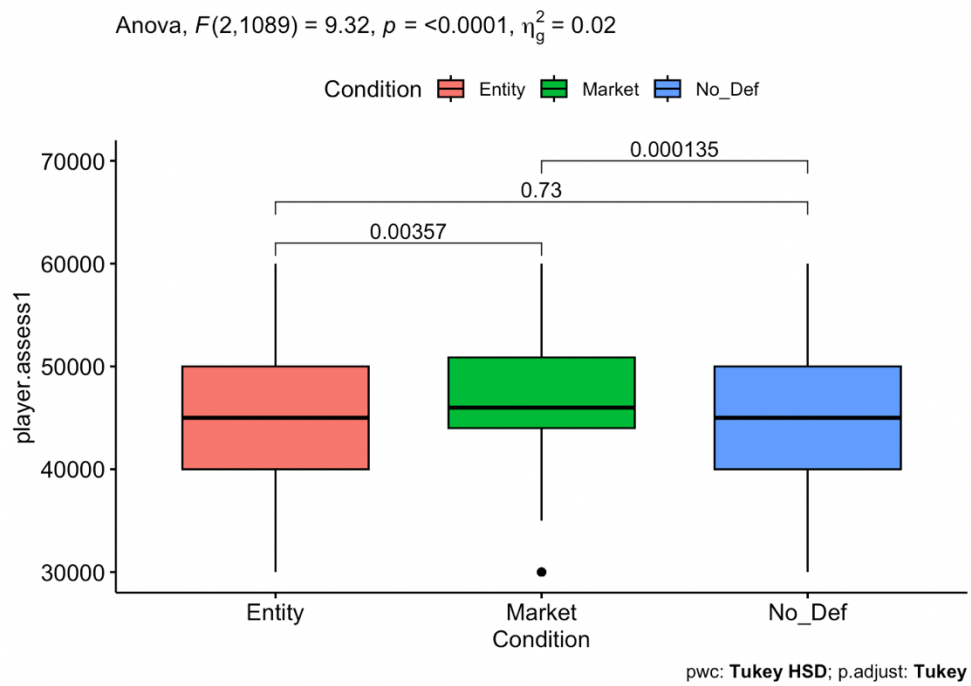
Note: This figure provides an overview of the experimental tasks. *Info RC* refers to price information regarding the replacement cost, *Info QP*, information regarding the quoted price, *Info VIU*, and information regarding the value in use. Participants were randomly assigned to one of the following three conditions: (1) market-based definition condition, wherein participants were presented with the market-based definition of fair value; (2) entity-specific definition condition, wherein participants were presented with the entity-specific definition of fair value; and (3) no-definition condition, wherein participants did not present a definition of fair value. In the market-based and entity-specific definition conditions, participants were provided with the definition of fair value before reading the scenario. In the no-definition condition, the participants did not propose a definition of fair value. Instead of a definition, participants read a business document as a placebo before reading the scenario. In the scenario, participants are presented with three pieces of pricing information for the machinery: information regarding the replacement cost (RC), the quoted price (QP) equivalent to the net realizable value (NRV), and the value in use (VIU). This study assumes only one pattern:  $VIU > RC > NRV$ . After reading the scenario, participants assess the “fair value” of the machinery using additional information regarding the pricing of the machinery and answer some questionnaires regarding the decision process of the assessment.

**Figure 2 Expected participants' decision-making process**



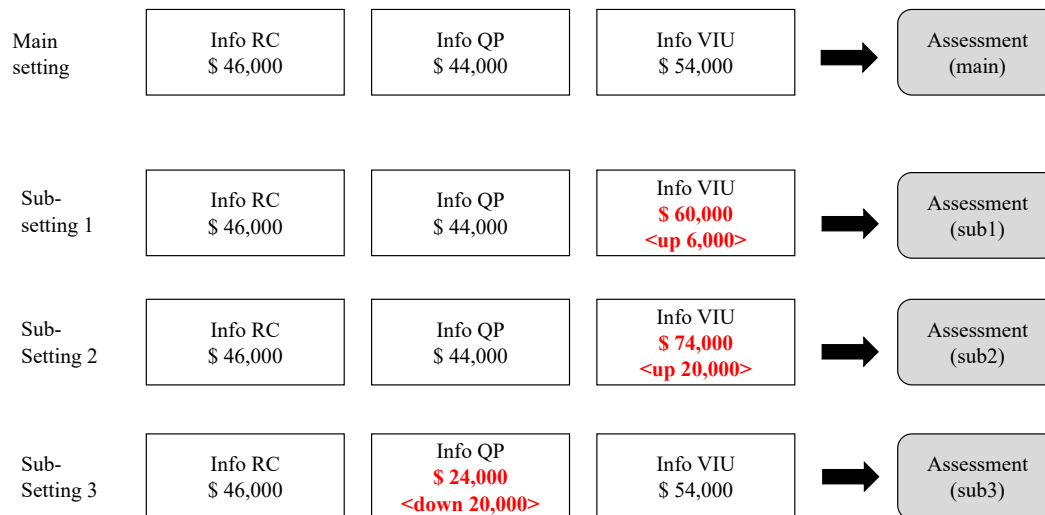
Note: We predominantly hypothesize a participant's decision-making process as follows: Two pathways exist in the decision-making process, referring to the dual process theories of thinking and reasoning discussed mainly in cognitive science and psychology. The first pathway is the process of shaping attitudes toward fair value based on the definitions that are (or are not) offered (left side of the figure). This pathway A draws on the idea of 'System 2' of the dual process theory, which is a slow system that observes System 1's intuitive outputs and provides the basis for a higher level of rationality in their reasoning and decision-making. The second pathway is the process of weighting the price information given within a specific M&A scenario (right side of the figure). This pathway B requires judgment in a specific context and draws on the idea of 'System 1' of the dual process theory, which is a fast decision-making system responsible for intuitive decision-making based on emotions, vivid imagery, and associative memory. Using these two paths, participants assessed the fair value of assets in the scenario (bottom of the figure).

