

THE LOWER BID BIAS

Omer Dekel and Amos Schurr *

ABSTRACT: Competitive Bidding (CB) is the most common method used by governments to receive bids from prospective suppliers. Each year the US government awards millions of contracts, totaling more than 300 billion dollars, through the conduct of CB's. Although this method is meant to ensure objective consideration of the proposals, our research, the first to be conducted with government officials, demonstrates that this expectation is not met. We found that when bid evaluators charged with comparing the qualitative parts of competing bids are aware of their prices, a systematic bias occurs, giving an unjust advantage to the lower bidder. We term this phenomenon the Lower Bid Bias. We also show that the bias can be eliminated through the conduct of a two-stage CB, in which the bid price is revealed only at the end of the review process. Therefore, we suggest a rule whereby any competitive procurement based on qualitative evaluation criteria will be conducted through a two-stage CB.

* OMER DEKEL is a Senior Lecturer at Ramat-Gan Center of Law & Business, Israel. AMOS SCHURR is a PhD Candidate at the School of Education, the Hebrew University of Jerusalem, Israel. We would like to thank Judith Avrahami, Ravid Dekel, Yoav Dotan, Yuval Feldman, Einav Hart, Yaakov Kareev, Ma'ayan Menashe, Ariel Porat, Ilana Ritov, Boaz Shnoor, Adi Sorek (iec), Doron Taichman, Shahar Weller, Sarit Yakuti, Eyal Zamir.

1. INTRODUCTION

In any given country, the government is always the biggest single purchaser, both in expenditure and in number of acquisitions, and most of its purchasing is conducted through competitive procedures. For example, according to the Federal Procurement Data System (2012), in 2010 the federal government procured approximately 532 billion dollars worth of goods, services and infrastructure. Of this, 343 billion dollars were expended through the conduct of more than 3 million competitive procedures. In 2011, government procurement totaled some 521 billion dollars; with 334 billion dollars spent through competitive procedures. Needless to say, millions of additional competitive procedures, worth billions of dollars, are conducted each year by state and local governments.

Thus we are dealing with hundreds of billions of dollars spent each year in tens of millions of competitive acquisitions. We are also dealing with a tremendous variety of acquisitions, from the purchase of simple shelf products (like office supplies) or services (like cleaning or door keeping), to the purchase of complex products and services (like I.T. systems, military projects or infrastructure works), at times possessing huge economic value (like mega construction projects or big weapon transactions).

In some cases, the criterion for winning the competition is price alone. This procedure is usually called "Invitation for Bids" (IFB) (FAR § 14.101, § 14.408-1(a)). In other cases, especially when complex or big transactions are at stake, choosing the preferred supplier will not be based on price alone but on other evaluation criteria as well. In that case, the invitation records will quote a variety of evaluation criteria (where price is only one of them), and the winning bidder will be the one whose bid optimally meets the various criteria and receives the highest overall score. Of course, in such cases the winner will not necessarily be the bidder who submitted the lowest bid, but rather the one who submitted the best offer as a whole. This procedure is usually termed "Request for Proposals" (RFP) (FAR § 15.203(a)(4), § 15.304(a)), and it is generally used for more

complicated or larger transactions. It is also utilized at times in the procedure known as "Request for Quotations" (RFQ) (FAR § 13.101-1(a)(2)), even though this procedure is reserved as a rule for acquisitions that do not exceed 6.5 million dollars (FAR § 13.000).¹

For example, in a RFP for the acquisition of a technologically advanced product such as an I.T. system, the winner is the bidder that gets the highest score according to the qualitative, technical and financial evaluation criteria determined in the RFP. The evaluation criteria can relate to the product being offered (like computer memory, speed, graphic display, reliability etc.), as well as to the bidder's characteristics and skills (like its economic strength, technical skills, past performance etc.).

In general, competitive procurement procedures are not conducted by governments on a voluntary basis, but rather are mandated by law. Thus, the U.S. Code states that, with certain limited exceptions, "an executive agency in conducting a procurement for property or services - (A) shall obtain full and open competition through the use of competitive procedures..." (41 USC § 253(a)(1)(A). See also 10 USC § 2304(a)(1)(A); FAR § 6.101(a)). We all expect, and the law itself dictates, that the bids evaluator, called a "Contracting Officer" (CO)² (48 CFR 1.602-2; FAR § 2.101), will make her decision as to the best proposal on a rational, fair and equal basis (FAR § 1.102(b)(3)-(4); § 1.102-2(c); Dekel 2008, pp. 247-249). We also expect that the CO "...shall evaluate competitive proposals and then assess their relative qualities solely on the factors and subfactors specified in the solicitation." (FAR § 15.305(a). See also FAR § 13.106-2(a)(2)). Deviation from these expectations constitutes an infringement of the CB rules, and a violation both of the law and of the basic objectives of the public procurement process.

¹ From now on we will use the phrase Competitive Bidding (CB) to describe any competitive procurement method based on evaluation criteria besides price, mainly Requests for Proposals (RFP) and Requests for Quotations (RFQ).

² By "Contracting Officer (CO)" we mean any official who deals with the review and evaluation of bids or proposals, including Contracting Officer Representatives (COR), Contracting Officer Technical Representatives (COTR), Technical Evaluation Panel (TEP), etc. See FAR § 2.101.

