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Role of psychological reference points in mergers and acquisitions: 52-week high as a reference price in European takeover activity

Finance

Master's thesis

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Abstract
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ROLE OF PSYCHOLOGICAL REFERENCE POINTS IN MERGERS AND ACQUISITIONS
52-week high as a reference price in European takeover activity

PURPOSE OF THE STUDY

This thesis examines the role of a target company's 52-week high stock price as a psychological reference point in mergers and acquisitions. It builds on a new strand of M&A literature linking mergers and acquisitions to psychological considerations. The first objective of this thesis is to test whether the 52-week high acts a psychological reference point in European mergers and acquisitions. To provide added credibility to my findings and to alleviate any concerns for the results arising from data mining, I supplement my analysis by interviewing mergers and acquisitions professionals, investment bankers. The second objective of the thesis is to investigate how the 52-week high compares to other potential reference price candidates. The findings should allow comparison of differences between US and European markets, and analysis of practical implications for bidders and targets alike.

DATA AND METHODOLOGY

The data set consists of 3009 acquisitions of majority stakes of public targets in Western Europe during 1997–2008. For an observation to be accepted into the sample, I require that both offer price from SDC M&A database and target stock price development for the 395 days prior to a bid from Thomson Datastream database are available.

Due to a high number of potential extreme outliers, variables are winsorised to make them more robust to outliers. In addition to OLS regressions, I employ a variety of other methods in testing the hypotheses: The nonlinearity in the relation between offer premiums and 52-week highs is inspected using RESET-tests and kernel regressions, and on the basis of these tests a piecewise regression model is adopted. The variation of effect strength across countries, subsamples, and over time is assessed using interaction variables. The impact of surpassing the reference point on deal success is analyzed with probit regressions, and the impact of 52-week high driven bids on bidder shareholder wealth is estimated using a 2-stage least squares specification. Cumulative abnormal returns for bidders are calculated using a standard event study approach.

RESULTS

The results provide strong support for the hypotheses. The psychology of reference points draws offer premiums upwards, and surpassing the reference level increases deal success discontinuously. The effect on offer premiums is greater than average in deals with multiple bidders, and below average in deals with financial buyers, deals financed with stock and in the second half of the sample period. Little variation exists across the largest sample countries, and the differences between the smaller countries cannot be explained by regulation. The investment bank interviews confirm the use of past price levels as negotiation arguments, and that psychology can be a consideration especially in price setting. Bidder shareholders perceive the value transfer due to psychology and react negatively. The level of market 52-week high relative to current valuation also influences clustering of merger activity over time, and contributes to the merger wave puzzle. As such, the 52-week period is found to have no special role, but the 52-week high still acts as a proxy for the reference effects in general. Investors are found to have short memories, and overall, their reference considerations seem to be best described by the 1-month average price.

KEYWORDS

M&A, merger, acquisition, takeover, psychology, 52-week high, reference point, anchoring, prospect theory, loss aversion, disposition effect, behavioral finance.

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TUTKIELMAN TAVOITTEET

Tässä työssä tutkitaan kohdeyrityksen 52 viikon korkeimman osakekurssin roolia psykologisena viitetasona yrityskauppatilanteissa. Työ pohjautuu yrityskauppoja koskevan kirjallisuuden uuteen haaraan, joka tutkii yhteyttä yrityskauppojen ja psykologisten viitetasojen välillä. Työn ensimmäisenä tavoitteena on testata, toimiiko 52 viikon huippuhinta merkittävänä sijoittajien viitetasona eurooppalaisissa yrityskaupoissa. Analyysia tuetaan investointipankkiirien haastatteluilla. Yrityskauppojen ammattilaisina heidän pitäisi olla tietoisia sijoittajapsykologian mahdollisesta roolista tai pystyä tarjoamaan vaihtoehtoisia selityksiä löydöksilleni. Työn toinen tavoite on tutkia, miten 52 viikon korkein kurssi vertautuu muihin mahdollisiin viitehintakandidaatteihin. Työn tulosten pitäisi mahdollistaa sekä vertailut yhdysvaltalaisten ja eurooppalaisten markkinoiden välillä että käytännön johtopäätösten tekemisen yrityskauppatilanteita varten.

LÄHDEAINEISTO JA MENETELMÄT

Tutkimusaineisto koostuu 3009 julkisen kohdeyrityksen osake-enemmistön ostotarjouksesta Länsi-Euroopassa vuosina 1997–2008. Jotta havainto kelpuutettaisiin otokseen, on tarjoushinnan oltava saatavilla tietokannasta SDC Mergers and Acquisitions ja kohdeyrityksen kurssikehityksen 395 päivän ajalta ennen tarjouksen julkistamista tietokannasta Thomson Datastream.

Mahdollisten vieraiden havaintojen suuren määrän johdosta winsoroin tutkimani muuttujat. Lineaaristen regressiomallien lisäksi käytän useita muita metodeja testatessani hypoteeseja: tutkin epälineaarisuutta tarjouspreemioiden ja 52 viikon huippuhintojen välillä käyttäen RESET-testiä ja kernel-regressioita, ja päädyn paloittaiseen lineaariseen regressiomalliin. Tutkin 52 viikon huipun vaikutuksen voimakkuutta eri maissa, eri osaotoksissa ja suhteessa huipun ajankohtaan käyttämällä interaktiomuuttujia. Viitetason ylittämisen vaikutusta ostotarjousten hyväksymisen todennäköisyyteen puolestaan tutkin probit-regressioilla ja viitetasovetoisten tarjousten vaikutusta tarjouksentekijän osakkeenomistajien varallisuuteen tapahtumatutkimusmenetelmän ja kaksivaiheisen pienimmän neliösumman menetelmän avulla.

TULOKSET

Tulokset tukevat vahvasti hypoteeseja. 52 viikon huipulla on positiivinen vaikutus tarjouspreemioihin, ja viitetason ylittäminen nostaa selvästi tarjouksen hyväksymistodennäköisyyttä. Vaikutus tarjouspreemioihin on keskimääräistä suurempi, kun samasta kohdeyrityksestä kilvoittelee monta tarjoajaa, ja keskimääräistä pienempi otoskauden jälkimmäisellä puoliskolla, osakerahoitteisissa kaupoissa ja kun ostaja on pääomasijoittaja. Investointipankkiirien haastattelut tukevat käsitystä siitä, että sijoittajapsykologia otetaan ajoittain huomioon yrityskauppatilanteissa. Ostajan osakkeenomistajat tunnistavat psykologiasta johtuvan arvonmenetyksen ja reagoivat negatiivisesti. Markkinaindeksin 52 viikon huippu selittää osaltaan yrityskauppojen kasautumista aalloiksi. 52 viikon ajanjaksolla ei vaikuttaisi olevan sijoittajille erityistä merkitystä, vaan 52 viikon huippu toimii vain instrumenttina viitetasovaikutuksille. Osakkeenomistajien muisti vaikuttaa lyhyeltä, ja yhden kuukauden keskihinta vaikuttaa kuvaavan parhaiten heidän viitetasoriippuvuuttaan.