**Figure 3 Boxplot of the assessment and results of the ANOVA**



Note: This figure presents a boxplot of the assessment by condition and results of the ANOVA. The multiple comparisons were conducted by the Turkey HSD.

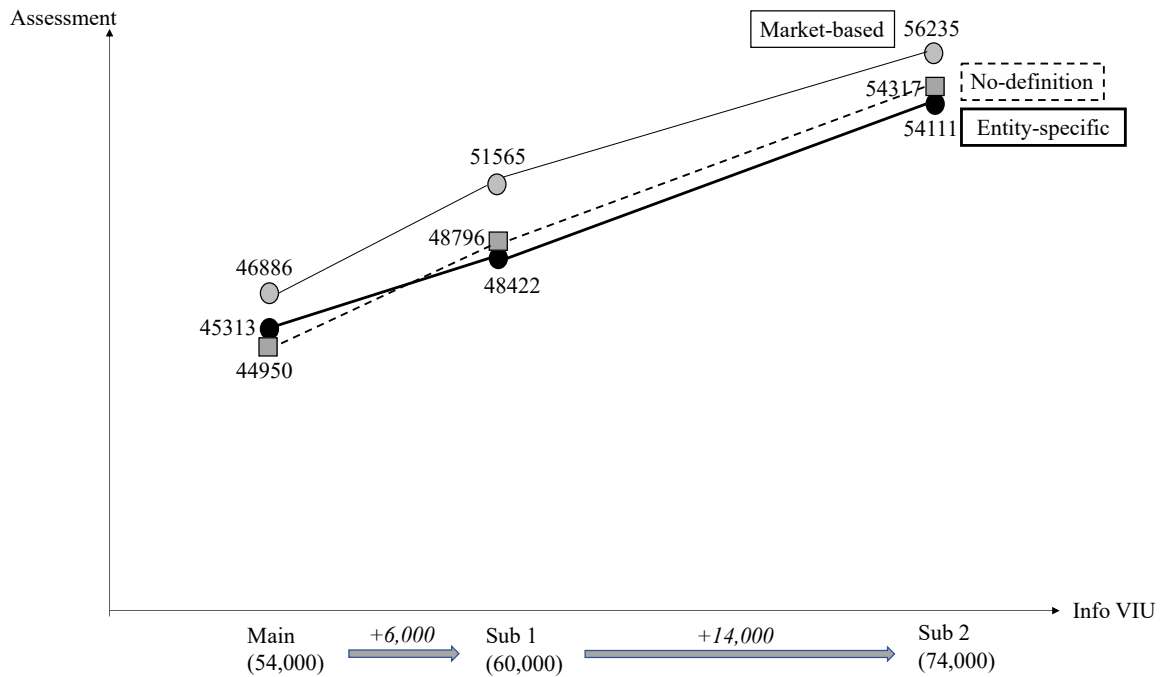
**Figure 4 An additional experimental design: effect of the change of price information on assessment levels**