In the current research, the first to examine government officials in a controlled experiment, we show that in reality those expectations are not met, due to systematic bias in the bids' evaluation process. We demonstrate that when a CO is exposed to the bids' prices while comparing the qualitative components of competing bids, she tends to under value the qualitative differences between the bids – a bias which significantly improves the lowest bid's chances of winning the CB and most likely distorts the ultimate outcome of the CB. We demonstrate this through three experiments conducted with Israeli government officials, involved regularly in these kinds of decisions. We term this bias the Lower-Bid Bias. However, we also show that this bias can be easily neutralized by conducting a two-stage CB, in which the bid price is submitted in a separate envelope that is opened only at the end of the bid examination process, when the only decision left is the choice of the winning bidder.³ We therefore suggest debiasing through law (Jolls and Sunstein 2006) – setting a rule requiring any public entity conducting a competitive acquisition procedure involving the evaluation of qualitative elements to utilize a two-stage CB.

The second section of the article presents theoretical background regarding the psychological mechanisms that create the lower-bid bias. The third section presents the experimental evidence for the above propositions - a survey and two experiments, conducted among frequent bidders and government employees involved in government procurement. First, we show that both those conducting the CB's and those that frequently participate as bidders share the view that exposure to the bids' prices can bias the bid evaluator's judgment in favor of the lower bid. Second, we present the results of two different controlled experiments among Israeli government procurement professionals, that exposing the bid evaluator to the bids' prices gives preference to the lower bidder. We demonstrate this by showing that shifting from comparison of the qualitative parts of the bids without

³ Here a distinction must be drawn between "Two Stage Competitive Bidding" and "Two Step Sealed Bidding". The latter refers to a bidding process in which the bids do not include any proposed price. Only after the bids are reviewed, the bidders whose bids were found to be suitable are invited to submit their price proposals (for more details see chapter 7 below).

knowing their prices (two-stage CB) to their comparison together with the prices (one-stage CB) leads to decrease in the difference between the bids' qualitative scores. This gives an advantage to the lower bidder and significantly improves her chances of winning the CB. The fourth and the fifth sections explain why this bias is undesirable and present our normative suggestion for neutralizing the lower bid bias: the adoption of a two-stage CB as the rule for any competitive procurement procedure based on evaluation criteria – a suggestion that its effectiveness was also proved by our experiments. The fifth section also analyzes various arguments that can be raised against the suggested mechanism. The sixth section summarizes the findings and recommendations presented in the article and briefly discusses some further applications and future research.

2. COGNITIVE BIASES THAT CAN CREATE THE LOWER BID BIAS – A SURVEY OF THE LITERATURE

From a psychological perspective there seem to be several reasons why comparing the qualitative parts of competing bids jointly with their prices is likely to create the lower bid bias, whereas comparing the qualitative parts separately is not:

First, basic research in decision-making suggests that people are highly sensitive to the context in which decisions are made (Ariely and Levav 2000; Huber, Payne and Puto 1982; Nowlis, Kahn and Dhar 2002; Shafir 1993; Simonson and Tversky 1992). In particular, substantial evidence suggests that the evaluation procedure plays an important role in determining people's preferences. For example, when people evaluate options separately, they have different preferences than when they evaluate the same options jointly (Bazerman, Loewenstein and White 1992; Nowlis and Simonson 1997; Kahneman et al 1993; Hsee 1996; Bazerman, Tenbrunsel and Wade-Benzoni 1998;). There are many reasons why joint evaluation (JE) invokes different preferences than separate evaluation (SE). For instance, attributes that are hard-to-evaluate in one context become easy-to-evaluate in the other (Hsee, 1996; 2010). In our research, we propose that when evaluators compare bids' qualitative components without knowing their prices (SE) the results are different than when

they compare them knowing their prices. (JE). This is primarily because price is a much less ambiguous attribute – with a much clearer practical significance – than the bids' qualitative components (like experience, seniority, financial turnover, past performance etc.) (Nowlis and Simonson 1997). Therefore, comparing competing bids in one stage (quality and price together) leads the evaluator to focus on the difference between prices and to under-weigh differences in quality. The actual consequence of this tendency is reduction in the gap between the scores awarded to the quality components of the bids and hence grants the lower bid an unjust advantage.

Another reason for the lower bid bias may be the well known **confirmation bias**, according to which people tend to give greater weight to information, evidence or arguments that support the result that they wish to reach in any event; and conversely to give insufficient weight to information or evidence that negates or weakens that result - sometimes to the point of completely discounting such evidence (see, for example, Kuhn 1989, p. 677; see Nickerson 1998 for a comprehensive review of the literature on the confirmation bias). This phenomenon exists not only in situations in which the party making the decision has an interest in reaching the particular result (a motivated bias), but also in situations in which the person does not have an interest in the particular result, but has already formulated a position regarding the matter (unmotivated bias) (Ross, Lepper, and Hubbard 1975). Regarding the subject of this paper, we argue that in many cases, the bid evaluator will – at a preliminary stage of the bid examination process - identify the lowest bid as the favored one and therefore as the one that should win. This desire is then translated, consciously or subconsciously, into a preference for that bid, through the granting of excess points to its other components.

The last phenomenon that can be relevant is the **halo effect**, according to which decision-makers tend to focus on the most prominent characteristic of the subject that they are evaluating (whether a person, an object or a bid that has been submitted in a CB), and their impression of this characteristic affects both their overall evaluation of the subject and their view of its other characteristics. The first researcher to notice this effect was

Thorndike (1920), who showed that people tend to attribute success, happiness and higher social status to people with attractive external appearances. The phenomenon was later found to exist with regard to other subjects of evaluation, with prominent positive attributes affecting not only the way they are perceived overall, but also the attitude towards their individual characteristics. (See, for example, a demonstration of this phenomenon with respect to television programs at Backwith and Lehmann 1975). For our purposes, if we assume that low price is perceived by the bid evaluator as a prominent positive attribute, that perception will affect the evaluation of the entire bid, including all of its non-price components. Therefore, when the bid evaluator is required to assess the qualitative aspects of the lower bid, she will be biased in favor of overvaluing them, even though there is no affiliation between the bid's price and the bid's other attributes.

