

Effect of price quoting on financial asset prices: an experimental analysis

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Stock options are usually sold in bundles of 100 units, and their price can be quoted either per unit or per bundle. In this article, the effect of different methods of quoting financial asset prices on the subjective value of a contract was examined experimentally. In particular, we examined differences in participants’ Willingness-To-Pay and Willingness-To-Accept for financial assets depending upon whether prices are quoted per unit or per bundle. We found that participants bid (ask) a higher price when prices are quoted per unit than when they are quoted per bundle. The results indicated that different quoting methods affect the bidding price for risky assets. These results can have important implications for trading on financial markets.

1. Introduction

The ‘framing effect’, which has been tested in many behavioural and experimental economics studies (Tversky and Kahneman, 1981; Kuhberger, 1998), is observed when a decision maker’s risk tolerance (as implied by his or her choices) is dependent upon how a set of options is described. In research studies on the framing effect, logically equivalent choice situations are described differently and the resulting preferences are studied.

The purpose of the current article is to experimentally examine the effect of different quoting methods of financial asset prices on the subjective value of a contract. For example, in the US stock and index options contracts, which are usually sold in bundles (mostly 100 units), prices are quoted per unit, whereas in Israel prices are quoted per bundle. To illustrate, on 14 February 2006, the quoted price for a call option on the S&P 500 with a strike price of 1270 points, to be realized in March 2006, was \$21. As this price is for

one unit, the price of a contract with 100 units is \$2100 (from the CBOE – Chicago Board Options Exchange). Alternatively, if the same asset were to be traded on the Israeli stock exchange, the theoretical price quoted for the bundle would be \$2100. However, based on the framing effect, we expect that the same asset price will be different in the US and in the Israeli stock exchange market, due to the different quoting methods in the two countries.

In this article, we experimentally examine participants’ Willingness-To-Pay (WTP) and Willingness-To-Accept (WTA) for one unit of financial assets when buying (or selling) a number of separate units versus their WTP (or WTA) for one unit when buying (or selling) a bundle of assets. The different quoting methods represent an example of the framing effect. An extension of the framing principle, known as mental accounting (Thaler, 1990, 1999), refers to the implicit methods people employ to code and evaluate financial outcomes. For example, using the mental accounting

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concept, Schade and Kunreuther (2001) compare the price someone is willing to pay for purchasing an object along with a warranty ('bundling condition'), should the item be defective with the case in which these items are sold separately ('unbundling condition'). They found that WTP for the same warranty differed significantly between the bundling and unbundling cases.

Another purpose of our study is to examine whether professionals (defined as 'experienced experts') are subject to the same behavioural biases as are less knowledgeable individuals. Studies have shown that professional investor experience and expertise is not sufficient to immunize one's judgement against biases, heuristics and decision anomalies when making choices for oneself (Kahneman and Tversky, 1979; Benartzi and Thaler, 1995; Shiller, 2001). Moreover, in the literature on the framing effect, there is some evidence that people with experience or expertise are not immune to framing effects (e.g. Roszkowski and Snelbecker, 1990; Loke and Tan, 1992). Therefore, it is interesting to examine the effect of different quoting methods on bidding patterns among professionals in comparison to those of less knowledgeable individuals.

The article is organized as follows. Section II presents the main hypothesis. Section III describes the experimental procedure. Section IV presents the results, and, finally, Section V concludes.

II. The Main Hypotheses

Hypothesis 1: Based on the framing effect and its concomitant behavioural effects, our hypothesis is that participants' bidding (asking) prices are influenced by different quoting methods. In particular, we expect that the price per unit will be higher when the price is quoted per unit than when it is quoted per bundle.

Hypothesis 2: We expect that professionals' bidding (asking) prices will be influenced by different quoting methods than those of nonprofessionals.

III. The Experiment

The experiment comprised two groups of participants: (a) 67 undergraduate students of economics at the Academic College of Emek Yezreel and (b) 24 professionals working as financial advisors at a large financial bank in Israel. In a Second-Price Auction (SPA), participants were asked to place a bid for buying (WTP) and selling (WTA) different lotteries.

The SPA is a common method for eliciting participant preference and risk attitude (Di Mauro and Maffioletti, 2004). In the instructions, participants were told that in the case of a buying (selling) auction, the participant with the *highest (lowest)* bidding (asking) price will win the auction but will pay (receive) the *second highest (lowest)* bidding (asking) price in the group participating in the auction.¹

For each auction, the participants received an initial balance. At the end of the experiment, participants were randomly divided into groups of five by a computer program, and SPA was applied to determine the winner and the price. One of the problems was selected randomly for each participant, and each was paid 20% of the final outcome for the selected problem. The average payment was 20 New Israeli Shekels (approximately equivalent to US\$4.50).