AVAINSANAT

Yrityskauppa, yritysosto, fuusio, psykologia, 52 viikon korkein kurssi, kurssihuippu, viitetaso, ankkuroituminen, prospektiteoria, tappioiden välttely, dispositio-ilmiö, rahoituksen käyttäytymistiede.

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1. INTRODUCTION

1.1. Background

The abundance of mergers and acquisitions related research in the last two decades has left the subject somewhat trite. Extant research rather extensively covers the traditional motives, and examines wealth effects across different geographies and different time periods. However, despite the recent surge of behavioral finance literature, the evidence on impact of behavioral factors on mergers and acquisitions is still relatively scarce. This paper contributes to that slowly expanding sphere of evidence, and tests a fresh behavioral theory on the impact of psychological reference points on mergers and acquisitions activity using a sample of European transactions. I start by outlining the psychological context necessary for the understanding of this study. For a reader less familiar with mergers and acquisitions literature, I suggest first referring to Appendix A for key M&A terminology, however.

The concept of psychological reference points derives from the decision-making theory of anchoring and adjustment, first discussed by Amos Tversky and Daniel Kahneman (1974). The authors observe that humans put too much emphasis on single values, anchors, in decision-making, and tend to be unable to adjust their decision-making for all available information. Transforming this idea to an economic context, Kahneman and Tversky (1979) present the prospect theory, stating that people evaluate gains and losses relative to established anchors, reference points. They further suggest that people are loss averse, that is, losing an amount of wealth decreases their satisfaction more than gaining the same amount would increase it.

Shefrin and Statman (1985) are the first to provide empirical evidence on the effects of reference-dependence and loss aversion on investor psychology. The authors show that investors tend to hold on to stocks that have lost value for too long, and sell stocks that have gained value too soon. Investors seem to act in line with prospect theory, and evaluate their situation with respect to a reference price, at which they purchased their stocks.

Although the specific process of reference point formation is still largely unknown, it is also clear that, although reference points are salient, people do update their reference points over time as new information arrives. Thus, besides the purchase price, investor psychology may be impacted by various other reference considerations. Studies on human memory suggest

that instead of details, people are much more likely to remember the general meaning of information. Further, when details are remembered, they are often novel or unusual. Based on these results, finance literature tests for the impact of various other reference prices, such as historical minimum, maximum, and average prices.

It is of course likely that investors' reference considerations are not purely a factor of a single price measure, but composed of various components. However, in naturally occurring price sequences, it is often impossible to distinguish the effects of several partially overlapping, interlinked reference points from each other. Thus, empirical literature commonly focuses on identifying reference effects around a single price measure, for which data is available or which is assumed to most strongly influence investor behavior. One maximum in particular, a stock's 52-week high price, has drawn a lot of attention in research (see e.g. Core and Guay, 2001; George and Hwang, 2004; Huddart et al., 2009). Widely cited in various financial media alongside current prices, a stock's 52-week high price has the potential to act as a particularly salient reference measure. However, the question about the relative importance of the reference points is still largely under debate, and further evidence is required before conclusions can be drawn.

1.2. Motivation and definition of the research problem

Despite a wide array of academic literature on the subject, it is common to hear investment bankers regard company valuation more as an art than a science. As merger motivations range from synergistic gains to managerial empire-building, valuation is partly subjective, and different prices may be justified depending on from whom we ask. Combined with the natural uncertainty of the target side having more information on what they are selling than the bidders do, this suggests that no correct price can be set with precision, but that the final price reached will often reflect the outcome of negotiations. This uncertainty, in turn, translates to ample room for the price setting and its reception to reflect also psychological considerations. Consequently, as put forward by a recent paper from Malcolm Baker, Xin Pan, and Jeffrey Wurgler (2009), also mergers and acquisitions can be expected to be influenced by anchoring and reference-dependence.

To empirically evaluate the effect that reference points may have on merger activity, Baker et al. (2009) examine a sample of US mergers and acquisitions for the years 1984–2007, and hypothesize that the 52-week high may act as an important reference point not only for the

target shareholders considering an offer for their shares, but also for the bidder side considering the price they should pay. To simplify, being loss-averse, target shareholders may be unwilling to sell their shares at a price below the reference point. The bidders may either anticipate this or by looking at past prices when trying to come up with an objective valuation become anchored to the 52-week high measure as well. In addition, target argumentation in price negotiations may be constructed so as to try to anchor the bidder's view to this desirable position.

Baker et al. (2009) show that across a large sample, the psychology of the 52-week high price does influence both offer premiums and deal success rate, as well as merger clustering over time. Further, bidder shareholders seem to be able to assess when the offer price is driven upwards by psychological considerations, resulting in below-average announcement reactions.

As a completely new strand in the mergers and acquisition research, the results of Baker et al. (2009) have generated both interest and discussion among researchers. The fact that psychological considerations affect the distribution of value in the largest existing economic transactions is also of considerable economic significance. Thus, this discussion might benefit from carefully verifying the results in a different geographic area. Further, as the 52-week high has such a prominent role in the US market, often accused of myopia with its quarterly reporting frequency, it could be expected that its effect on offer prices is even stronger in the European market more concentrated on annual reporting. Finally, to better analyze the practical implications of my results, it makes sense to assess the relative importance of various reference prices. Thus, my research question is two-fold:

1. Does the 52-week high act as an important psychological reference point in mergers and acquisitions in Europe?
2. How does the 52-week high compare against other potential reference prices?