To sum up, these three phenomena derived from psychological and decision making research – the relationship between separate and joint evaluation, the confirmation bias and the halo effect – help to explain what we have termed the lower bid bias.

3. THE EXPERIMENTS AND THEIR RESULTS

We conducted a survey and two experiments in order to determine whether exposure to the bid price leads the bid evaluator to a biased evaluation. The research was conducted with Israeli government officials, who deal with government procurement in their every-day life. First, we conducted a survey to determine the views of parties involved in government procurement procedures and of bidders who regularly participate in competitive procurement procedures – specifically, to determine their views concerning the effect of exposure to price on the bid evaluation process and on the outcome of the CB. Next, we conducted two within-subjects experiments to examine the effect of exposure to price on the bid evaluator's comparison of the qualitative components of the competing bids. In the first experiment, participants were asked to compare two bids based on eight evaluation criteria, while in the second experiment there were only five criteria. The participants in all these studies were

parties who are involved in the government procurement process. Note that the legal regime in Israel concerning competitive procurement in general, and bid evaluation and comparison in particular, is much the same as in the U.S.

3.1. *First study – a survey of government officials and frequent bidders views*

In order to examine the thesis that exposure to bid price impacts the process of evaluating bids, we conducted a survey among two groups: (1) 91 employees of various Israeli government entities, whose jobs entail involvement in procurement procedures, either because they are members of contracting committees (the analogue to the US Contracting Officer) or because they work with these committees (The analogue to Contracting Officer Representatives and Technical Evaluation Panels); and (2) 96 employees of Israeli companies that frequently participate as bidders in government CB's. The question reported here formed part of a 20 question survey measuring general views regarding CB's and contracting committees. Here we report the item (question 17) that relate specifically to the issue at hand. The survey was conducted during professional training courses on the subject of government procurement that took place in Israel during the years 2009 – 2011.

Participants were asked to indicate their positions regarding the following sentence, on a 5 point Likert scale ranging from 1 (strong disagreement) to 5 (strong agreement):

“Contracting committee members should not be exposed to the bids' prices until after the bid evaluation process is completed, so that the knowledge of the bids' prices does not affect their judgment.”

Most participants believed that the financial offers should be hidden from the contracting committee members until after the comparison of the bids' qualitative part, in order to prevent a bias ($M = 3.71$, $S.D. = 1.33$). However, concern regarding exposure to the bid price was stronger among bidders than among "public officials". Thus, the frequent bidders expressed stronger support for concealing the bid

price from bids' evaluators than did the public officials ($M = 3.93$, $S.D. = 1.25$ vs. $M = 3.49$, $S.D. = 1.37$, $t(176) = 2.22$, $p < 0.05$, respectively). The findings of the survey are summarized at Table A.1.

3.2. Second study (Experiment 2a) – the effect of exposure to bid price on the comparison process

The survey results served as the background for the next stage of our study. This consisted of an experiment designed to examine the question of whether the bid evaluator's exposure to price would influence her comparison of the other, non-price aspects of the bids – a comparison which, from a purely rational perspective, should be completely unaffected by the bid price.

3.2.1. Method

This was a within-subjects experiment, conducted among 36 Israeli government officials who serve as members of contracting committees or who work in the government procurement field. The experiment was conducted during a professional training program that took place in Israel during 2011. Participants were presented with a case involving a CB conducted by a municipality for the school transportation services, in which two bids had been submitted. Participants were given a table detailing eight quality criteria to be considered in choosing the CB winner (geographical location, references, the number of buses available to the bidder, the model of the buses used by the bidder, holding of ISO certification, the bidding company's years of operation, and the number of training hours undergone by the company drivers). The table also presented the maximum score that could be received for each one of these criteria, and the information provided by each of the two bidders regarding each one of the criteria. Participants were asked to score each bid for all of the eight evaluation criteria, with the maximum possible score for the quality components being 400 points out of a maximum possible overall score of 1,000 points. The remaining 600 points were to be allotted to the price component.

The case was presented to the participants on two different occasions, four weeks apart. The first time, the material was presented to the participants as a two-stage CB, and they were asked to assess the quality criteria without having been informed of the proposed bid prices. Four weeks later, the same participants were presented with new material, having been told that an error had occurred the first time around, and that they were therefore required to relate to the new information. The second information packet was completely identical to the one that had been presented four weeks earlier, except that this time, the information included the proposed bid prices, along with the points that each bid had received for its price component (meaning that the second case involved a one-stage CB). Additionally, in order to prevent the participants' memories of their responses during the first round from affecting their responses in the second round, the order of presentation of the quality components was changed on a random basis. In order to accurately determine the impact of exposure to the proposed price on the same participants, each participant was asked to provide identification on the form completed at each stage. (The experiment form is attached in Appendix B). After completing the form, the participants were asked to respond to a survey examining their views concerning the impact of knowledge of the bid prices on their own evaluations, on those of their colleagues, and on members of contracting committees in general.

3.2.2. Results

Assessment of the bids in the two-stage CB: As can be seen in the first column in Table 1 below, when the participants assessed the quality components of the two bids without being aware of the proposed prices, the mean evaluation of the qualitatively superior bid was higher than that of the qualitatively inferior bid ($M = 357.86$, $S.D. = 30.04$, vs. $M = 273.61$, $S.D. = 43.00$, respectively). This result shows a difference of 84.25 points in favor of the more expensive and the qualitatively superior bid, before the weighing of the bid price, and a difference of 34.25 points, after the weighing of the bid price (which gave the lower bid a 50 points advantage).

