J. Int. Financ. Markets Inst. Money 64 (2020) 101160

Contents lists available at ScienceDirect

Journal of International Financial Markets, Institutions & Money

journal homepage: www.elsevier.com/locate/intfin

Reservation prices in *shareholders' response to freeze-out tender offers* ☆

Assaf Hamdani [a], Beni Lauterbach [b], Yevgeny Mugerman [c,*]

[a] School of Law, Tel Aviv University, and ECGI, Israel
[b] Graduate School of Business, Bar Ilan University, and ECGI, Israel
[c] Graduate School of Business, Bar Ilan University, Israel

ARTICLE INFO

Article history:
Received 19 November 2018
Accepted 26 November 2019
Available online 27 November 2019

JEL classification:
G02
G31
G34

Keywords:
Freeze-out transactions
Reference points
Loss aversion

ABSTRACT

We employ a sample of 201 freeze-out tender offers (offers of controlling shareholders to buy all public shares) in Israel to examine how investors' decision (to accept or reject the offer) is influenced by alternative reference prices, some of which are commonly specified in freeze-out offers. Our findings reveal that average purchase price is the key reservation price – when freeze-out offer price exceeds our novel estimate of the minority shareholders' average purchase price of the shares, offer acceptance probability increases significantly. Thus, purchase price appears as a more fundamental behavioral anchor than its main competitor – the past 52-weeks high.

1. Introduction

In freeze-out transactions, controlling shareholders of publicly traded companies acquire the shares held by minority investors, thereby turning the firm into a privately held entity. Going private transactions can serve legitimate business purposes. For example, taking the company private facilitates synergies between the company and other companies held by the controlling shareholders, and/or saves the compliance costs associated with being a public company. Going private also enables companies to conceal from their competitors sensitive information about their business.

However, freeze-out offers may also be motivated by a less noble cause. Given that controlling shareholders have unfettered access to inside information about firm's value and expected performance, they may exploit this informational advantage and offer to buy all minority shares when market price is (deeply) discounted relative to the share's fair value (Bebchuk and Kahan, 2000). Clearly, minority shareholders face a tough decision: to sell their shares at the offer price (that regularly includes a nice premium over current market price) or to reject the offer because of a suspicion of possible exploitation.

☆ We are grateful to Yakov Amihud, Yaniv Grinstein, Eugene Kandel, Oded Palmon, Orly Sade, Yishay Yafeh, Eyal Winter, and the journal referees and responsible Editor (Chris Veld) for their constructive comments. We have benefitted from presentations at the 2nd Tel Aviv Behavioral Finance Conference, and seminars at Bar Ilan University, and the University of Vienna. We also thank Ori Kaz, and Tomer Yafeh for their outstanding research assistance. This project received partial financial support from the Ackerman Family Chair in Israeli Corporate Governance.

* Corresponding Author at: Bar-Ilan University Ramat Gan, 5290002 Israel.
E-mail addresses: ahamdani@tauex.tau.ac.il (A. Hamdani), beni.lauterbach@biu.ac.il (B. Lauterbach), yevgeny.mugerman@biu.ac.il (Y. Mugerman).

https://doi.org/10.1016/j.intfin.2019.101160
1042-4431/

Minority shareholders probably consider several firm and stock characteristics and their own expectations about the firm before deciding whether the offer premium relative to current market price is palatable. However, they may also use some behaviorally-based reference prices as a benchmark or reservation price for any offer. For example, a continuum of behavioral studies, starting with prospect theory (Kahneman and Tversky, 1979) and including recently the cognitive dissonance thesis (Kaustia, 2010; Chang et al., 2016; Fischbacher et al., 2017) all suggest that shareholders may use their share purchase price as a reference or even a reservation price. Some minority shareholders may be reluctant to tender their shares at a price below their purchase price. Such a loss aversion attitude is the common explanation for many observed phenomena, such as the disposition effect (the tendency of investors to exercise their gains and defer the exercise of their losses) – see Shefrin and Statman (1985). Is such a "disposition" effect attitude evident in the response to freeze-out offers as well?

The answer to the above question is not simple also because there exists a prominent competing behaviorally-based reference point. Baker et al. (2012) examine over 7000 merger and tender offers in the U.S. in 1994–2007. They find that the previous-year high (=peak) price of the stock affects both the premiums offered by the bidders and the success probability of mergers and acquisitions. The 52-weeks pre-offer high price is a price investors could get in the recent past. Investors may reject an offer at a price below the 52-weeks high just to avoid regret over their failure to sell at that high-price. In short, regret aversion suggests and Baker et al. (2012) confirm that when offer price exceeds the previous-year high, the probability of offer success increases.

The central goal of our study is to examine the relative merit of these two behaviorally-based reference or reservation prices (purchase price and last year's high price). It is possible that none, one, or both of them matters.

Our test environment is Israel, where freeze-out tender offers are much less regulated than in the U.S. and most other world economies. In the U.S. the board of directors has to render its opinion on the offer, and it normally relies on an expert fairness opinion. The process is also accompanied by considerable disclosure by the firm and bidder, and court appraisal is allowed. All these legal procedures may mitigate the impact of behavioral reference prices. In contrast, in Israel, controlling shareholders make their offers directly to the public, boards of directors don't intervene (don't even render any opinion on the offer terms), and controlling shareholders have very few disclosure requirements. Under such a relatively lax legal regime, investor behavioral reference prices are much more likely to have a significant impact on transaction outcomes.