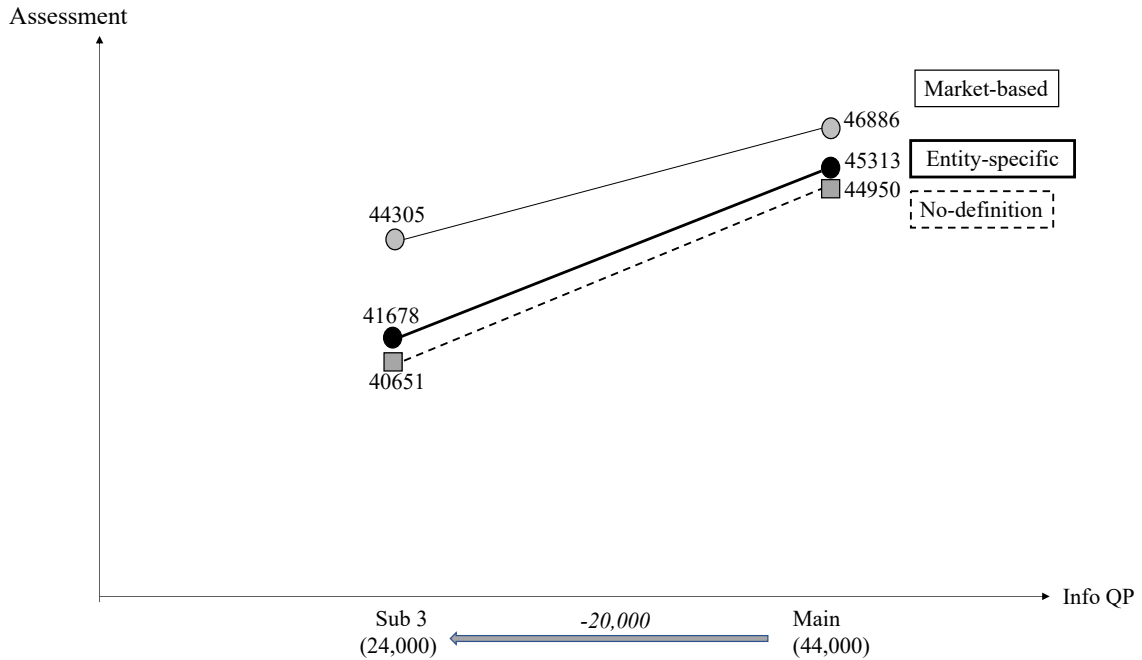
Note: This figure presents an additional experimental design of the effect of the change in price information on the assessment levels. In the experiment, we asked additional questions to all participants: When the value in use of the asset increased from \$54,000 to \$60,000 (sub-setting 1: + 6,000) and to 74,000 (sub-setting 2: +20,000), and when the quoted price of the asset decreased from \$44,000 to \$24,000 (sub-setting 3: -20,000), how did the assessment levels of the fair value of the assets change? *Info RC* refers to price information about the replacement cost, *Info QP*, information about the quoted price, *Info VIU*, and information regarding the value in use.

**Figure 5 Interaction plot of the change of Assessment when price information changed**

**Panel A Change of Assessment when information regarding VIU changes**



**Panel B Change of Assessment when information regarding QP changes**



Note: This figure presents the interaction plot of the change in assessment when the price information changes.

See Figure 4 for details on the setting of the change in price information.

**Table 1. Transition of fair value measurement rules for plant and equipment**

	<b>Definition of fair value</b>	<b>Measurement objectives</b>	<b>General guidelines for arriving at the fair values</b>
<b>IAS22 (1983)</b>	Fair value is the amount for which an asset could be exchanged between a knowledgeable, willing buyer and a knowledgeable, willing seller in an arm's length transaction (par.3).	The determination of fair values may be influenced by the intentions of the buyer (par.13).	None
<b>IAS22 (1993)</b>	Fair value is the amount for which an asset could be exchanged or a liability settled between knowledgeable, willing parties in an arm's length transaction (par.9).	The fair values of identifiable assets and liabilities acquired in an acquisition are determined by reference to their intended use by the acquirer (par.38).	(i) (T)o be used at their market value determined by appraisal. When there is no evidence of market value because of the specialised nature of the plant and equipment or because the items are rarely sold, except as part of a continuing business, they are valued at their depreciated replacement cost; (ii) to be used temporarily, at the lower of current replacement cost for similar capacity and net realisable value; and (iii) to be sold or held for later sale, rather than used, at net realisable value (par.39).
<b>IAS22 (1998)</b>	Same as above (par.9)	IAS 22 (revised 1998) no longer includes the guidance in IAS 22 (revised 1993) that indicated that the fair values of identifiable assets and liabilities were determined considering their intended use by the acquirer. As a consequence, the guidance for determining the fair value of land and buildings and plant and equipment has been modified to delete any reference to the acquirer's intended use of these assets (par.BC121)	(P)lant and equipment at market value, normally determined by appraisal. When there is no evidence of market value because of the specialised nature of the plant and equipment or because the items are rarely sold, except as part of a continuing business, they are valued at their depreciated replacement cost (par.40)
<b>IFRS3 (2004)</b>	Same as above (Appendix A)	None ※The intention of both IFRS 3 and SFAS 141 was that assets, both tangible and intangible, should be measured at their fair values regardless of how or whether the acquirer intends to use them (IFRS3(2008) par.BC262).	(F)or plant and equipment, the acquirer shall use market values, normally determined by appraisal. If there is no market-based evidence of fair value because of the specialised nature of the item of plant and equipment and the item is rarely sold, except as part of a continuing business, an acquirer may need to estimate fair value using an income or a depreciated replacement cost approach (par.B16).
<b>IFRS3 (2008)</b>	Fair value is the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date (par.2)	(B)oth tangible and intangible should be measured at their fair values regardless of how or whether the acquirer intends to use them (par.BC262)	None ※following IFRS 13



**Table 2. Descriptive statistics for each experimental condition****Panel A. Assessment, Attention to the referenced information [Pathway B], and****Confidence**

Condition		Assessment	Info RC	Info QP	Info VIU	Confidence
Entity-specific definition	Mean	45,313.36	5.49	5.26	5.77	81.21
	Median	45,000.00	6.00	5.00	6.00	23.42
	S.D.	6,799.81	1.10	1.30	1.12	90.00
Market-based definition	Mean	46,886.80	5.65	5.49	5.71	80.68
	Median	46,000.00	6.00	6.00	6.00	24.94
	S.D.	6,686.71	1.08	1.13	1.16	90.00
No definition	Mean	44,950.78	5.67	5.54	5.90	76.58
	Median	45,000.00	6.00	6.00	6.00	27.83
	S.D.	5,925.27	1.07	1.11	1.25	88.00