All 36 participants rated the more expensive and qualitatively superior bid higher than the lower and qualitatively inferior bid. Nevertheless, for 6 of the participants, the difference in the scores given to the two bids was less than 50 points. Thus, after the price component was factored in, the result was that 6 out of 36 participants who had evaluated the bids (16.67%) had chosen the lower and qualitatively inferior bid as the winner, despite the differences in quality between the two bids.

Assessment of the bids in the one-stage CB: As the second column in Table 1 below indicates, when the participants assessed the bids' quality components while being aware of their prices, the gap between the bids was reduced significantly. Thus, the mean evaluation of the more expensive and qualitatively superior bid was 367.08 (S.D = 22.32) whereas the mean evaluation of the quality components of the lower and qualitatively inferior bid was 297.42 (S.D. = 36.08). This result shows a difference of 69.66 points in favor of the more expensive and qualitatively superior bid before the weighing of the bid price, and a difference of only 19.66 points after the factoring in of the bid price (which again gave the lower bid a 50 point advantage). At this stage, 13 of the 36 participants (36.11%) chose the lower and qualitatively inferior bid as the winner of the CB.

Thus, the experiment indicated that the bid evaluators' exposure to the bid prices had led to: (1) a significant reduction of the difference between the total mean scores awarded to the two bids from a gap of 34.25 points to a gap of only 19.66 points – a decrease of about 40%; and (2) an impressive increase in the number of cases in which the lower bid had won the CB, from 6 cases to 13, out of 36.

Table 1. Summary of Experiment 2a results

	Two-stage CB (36 participants)	One-stage CB (36 participants)	Change as a result from the transition to a one-stage CB
Mean scoring of quality components of the lower bid (out of a possible 400 points)	273.61 (43.00)	297.42 (36.08)	An additional 23.81 points for the lower bid

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Mean scoring of quality components of the higher bid (out of a possible 400 points)	357.86 (30.04)	367.08 (22.32)	An additional 9.22 points for the higher bid
Difference in scoring (before weighting of bid price)	84.25 points in favor of the higher bid	69.66 points in favor of the higher bid	Difference in scoring reduced by 14.59 points
Final difference in scoring, after weighting of bid price (advantage of 50 points to the lower bid)	34.25 points in favor of the higher bid	19.66 points in favor of the higher bid	Final difference in scoring reduced by 42.59%
Number of participants (out of 36) choosing the lower bid as the winner	6/36 (16.67%)	13/36 (36.11%)	Chances for the lower bid to win the CB increased by 116%

The hypothesis of the study had been that exposure to price would cause a preference to be given to the lower bid, by reducing the gap between the bids' qualitative scores. In order to examine the hypothesis, we conducted a repeated measures analysis of variance (Repeated Measures ANOVA) of the difference between the two-stage CB and the one-stage CB in terms of the average score given to the quality components of each bid by each participant. The analysis found a main effect for CB type ($F(1, 35) = 11.19, p < 0.01, \text{partial } \eta^2 = 0.242$). In other words, knowledge of the price led to a change in the points given to the quality components for the two bids. Most importantly, in accordance with the research hypothesis, we found a clear interaction between the CB type (one-stage versus two-stage) and an increase in the points awarded to the quality components of the bids ($F(1, 35) = 5.909, p < 0.05, \text{partial } \eta^2 = 0.144$). In other words, the transition from a two-stage CB to a one-stage CB inflated the valuation of the lower bid significantly more than the expensive bid, reducing the gap between them and giving the lower bid a clear advantage.

Completion of the questionnaire at the end of the experiment: After the participants finished their evaluations of the bids in the one-stage CB (the second part of the experiment), they were asked to complete a questionnaire and to indicate their views, on a Likert scale ranging

from 1 (strong disagreement) to 5 (strong agreement), regarding the following questions:

1. Do you believe that the knowledge of the bid price affected your assessment of the bids?
2. Do you believe that the knowledge of the bid price affected the other bid evaluators?
3. Do you believe that in general, a CB committee will be affected by knowledge of the bid price when assessing the bids?
4. As a bidder in a CB, would you prefer that your bid be assessed by an evaluator who is aware of the bid price, or would you prefer that the prices remain undisclosed and that they are revealed only at the end of the process?

The participants believed that their own exposure to the price had a relatively minimal effect on their own evaluation ($M = 2.31$, $S.D. = 1.37$), which contrasted with the actual experiment results. The participants also believed that the exposure to the bid price had a much greater impact on the other participants, and on bid evaluators in general ($M = 3.31$, $S.D. = 0.93$, and $M = 3.80$, $S.D. = 0.99$, respectively). This inconsistency is not surprising given the "bias blind spot" – people's tendency to treat themselves as much less vulnerable to cognitive biases than the average person (Pronin and Kugler 2007) and as much less vulnerable to biases than they really are.

Furthermore, participants also believed that bidders in general would prefer to participate in a two-stage CB rather than in a one-stage CB ($M = 3.71$, $S.D. = 1.44$).

The survey findings lead to two conclusions: First, bid evaluators are aware that exposure to bid price is likely to bias their judgment, but are nevertheless unable to neutralize that bias. Second, they believe that a person who is actually involved in the evaluation process (such as members of contracting committees or CO's) will, as a general rule, be subject to this kind of bias. The significance of this is that the one-stage CB was perceived by the participants as generating a cognitive bias, while the two-stage CB was perceived as neutralizing this bias.

3.3. Experiment 2b – The effect of exposure to bid price on the comparison process – shorter version

In the second experiment we tested the generalizability of the findings of the previous experiment.