The Israeli test-field has two further advantages. First, given the rather liberal regulation, offer rejection rate is much higher than 23% (the rejection rate reported in the U.S. by Restrepo and Subramanian, 2015). In our Israeli sample, 43% of the freeze-out tender offers fail. In such a setting, where almost half of the freeze-out offers are rejected, behavioral aspects might play a more central role. Second, under Israeli regulation, freeze-out tender offers specify also three other price reference points: stock price one day before the offer announcement, past 6-months average price and past 12-months low price.[1] It would be interesting to examine any effect of these additional reference prices as well.

We develop an estimate of minority-shareholders average purchase price, and find that among all reference prices examined only it has an impact on tender offer outcomes. Freeze-out offer acceptance rate increases when offer price exceeds our estimate of the average purchase price of minority shareholders. This finding suggests that: (1) loss aversion plays an important role in investor decisions, and (2) purchase price is a more fundamental behavioral anchor than the past 52-weeks' high price.

The paper is organized as follows. Section 2 describes the setting, legal environment and data. Section 3 presents and interprets our empirical results, and Section 4 concludes.

2. Background and data

2.1. Some background

In the 21st century many stock exchanges experienced a drop in the number of listed firms – see Fig. 2 in Doidge et al. (2017), who call the phenomenon "the listing gap". Doidge et al. (2017) also show that about half of the U.S. listing gap is due to delisting. Many small firms reached a conclusion that trading on the exchange is not worthwhile for them (Doidge et al., 2018) and delisted using various mechanisms.

The Tel Aviv Stock Exchange has also experienced a decline in the number of listed firms. The number of listed companies has decreased from 654 at the end of 1999 to 448 at the end of 2018. However, unlike the U.S. where mergers were the primary delisting mechanism, the main delisting mechanism in Israel was going private transactions. This is because the vast majority (80–90%) of publicly traded companies in Israel have controlling shareholders, and these controlling shareholders preferred to take their companies private via the simple and speedy freeze-out offer course. Many of these controlling shareholders listed their firms in the 1990s when listing was a "fad". Yet, over time, given the increasing public company regulation and their companies dull trading volume, they realized that trading on the exchange is an unnecessary burden and sought their way out. This affords us a relatively large sample of freeze-out tender offers.

Some technical details on freeze-out tender offers in Israel are in order. Israeli freeze-out offers do not require the bidding controlling shareholders to negotiate with the board or secure board approval. Controlling shareholders simply make an

[1] The regulator probably wishes to provide target shareholders a wider price perspective on stock price distribution and the relative location of the offer price.

offer directly to minority shareholders. And, if, at the end of the offering period, controlling shareholders own at least 95% of the company's shares, the controlling shareholders buy all remaining public shares at the offer price and delist the stock from the exchange.[2]

In essence, Israeli law relies on minority investors to make an informed decision on whether or not to tender their shares without external guidance and based on limited information. This setting generates a relatively clean behavioral environment with no "distractive" interference of the boards and/or the courts, and without any professionally recommended reference price (such as the "fair value" traditionally assessed in U.S. firms by experts hired by the board).

2.2. Sample and data

Almost all of our data are collected from the Tel Aviv Stock Exchange (TASE) web site. Announcements of freeze-out offers are found in Maya (the TASE site collecting all public firms' immediate news releases). In the 2000–2016 period we found 274 freeze-out tender offer announcements. We read these offers, and extracted the following information: offer date, offer price, the number of shares the bidder offers to buy, the controlling shareholder holdings in company shares before the offer (in percent), stock price one day before offer announcement, the average price during the previous six months, the last 12-month-low and high prices, and the revised offer price (if offer price was revised before offer decision date). In addition, from the company annual reports, also available on Maya, we collect firm's total assets, the book value of equity and liabilities. TASE is also the source of firm's industry classification, and all price history of our sample's stocks and the Yeter (small stock) index.

Data on institutional investor holdings are obtained from Praedicta (a private financial data vendor in Israel). This is the only data item collected from outside the TASE web site.

We exclude from our sample: (1) freeze-out offers for companies with zero trading volume during the 20 trading days (roughly one month) preceding the offer (43 cases); and (2) offers where the offer premium relative to market prices (on day −42, day −6, and day −1 preceding the offer date) are all negative (30 cases). These exclusions are designed to eliminate extreme cases where market price (hence calculated premiums) are unreliable, and cases of companies in distress (commanding consistent negative premia).

Our final sample comprises 201 freeze-out offers in 170 different firms. The industry distribution is as follows: merchandising – 31%, manufacturing – 22%, real estate – 21%, holding companies – 18%, and others – 8%.

2.3. Estimating average purchase price

A key contender for the pertinent reference price for minority shareholders is their share purchase price. A record of public investors purchase prices is unavailable, and we could not find in the literature any estimator of public's purchase price. Thus, we have to devise our own estimator of the purchase price of minority shareholders.

If we adopt the strict assumption that minority shareholders buy and hold their shares until the time of the freeze-out offer, a suitable proxy is the volume-weighted average price of the stock over enough past days to capture volume that is equal to the total number of shares owned by minority shareholders. This measure is denoted APP100. However, given that the average turnover time of the float (shares held by the public) among our sample shares is about 27 months, we realize that a fair proportion of minority shareholders probably sold their shares within that period. Hence, APP100 appears as a rather inaccurate measure of minority shareholders purchase price. Cumulating over longer periods is necessary.

We could not find any evidence on the typical holding period of Israeli investors. Thus, we chose to estimate the average purchase price of minority shareholders by the weighted-average stock price over the period required for a 200% turnover of the float. We denote this variable – APP200. As a robustness test we also examine the effect of a weighted average price computed over the period required for 150% turnover (APP150).