Participants were asked to indicate their WTP and WTA for the basic lottery, which we named Lottery A. This lottery gave 10 and 2 tokens with probabilities of 0.3 and 0.7, respectively. In addition, participants were also asked to bid for one unit of Lottery A in case they were asked to buy (sell) 5, 10 or 50 units of this lottery. While the lottery occurs only once, a participant who wins the auction will pay (or get) the price of one unit multiplied by the number of units.

Participants were also asked to bid prices for bundles of 5, 10 and 50 units of Lottery A. The assets are described in Table 1.

IV. Results

To test the main hypothesis, we calculated the average ratio of a bid for one unit when buying a number of

Table 1. Assets description

Assets	Probabilities		Units
	30%	70%	
Lottery A	10	2	1
Lottery A * 5	10	2	Bidding for 5
Lottery A * 10	10	2	Bidding for 10
Lottery A * 50	10	2	Bidding for 50
Lottery 5 * A	50	10	1 bundle of 5 units
Lottery 10 * A	100	20	1 bundle of 10 units
Lottery 50 * A	500	100	1 bundle of 50 units

¹ Participants answered one problem at a time and could not return to their previous answers while answering the current problem.

units at the same time to the implied bid for a unit when the price is quoted as a bundle (with the same number of units).

Tables 2 and 3 describe the average prices for one unit of Lottery A for the students and the professionals, respectively, for each of the two cases: (a) bidding for a number of units (price quoted per unit) and (b) bidding for a bundle (price quoted per bundle). The tables also show the *t*-test values for the hypothesis that the average ratio does not differ from 1.

Tables 2 and 3 show that for both groups of participants, the bidding price per unit (WTP and WTA) is higher when the price is quoted per unit than when it is quoted per bundle (in most of the cases, the average ratio between them is significantly higher than 1). Therefore, we corroborate our hypotheses (1) and (2) and conclude that quoting method can affect the subjective value of an asset for both professional and non-professional participants. This result is compatible with the results of Schade and Kunreuther (2001), who found that WTP for the same warranty differed significantly between bundling and unbundling conditions.

Table 2. Prices and rates – students

	Average price per unit		Average ratio	<i>t</i> -Test* (<i>p</i> -value)
No. of units	Price quoted per unit	Price quoted per bundle		
WTP				
5	4.82	5.00	1.15	1.6 (0.06)
10	5.56	5.19	1.20	2.4 (0.01)
50	4.33	3.74	1.24	2.73 (0.00)
WTA				
5	4.88	4.61	1.24	2.32 (0.01)
10	4.76	4.78	1.12	1.42 (0.08)
50	4.29	3.82	1.31	2.84 (0.00)

Note: **t*-Test for the null hypothesis that the ratio equals 1.

Table 3. Prices and rates – professionals

	Average price per unit		Average ratio	<i>t</i> -Test* (<i>p</i> -value)
No. of units	Price quoted per unit	Price quoted per bundle		
WTP				
5	5.60	4.37	1.40	2.23 (0.02)
10	4.96	3.69	1.70	2.00 (0.03)
50	3.68	3.34	1.29	1.93 (0.03)
WTA				
5	3.97	4.10	1.05	0.65 (0.26)
10	4.19	3.81	1.17	1.87 (0.04)
50	4.39	3.60	1.53	1.83 (0.04)

Note: **t*-Test for the null hypothesis that the ratio equals 1.

One possible explanation for our results is based on the assumption that participants focus on the mean and variance of an asset when buying (selling) a risky asset. It is possible that in the case of one unit out of *n* units, risk aversion is applied to each unit, as opposed to applying risk aversion to the entire portfolio in the case of a bundle. This means that in the case of one unit out of *n* units, participants take into consideration the risk applicable to one unit and not the risk of the entire bundle. In the case of a bundle, participants take into consideration the risk associated with the entire bundle.

An alternative explanation is based on the isolation effect (Kahneman and Tversky, 1979). According to this effect, in order to simplify the choice between alternatives, people often disregard the components shared by the alternatives and focus on the components that distinguish them. Again we assume that participants focus on the asset's mean and variance when buying (selling) a risky asset. It is possible that in order to simplify the pricing task, participants disregard the variance of the portfolio while taking into consideration only the unit variance and focus on the portfolio mean that distinguishes them.

Finally, our results confirm previous studies that people with experience or expertise are not immune to behavioural effects, such as the framing effect (Roszkowski and Snelbecker, 1990; Loke and Tan, 1992).

V. Conclusions

Participants bid (ask) a higher price when prices are quoted per unit than when they are quoted per bundle. These results indicating that different quoting methods affect the bidding price of risky assets can have important implications for trading on financial markets as well as for market microstructure.

The study's findings indicate that assets are more attractive for participants (both professionals and non-professionals) and that the market price may be higher when the quotation method is per unit. Therefore, on real-life markets it is possible that using the quoting per unit method will lead to a higher demand than on those markets using the quoting per bundle method.

Finally, these results are not limited to financial markets and can be applied to other markets where participants buy and sell a number of units of the same product.

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