1.3. Contribution to existing literature

This thesis aims to contribute to the existing literature by providing empirical evidence on the impact of psychological research points on mergers and acquisitions activity in key European markets. Specifically, the thesis contributes to the literature in three ways:

1. By testing, whether the psychology of the 52-week high influences merger activity in a recent European sample. As the tests of Baker et al. (2009) contribute to merger research in a unique, previously untested way, this thesis provides an important robustness check for their specifications and lays a foundation for exploring the differences between the US and European markets

2. By providing important anecdotal evidence from a series of practitioner interviews. To alleviate any concerns of relations arising solely from data mining, I conduct a small series of interviews on investment bankers. As mergers and acquisitions professionals, their views can provide credibility for the relations found in the data

3. By comparing the relative importance of different reference point measures against each other. This contributes to the discussion of the single most prominent investor reference price and could also allow a better assessment of the implications for M&A in practice

1.4. Limitations of the study

There are four important limitations that should be remembered while reading this study. First, the availability of offer prices in the Securities Data Company (SDC) Mergers and Acquisitions database limits my sample period to begin from the late 1990s. Further, the availability of offer prices seems to be better for companies based in United Kingdom. Due to these two factors, the number of observations especially for the smaller countries is even lower than commonly observed in European M&A samples. This limits the inferences that can be drawn on a country level. However, overall my sample is still relatively large, and sufficient to assess the impact of reference points on M&A on a European level.

Second, some concerns may also arise from the representativeness of the relatively small body of expert interviews, and limiting the interviews to only bankers working in Finland. However, it should be remembered that the role of these interviews is just to provide anecdotal evidence and a benchmark to further validate the findings from the data. Further, all the bankers interviewed have a long track record, and have either worked in an international bank based in Europe outside of Scandinavia, or taken part extensively in international deals. Their seniority and experience thus give added credence to the results despite the small number of interviews.

Third, I do not have the data to assess the importance of investor purchase prices as reference points. A purchase price of a stock is the most commonly utilized measure for investor reference points in extant research. Further, the anecdotal evidence from the investment banker interviews shows that the purchase prices of large owners are often analyzed when setting the offer price, suggesting that purchase prices might act as an important reference point also in a mergers and acquisitions context. Unlike reference measures based on past price development, purchase prices are unique for every investor, however. This kind of data is not widely available, and because obtaining it would be at least time-consuming if not downright impossible, this kind of an analysis is outside the scope of this thesis.

Fourth, it is in theory possible that the mandatory bid regulation has an effect on bid price reference-dependence in Europe. As the development of this regulation across Europe has been heterogeneous and the laws have often been revised multiple times prior to reaching their current forms, it is impossible to completely account for the impact of this regulation. However, the similarity of my results to those found by Baker et al. (2009) in United States, the tests I am able to perform on the impact of regulation, and the findings about the relative importance of different reference prices point to regulatory framework having no or at most a negligible impact on the results.

1.5. Main findings

The main finding of this study is that psychological reference considerations play a significant role in mergers and acquisitions activity. My analysis utilizes a wide assortment of methods ranging from RESET-tests, kernel regressions and piecewise regressions to interaction variables, probit regressions, and 2-stage least squares specifications to examine the impact of reference-dependence on various aspects of mergers and acquisitions.

The 52-week high price has an economically and statistically significant effect on offer premiums, a finding robust to various model specifications and alternative explanations offered by the investment bank interviews. Further, the effect of the 52-week high on offer premiums diminishes the further the pre-bid prices are from the reference point, and the further away in the past the high has been reached. For the most part, there are no statistically significant differences in effect magnitude across the sample countries, but in Netherlands and Austria the effect appears particularly powerful, while in Italy it is reversed. These differences cannot be explained by the mandatory bid regulation, but may be attributed to the piecewise

model constructed on the complete sample not being entirely adequate for each single country, or purely to the higher degree of randomness arising from the small number of observations in these smaller countries.

Surpassing the 52-week high price has also a significant impact on deal success, and the bidder shareholders seem to be able to rationally assess bids driven by the 52-week high as value-destructive for themselves. The proximity of the current market valuation level to its 52-week high also acts as a significant predictor of overall merger activity. The anecdotal evidence from the investment bank interviews supports the results.

Contrary to expectations, the 52-week high price does not appear to act as the single most relevant investor reference point, however. While providing a proxy for the value transfer that reference points inflict in mergers and acquisitions, it has no apparent special role compared to other maximum, minimum, or average prices. My tests indicate that the 1-month average price acts as the best single proxy for investor reference-dependence, closely followed by the 1-month high price. The effects of reference-dependence are stronger for reference measures based on shorter time periods, and as such, my tests act as conservative estimates or lower limits for the true reference-dependence.

1.6. Structure of the study

The rest of the paper is organized as follows. Section 2 reviews the relevant literature supplemented with investment banker observations on the M&A price determination process. Section 3 introduces the hypotheses. Section 4 explains the construction of the data set and provides an overview of the methodology used. Section 5 presents the main body of the interview material and empirical results based on the data. Finally, Section 6 offers my conclusions and provides suggestions for further research.

2. LITERATURE REVIEW

This section presents an overview on the literature related to my study on the impact psychological reference points on M&A activity. In Section 2.1., I first outline the psychological theory relevant to understanding reference points, and in Section 2.2. continue to show what kind of consequences reference-dependence has for economic activity in general. I also establish a link between past stock prices and investor reference points and discuss various price measures as potential reference points.

The latter subsections concentrate on M&A activity specifically. As one of the main hypotheses tested in this study is the impact that reference points may have on M&A offer pricing, I first need to understand the pricing process and other factors affecting the price. For this purpose, Section 2.3. combines insights from the investment banker interviews with existing research to create a comprehensive picture on offer pricing. Further, it is also hypothesized that bidder shareholders can at least partly assess when the offer price is driven upwards by the psychology of the 52-week high, resulting in below average announcement returns. Thus, it makes sense to first look at what kind of abnormal returns mergers usually generate. This is done in Section 2.4. along with a brief glimpse on merger motivations in general.

The psychology of the reference points is also expected to have an impact on the clustering of merger activity in time. Thus, Section 2.5. introduces the research on merger waves. Finally, to better compare my results to those of the previous study by Baker et al. (2009) where possible, any differences in legal frameworks affecting merger activity should be documented. A potentially important distinction is the mandatory bidding rule affecting European merger pricing, introduced in Section 2.6. In addition to the final subsection on legislative differences, each subsection discusses the differences between the findings in international and European research, where applicable.

2.1. Anchoring, prospect theory and reference points

To understand how a single, at a first glance largely irrelevant past price measure such as the 52-week high stock price can have an impact on merger activity, one first needs to understand anchoring, and the concept of reference points. Anchoring refers to a behavioral bias, a common human tendency to overly emphasize a specific value in decision making. Once an anchor has been set, people usually weigh it disproportionately much in their decisions, partially ignoring any additional information available.