Last, as a precautionary measure, we omit APP200 observations in firms where the time needed for a 200% turnover of the float exceeds ten years. This excludes 23 offers by firms whose shares are extremely illiquid and for which APP200 might be a poor measure of minority shareholders' average purchase price.

3. Empirical results

3.1. Sample characteristics

Table 1 describes the sample. The first noteworthy attribute is the relatively large overall offer failure rate of 43%. Further, this failure rate climbs to 48% when we consider only the 170 first-time offers in our sample (i.e., omit 31 s and third offers in firms where the first freeze-out offer was rejected). When compared to existing international evidence, these failure rates appear relatively large. Restrepo and Subramanian (2015) report a failure rate of 23% in 2005–2012 in the U.S., while Bøhren and Krosvik (2013) find a failure rate of 11% in Norway in 1999–2011.

[2] By law, after controlling shareholders secure 95% of the shares, remaining (non-tendering) minority shareholders must sell their shares to the controlling shareholders at the offer price.

Table 1
Sample descriptive statistics.

	Overall sample	Successful offers	Failed offers
Freeze-out offers	(N = 201, 100%)	(N = 114, 57%)	(N = 87, 43%)
1st offer (N, %)	(170, 100%)	(89, 52%)	(81, 48%)
Repeated, 2nd offer (N, %)	(27, 100%)	(21, 78%)	(6, 22%)
Repeated, 3[d] offer (N, %)	(4, 100%)	(4, 100%)	(0, 0%)
Target firms			
Mean control group pre-offer holdings[a]	0.821	0.842	0.793
Median control group pre-offer holdings	0.853	0.865	0.832
Mean total assets (thousands of NIS)[b,c]	1,047,032	1,430,197	626,025
Median total assets (thousands of NIS)[c]	220,450	243,613	206,165
Median Amihud's illiquidity measure (%/million NIS)	6.19	6.72	5.89
Mean Tobin's Q	1.10	1.07	1.15
Median Tobin's Q	0.99	0.99	0.98
Mean ROA	0.011	0.025	−0.008
Median ROA	0.031	0.029	0.032
Mean leverage	0.666	0.651	0.685
Median leverage	0.651	0.649	0.674
Mean distance to success[d]	0.662	0.632	0.699
Median distance to success[d]	0.660	0.629	0.703

[a] The difference in mean control group holdings between successful and failed offers is statistically significant at the 1% level.
[b] The difference in mean total assets between successful and failed offers is statistically significant at the 10% level.
[c] The average exchange rate during the sample period was about 4 New Israeli Shekels (NIS) per U.S. Dollar.
[d] Distance to success is the fraction of minority shares needed to achieve the 95% ownership threshold, computed as [(0.95-X)/(1.00-X)], where X is the pre-offer share of firm's equity held by the control group. The difference in mean distance to success between successful and failed offers is statistically significant at the 1% level.

Table 1 also describes the sample firms (in Column 1), distinguishing between successful offers (Column 2) and failed offers (Column 3). The mean (median) pre-offer controlling shareholders' proportion in equity is 82% (85%). Abudy and Lauterbach (2015) report that the mean controlling shareholder holdings in a sample of closely-held Israeli public firms during 1999–2010 is about 77%. Hence, our sample firms are characterized by above average controlling shareholders holdings. The relatively small proportion of equity held by the public in our sample firms probably encouraged their controlling shareholders to attempt the freeze-out offers. Given their median holdings of 85%, these controlling shareholders needed only 10% more (2/3 of the public holdings) in order to secure the 95% holdings that are required for going private. Of course there are more fundamental reasons for going private such as potential synergies and avoiding the heavy regulatory costs of being a public company. Nevertheless, the companies that made freeze-out offers are those where the distance from the private firm status (amount of shares needed to be acquired) was relatively small.

The mean total assets of our sample firms on the end of the calendar year preceding the offer is about 1 billion New Israeli Shekels (NIS), which is about 250 million U.S. Dollars, yet the median is 220 million NIS only. Evidently, these are small firms, and not surprisingly they are also illiquid. The median Amihud (2002)'s Illiquidity measure (ILLIQ) of our sample stocks is 6.19 (% per million NIS), which translates into about 25 (% per million U.S. Dollars).[3] Further, the sample firms exhibit mediocre growth prospects and performance, with a mean Tobin's Q of 1.1 and a mean Return on Assets (ROA) of 1.1%. The mean leverage (debt divided by total assets) is close to 2/3.

The differences between firms with successful offers and failed offers can be observed by comparing Columns 2 and 3 in Table 1. Tobin's Q, ROA, Amihud's ILLIQ and leverage appear similar in firms with successful offers and firms with failed offers – see especially the close medians. However, firms with successful offers appear to be larger and with a higher pre-offer control group holdings. The difference in mean total assets between firms with successful offers and firms with failed offer is statistically significant at the 10% level, while the difference in mean control group holdings between firms with successful offers and firms with failed offers is statistically significant at the 1% level.

The interpretation of these findings is straight-forward. First, controlling shareholders of larger firms may be somewhat more successful in their tender offers because there is more information on large firms, hence public investors may be less uncertain and hesitant about them. This results in a higher proportion of large firms (and a higher average total assets) in the successful offers subsample.

Likewise, the finding that firms with accepted freeze-out offers start with a higher control group holdings is not surprising. When pre-offer control group holdings are relatively high, the distance to success (amount of shares the control group needs to buy) is shorter and more feasible. In fact, another and perhaps better predictor of offer success probability may be the fraction of publicly-held shares needed to secure the 95% ownership threshold that assures offer success. We define this distance to success variable as [(0.95-X)/(1.00-X)], where X is the pre-offer share of firm's equity held by the control group.[4]

[3] The mean of the Amihud's ILLIQ measure in our sample is considerably biased by a few large outlies. Thus, we rely on the more robust median statistics. Amihud (2002) reports a mean ILLIQ of 0.337 (% per million U.S. Dollars) for NYSE firms, which illustrates the relative illiquidity of our sample stocks.
[4] We are grateful to the referee for suggesting to us this measure.