3.3.1. Method

Experiment 2b employed the same design as Experiment 2a, with a few changes: The bids included just five evaluation criteria, rather than eight. In addition, since the experiment was conducted during a shorter professional training course the participants - government employees - rated the bids over a two week period (rather than four). Also, participants were not asked to fill out a survey at the end of the experiment.

3.3.2. Results

Assessment of the bids in the two-stage CB: In keeping with the results of experiment 2a, and as can be seen in the first column in Table 2 below, when participants assessed the quality criteria of the two bids without being aware of the proposed prices, the mean evaluation of the qualitatively superior bid was higher than that of the qualitatively inferior bid ($M = 370.93$, $S.D. = 21.99$, vs. $M = 283.57$, $S.D. = 34.41$, respectively). This result shows a difference of 87.36 points in favor of the more expensive and qualitatively superior bid, before the weighing of the bid price, and a difference of 37.36 points, after the weighing of the bid price (which gave the lower bid a 50 points advantage). All 29 participants rated the more expensive and qualitatively superior bid higher than the lower and qualitatively inferior bid. Nevertheless, for five participants, the difference in scores was less than 50 points. Thus, after the price component was factored in, the result was that 5 out of 29 participants (17.24%) had chosen the lower and qualitatively inferior bid as the winner, despite the differences in quality between the two bids.

Assessment of the bids in the one-stage CB: As the second column in Table 2 below indicates, when participants assessed the quality criteria while being aware of the bid prices, the gap between the bids' scores was reduced. The mean evaluation of the more expensive and

qualitatively superior bid was 371.38 (S.D = 25.27), whereas the mean evaluation of the quality components of the lower and qualitatively inferior bid was 295.52 (S.D. = 47.62). This result shows a difference of 75.86 points in favor of the more expensive and qualitatively superior bid before the weighing of the bid price, and a difference of only 25.86 points after factoring in the bid price (which again gave the lower bid a 50 point advantage). At this stage, 10 of the 29 participants (34.48%) chose the lower and qualitatively inferior bid as the winner of the CB.

Thus, the experiment indicated that the bid evaluators' exposure to the bids' prices had led to: (1) a reduction of the difference between the total mean scores awarded to the two bids from a gap of 37.36 points to a gap of only 25.86 points – a decrease of about one third; and (2) an increase in the number of cases in which the lower bid had won the CB, from 5 cases to 10, out of 29.

Table 2. Summary of Experiment 2b results

	Two-stage CB (29 participants)	One-stage CB (29 participants)	Change as a result from the transition to a one-stage CB
Mean scoring of quality components of the lower bid (out of a possible 400 points)	283.57 (34.41)	295.52 (47.62)	An additional 11.95 points for the lower bid
Mean scoring of quality components of the higher bid (out of a possible 400 points)	370.93 (21.99)	371.38 (25.27)	An additional 0.45 points for the higher bid
Difference in scoring (before weighting of bid price)	87.36 points in favor of the higher bid	75.86 points in favor of the higher bid	Difference in scoring reduced by 11.50 points
Final difference in scoring, after weighting of bid price (advantage of 50 points to the lower bid)	37.36 points in favor of the higher bid	25.86 points in favor of the higher bid	Final difference in scoring reduced by 30.78%
Number of participants (out of 29) choosing the lower bid as the winner	5/29 (17.24%)	10/29 (34.48%)	Chances for the lower bid to win the CB increased by 100%

The hypothesis of the study had been that exposure to price would decrease the gap between the qualitative parts of the competing bids in favor of the lower bid. As in Experiment 2a, in order to examine the hypothesis, we conducted a repeated measures analysis of variance (Repeated Measures ANOVA) of the difference between the two-stage CB and the one-stage CB in terms of the average score given to the quality components of each bid by each participant. The analysis found a non significant main effect for CB type ($F(1, 29) = 11.19$, $p < 0.01$, partial $\eta^2 = 0.043$). In other words, the procedure did not affect the scoring of the bids. Here again, in accordance with the research hypothesis, we found a clear interaction between the CB type (one-stage versus two-stage) and an increase in the points awarded to the quality criteria of the bids ($F(1,28) = 4.782$, $p < 0.05$, partial $\eta^2 = 0.146$). In other words, the transition from a two-stage CB to a one-stage CB inflated the valuation of the lower bid's qualitative part significantly more than that of the expensive bid and thus gave the lower bid a clear advantage.

4.3. Discussion

Taken all together, the experiments described above give rise to the following conclusions: First, parties who take part in CB's, whether government officials who conduct CB's or parties in the private sector who participate in CB's as bidders, share the opinion that bid evaluators should not be aware of the bids' prices, since they believe that such awareness gives an advantage to the lower bidder. Second, this belief is clearly supported by the results of our experiments. This means that shifting from comparison of the qualitative parts of the competing bids without knowing their prices (two-stage CB) to their comparison together with the prices (one-stage CB) leads to decrease in the difference between the bids' qualitative scores. This phenomenon clearly gives preference to the lower bidder – a preference which is a consequence of the context in which the comparison takes place, rather than of objective values, and which therefore justifies an effort to neutralize it.

Furthermore, it may be reasonably assumed that this bias has a greater impact in reality than in the experimental setting. This is due to the degree to which actual CO's are motivated to reach what they identify as a desired bargain (Kunda 1990) and to the much greater attention that real CO's pay to CB results. Unlike participants in an experiment, who are indifferent to its results, CO's, who conduct real-world CB's, are strongly motivated to prefer the bid that they perceive to be more attractive. If that bid is indeed the lowest, this motivation may amplify the bias demonstrated in the experiments (see, Lord, Ross and Lepper 1977; Kunda 1987; Edwards and Smith 1996).