**Panel B. Items to focus on when considering fair value [Pathway A]**

Condition		Simple average	Weighted average by context	Emphasis on replacement cost	Emphasis on quoted price	Emphasis on value in use
Entity-specific definition	Mean	5.42	5.53	5.41	5.44	5.56
	Median	5.50	5.50	5.50	5.50	5.50
	S.D.	1.13	0.97	1.10	1.07	0.96
Market-based definition	Mean	5.53	5.60	5.58	5.56	5.49
	Median	5.50	5.50	5.50	5.50	5.50
	S.D.	1.06	0.94	0.91	0.87	1.08
No definition	Mean	5.10	5.70	5.45	5.37	5.43
	Median	5.50	6.00	5.50	5.50	6.00
	S.D.	1.53	1.08	1.15	1.24	1.29

Note: These tables present descriptive statistics for each experimental condition. Panel A presents the levels of assessment, attention to the referenced information (*“In the assessment of the fair value of the machine, how*

*important is the price information RC, QP, and VIU presented above? Please indicate the importance of each piece of information on a 7-point scale (1 = not at all important, 7 = very important).”), and participants’ confidence (“Please indicate how confident you are in your assessment on a scale of 0–100 with endpoints labeled as “not at all confident” (0) and “very confident” (100).”), as described in supplementary file 2.*

*Assessment* refers to participants’ assessment of the fair value of the machine (“*Based on the pricing information, what would be the fair value of the machine if you follow the proposed definition of fair value? Please evaluate the amount.*”). *Info RC* refers to the degree to which participants judged the information about the RC (replacement cost) of the machine to be important, *Info QP*, the information about QP (quoted price), *info VIU*, and information about VIU (value in use). Panel B presents the levels of the items to focus on when considering the fair value (“*In the assessment of the fair value of the machine, how much do you agree with the following questions?*”) described in supplementary file 2. S.D. indicates standard deviation.

**Table 3. Results of the ANOVA and Kruskal-Wallis test of the Assessment of fair value between conditions**

**Panel A. Results of the ANOVA of the Assessment**

Source of Variation	SS	df	MS	F-statistic	p-value
Condition	779,550,000	2	389,777,456.0	9.322	0.000
Residuals	45,537,000,000	1089	41,815,077.0		

**Panel B. Tests of Simple Effects (the Tukey HSD)**

Source of Variation	df	CI lower	CI upper	p-value
Entity vs. Market	1	432	2715	0.003
Entity vs. No-definition	1	-1489	764	0.730
Market vs. No-definition	1	-3046	-826	0.000

**Panel C. Result of the Kruskal-Wallis test of the Assessment**

	Entity-specific	Market-based	No-definition	Kruskal-Wallis test		
				chi-squared	df	p-value
Assessment (Median)	45,000.00	46,000.00	45,000.00	18.47	2	0.000
# of Observation	344	364	384			

**Panel D. Tests of Simple Effects (Dunn's test)**

Source of Variation	df	Z-value	p-value
Entity vs. Market	1	-2.853	0.000
Entity vs. No definition	1	1.257	0.209
Market vs. No-definition	1	4.209	0.000

Note: Panels A and B present the results of the ANOVA and simple main effects tests for condition (entity-specific, market-based, and no-definition) factors. In panel B, we used Tukey's honest significant difference test for multiple comparisons. *CI*: 95% confidence interval. Panels C and D present the results of the Kruskal-Wallis test and the simple main effects tests for condition (entity-specific, market-based, and no-definition) factors. In panel D, we used Dunn's test for multiple comparisons following a significant Kruskal-Wallis test.

**Table 4. Results of regression analyses**

**Panel A. Results of regression analyses under the entity-specific condition**

	model1	model2	model3	model4	model5	model6
(Intercept)	45419.107***	45157.882***	45245.940***	45757.820***	45720.487***	45503.731***
	(368.712)	(361.958)	(367.375)	(1435.903)	(1411.087)	(1435.010)
<i>Simple</i>	-691.126*		-562.977	-405.364		-369.871
	(351.140)		(481.866)	(386.921)		(494.300)
<i>Weighted</i>	645.276		369.406	511.625		255.238
	(409.209)		(434.389)	(414.366)		(440.387)
<i>EmphasisRC</i>		-1265.217***	-1100.245**		-1169.315***	-1076.351**
		(437.003)	(477.539)		(437.534)	(476.121)
<i>EmphasisQP</i>		453.715	610.661		705.321	781.622
		(458.852)	(507.244)		(467.177)	(510.696)
<i>EmphasisVIU</i>		1083.074***	1061.720**		947.648**	935.113**
		(390.553)	(414.651)		(394.095)	(416.682)
<i>Age</i>				35.283	28.130	29.558
				(36.618)	(36.214)	(36.351)
<i>Year_work</i>				6.068	18.317	14.254
				(41.242)	(40.200)	(40.795)
<i>Gen (women = 1)</i>				748.052	595.851	585.627
				(741.913)	(734.793)	(736.309)
<i>Major_finance</i>				67.162	93.962	256.211
				(1367.553)	(1335.809)	(1353.698)