Table 1 reviews also the mean and median of distance to success. The mean (median) distance to success is 66.2% (66.0%). In sum, firms that eventually succeed in their offers are, typically and on average, firms with relatively shorter distance to success.

3.2. Offer premium characteristics

Table 2 presents alternative measures of the offer premium. There are four estimates that are based on the reference prices provided by Israeli regulation in each offer proposal. The mean offer premium relative to stock price a day before the offer is 19.3%; the mean premium relative to the previous 12-month high price is −15.9%; the mean offer premium relative to the previous 12-month low price is 51.5%; and the mean offer premium relative to the previous six month average price is 19.3%.

The offer premium relative to stock price one day before the offer may be a biased estimate of the premium relative to the pre-offer market price. This is because information leaks may increase stock price in the days preceding the offer. To alleviate this potential problem we compute, as is common in the literature (see Baker et al., 2012, for example), offer premium relative to stock price a month (21 trading days) before the offer. The mean offer premium relative to the stock price 21 trading days before the offer is 21.8%.

The next premium we compute and describe is the offer premium relative to our estimated minority shareholders' average purchase price. Average purchase price may be an important reference price, hence offer premium relative to it is of interest. Table 2 reports that the mean offer price premium relative to APP200 (our estimate of the average purchase price) is −1.4%. For robustness purposes we also compute offer premium relative to APP150 whose mean is −0.7%.

Last, we compute and present the proportion of firm's market capitalization offered as a premium to public investors. Barclay and Holderness (1989) suggest that this proportion equals public holdings' proportion times the offer premium proportion. As Table 2 reports, on average, the control group offered public shareholders a premium equal to 4.2% of the market value of firm's equity a month before the offer.

Table 2 also reports the difference in premiums between successful and failed offers. Interestingly, most of our premium measures are almost identical in successful and failed freeze-out offers. When premiums are calculated relative to the one-day or 21-days pre-offer price, relative to the previous 12-month low price or relative to the previous six-month average price, there are almost no differences between the mean premium in successful offers and the mean premium in unsuccessful offers. This finding indicates that offer success probability might not depend on these four premia measures. Also interesting is the finding in the last row of the table that on average public investors are offered a somewhat higher stake of equity market capitalization in failed offers.

The only premium measures that are significantly different between successful (=accepted) and failed (=rejected) freeze-out offers are the offer premiums over the last-12-month high price, and the offer premiums over APP200 (APP150). The mean offer premium (relative to the 12-month high price) for successful offers is higher than that for failed offers by 11.6%, a difference that is both statistically significant (at the 1% level) and economically meaningful.

The respective differences in mean premium between successful and failed offers become even larger when we examine the APP200- and APP150-based premia. Interestingly, when the premium is calculated relative to APP200, the mean differences between successful and failed offers are larger and more statistically significant than when they are calculated relative

Table 2
Freeze-out offer premiums.

	Overall sample	Successful offers	Failed offers	Difference between successful and failed offers
Mean offer premium relative to stock price 21 days before the offer	0.218	0.222	0.213	0.009
Mean offer premium relative to stock price one day before the offer	0.193	0.184	0.205	−0.021
Mean offer premium relative to the pre-announcement 12-month-high price	−0.159	−0.109	−0.225	0.116***
Mean offer premium relative to the pre-announcement 12-month-low price	0.515	0.514	0.516	−0.002
Mean offer premium relative to the pre-announcement 6-month-average price	0.193	0.196	0.189	0.007
Mean offer price premium relative to APP200[a]	−0.014	0.072	−0.131	0.203***
Mean offer price premium relative to APP150[b]	−0.006	0.069	−0.106	0.175**
Mean percentage of total market value offered as a premium[c]	4.2%	3.5%	5.0%	−1.5%

*** Indicates statistical significance at the 1% level.
** Indicates statistical significance at the 5% level.
[a] Average purchase price 200 (APP200) of target investors is calculated as follows: (1) For each target, we compute the percentage daily turnover (number of shares traded on that day divided by the number of shares in the float); (2) Then, we aggregate these daily turnovers for every offer, starting on day −21 relative to the offer announcement and moving back in time; (3) APP200 is the weighted (by turnover) price of the stock over the period from day −21 till the day where the cumulative percentage turnover reaches 200%.
[b] Average purchase price 150 (APP150) of target investors is the weighted (by turnover) price of the stock over the period from day −21 till the day where the cumulative percentage turnover reaches 150%.
[c] This premium is calculated as the premium over day −21 market price multiplied by the stake of equity held by the minority.

to APP150. It appears that the premium relative to APP200 might be a better predictor of offer success than the premium over APP150. This might indicate that APP200 is a more relevant reference price than APP150. Thus, APP200 serves as our central proxy of minority shareholders purchase price in the remaining empirical analysis.

It is noteworthy that all the results documented in Table 2 remain qualitatively the same when we winsorize or trim 5% of the premiums (2.5% of the highest and 2.5% of the lowest premiums).

3.3. Which offer premium measure best predicts freeze-out offer success?

First, we attempt to develop a benchmark model for predicting freeze-out offer success. Table 1 suggests that distance to success (or pre-offer control group holdings) and firm's total asset might affect offer success probability. A third explanatory variable suggested by Table 1 is a dummy variable for second and third offers. In second and third offers ("repeated offers"), both the control group and the public might be more knowledgeable and experienced, hence in repeated offers we expect (and observe in Table 1) a higher success rate.