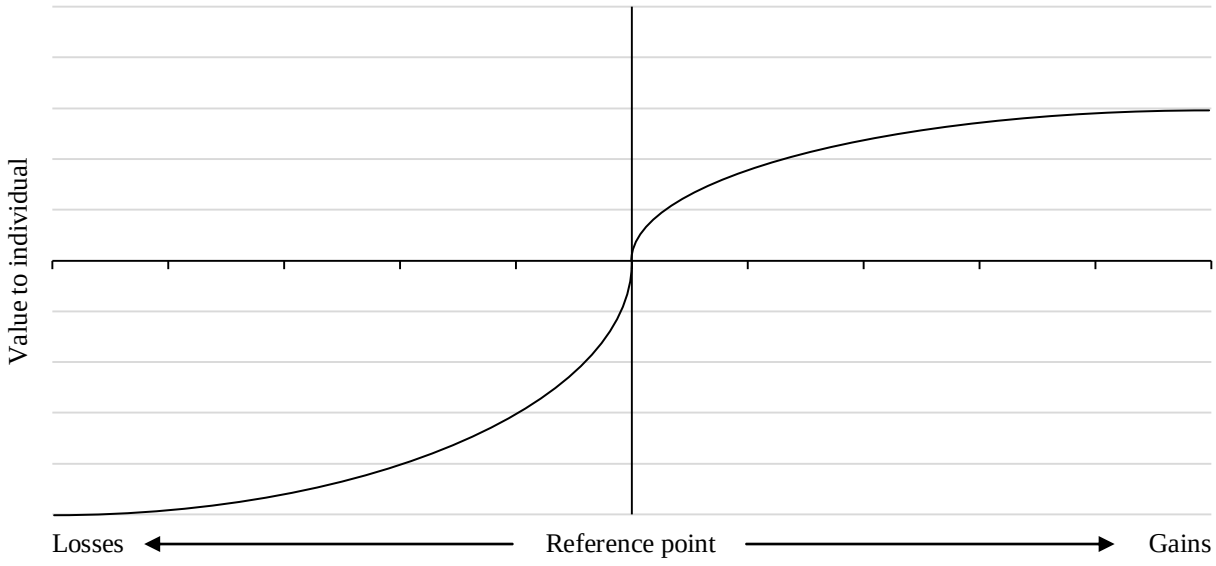
Anchoring as a concept is first discussed by Amos Tversky and Daniel Kahneman (1974). The authors observe that as people make estimates based on an initial value that has been obtained from a previous context, they tend to adjust the starting values insufficiently. That is, under otherwise identical conditions, “different starting points yield different estimates, which are biased toward the initial values”. Decision-making is partially determined by frames of

reference, established anchors, which vary both across individuals and over time. This leads to systematic and predictable errors in decision-making.

In 1979 Kahneman and Tversky transfer this idea of reference-dependence to behavioral economics and finance. The authors contradict the expected utility theory prevalent even in modern microeconomics, and present their own alternative formulation, the prospect theory. The expected utility theory states that under uncertainty, individuals choose the behavior that maximizes their expected utility, that is, choose the alternative that has the highest expected value. However, prospect theory postulates that individuals do not value only absolute levels of wealth, but also changes relative to established anchors, reference points. Further, individuals do not weigh gains and losses equally, but are loss averse, that is, strongly prefer avoiding losses to acquiring gains. This leads to a value function that is steeper in the negative than in the positive domain, as presented in Figure 1. The value function is also concave in the domain of gains and convex in the domain of losses. This signifies that when moving further away from the reference point, both the marginal pain associated with losses and the marginal satisfaction associated with gains decrease.

Figure 1:
Prospect theory value function

This figure depicts an individual's value function as suggested by the prospect theory. Individuals are loss averse, which shows in the fact that the value function is steeper in the negative than in the positive domain. The reference point denoted in the figure is the point to which gains and losses are compared.



Individuals derive their reference points from the context at hand. The reference point can be based on either the status quo or an expectation or aspiration level, but can also be influenced by whether the situation is framed in terms of gains or losses (Kahneman and Tversky, 1979; Kahneman, 1992). With a note to the aspiration level, the authors also point out that, being loss averse, initial losses may lead individuals to take increasing gambles in hopes of breaking even. Finally, Kahneman (1992) recognizes that in many situations, decision-making may be influenced by multiple different reference considerations. The research to date sheds only a little light on the simultaneous impact of such multiple reference points, however. Having laid out the foundation for understanding this commonly observed deviation from rationality, I next turn to its practical implications. In the next subsection, I review evidence on how reference-dependence manifests itself in economic activity in general, and specifically, in the trading behavior of investors.

2.2. Empirical evidence on the impact of reference-dependence

The advent of prospect theory sparked a wealth of research on identifying the impact of behavioral biases in the real world. Subsequently, reference-dependence has been reported to be of great importance in many of the economic decisions people face in their everyday life.

2.2.1. General field evidence on reference-dependence

The purpose of this subsection is not to meticulously document each and every empirical result ever published on the impact of reference points, but to illustrate the wide degree of economic implications that loss aversion and reference-dependence have. I concentrate mainly on the relatively smaller body of evidence that has been gathered in real-world settings, as opposed to the majority of tests executed in artificial laboratory settings. As pointed out by Bertrand et al. (2005), even if one takes the laboratory evidence at face value, it offers little guidance on the empirical magnitude of the psychological effects. This is because in real-life settings, the consequences of the decisions made are a lot more substantial, and the effects of psychology may be small compared to economic factors such as price. I cover evidence regarding labor supply, consumer purchase behavior, and personal consumption among others. The role of past stock prices as investor reference points is left to its own subsection.

The first example deals with how prospect theory might manifest itself in stock prices in general, through the equity premium. Equity premium has long been one of the unsolved

puzzles in finance: Equities tend to have more variable returns than bonds do, and to compensate investors for this additional risk, the expected returns should in general be higher for stocks than for bonds. However, Mehra and Prescott (1985) show that realized equity premiums actually imply that investors are absurdly risk-averse. Benartzi and Thaler (1995) explain the anomaly away by suggesting that investors are not averse to risk, but to loss, that is, negative returns, and that the level of zero returns would act as a reference point. Because annual stock returns are negative much more frequently than annual bond returns, investors demand compensation for the loss in the form of equity premium. The authors' argumentation of the prospect theory explaining the equity premium is further backed by the asset pricing model tests of Barberis, Huang, and Santos (2001).