The experiments thus reach two conclusions that are actually flip sides of the same coin: First, that exposure to price does lead to lower bid bias; and second, that non-disclosure of the price can neutralize that bias. From a legal perspective, two questions remain to be asked: First, is the lower bid bias in fact undesirable? After all, the purpose of a CB is to select the best bid. Does the lower bid bias make it harder to achieve that goal? Second, if this bias is indeed undesirable, can it be neutralized by a legal rule?

5. IS THE LOWER BID BIAS UNDESIRABLE?

We can point to four different reasons why the lower bid bias is undesirable and why any legal regime should be expected to search for a legal mechanism that can neutralize it.

First, the results of the experiment show that when the bid evaluator is exposed to the lowest bid's price, she is more likely to classify it as better, in its entirety, than the other bids, even if in reality it is not. In other words, the lowest bid price casts the entire bid in a better light, even when this is not justified in reality. Consequently, the evaluator will perceive non-price components of the bid as being better than they actually are, and the bid in its entirety is awarded points that it does not deserve. This can lead to an undesired outcome.

Second, and as a related matter, it can be assumed that the CB administrator had established the proper weight to be accorded to the price component in relation to the other evaluation criteria. A bias which causes the bid evaluator to give either excessive or

insufficient points to various non-price criteria, because of the attractiveness or non-attractiveness of the bid price, constitutes a de facto change of the relative importance given to the price criterion. This result is also not a desirable one and very likely will not lead to an efficient outcome. The argument that this distortion could be eliminated by adding additional weight to the qualitative evaluation criteria, at the expense of the price criterion, is not convincing. It is much easier, more accurate and less costly to neutralize the relevant bias directly. In addition, it is impossible to estimate the extent of the bias in advance. Third, when bid evaluators habitually deviate from the CB rules, there is a real danger that the ultimate result will be a reduction in the public's faith in the CB mechanism as a reliable process, and a situation in which serious parties are deterred from participating in competitive procurement processes. A situation in which the rules of a CB are in fact only a preferred frame of reference rather than an absolute set of rules that are consistently and uniformly applied to all participants will, in the long run, harm the efficacy of the procurement process as a whole.

Finally, a deviation from the CB's evaluation criteria infringes upon the legitimate expectations of the competing bidders that the predetermined criteria will in fact be binding, and applied as such. A deviation from the CB's rules is generally not perceived by losing bidders as having any legitimacy, and this provides these bidders with an incentive to appeal to the courts to intervene in the ultimate decision. This result is inefficient, as it increases the burden placed on courts, increases the costs borne by the government and ultimately by the bidders, and in many cases leads to delays in the performance of the contract.

The above indicates that, ultimately, a deviation from the CB rules is not desirable, even if the purpose is to award the contract to a bidder who appears to be the most attractive.

6. DEBIASING THROUGH LAW – A TWO-STAGE COMPETITIVE SEALED BIDDING

We suggest neutralizing the lower bid bias by adopting a rule requiring any competitive procurement based on evaluation criteria

other than price, mainly RFP's and RFQ's, to be conducted through a two-stage CB. According to the two-stage CB mechanism, the bid price is submitted together with the other parts of the bid, but in a separate envelope which is opened only after the process of reviewing the bids is completed. In addition, we propose that the price envelopes for bids that have been ruled out should not be opened, and should be returned to the bidders as they were, without anyone being made aware of their contents. We recommend further that the one-stage CB procedure may be used only under exceptional circumstances when it comes to RFP's. We see two main advantages in the suggested arrangement:

First, as the above experiments indicate, if the bid evaluator is not exposed to the bids' prices, concerns regarding the lower bid bias are eliminated. This means that the bid evaluator will evaluate the non-price components of the bid in a more rational and objective manner and with fewer external influences.

Second, the fact that a two-stage CB helps to neutralize the lower bid bias has an additional value, in that it strengthens the outward appearance of the CB as a mechanism in which the bid review and evaluation process is fair, objective, and based on relevant factors. The public in general, and potential bidders in particular, will know that the procurement process is more reliably fair (This was also confirmed in the survey described above, which indicated that bidders prefer a two-stage CB over a one-stage CB). Reliability is of great importance in this context, since it serves to reduce the suspicion that losing bidders naturally feel with respect to government authorities' decisions – a suspicion that is often shared by the general public and sometimes by the courts as well. A reduction of this suspicion increases the public's faith as well as that of potential bidders in the government procurement process, and thus encourages participation in it. The reinforcement of this faith in the government may also serve to chill the natural tendency of losing bidders to take legal measures against the CB result. Finally, the increased faith in the CO's exercise of judgment may reduce the likelihood that a court will intervene in her decisions, and may legitimize a conferral of greater discretion on the CO in this context. In other words, conducting two-stage CB's may increase the

willingness of potential bidders to participate in the process, diminish the tendency of losing bidders to challenge the results of the process in court, and make courts more willing to allow the CO's broader discretion regarding the decisions they make. Each of these developments can improve the overall efficiency of government procurement process.

One argument against the two-stage CB relates to its costs. The fact that the bids' prices are disclosed only after all the other stages of the CB have been completed means that the process will most likely take longer, and cost more, than a one-stage CB. The one-stage CB process is generally shorter, because as soon as the bid envelopes are opened, the bid evaluator is able to gain an immediate impression of the bids which are likely to win the contest and those which are not. This allows the bid evaluator to ignore the latter group of bids and to focus her attention solely on the bids that have a real chance of winning. In contrast, a two-stage CB process requires a review of all the bids that have been submitted, as their prices are disclosed only after the review process is complete. This means that the bid evaluator may need to devote precious time to the evaluation and assessment of bids which have no chance of actually winning the CB. This ultimately wasteful expenditure of time can be prevented if a one-stage CB is used.