To these three variables we add two more potentially important explanatory variables. The first is stock market return in the period between offer proposal and decision dates. The idea is that if market declines between offer proposal and decision dates, the offer becomes more attractive, and its acceptance probability may increase. The second added variable is a dummy variable equal to 1 when at least one institutional investor holds firm shares (and equals 0 otherwise). Lauterbach and Mugerman (2018) show that institutional investor presence decreases freeze-out offers' acceptance probability, perhaps because institutional investors are better equipped to identify and oppose exploitive freeze-out offers. Last, we also employ calendar year and industry fixed effects as controls.[5] It is noteworthy that in the current specification we do not add any offer premium as an explanatory variable. The incremental explanatory power of offer premiums, if any, will be examined later.

Table 3 presents Probit and linear probability (OLS) benchmark model results. The table shows that the alternative measures – "distance to success" and "pre-offer holdings" of the control group, are both good predictors of offer success. Higher (lower) pre-offer holdings (distance to success) of the control group increase success probability significantly. However, "distance to success" achieves a higher z-score and explanatory power (pseudo-R^2) than "pre-offer holdings", and when both these variables are entered as explanatory variables, only "distance to success" attains statistical significance (see the third Probit column in the table). It appears that the fraction of minority shares needed to be persuaded for the offer to succeed, is a more fundamental variable when attempting to explain tender freeze-out offers success probability. Thus, we employ distance to success in the rest of our empirical analysis.

Table 3 further shows that, as expected, success probability is significantly higher in repeated freeze-out offers and in larger firms, and is lower when institutional investors hold firm shares. Market return between offer and decision dates is statistically insignificant, thus it is omitted in our parsimonious models. OLS regressions yield similar results and identical conclusions as our Probit analysis. In conclusion, the emerging benchmark model for offer success comprises as explanatory variables the natural logarithm of firm's total assets, control group distance to success, and dummy variables for institutional investor presence, repeated offers, industry and calendar year.

Table 4 examines the impact of six alternative offer premium measures by adding them to our benchmark offer success model. Four of the measures are based on the reference prices outlined (by order of the Israeli Security Authority regulation) in each freeze-out proposal: the previous 12-month high price, the previous 12-month low price, the previous six-month average price and the market price one day before the offer. The two other premiums are the premium relative to stock market price 21 trading days prior to the offer and the premium relative to our estimate of the average purchase price of minority shareholders (APP200).

Rational market theorists would probably argue that the offer premium relative to the 21-day pre-offer market price is the cardinal and perhaps only premium that matters. According to the rational view, market prices are accurate, hence offer premium relative to a pre-offer "clean" price (stock price 21 trading days before the offer) is the correct measure of offer economic attractiveness. Behavioral economists add the insights that premiums relative to the previous-year (52 weeks) high price and relative to the average purchase price of minority shareholders (APP200) might also impact minority shareholders decision and offer success likelihood.

In Table 4 we see that the premium relative to APP200 has a statistically significant effect (at the 5% level) on offer acceptance. Offer success probability increases with this estimate of minority shareholders' purchase price. Offer premium relative to the pre-offer 12-month high price has a positive yet statistically insignificant effect when added to our benchmark model. However, when we drop institutional presence from the list of explanatory variables, the effect of the premium over the 52 weeks high becomes statistically significant at the 10% level. This suggests that the offer premium relative to the 52-weeks high might have some effect on offer success probability. The rest of the offer premia measures we attempt have insignificant effects on offer success likelihood. We also perform some robustness tests, employing trimmed and winsorized premiums. The results are similar, hence the conclusions remain the same.

[5] In unreported tests we also add firm and stock characteristics such as ROA, Tobin's Q, Amihud's illiquidity measure and leverage as controls. These additional control variables have insignificant impact and do not change any of our significant findings and conclusions.

Table 3
Factors affecting freeze-out offer success.

	Probit			Parsimonious Probit	Parsimonious OLS
Log total assets	0.17**	0.18**	0.18**	0.18**	0.05**
	(0.08)	(0.08)	(0.08)	(0.08)	(0.03)
Institutional presence	−0.57**	−0.50*	−0.51*	−0.49*	−0.14*
(dummy variable)	(0.28)	(0.28)	(0.29)	(0.28)	(0.09)
Market interim return	2.01	1.34	1.44		
	(2.18)	(2.14)	(2.13)		
Control group holdings	4.50***		1.12		
(share in firm's equity)	(1.34)		(1.75)		
Distance to success		−3.56***	−2.85**	−3.61***	−1.05***
		(0.86)	(1.41)	(0.86)	(0.27)
Repeated offers	1.23***	1.18***	1.19***	1.15***	0.30***
(dummy variable)	(0.33)	(0.34)	(0.33)	(0.32)	(0.08)
Observations	187[a]	187[a]	187[a]	188[a]	201
Pseudo R^2/R^2	21.85%	22.79%	22.89%	22.66%	30.02%
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes

The table reports estimates of Probit regression models and OLS regression models. The dependent variable equals 1 if the freeze-out offer has been accepted, and equals 0 otherwise. Log total assets is the natural logarithm of firm's total assets (in thousands of New Israeli Shekels); Institutional presence is a dummy variable that equals 1 (0) when institutional investors have some (no) holdings in the company stock in the quarter preceding the offer; Market interim return is the market return from offer announcement to offer decision, where the market is Israeli small stock (Yeter) index return (all of our sample stocks belong to this index); Control group holdings is the pre-offer share of firm's equity held by the control group; Distance to success is the fraction of minority shares needed to achieve the 95% ownership threshold, computed as [(0.95-X)/(1.00-X)] where X is the pre-offer share of firm's equity held by the control group; and Repeated offers is a dummy variable equal to 1 for the second and third offers of a firm that failed in its first offer. Robust standard errors that correct for clustering at the firm level are reported in parentheses below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

[a] The sample size in the Probit analysis decreases from 201 to 188 observations because in eleven cases industry predicts the outcome perfectly, and because the two offers in calendar year 2000 are successes. (Cases where a dummy variable predicts outcome perfectly must be dropped from Probit.). Last, in one case, the firm's stock was delisted from the stock exchange during the announcement to decision period. Hence, we cannot calculate the relevant market interim return in this case.