Camerer et al. (1997) find that reference-dependence influences also labor supply, showing that the amount of hours worked by taxi drivers is influenced by daily reference income targets instead of the daily fluctuations in the amount of clientele. That is, cab drivers seem to work less on good days, and more on bad days. This would actually imply downward-sloping labor supply curves, the opposite of what is generally predicted by economics.

Putler (1992) and Hardie et al. (1993) find that consumer price elasticity is asymmetric, as predicted by the prospect theory. Consumers decrease the amount of goods bought more after a price increase than they increase their buying after a similar price decrease, a reaction the authors attribute to loss aversion.

Shea (1995) shows that despite receiving bad news about next year's wages, unionized workers do not cut down their spending as expected, which Bowman et al. (1999) argue to show that the workers are reluctant to cut their consumption below their current reference level. McGlothlin (1956) and Ali (1977) show that people betting on horse races tend to bet on increasingly less-likely winners, as the day progresses. As the track takes a cut of the betting, it is likely that bettors are showing a negative balance towards the end of day. Thus, the behavior of moving towards long shots is consistent with taking increasing risks to achieve break-even reference profits, and the unwillingness to end the day at loss.

Finally, Genesove and Mayer (2001) focus on the real estate markets and find that the asking prices for houses are strongly affected by their purchase prices. It appears that instead of trying to anticipate what the market is ready to pay, sellers are averse to selling the houses at a loss relative to the purchase price. The purchase price has been shown to be an important

reference point also for investors, which will be discussed more thoroughly in the next subsection.

2.2.2. Role of past stock prices as investor reference points

Purchase prices

The examples of the previous subsection illustrate how reference-dependence enters into considerations of economic agents across a wide variety of situations. Besides the general economic effects of prospect theory, finance literature is of course particularly interested in the implications that prospect theory has for investor behavior. Shefrin and Statman (1985) are the first to make this link with their empirical evidence. The authors put loss aversion and prospect theory in a wider theoretical context, and provide evidence on what they call the disposition effect. They document a tendency of investors to sell stocks that have gained value and hold on to stocks that have lost value relative to a reference point. Loss-averse investors are unwilling to recognize losses, and take increasing gambles to break even by holding on to the losing stocks. This behavior is inconsistent with expected utility maximization, because as Ritter (2003) points out, investors act as trying to maximize their taxes. What is more, Grinblatt and Han (2005) point out that the well-faring stocks the investors sell tend to outperform, while those they hold on to tend to underperform the market in subsequent periods. Thus, the investors end up throwing away a part of their profits.

The disposition effect has been well-documented in several studies using aggregate market-wide data (e.g. Lakonishok and Smidt, 1986; Ferris et al., 1988; Bremer and Kato, 1996), data from individual investors' accounts (e.g. Odean 1998; Shapira and Venezia, 2001; Grinblatt and Keloharju, 2001; Coval and Shumway, 2005), and also in studies using an experimental questionnaire design (e.g. Weber and Camerer, 1998; Oehler et al., 2002). Studies document that while sophistication and experience reduce the disposition effect, also professional investors still exhibit it (e.g. Shapira and Venezia, 2001; Garvey and Murphy, 2004; Coval and Shumway, 2005; Feng and Sheasholes, 2005). All in all, evidence of reference-dependence is abundant on this front.

The main body of disposition effect research utilizes the purchase price as their reference point measure of choice. With investors, the purchase price of a stock is of course a natural reference point against which to evaluate gains and losses. However, although the purchase price is a salient comparison point, it can be expected that investors update their reference

points over time as new information arrives. In line with this prediction, Brown et al. (2006) study the disposition effect using the purchase price of a stock as a reference point, and find that after 200 days from the purchase, the disposition effect fades away. The authors interpret the evidence as investors updating their reference points over time.

Other past price measures

Relatively little is known about the process of how investors update their reference points. The difficulty with measuring reference points is of course that they exist only in the investors' minds. If investors update their reference points over time, in theory any price in an asset's time series could act as a reference point. Here, research on human learning and memory comes to aid by suggesting that investors may set their reference points on two features of the stock price: average and extremes. It has been shown that with a number of contexts, such as text, language, pictures, and feeling of satisfaction, people are more likely to remember the general meaning of information instead of specific details (Anderson, 1974; Mandler and Ritchey, 1977; Anderson, 1995). And when details are remembered, those details are particularly novel or unusual (Fiske and Taylor, 1991; Fredrickson and Kahneman, 1993). Summing up, this suggests that people do not remember a continuous record of events, but instead averages and salient, extreme values.

Research utilizing alternate reference point measures is still relatively scarce, and alternate measures are mainly utilized when purchase prices are not available. One such case is when studying the disposition effect in employee stock option exercise. Heath et al. (1999) study employee stock options, and find strong reference point effects for maximum stock prices reached during the year preceding option exercise. In a similar vein, Core and Guay (2001) find that option exercises are greater when stock prices hit 52-week highs, and less when they hit 52-week lows. Grinblatt and Keloharju (2001) find reference price effects in trading activity when new highs or lows compared to the past month are attained. Itzhak and Douglas (2006) show that institutional investors do not exhibit the disposition effect with respect to the purchase price, but with respect to highest historical stock price.

In a more novel context, Loughran and Ritter (2002) explain why issuers do not get upset by underpricing by arguing that the mid-point of an IPO price range acts as a reference point for the issuers, a view partly supported by empirical tests of Ljunqvist and Wilhelm (2005). Kaustia (2004) studies the disposition effect in an IPO aftermarket. He finds limited evidence

for the offer price as an investor reference point, but significant reference price effects when new high and low prices are attained compared to the previous month. In line with the result of people remembering novel information, Kliger and Kudryavtsev (2008) suggest post-event prices of surprising firm-specific events as a potential reference point measure. The authors study earnings announcements containing surprise information, and present evidence that at least some reference point updating happens following such announcements. Weber and Camerer (1998), Chui (2001), and Oehler et al. (2002) all use a questionnaire to test for disposition effect, and present supporting evidence for both of their reference point candidates, the purchase price and the last period price. Gneezy (2005) presents test subjects a hypothetical financial asset following a random walk, and finds evidence on reference price effects around the historical peak price. Finally, Baucells et al. (2008) find that the most important reference points for their test subjects are the purchase price, the current price, and the average price.