Manager_experience				1403.367	1298.120	1359.078
				(1177.557)	(1158.664)	(1162.759)
M&A_experience				-2620.167***	-2663.101***	-2560.234**
				(997.009)	(987.337)	(995.629)
Num.Obs.	344	344	344	344	344	344
R2	0.013	0.045	0.051	0.046	0.076	0.079
R2 Adj.	0.008	0.037	0.036	0.023	0.051	0.048
RMSE	6744.06	6635.58	6616.23	6633.14	6526.01	6517.91

**Panel B. Results of regression analyses under the market-based condition**

	model1	model2	model3	model4	model5	model6
(Intercept)	46700.035***	46709.786***	46638.851***	45201.286***	45848.167***	45727.692***
	(350.253)	(344.807)	(351.355)	(1331.361)	(1340.309)	(1352.495)
<i>Simple</i>	1045.604***		584.844	1059.681***		601.110
	(367.871)		(429.774)	(393.063)		(445.074)
<i>Weighted</i>	617.289		160.747	628.816		120.787
	(416.571)		(463.401)	(422.879)		(479.642)
<i>EmphasisRC</i>		1152.255**	971.053**		1202.483**	1025.235**
		(461.131)	(483.269)		(466.922)	(492.309)
<i>EmphasisQP</i>		626.237	443.598		598.342	407.634
		(465.081)	(483.379)		(470.484)	(491.708)
<i>EmphasisVIU</i>		390.814	115.633		408.457	166.534
		(365.143)	(417.575)		(382.694)	(432.393)

<i>Age</i>				-18.226	6.672	-1.925
				(52.106)	(51.972)	(52.321)
<i>Year_work</i>				1.339	-40.206	-22.079
				(75.353)	(74.693)	(75.795)
<i>Gen (women = 1)</i>				356.196	601.127	521.406
				(710.804)	(707.385)	(710.823)
<i>Major_finance</i>				-430.580	-1249.577	-1157.312
				(1458.174)	(1464.101)	(1489.665)
<i>Manager_experience</i>				2004.704	1663.109	1814.273
				(1325.601)	(1320.790)	(1325.055)
<i>M&amp;A_experience</i>				-243.405	75.115	-75.292
				(1199.838)	(1190.846)	(1195.672)
Num.Obs.	364	364	364	364	364	364
R2	0.049	0.061	0.067	0.058	0.071	0.076
R2 Adj.	0.043	0.053	0.054	0.034	0.044	0.044
RMSE	6512.67	6469.80	6450.63	6482.34	6437.75	6419.25

**Panel C. Results of regression analyses under the no-definition condition**

	model1	model2	model3	model4	model5	model6
(Intercept)	44884.105***	44912.825***	44883.538***	47350.505***	46899.073***	47236.516***
	(309.398)	(300.436)	(307.006)	(925.989)	(879.125)	(926.141)
<i>Simple</i>	-224.831		-106.692	331.491		323.085
	(208.016)		(261.362)	(256.566)		(289.241)

<i>Weighted</i>	132.004		90.707	-101.321		-218.570
	(294.071)		(308.526)	(308.647)		(331.550)
<i>EmphasisRC</i>		-448.305	-439.008		-264.507	-277.918
		(289.501)	(294.525)		(286.221)	(290.904)
<i>EmphasisQP</i>		-525.936**	-492.948*		-302.930	-372.034
		(265.365)	(281.487)		(266.030)	(278.293)
<i>EmphasisVIU</i>		352.050	382.584		568.870**	504.384*
		(241.891)	(297.075)		(246.726)	(298.800)
<i>Age</i>				89.266***	88.451***	83.897**
				(33.930)	(33.419)	(33.832)
<i>Year_work</i>				-72.131	-76.225	-66.537
				(49.131)	(48.222)	(49.034)
<i>Gen (women = 1)</i>				668.651	659.938	618.851
				(605.358)	(602.122)	(603.845)
<i>Major_finance</i>				-1628.226	-1400.999	-1681.216
				(1132.364)	(1112.022)	(1154.374)
<i>Manager_experience</i>				-379.842	-245.652	-243.199
				(907.416)	(904.508)	(911.987)
<i>M&amp;A_experience</i>				-2206.322**	-2015.044**	-2112.758**
				(946.347)	(939.719)	(943.960)
Num.Obs.	384	384	384	384	384	384
R2	0.003	0.026	0.027	0.074	0.088	0.091
R2 Adj.	-0.002	0.018	0.014	0.052	0.063	0.062

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RMSE	5908.39	5839.98	5838.12	5693.45	5652.03	5640.99
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Note: Regression model for the dependent variable: level of the participants' assessment of fair value ( $Assess_i$ ).