3.4. A finer test of the relative merit of our two behavioral reference prices

The results so far suggest that the pre-offer average purchase price of minority shareholders and the pre-offer 52-weeks high price of the stock are potentially influential reference or reservation prices for some minority shareholders. In this section we test more directly the impact of these two possible reference prices.

Baker et al. (2012) contend that a sharper prediction of the hypothesis that a particular price serves as a reference price is that this price creates a discontinuity in offer acceptance likelihood. Accordingly, they suggest, in their equation (3) on page 64, to construct a dummy variable for cases where offer price exceeds the reference price, and add this dummy variable to the list of explanatory variables in the Probit analysis. They also suggest to add as explanatory variables a quartic polynomial of the "rational" offer premium (offer premium relative to stock price one month before the offer date). This polynomial is intended to capture all possible effects of the "rational" offer premium.

Following Baker et al. (2012), we construct two dummy variables: Dum_High that equals 1 when offer price exceeds the pre-offer 52 weeks high price (and equals 0 otherwise); and Dum_APP that equals 1 when offer price exceeds APP200, our estimate of minority shareholders purchase price of the shares (and equals 0 otherwise). Each of these dummy variables serves to test whether the price it represents creates discontinuity and can be entitled a reference or reservation price.

Table 5 presents the results of Probit analyses based on our benchmark model and the above-discussed additions. In columns (1) and (2) we observe that when each dummy variable is considered on its own, it scores a statistically significant positive coefficient. Dum_APP is statistically significant at the 1% level in the analysis summarized in column (1), and Dum_High is statistically significant at the 5% level in the analysis summarized by column (2).

However, when both dummy variables are used as explanatory variables in the same Probit analysis, only the coefficient of Dum_APP is highly statistically significant – see column (3) of the table. It appears that the purchase price of investors is the more fundamental price reference point, and that when offer price exceeds our estimate of the average purchase price of investors, freeze-out offers become much more attractive to minority shareholders and their acceptance rate increases significantly. Another possible implication of this result is that the past documented effect of the 52-weeks high price may be due to its correlation with the more fundamental average purchase price of investors. (The correlation between Dum_APP and Dum_High in the 167 cases employed in Table 5 is 0.36.) Previous research of reference points does not control for the potentially important effect of purchase price.

Column (4) summarizes a Probit analysis identical to that of column (3) except that we use a linear effect of the rational offer premium. Comparing columns (3) and (4) we find that the polynomial of the "rational" offer premium does contribute

Table 4
Which offer premium matters in the case of multiple reference points?

Premium over the pre-announcement 12-month-high price	0.61* (0.37)	0.53 (0.38)					
Premium over the pre-announcement 12-month-low price			0.05 (0.28)				
Premium over the pre-announcement 6-month-average price				0.27 (0.46)			
Premium relative to stock market price one day before the offer					0.12 (0.49)		
Premium relative to stock market price 21 days before the offer						0.36 (0.44)	
Premium over the APP200							0.55** (0.25)
Log total assets	0.14* (0.08)	0.15* (0.08)	0.18** (0.08)	0.18** (0.10)	0.18** (0.08)	0.19** (0.08)	0.16 (0.09)
Institutional presence (dummy variable)		−0.41 (0.28)	−0.52* (0.29)	−0.52* (0.29)	−0.48* (0.28)	−0.47* (0.28)	−0.43 (0.31)
Distance to success	−3.75*** (0.87)	−3.61*** (0.87)	−3.72*** (0.89)	−3.74*** (0.87)	−3.64*** (0.87)	−3.66*** (0.87)	−2.90*** (0.97)
Repeated offers (dummy variable)	1.08*** (0.32)	1.12*** (0.33)	1.06*** (0.32)	1.05*** (0.32)	1.15*** (0.32)	1.14*** (0.32)	1.35**** (0.35)
Observations	188[b]	188[b]	183[c]	183[c]	188[b]	188[b]	167[d]
Pseudo R^2/ R^2 (%)	22.69	23.52	23.33	23.44	22.68	22.85	27.27
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The table reports results of Probit regressions. The dependent variable equals 1 if the freeze-out offer is accepted, and equals 0 otherwise. The independent variables are the offer premium over four alternative reference prices specified in the offer proposal: the pre-announcement 12-month-high, pre-announcement 12-month-low, pre-announcement 6-month-average, and market price one day before the offer announcement; the premium relative to stock market price 21 trading days prior to the offer; and the premium relative to our estimate of the average purchase price of minority shareholders (APP200[a]). The premium is calculated as the natural logarithm of offer price divided by the respective reference price. Log total assets is the natural logarithm of firm's total assets (in thousands of New Israeli Shekels); institutional presence is a dummy variable that equals 1 (0) when institutional investors have some (no) holdings in the company stock in the quarter preceding the offer; distance to success is the fraction of minority shares needed to achieve the 95% ownership threshold, computed as [(0.95-X)/(1.00-X)], where X is the pre-offer share of firm's equity held by the control group; and repeated offers is a dummy variable equal to 1 for the second and third offers of a firm that failed in its first offer. Standard errors that correct for clustering at the firm level are reported in parentheses below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

[a] See Table 2 for details on the calculation of APP200.