Special role of the 52-week high

One maximum in particular, a stock's 52-week high price, has drawn a lot of attention in research. Investors who may already be psychologically prone to remember maxima may be further swayed towards the 52-week period by the financial press commonly reporting the one-year maxima. For example, the Wall Street Journal, Financial Times, and the South China Morning Post all print lists of 52-week highs in addition to current price information each day. The results of both Benartzi and Thaler (1995) and Heath et al. (1999) further support the claim that investors seem to evaluate their investments on average over a backward horizon of one year. Finally, the expert interviews conducted indicate that the 52-week period has indeed established itself as a common backward evaluation period also for bankers in mergers and acquisitions.

In addition to the results of Heath et al. (1999) and Core and Guay (2001) presented above, also various other studies concentrate specifically on the reference effects of the 52-week high. George and Hwang (2004) compare various momentum strategies, and find that traders use the 52-week high price as an important reference point. Their results are verified by Marshall and Cahan (2005) on a different geography. Poteshman and Serbin (2003) study early exercise of exchange-traded options, and find that reaching a new 52-week high is a significant reference trigger of early exercise. Huddart et al. (2009) find significant volume effects around a stock's 52-week high and low prices. Finally, Baker et al. (2009) demonstrate

that the 52-week high acts as a significant reference price in a mergers and acquisitions context, impacting various aspects of merger activity.

Simultaneous effect of multiple reference points

Although it is clear that decisions may in reality be based simultaneously on multiple competing reference points, no direct comparison of the simultaneous effect is possible for naturally occurring asset price sequences. This is because in naturally occurring sequences, different reference measures, for example a 52-week high and 52-week average price, are highly correlated with each other. Consequently, empirical literature focuses more on determining the single reference point that most strongly influences investor behavior, yet even there no comprehensive comparisons exist.

Importantly, the restriction of not being able to compare the simultaneous effect of multiple reference points does not hold true for a laboratory setting. Baucells et al. (2008) present an experimental design, where price series are generated so that the individual effects of various interlinked reference points can be disentangled. The authors find that in order of importance, most of their test subjects' reference considerations are captured by the purchase price, the current price, and the average price. They find little or no role for both high and low prices.

The study of Baucells et al. (2008) mentioned above provides a new direction for research, and in future evidence from the laboratory needs to be combined with evidence from the markets to form a complete picture of the simultaneous effects of multiple reference points. However, to form this picture, a lot more evidence is required both from the field and from laboratory settings on the effects of different reference prices.

2.2.3. Negotiations considerations

Barring hostile takeover attempts, the price offered in a takeover bid usually reflects the outcome of more or less complex negotiations. As the psychological reference-dependence seems to influence human behavior so strongly, it can be expected that the parties of a negotiation try to take advantage of it. Indeed, Kahneman (1992) touches upon the implications of the anchoring bias for a negotiations setting and notes that negotiators have an interest in misleading their counterparties about their intentions. Thus, high claims and low offers are made in the hope of anchoring the other party's view to a desirable position, and to produce a view of one's willingness to make concessions.

Neale and Bazerman (1991) present alternatives on how negotiators in union negotiations try to take advantage of the psychology of anchoring and reference-dependence. Frank (1985) asserts the use of peer groups as reference points in wage bargaining, a view backed by the empirical tests of Babcock et al. (1996). Further, Babcock et al. (1996) show that negotiation parties tend to pick "self-serving" reference groups that are often different from each other, and are ones that that best back up the claim of their own side. Northcraft and Neale (1987) find that such negotiation arguments really do work, as they show that the asking price has an impact on the estimates of the value of a house. Again there is evidence that expertise and experience do not completely eliminate the effect. Northcraft and Neale (1987) find that the bias persists even among professional real estate agents, who maintain that the asking price is irrelevant.

2.3. Pricing of mergers and acquisitions

Besides the role psychology may take in influencing the actors in mergers and acquisitions pricing, the price setting process is firmly grounded on the parties' perceptions of the economic reality. The form of the deal, target and acquirer characteristics may all have an impact on pricing. This section combines results from extant research and insights from the investment banking interviews to a concise review on the price setting process and the determinants of offer pricing. I first review the central role that synergies have in the offer pricing. Next, I examine how roles in price setting are divided between investment bankers and the board of directors. Finally, I present the central price determinants recognized by extant research.

2.3.1. Importance of synergies

According to the investment bankers interviewed, the price determination process starts first and foremost by execution of a formal valuation on the target company's business. Potential synergies constitute the key aspects in this valuation, and a coherent account for their role comes from the theory of corporate diversification. Diversification theory suggests that large corporations can be regarded as a bundle of heterogeneous assets, with each asset potentially having various uses. As market conditions change, some firms face a shortage of specific assets, while others may not employ their assets either to full capacity or in their best use. Thus, combining two firms may result in improved asset utilization, a synergy. Such synergies may be derived for example from creation of internal capital markets to either obtain more funds or distribute the funds more efficiently, cost reductions due to economies

of scale, better utilization of interest tax shields, improved management, or increased market power and market access (e.g. Lang et al., 1989; Servaes, 1996).

In the expert interviews, the distinction between strategic and financial buyers is emphasized. Financial buyers are typically more short-term oriented, looking to improve specific aspects in the target company to eventually resell the company at a profit. Strategic acquirers, on the other hand, are buyers, who have an interest in the target company's business specifically, and view the target as crucial to the survival of their own business. It is specifically with strategic buyers that a lot of focus is put on to determine the potential synergies arising from the deal. In the recent years, the surge of private equity –driven deals has put an upward pressure for the prices paid by strategic acquirers. The private equity houses appearing as competitors on many transactions have often set the expectations level for what can be paid even without realizing any synergies, giving the sellers a strong argument to gouge a higher bid from strategic buyers.

In addition to the total value of synergistic gains, the acquirer and the target have to agree on how these gains will be divided between the parties' shareholders. In most acquisition attempts, where the bid is not actively opposed by the target management, the bidder and the target may meet on a negotiations table and try to come up with terms acceptable to both parties. What is more, synergies are but one aspect in these negotiations, and price is but one of interdependent deal characteristics that have to be agreed upon. The negotiations are complicated by setting of the means of payment, agreeing on the roles of specific managers after the deal, or negotiators hiding their true intentions, just to name a few. All this means that a single specific price cannot be established with certainty, but only a likely range of values that the parties then negotiate on to determine the ultimate price.

2.3.2. Division of roles between boards of directors and financial advisors

A modern M&A transaction is often such a complicated and large scale process that financial advisors, typically investment bankers, are employed by boards of directors on both sides of the table. This is done to obtain a valuation benchmark, assistance for deal execution, and, specifically on the sell-side, to protect the legal standing of the board by obtaining further proof that its reaction to a bid is in the interest of shareholders.