The independent variables are the items to focus on when considering fair value: (1)  $Simple_i$ , the participants' agreement levels on a scale of 7 points to the question that fair value should incorporate each price information equally; (2)  $Weighted_i$ , the participants' agreement levels on a scale of 7 points to the question that fair value should reflect the weighted value of each pricing information according to its content; (3)  $EmphasisRC_i$ , the participants' agreement levels on a scale of 7 points to the question that fair value should reflect a replacement cost-oriented valuation; (4)  $EmphasisQP_i$ , the participants' agreement levels on a scale of 7 points to the question that fair value should reflect a quoted price-oriented valuation; and (5)  $EmphasisVIU_i$ , the participants' agreement levels on a scale of 7 points to the question that fair value should reflect a value-in-use-oriented valuation. We control for several factors  $X_i$ , including individual demographic characteristics identified in the literature, such as gender ( $Gen$ , dummy for women), age ( $Age$ ), years of work experience ( $Year\_work$ ), participants' majors in finance-related content (accounting, finance, management, etc.) ( $Major\_finance$ , dummy variable that takes 1 if participants' major is finance-related content), participants' managerial experience ( $Manager\_experience$ , dummy variable that takes 1 if participants have experience as a manager), and participants' M&A experience ( $M\&A\_experience$ , dummy variable that takes 1 if participants have experience with corporate M&A. All variables were centered. The analysis in panel A used the subsample restricted to the participants under the entity-specific condition; panel B, market-based condition; and panel C, no-definition condition. Significance levels: \*\*\*,  $p < 0.01$ ; \*\*,  $p < 0.05$ ; \*,  $p < 0.10$ .



**Table 5. Results of regression analyses to test H3**

**Panel A. Results of regression analyses under all conditions (full sample)**

	model1	model2	model3	model4	model5	model6	model7	model8
(Intercept)	44907.520***	45114.456***	44929.658***	45124.519***	45119.965***	45470.265***	45138.233***	45668.410***
	(331.834)	(239.632)	(332.561)	(239.177)	(670.371)	(646.816)	(670.815)	(649.144)
<i>DED</i>	1238.246***		1223.424***		1688.720***		1673.210***	
	(412.632)		(412.893)		(428.068)		(428.524)	
<i>MAD</i>		1787.647***		1829.288***		2025.387***		2087.331***
		(415.827)		(415.352)		(425.750)		(425.148)
<i>InfoRC<sub>i</sub></i>	238.649	206.073	222.027	160.120	233.978	198.114	220.278	145.342
	(203.196)	(202.436)	(203.866)	(202.969)	(201.996)	(201.513)	(202.681)	(201.888)
<i>InfoQP<sub>i</sub></i>	23.917	-23.514	23.236	-20.324	9.083	-43.544	8.361	-40.344
	(180.334)	(179.412)	(180.334)	(179.048)	(180.695)	(180.209)	(180.722)	(179.694)
<i>InfoVIU<sub>i</sub></i>	248.930	269.920	45.947	14.230	309.811*	320.255*	140.878	24.252
	(174.574)	(173.951)	(266.822)	(205.062)	(176.391)	(175.801)	(267.522)	(206.946)
<i>DED</i> ×			344.005				286.328	
<i>InfoVIU<sub>i</sub></i>								
			(341.981)				(340.868)	
<i>MAD</i> ×				834.446**				960.982***
<i>InfoVIU<sub>i</sub></i>								
				(356.243)				(357.089)
<i>Age</i>					24.318	30.241	23.164	32.324
					(21.554)	(21.592)	(21.601)	(21.544)

<i>Year_work</i>					-15.363	-13.817	-14.733	-19.362
					(28.260)	(28.169)	(28.273)	(28.163)
<i>Gen</i>					855.630**	681.913*	838.606**	677.382*
<i>(women = 1)</i>								
					(396.161)	(395.864)	(396.733)	(394.729)
<i>Major_</i>					-733.052	-390.154	-723.507	-458.795
<i>finance</i>								
					(726.306)	(715.862)	(726.493)	(714.258)
<i>Manager_</i>					915.251	786.352	922.801	699.285
<i>experience</i>								
					(650.663)	(648.621)	(650.814)	(647.564)
<i>M&amp;A_</i>					-1588.462***	-1602.643***	-1594.331***	-1683.212***
<i>experience</i>								
					(591.676)	(589.725)	(591.798)	(588.790)
Num.Obs.	1092	1092	1092	1092	1092	1092	1092	1092
R2	0.012	0.021	0.013	0.026	0.033	0.039	0.033	0.045
R2 Adj.	0.009	0.017	0.009	0.021	0.023	0.029	0.023	0.035
RMSE	6472.59	6444.79	6469.58	6428.57	6405.28	6384.72	6403.19	6363.40

**Panel B. Results of regression analyses under the with-definition (both the entity-specific and the market-based definition) conditions (sub-sample restricted to with-definition conditions)**

model1

model2

model3

model4

(Intercept)	45365.390***	45350.490***	44621.364***	44953.350***
	(364.817)	(364.165)	(986.620)	(996.969)
<i>MAD</i>	1540.424***	1593.054***	1466.604***	1530.465***
	(509.404)	(509.094)	(522.586)	(522.219)
<i>InfoRC<sub>i</sub></i>	216.456	175.259	242.790	196.748
	(266.325)	(266.624)	(266.338)	(266.607)
<i>InfoQP<sub>i</sub></i>	96.674	102.751	94.270	102.761
	(227.268)	(226.833)	(229.269)	(228.752)
<i>InfoVIU<sub>i</sub></i>	396.433*	-56.580	421.861*	-77.573
	(237.757)	(331.520)	(241.450)	(339.255)
<i>MAD × InfoVIU<sub>i</sub></i>		873.784*		957.082**
		(446.573)		(457.827)
<i>Age</i>			2.796	8.089
			(28.389)	(28.433)
<i>Year_work</i>			2.501	-5.860
			(35.010)	(35.154)
<i>Gen (women = 1)</i>			680.540	723.401
			(515.750)	(514.914)
<i>Major_finance</i>			198.259	44.538
			(987.695)	(988.053)
<i>Manager_experience</i>			1660.941*	1477.243*
			(890.662)	(892.848)