While this argument is factually true, it does not diminish the strength of our proposal. Conducting a two-stage CB does take longer than conducting a one-stage CB, but neither the additional time (nor the additional cost) will be significant in comparison to the advantages involved in the two-stage CB.

Another possible argument against the two-stage CB is that it cannot neutralize all possible biases, because other, non-price aspects of the various bids can still affect the bid evaluator's exercise of judgment – matters such as the identity of the bidder or the bidder's other characteristics. Thus for example, the bid evaluator may prefer a bidder who has a strong reputation in the field over one who does not, and the two-stage CB will not prevent this. This is indeed a valid argument, as the two-stage CB does not serve as a panacea for any cognitive bias which may distort the bid evaluator's judgment. Nevertheless, as has also been noted, the two-stage CB does

neutralize a bias which is of key importance in the decision-making process in most CB's – the bias in favor of bids with a lower price. To the extent that the two-stage CB does succeed in this regard, and it would seem that it does, that success should be sufficient to justify its adoption as the rule for the conduct of any competitive procurement process that includes a variety of evaluation criteria.

7. SUMMARY, CONCLUSIONS AND FURTHER APPLICATIONS

In the current research we have demonstrated that exposing bid evaluators to bid prices biases the entire comparison process. We have also introduced an effective way to remedy this bias through the conduct of a two-stage CB.

A review of the legislation that regulates government procurement indicates that the two-stage CB process is almost never mentioned, and is never mandated. Thus, the Federal Acquisition Regulations doesn't even mention this procedure. The closest process that is mentioned, called a "Two-Step Sealed Bidding" (FAR § 14.5), relates to voluntary procedure in which the bids submitted in the first phase include merely technical aspects. Only in the second phase of the CB, which begins after the technical bids are reviewed, are the bidders who passed the first stage invited to submit their price offers. This process is uncommon and is reserved for cases involving complex technical issues. The aim of this mechanism is to allow the government to formulate its exact requirements during the acquisition process. Our suggestion is very different, both in terms of its method and its mandatory nature. A review of state legislation also indicates that there are no mentions of two-stage CB's, except in Virginia where it is called "Combined Two Step Sealed Bidding", a process the government may use on a voluntary basis.⁴

In light of the lower bid bias to which CO's are subject – a bias which has been proven in the experiments described above – and in light of the fact that this bias can be neutralized simply and efficiently, we suggest a normative adjustment that reflects this insight. This can be done through the establishment of the two-stage CB as the rule for

⁴ See <http://www.eva.virginia.gov/library/files/APSPM/Chapter6.pdf>.

any competitive procurement processes based on evaluation criteria other than price alone.

This is the time to briefly point out a number of potential further applications of our research. The phenomenon of a distorting effect that may occur with joint evaluation or comparison – an effect that can be eliminated by shifting to separate evaluation or comparison – can be found in other areas of law and decision making. We will illustrate this in a nutshell with reference to three well-known examples:

The first example regards the impact of exposing juries to a defendant's prior criminal record on the constitutional right to a fair trial. There is significant debate regarding the legitimacy of the use of defendant's prior convictions for impeachment (Blume 2008, p. 482-83). Empirical research conducted in recent years demonstrates that exposing the jury to the defendant's prior criminal record before they reach their verdict does indeed affect their discretion and can even cause false convictions (Eisenberg and Hans 2009; Blume 2008). Our findings regarding the impact of additional information on the evaluation process of decision makers can lend strong support to that empirical evidence and to the recommendation that such information be withheld.

Another legal application for our findings can be found in the Americans with Disability Act (ADA) (42 U.S.C. § 12101). Section 102(d)(2)(A) of the ADA states that with few exceptions "a covered entity shall not conduct a medical examination or make inquiries of a job applicant as to whether such applicant is an individual with a disability or as to the nature or severity of such disability." Here again, one probable explanation for this rule is the effort to eliminate implicit bias against people with disabilities, by hiding certain facts from decision makers during the applicant evaluation process.

A final example relates to decisions concerning grant applications. In order to optimally allocate a pre-determined budget, grant decisions must take into account various considerations regarding quality and cost. Just as with competitive bidding procedures, awareness of the amount requested in a given application may unjustly affect the way it is evaluated overall. Our findings on the impact of exposure to price in

the CB context may justify the adoption of a similar rule or guideline in the realm of grant evaluation, requiring that proposals be evaluated first on their merits, without the decision maker knowing the requested sum.

These three examples share three common attributes with the case of CB's. First, all of them deal with an evaluation or comparison process. Second, in each case there is a piece of information that can bias the decision maker's discretion. Third, in each case the bias can be neutralized by withholding the information from the decision maker during the evaluation or comparison process. In such cases, and in other similar kinds of cases, a rule prohibiting the exposure of the decision maker to the information that tends to induce bias – until a decision has been made - should be considered very seriously.

As for future research, we have already begun investigating CO's decision making concerning disqualification or acceptance of problematic bids. In other words, do CO's adopt a more lenient approach towards problematic bids when they are lowest in price, and if so – why? This question, however, is beyond the scope of the current research and merits its own investigation. We leave that for future research.

APPENDIXES

Appendix A.

Table A1. Survey results

Rate your agreement with the following sentence, from 1 (strongly disagree) to 5 (strongly agree).	Bidders	Public officials	Total
Contracting committee members should not be exposed to the bids' prices until after the bids evaluation process is completed, so that the knowledge of the bids' prices does not affect their judgment.	3.93 (1.25)	3.49 (1.37)	3.71 (1.33)

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Appendix B. Experiment 2a form

The municipality of Ramat-Gan conducted a Request for Proposals (RFP) for the transportation of the city’s schoolchildren during the academic year 2011-2012. A weight of 60% was given to the bid price and 40% was given to quality criteria. Two bids were submitted.