The focal point of an investment bank's work is the execution of the deal, and the formal valuation of the target company. However, it should be noted that according to the interviews,

price is always subject to other conditions agreed upon, with emphasis on transaction security. Further, the bankers often define the price range for the target company in an ideal world, sidestepping potential conflicts of interest affecting the decision-making process. A key distinction and often the point of major divergence on the valuation process between the sell-side and buy-side advisors is also the fact that sell-side estimates are often based on the views of the management of the target company, while the buy-side relies more heavily on public analyst estimates.

The interviews reveal that an important analysis affecting pricing considerations is one the bankers make on the owners of the company and their reactions to a potential bid. If possible, the historical purchase prices of large and institutional owners of the target company are benchmarked, especially if they have become owners recently before a bid. This serves as the first piece of anecdotal evidence that also in an M&A context, reference-dependence manifests itself. The evidence is even stronger, as it concerns professional investors. Besides this analysis, a multitude of bid-specific characteristics affect the pricing, as discussed further in the next subsection.

A board's view of an acceptable price level is not only based on the bankers' advice, however. The investment bank interviews indicate three other major sources of information. First, the opinion of a board may be partly based on previous approaches made on the target company by interested buyers. This information is mainly available to the target's board, however, as most such approaches may have never led to a public takeover bid, due to the board or major owners having opposed them so fervently. Using such approaches as a benchmark is, again, evidence for reliance on past reference values. Second, when choosing a sell-side advisor, the target company often receives preliminary indications of its value from various banks, providing the board members a range of values to benchmark against. Aside from these previous approaches and bankers' indications, it is uncommon that a roll call would be made among the board of directors, and each member would state a price that would be fair in their opinion. Third, a board's view may be influenced by the personal views of one or more long-term board members, who have previously participated in acquisitions. Finally, extant research suggests that mergers and acquisitions may be motivated by a wide range of motives other than pure shareholder value creation (See Section 2.4 for an overview). Such motives may of course have an impact on both the level of prices the acquirer board is willing to pay, and the level of prices the target board is willing to accept.

The interviews also reveal that on the sell-side, the target board and shareholders often focus on recent acquisition premiums offered in the local market. Thus, it is generally hard to succeed with an offer that is below the market price increased with the average premium level, especially with a cash offer. This is a third indication of reference-dependence, as rationally past premium levels should not impact the pricing of a specific transaction in any way. In Finland, a common premium is in the range of 20–30%. Surpassing the past premium level is not a guarantee for success, however, as even though a premium is fair compared to the price prior to a bid, controlling for size, liquidity and analyst coverage may reveal that the premium is too low compared to a price that could be achieved with effective investor relations activity.

All in all, the price determination process is an interplay between the board and investment bankers. Neither side appears to commonly dominate the decision-making process, although the board has the final say on the matter.

2.3.3. Central offer price determinants

Prior to the availability of offer prices in the Securities Data Company (SDC) Mergers & Acquisitions database, takeover literature regularly used target cumulative abnormal returns around the offer announcement date as a proxy for offer prices (see e.g. Walkling and Edmister, 1985; Schwert, 2000). This is, of course, a noisy proxy as the abnormal returns reflect also other aspects of the bid, such as the likelihood of bid success. Further, the approximation of abnormal returns by a market model always adds some noise to the results. Other studies used to rely wholly on hand-collected data on offer prices. For example, Bradley (1980) is the first to systematically analyze offer prices, Walkling (1985) studies the impact of offer premiums on tender offer success using a logistic analysis, and Eckbo and Langohr (1989) concentrate on the impact of disclosure requirements on the offer prices. More recently, the availability of offer prices via SDC has provided a cleaner and easier-to-collect measure for research purposes. Officer (2003) is one of the first to utilize this data. Combining the offer price data with their hand-collected sample from the earlier years, Betton et al. (2008, 2009) present a comprehensive overview on the cross-sectional determinants of US offer prices.

All in all, extant research controls for a plethora of potential price determinants. Instead of trying to document every financial and corporate governance variable ever tested in the

literature, I concentrate on the handful of variables on whose inclusion relatively little disagreement exists in the modern offer price literature. I group the variables into acquirer, target, and deal characteristics. The sign after the variable name describes the expected relation between the variable and offer premium.

Acquirer characteristics

MARKET CAPITALIZATION (+ / -): A measure of firm size. From an agency viewpoint, if managers feel they gain more benefits to themselves by managing more assets, they might be willing to pay more for larger targets, suggesting a positive relation between offer premium and target size relative to acquirer, and a negative relation between offer premiums and acquirer size. Larger acquirers also have more bargaining power in merger negotiations, which should lead to lower premiums. On the other hand, managers of large acquirers are likely to have access to a larger amount of free cash flow, and thus be more subject to making value-destroying acquisitions, due to for example paying too much (Jensen, 1988). Further, managers of large firms are more subject to hubris, and thus, overpayment. The results of Moeller et al. (2004) support the view that larger acquirers pay more.

MARKET-TO-BOOK RATIO (+): A measure of a firm's investment opportunities and relative valuation level. Acquirers with high market-to-book ratios face plenty of alternative investment opportunities, but still choose to buy the target. Consequently, it can be expected that they are better able to profitably exploit the target's resources, and more willing to pay a higher premium (Lang et al., 1989; Lang et al. 1991). An acquirer's market-to-book ratio, and specifically its magnitude compared to a target's market-to-book ratio, acts also as measure of the acquirer's relative valuation. Acquirers overvalued relative to targets may be willing to pay higher premiums, when paying with stock (Shleifer and Vishny, 2003). Evidence seems to generally support the positive relation. For example, Officer (2003) and Moeller et al. (2004) present evidence on positive relation, while the results of Servaes (1991) are inconclusive.

TOEHOLD OWNERSHIP (-): Betton and Eckbo (2000) posit that if possible, acquirers should strive to establish a toehold, a substantial block ownership stake in the target, prior to making a takeover bid. Intuitively, the toehold both reduces the number of shares that have to be purchased at a premium after the announcement, and is still likely to provide a gain, should a rival bidder win the bidding competition and purchase the toehold. Acquiring a toehold also

decreases the probability that a rival bidder can acquire one. Thus, toehold acts also as a competitive advantage in a bidding contest, and can at least partly deter competition, leading to lower observed offer premiums. The interviews support the negative relation between offer premiums and bidder toeholds, as do the empirical results of Betton and Eckbo (2000) and Betton et al. (2008, 2009).