[b] The sample size in this Probit analysis decreases from 201 to 188 observations because in eleven cases industry predicts the outcome perfectly, and because the two offers in calendar year 2000 are successes. Cases where a dummy variable predicts outcome perfectly must be dropped from Probit.

[c] Sample size decreases from 201 to 183 observations because in eleven cases industry predicts the outcome perfectly, because the two offers in calendar year 2000 are successes, and because there are five cases where the 12-months-low and 6-month-average prices are not disclosed in the offer proposal.

[d] Sample size decreases from 201 to 167 because we omit 23 cases with extremely low turnover (in these stocks the time needed for a 200% turnover of the float exceeds ten years); because in nine cases industry predicts the outcome perfectly, and because the two offers in calendar year 2000 are successes.

significantly to explanatory power.[6] However, changing formulations does not alter the central result. In both columns (3) and (4) the prominent reference price is APP200.

Another way to examine the relative merit of the 52 weeks high price and the average purchase price (APP200) as pertinent reference prices is to find cases where these two reference prices disagree (i.e., have opposite predictions) regarding the attractiveness of the freeze-out offer price. Out of the 167 offers examined in Table 5, in 54 cases offer price exceeds both the 52 weeks' high and APP200, in 19 cases offer price exceeds only the 52 weeks' high price, in 39 cases offer price exceeds only APP200, and in 65 cases offer price is below both 52 weeks' high and APP200. This affords us to define the following three dummy variables: (1) Dum_Both that equals 1 when offer price exceeds both APP200 and the 52 weeks' high (and equals 0 otherwise); (2) Dum_only_APP that equals 1 when offer price is higher than APP200 and lower than the 52 weeks' high (and equals 0 otherwise); and Dum_only_High that equals 1 when offer price is higher than the 52 weeks' high and lower than APP200 (and equals 0 otherwise). The cases where offer price is below both APP200 and the 52 weeks' high are left as a baseline - for them all above-constructed dummies equal zero.

Column (5) of Table 5 documents the results of a Probit analysis that employs the three new dummy variables. Of particular interest are the coefficients of Dum-only_APP and Dum_only_High. The coefficient of Dum_only_APP is positive and statistically significant, while the coefficient of Dum_only_High is close to zero and statistically insignificant. This illustrates that when there is a dispute between APP200 and the 52 weeks' high, APP200 dominates. In cases where only APP200

[6] The Pseudo-R^2 of the Probit analysis with the polynomial (column 3) is considerably higher than that with the linear form (column 4), and the higher order terms of the quartic polynomial are statistically significant.

Table 5
Tests of the two prominent behavioral reference prices.

	(1)	(2)	(3)	(4)	(5)
Premium over the pre-announcement 21-day-price	4.21* (2.51)	1.99 (2.62)	4.06 (2.53)	0.69 (0.70)	3.86 (2.49)
(Premium over the pre-announcement 21-day-price)^2	49.91*** (15.65	51.85*** (19.84	50.75**** (16.01		50.15*** (16.18
(Premium over the pre-announcement 21-day-price)^3	−253.10*** (81.44)	−243.43** (94.39)	−261.42*** (82.94)		−253.14*** (84.35
(Premium over the pre-announcement 21-day-price)^4	277.32*** (104.42	265.60** (116.16	290.51*** (106.51		277.78** (108.61
Dum_High (Offer price >= 52 weeks High-price)		0.60** (0.28)	0.31 (0.30)	0.27 (0.28)	
Dum_APP (Offer price >=APP200)[a]	1.04*** (0.29)		0.96*** (0.29)	0.73*** (0.27)	
Dum_ Both (Offer price>=APP200 & Offer price>=52 weeks High-price)				1.28*** (0.38)	
Dum_only_APP (Offer price>=APP200 & Offer price < 52 weeks High-price)				0.84*** (0.34)	
Dum_only_High (Offer price < APP200 & Offer price>=52 weeks High-price)				0.07 (0.52)	
Log total assets	0.32*** (0.11)	0.35*** (0.10)	0.32*** (0.11)	0.18* (0.10)	0.32*** (0.11)
Institutional presence (dummy variable)	-0.73** (0.36)	-0.78** (0.34)	-0.74** (0.36)	-0.45 (0.32)	-0.73** (0.36)
Distance to success	−3.33*** (1.05	−3.23*** (1.01	−3.35*** (1.05	−3.22*** (0.99	−3.42*** (1.07
Repeated offers (dummy variable)	1.62*** (0.36)	1.76*** (0.34	1.64*** (0.36	1.31*** (0.37	1.68*** (0.36
Observations	167[b]	167[b]	167[b]	167[b]	167[b]
Pseudo R^2 (%)	38.17	34.15	38.54	30.15	38.69
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes

The table reports results of Probit analyses. The dependent variable equals 1 if the freeze-out offer is accepted, and equals 0 otherwise. The independent variables are a quartic polynomial of the offer premium over the stock price 21 days before the announcement day; offer price >= target high-price is a dummy variable equal to 1 if offer price >= the target highest price in the period from day −21 to day −250 preceding the offer (equals 0 otherwise); offer price > = APP200[a] is a dummy variable that equals 1 if offer price >= APP200 (equals 0 otherwise); The dummy variables denoted in short as D1, D2, and D3 are based on the two above dummy variables; Institutional presence indicator equals 1 (0) when institutional investors have some (no) holdings in the company stock in the quarter preceding the offer; Log total assets is the natural logarithm of firm's total assets (in thousands of New Israeli Shekels); distance to success is the fraction of minority shares needed to achieve the 95% ownership threshold, computed as [(0.95-X)/(1.00-X)], where X is the pre-offer share of firm's equity held by the control group; and repeated offers is a dummy variable equal to 1 for the second and third offers of a firm that failed in its first offer. Standard errors that correct for clustering at the firm level are reported in parentheses below the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

[a] See Table 2 for details on the calculation of APP200.