<i>M&amp;A_experience</i>			-1545.643**	-1641.179**
			(753.033)	(752.606)
Num.Obs.	708	708	708	708
R2	0.022	0.027	0.034	0.040
R2 Adj.	0.016	0.020	0.019	0.024
RMSE	6703.49	6685.28	6661.38	6640.53

**Panel C. Results of regression analyses by conditions (sub-sample)**

	Model1	Model2	Model3	Model4	Model5	Model6
Sub-sample	Entity-specific definition		Market-based definition		No-definition	
restricted to	condition		condition		condition	
(Intercept)	45288.050***	46157.567***	46899.196***	45323.712***	44958.283***	47003.589***
	(371.947)	(1410.513)	(347.881)	(1371.069)	(305.307)	(875.939)
<i>InfoRC<sub>i</sub></i>	-74.996	67.257	466.454	460.206	152.168	105.449
	(379.497)	(379.633)	(374.571)	(379.176)	(307.800)	(302.148)
<i>InfoQP<sub>i</sub></i>	-100.751	-129.188	390.493	436.113	-256.613	-310.431
	(313.458)	(313.678)	(330.205)	(337.377)	(293.056)	(288.526)
<i>InfoVIU<sub>i</sub></i>	43.140	-49.090	640.541*	585.053*	90.360	223.435
	(342.701)	(352.090)	(331.656)	(345.530)	(248.128)	(247.133)
<i>Age</i>		35.028		0.244		93.665***
		(36.650)		(52.363)		(33.669)
<i>Year_work</i>		9.046		-48.430		-82.530*

		(40.750)		(75.068)		(48.600)
<i>Gen (women = 1)</i>		779.865		419.306		627.858
		(749.688)		(719.058)		(607.642)
<i>Major_finance</i>		-286.397		-176.933		-1471.706
		(1357.754)		(1483.607)		(1101.664)
<i>Manager_experience</i>		1349.681		1642.952		-303.108
		(1205.938)		(1333.160)		(910.750)
<i>M&amp;A_experience</i>		-2802.240***		-111.320		-1996.020**
		(977.794)		(1211.032)		(945.561)
Num.Obs.	344	344	364	364	384	384
R2	0.001	0.041	0.036	0.046	0.002	0.075
R2 Adj.	-0.008	0.015	0.028	0.019	-0.005	0.050
RMSE	6787.58	6649.93	6554.77	6522.82	5910.21	5692.29

Note: Regression model for the dependent variable: level of the participants' assessment of fair value ( $Assess_i$ ).

Independent variables are dummy variables ( $DED_i$ : a dummy variable that takes 1 if the experiment is under the with-definition (entity-specific and market-based) condition (0 if under the no-definition condition);  $MAD_i$ : a dummy variable that takes the value of 1 if the experiment is under the market-based definition condition (0 if under the entity-specific definition or no-definition condition), and the levels of the participants' attention to price information regarding the replacement cost ( $InfoRC_i$ ), quoted price ( $InfoQP_i$ ), and value in use ( $InfoVIU_i$ ) related to pathway B in Figure 2. We control for several factors  $X_i$ , including individual demographic characteristics identified in the literature, such as gender ( $Gen$ , dummy for women), age ( $Age$ ), years of work experience ( $Year\_work$ ), participants' majors in finance-related content (accounting, finance, management, etc.) ( $Major\_finance$ , dummy variable that takes 1 if participants' major is finance-related

content), participants' managerial experience (*Manager\_experience*, dummy variable that takes 1 if participants have experience as a manager), and participants' M&A experience (*M&A\_experience*, dummy variable that takes 1 if participants have experience with corporate M&A). All the variables were normalized. The analysis in panel A used the full sample; in panel B, the subsample was restricted to with-definition conditions, panel C, by condition (Models 1 and 2, the entity-specific condition: Models 3 and 4, the market-based condition: Models 5 and 6, the no-definition condition), respectively. Significance levels: \*\*\*,  $p < 0.01$ ; \*\*,  $p < 0.05$ ; \*,  $p < 0.10$ .