[1st version The bid prices were submitted in separate sealed envelopes, to be opened after the examination of the other parts of the bids (two stage sealed bidding).]

[2nd version “The Carrier Ltd.” submitted the lowest bid, at \$800,000 and received the full 600 points (out of 1,000) for the price criterion. The other bid, submitted by “The Transporter Ltd.”, for \$875,000, scored only 550 points for that criterion.]

As a member of the contracting committee you are asked to score the bids with respect to the other criteria:

Criterion	Max. points	"The Carrier"	Points	"The Trans."	Points
[2 nd version only: Price]	600	\$800,000	600	\$875,000	550
Years of operation	60	8 years		12 years	
Bus model	30	Mercedes "VIP" 2011		Mercedes "Dolphin" 2010	
Recommendations	70	2 good, 1 moderate		5 good	
No. of buses owned by the bidder	60	12 buses		20 buses	
Average experience of the drivers	70	12 years		20 years	
Training hours per	30	35 hours		20 hours	

THE LOWER BID BIAS

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driver					
ISO certification	50	Not certified, but is at the final stage of the process for obtaining certification		Has certification	
Distance from R.G.	30	Bnei-Brak (5 Km)		Ra'anana (15 Km)	
Total	1,000				

TableB1. Experiment 2a results: The mean score for the bids' components at each stage

Criterion ⁵	Max. points	"The Carrier"	Average points		"The Trans."	Average points	
			"The Carrier"			"The Trans."	
			2 stage CB	1 stage CB		2 stage CB	1 stage CB
<u>2nd version only:</u> Price	600	\$800,000	---	600	\$875,000	---	550
Years of operation	60	8 years	43.33 (12.31)	49.72 (8.53)	12 years	55.41 (9.81)	58.47 (4.28)
Bus model	30	Mercedes "VIP" 2011	28.56 (4.07)	29.31 (2.44)	Mercedes "Dolphin" 2010	24.39 (5.12)	25.72 (4.31)
Recommendations	70	2 good, 1 moderate	37.64 (12.15)	44.58 (11.29)	5 good	67.03 (6.00)	66.81 (7.85)
No. of buses owned by the bidder	60	12 buses	36.56 (10.90)	39.28 (9.24)	20 buses	54.25 (8.00)	56.25 (9.88)
Average experience of the drivers	70	12 years	49.58 (12.56)	56.94 (12.21)	20 years	67.03 (6.12)	68.19 (5.09)
Training hours	30	35 hours	28.50	28.42	20 hours	20.42	21.81

⁵ The order of the criteria was randomly changed between the two phases of the experiment, in order to prevent participants from remembering the answers they gave in the first stage of the experiment.

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per driver			(3.28)	(3.29)		(5.53)	(3.72)
ISO certification	50	Not certified, but is at the final stage of the process for receiving certification	21.94 (18.02)	20.69 (19.71)	Has certification	49.72 (1.67)	46.66 (10.95)
Distance from R.G.	30	Bnei-Brak (5 Km)	27.50 (3.68)	28.75 (3.85)	Ra'anana (15 Km)	19.61 (6.48)	23.17 (7.76)
Total (quality)	400		273.61 (43.00)	297.42 (36.08)		357.86 (30.04)	367.08 (22.32)
Total	1,000		873.61	897.42		907.86	917.08

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Appendix C. Experiment 2b form

[The preface is exactly the same as in Appendix B]

Criterion	Max. points	"The Carrier"	Points	"The Trans."	Points
[2 nd version only: Price]	600	\$800,000	600	\$875,000	550
Years of operation	75	8 years		12 years	
Recommendations	80	2 good, 1 moderate		5 good	
No. of buses owned by the bidder	70	12 buses		20 buses	
Average experience of the drivers	75	12 years		20 years	
Distance from R.G.	100	Bnei-Brak (5 Km)		Ra'anana (15 Km)	
Total	1,000				

TableC1. Experiment 2b results: The mean score for the bids' components at each stage

Criterion ⁶	Max. points	"The Carrier"	Average points		"The Trans."	Average points	
			"The Carrier"			"The Trans."	
			2 stage CB	1 stage CB		2 stage CB	1 stage CB
2 nd version only: Price	600	\$800,000	---	600	\$875,000	---	550
Recommendations	80	2 good, 1 moderate	42.96 (8.83)	47.65 (11.86)	5 good	78.79 (3.18)	78.97 (5.57)

⁶ The order of the criteria was randomly changed between the two phases of the experiment, in order to prevent participants from remembering the answers they gave in the first stage of the experiment.

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No. of buses owned by the bidder	70	12 buses	44.41 (11.63))	47.52 (10.33)	20 buses	66.89 (8.06))	69.14 (2.70))
Average experience of the drivers	75	12 years	49.95 (13.78)	53.73 (14.59)	21 years	72.59 (5.77))	72.97 (5.09))
Distance from R.G.	100	Bnei-Brak (5 Km)	91.72 (12.48)	90.86 (22.83)	Ra'anana (15 Km)	79.31 (16.73)	76.38 (21.99)
Years operation of	75	8 years	56.59 (9.68))	55.57 (9.68))	12 years	73.34 (3.30))	73.93 (2.45))
Total (quality)	400		283.5 7 (34.41)	295.5 2 (47.62)		370.9 3 (21.99)	371.3 8 (25.26)
Total	1,000		883.57	895.52		920.93	921.38

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