[b] Sample size decreases from 201 to 167 because we omit 23 cases with extremely low turnover (in these stocks the time needed for a 200% turnover of the float exceeds ten years); because in nine cases industry predicts the outcome perfectly, and because the two offers in calendar year 2000 are successes.

predicts a higher acceptance rate (Dum_only_APP = 1), offer acceptance likelihood significantly increases. In contrast, in cases where only the 52 weeks' high predicts a higher acceptance rate (Dum_only_High = 1) offer acceptance rate is unaffected, i.e., remains as in the baseline case.

The evidence that only APP200 behaves like a genuine reference price is probably our most important finding. It suggests that purchase price may be the most fundamental price anchor for investors; thus, empirical tests of any competing candidate, such as the 52 weeks' high price, must take purchase price into account.

4. Summary and conclusions

The decision to accept or reject a going-private ("freeze-out") tender offer is amongst the most important financial decisions minority shareholders must make. Using a sample of 201 freeze-out tender offers in Israel during 2000–2016, we study the impact of various behaviorally-based potential reference prices on investors' decision, i.e., on offer acceptance likelihood.[7]

We find that a novel estimate of minority shareholders' purchase price, equal to the volume-weighted average price of the stock from day −21 relative to the offer and going back till a 200% turnover of the float (shares held by minority shareholders), serves as an important reference or even reservation price for investors. When freeze-out offer price exceeds this estimated average purchase price, offer acceptance likelihood increases significantly. Other potential behavioral reference prices, and in particular the previous 52 weeks' high price of the stock (suggested in Baker et al., 2012), have insignificant effects on offer acceptance likelihood, and do not appear as relevant reference prices for minority investors' decisions once average purchase price is taken into account.

[7] In Israel, the investor protection and information disclosure accompanying freeze-out tender offers are relatively weak, and about half of the offers are rejected, which may facilitate a more-pronounced behavioral impact.

Future studies should recognize the fundamental effect of purchase price on investor decisions. It appears that purchase price should be used as control in many studies, and in particular in studies of behavioral phenomena or reference prices. Our novel estimate of the average purchase price proved itself in this study, and it may serve well in other studies. Nevertheless, future studies could challenge our measure and attempt improving the methodology of estimating the reference purchase price.

References

Abudy, Menachem, Lauterbach, Beni, 2015. Changes in controlling shareholders holdings: do they entail financial tunneling?. Adv. Financ. Econ. 18, 47–63.
Amihud, Yakov, 2002. Illiquidity and stock returns: cross-section and time-series effects. J. Financ. Markets 5, 31–56.
Baker, Malcolm, Pan, Xin, Wurgler, Jeffrey, 2012. The effect of reference point prices on mergers and acquisitions. J. Financ. Econ. 106, 49–71.
Barclay, Michael, Holderness, Clifford, 1989. Private benefits from control of public corporations. J. Financ. Econ. 25, 371–395.
Bebchuk, Lucian A., Kahan, Marcel, 2000. Adverse selection and gains to controllers in corporate freeze-outs. In: Morck, R. (ed.), Concentrated Corporate Ownership, University of Chicago Press, Chicago, 2000, pp. 247–59.
Bøhren, Øyvind, Krosvik, Nils Erik, 2013. The economics of minority freeze-outs: evidence from the courtroom". Int. Rev. Law Econ. 36, 48–58.
Chang, Tom, Solomon, David, Westerfield, Mark, 2016. Looking for someone to blame: delegation, cognitive dissonance, and the disposition effect. J. Finance 71, 267–302.
Doidge, Craig, Karolyi, Andrew, Stulz, Rene, 2017. The U.S. listing gap. J. Financ. Econ. 123, 464–487.
Doidge, Craig, Kahle, Kathleen, Karolyi, Andrew, Stulz, Rene, 2018. Eclipse of the public corporation or eclipse of the public markets?. NBER Corporate Finance Working Paper, 24265.
Fischbacher, Urs, Hoffmann, Gerson, Schudy, Simeon, 2017. The causal effect of stop-loss and take-gain orders on the disposition effect. Rev. Financ. Stud. 30, 2110–2129.
Kahneman, Daniel, Tversky, Amos, 1979. Prospect theory: an analysis of decision under risk. Econometrica 47, 263–291.
Kaustia, Markku, 2010. Prospect theory and the disposition effect. J. Financ. Quantit. Anal. 45, 791–812.
Lauterbach, Beni, Mugerman, Yevgeny, 2018. Institutional investors' impact on the terms and outcome of freeze-out tender offers. ECGI Finance Working Paper, 573/2018.
Restrepo, Fernán, Subramanian, Guhan, 2015. The effect of Delaware doctrine on freeze-out structure and outcomes: evidence on the unified approach. Harvard Bus. Law Rev. 5, 205–236.
Shefrin, Hersh, Statman, Meir, 1985. The disposition to sell winners too early and ride losses too long: theory and evidence. J. Finance 40, 777–790.