**Table 6. Descriptive statistics for each experimental condition: effect of the change of price information on assessment levels**

**Panel A assessment**

Condition		Assessment (main)	Assessment (sub1)	Assessment (sub2)	Assessment (sub3)
Entity-specific definition	Mean	45313.36	48422.23	54111.67	41678.29
	Median	45000.00	9791.94	13046.00	10781.53
	S.D.	6799.81	50000.00	54000.00	40500.00
Market-based definition	Mean	46886.80	51565.50	56235.45	44305.22
	Median	46000.00	8881.37	12475.51	9610.65
	S.D.	6686.71	50000.00	55000.00	45000.00
No definition	Mean	44950.78	48796.83	54317.14	40651.02
	Median	45000.00	8170.25	10917.54	10122.94
	S.D.	5925.27	50000.00	50500.00	40000.00

**Panel B. Attention to the referenced information in sub-setting 1 and 2 [pathway B]**

Condition		Sub-setting 1			Sub-setting 2		
		InfoRQ	InfoQP	InfoVIU	InfoRQ	InfoQP	InfoVIU
Entity-specific definition	Mean	5.42	5.35	5.74	5.43	5.36	5.67
	Median	1.12	1.27	1.13	1.21	1.28	1.23
	S.D.	6.00	5.00	6.00	6.00	5.00	6.00
Market-based definition	Mean	5.61	5.51	5.67	5.57	5.55	5.65
	Median	1.01	1.08	1.19	1.05	1.04	1.21
	S.D.	6.00	6.00	6.00	6.00	6.00	6.00
No definition	Mean	5.66	5.48	5.63	5.61	5.43	5.65
	Median	1.11	1.21	1.45	1.18	1.27	1.42

S.D.            6.00            6.00            6.00            6.00            6.00            6.00

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**Panel C. Attention to the referenced information in sub-setting 3 [pathway B]**

Condition		Sub-setting 3		
		InfoRQ	InfoQP	InfoVIU
Entity-specific definition	Mean	5.40	5.24	5.58
	Median	1.18	1.40	1.18
	S.D.	6.00	5.00	6.00
Market-based definition	Mean	5.55	5.48	5.58
	Median	1.06	1.17	1.19
	S.D.	6.00	6.00	6.00
No definition	Mean	5.49	5.36	5.47
	Median	1.18	1.45	1.43
	S.D.	6.00	6.00	6.00

Note: This table presents descriptive statistics of the effect of the change in price information on the assessment levels for each experimental condition. See the notes in Figure 4 for descriptions of *Main*, *sub1*, *sub2*, and *sub3*.

Panel B and C presents the attention to the referenced information (“*In the assessment of the fair value of the machine, how important is the price information RC, QP, and VIU presented above? Please indicate the importance of each piece of information on a 7-point scale (1 = not at all important, 7 = very important).*”) in subsetting 1, 2, and 3. *Info RC* refers to the degree to which participants judged the information about the RC (replacement cost) of the machine to be important, *Info QP*, the information about QP (quoted price), *info VIU*, and information about VIU (value in use).



**Table 7. Results of the two-way ANOVA with mixed design (Condition factor: between participants, Setting factor: within participants)**

**Panel A. Results of the two-way ANOVA when the value in use changed**

Source of Variation	SS	df	MS	F-statistic	p-value
Condition	3,661,953,003.029	2	1,830,976,501.514	10.123	0.000
Setting	46,194,940,899.670	2	26,605,735,589.762	522.989	0.000
Condition × Setting	242,023,285.591	4	9,696,025.339	1.370	0.246
Residuals	96,189,898,166.225	1088			

**Panel B. Multiple comparisons when the value in use changed**

Source of Variation	df	F-statistic	p-value
Entity vs. Market	1	3.905	0.000
Market vs. No definition	1	3.886	0.000
Entity vs. No definition	1	0.125	0.899
Main vs. Sub1	1	16.843	0.000
Sub1 vs. Sub2	1	18.431	0.000
Main vs. Sub2	1	27.950	0.000

**Panel C. Results of the two-way ANOVA when the quoted price changed**

Source of Variation	SS	df	MS	F-statistic	p-value
Condition	3,128,408,174.057	2	1,564,204,087.028	15.684	0.000
Setting	6,695,902,288.728	1	6,695,902,288.728	147.077	0.000
Condition × Setting	279,286,416.265	2	139,643,208.132	3.067	0.046
Residuals	49,578,279,459.091	1087			

**Panel D. Multiple comparisons when the quoted price changed**

Source of Variation	df	F-statistic	p-value
Entity vs. Market	1	3.955	0.000
Market vs. No definition	1	5.410	0.000
Entity vs. No definition	1	1.325	0.185
Entity vs. Market vs. No at the main setting	2	9.321	0.000
Entity vs. Market vs. No at the sub3	2	12.703	0.000
Main vs. sub3 at the entity condition	1	44.770	0.000
Main vs. sub3 at the market condition	1	31.265	0.000
Main vs. sub3 at the No condition	1	75.182	0.000
Entity vs. Market condition at the main setting	1	3.235	0.000
Market vs. No condition at the main setting	1	4.092	0.000
Entity vs. No condition at the main setting	1	0.755	0.450

Entity vs. Market condition at the sub3	1	3.434	0.000
Market vs. No condition at the sub3	1	4.911	0.000
Entity vs. No condition at the sub3	1	1.36	0.173

Note: Panels A and B present the results of the two-way ANOVA when the value in use changed and the simple main-effects tests. In panel B, we used Tukey's honest significant difference test for multiple comparisons.

Panels C and D present the results of the two-way ANOVA when the quoted price changes and simple main effects tests. In panel D, we used Tukey's honest significant difference test for multiple comparisons.