Target characteristics

MARKET CAPITALIZATION (+ / -): A measure of firm size. Smaller targets may be integrated more easily into the acquirer, making them more valuable. This suggests a negative relation between offer premiums and target size. Further, there may be more information asymmetries about the value of smaller targets, making it more difficult to value them accurately. Thus, as a merger bid by custom has to be made with a premium, more uncertainty about the true value will likely result in higher bids, as the acquirer wants to make sure that the deal succeeds. There are also grounds for a positive relation. It can be argued that if acquirers gain from acquisitions, they will benefit even more from larger acquisitions and are thus willing to pay higher premiums to secure larger absolute gains. Alternatively, target bargaining power relative to larger acquirers increases in size, supporting a positive relation. As discussed in the previous subsection, the interviews also indicate target size as an important control variable. Evidence here is inconclusive. For example, Jarrel and Poulsen (1989) and Stulz et al. (1990) show that target announcement returns increase with target size. Travlos (1987) and Lang et al. (1991) find no significant relation. Betton et al. (2009) provide evidence of a significant negative effect on offer prices.

MARKET-TO-BOOK RATIO (+ / -): A measure of a firm's investment opportunities and relative valuation level. It can be expected that acquirers are willing to pay more for targets with abundant investment opportunities. This predicts a positive relation between offer premium and a target's market-to-book ratio. Again, especially with stock deals, also a negative relation can be expected, as relatively overvalued acquirers might be willing to overpay for relatively less overvalued targets. Servaes (1991) presents evidence in favor of a negative relation, while the results of Goergen and Renneboog (2004), and Betton et al. (2008) advocate a positive relation. Officer (2003) finds no significant impact on premiums offered.

STOCK PRICE RUN-UP (+): Takeover bids are typically preceded by a continuous rise in the target stock price. This run-up is commonly attributed solely to the rumors of the bid leaking out to the public. According to this conventional view, the run-up is caused by anticipation of the offer premium, and thus reflects only information that is already known to the bidder. Thus, any run-up should have no effect on the planned offer price (Schwert, 1996). An alternative explanation is that the run-up is caused at least partially by new information on the target's fundamental value. Should this be the case, the bidder would also be forced to respond by marking up the planned offer price, a view developed by Betton et al. (2008). Betton et al. (2008, 2009) sharpen up Schwert's tests using offer prices instead of abnormal returns. They define offer markup as the offer price in relation to the closing price of the day before and find a statistically significant positive relation between markups and target run-ups. Thus, the authors show that price run-up is also an important determinant of offer premiums, a dollar increase in run-up increasing the offer price by $0.80.

LIQUIDITY (+ / -): Target stock liquidity can act as an important determinant of offer premiums due to increasing the costs of acquiring a toehold. If the stock is illiquid, starting to acquire a toehold may cause substantial price movements and attract investor attention or even media speculation about a potential acquisition. Thus, increasing the toehold further can become expensive and potential competitive bidders may emerge. To the extent that toeholds decrease offer premiums, this suggests an inverse relation between offer premiums and target stock liquidity. Alternatively, the interviews suggest that controlling for liquidity may reveal that a premium is too low or high, because the current market price can be distorted by individual large trades. Using alternative liquidity variables, Betton et al. (2008) find an insignificant positive relation while Betton et al. (2009) find a significant positive relation.

Deal characteristics

MULTIPLE BIDDERS (+): A measure for competition on acquiring the target. Any competition improves the bargaining position of the target's board, and higher offer prices are required to seal the deal. The winning bidder is likely to have to outbid the competition, resulting in a positive relation between offer premiums and bidder competition. This relation is documented extensively with both abnormal returns (e.g. Bradley et al., 1988; Stulz et al., 1990; Servaes, 1991) and with offer prices (Betton et al., 2009).

HORIZONTAL MERGERS (+ / -): When the target is operating in the same industry as the acquirer, it is likely that a merger will more easily allow the sharing of common overheads. Further, acquirer managers knowing the industry and spotting what they think is an underperforming target might be more subject to hubris, and thus willing to pay more. These considerations suggest a positive effect on the offer premium. On the other hand, the acquiring company's managers are on average likely to be able to value the target and its prospects more accurately, when they know the industry and have competed with the target in the past. Whether this more accurate valuation is higher or lower, cannot be said. Thus the relation between offer price and horizontal mergers is ambiguous. Empirical results are also inconclusive on the subject. For example, neither Maquieira et al. (1998) nor Betton et al. (2009) find a statistically significant effect on offer premiums, while Martynova and Renneboog (2006) present evidence on higher target returns for mergers and acquisitions that are not horizontal.

FORM OF PAYMENT - STOCK (+ / -): There are reasons to expect that the magnitude of offer premium also depends on the method of payment. First is taxation. It is commonly observed that target shareholders pay an immediate capital gains tax, if they tender their shares in cash. Conversely, payment in securities allows deferral of taxes. This predicts that ceteris paribus, offer premiums should be higher in cash deals than in stock deals: the difference in offer premiums between a cash offer and a stock offer should be equal to the difference in the present value of the deferred taxes and the immediate tax liability. Shleifer and Vishny (2003) present a converse argument stating that acquirers may be more willing to pay in stock when the shares of their firm are overvalued relative to the shares of the target firm. On paper, this allows stock acquirers to pay more. It can also be argued that target shareholders perceive this possibility and mark down stock offers accordingly, leading to higher required payments to complete the deal. In the short-term, before the overvaluation corrects itself, it might thus appear that offer premiums are higher in stock offers. Measured with offer prices or abnormal returns, results generally support the negative relation (e.g. Schwert, 2000; Andrade et al., 2001; Officer, 2003; Betton et al. 2009)

DEAL HOSTILITY (+): Hostile takeovers are deals where completion is deemed being opposed by the target's board of directors. Whether the hostility represents only aggressive target bargaining or entrenched management protecting its position, higher offer premiums

may be required to convince shareholders to act against the wishes of the board. Considering that a hostile bid would be made to replace the poorly performing entrenched management, hostility might also be a measure of clear improvement potential in the target company, giving acquirers a reason to pay more. The expert interviews indicate that indeed, a higher premium may be required in order to convince the shareholders to act against the wishes of the board. Extant research generally verifies the positive relation between offer premiums and deal hostility (e.g. Servaes, 1991; Goergen and Rennebook, 2004; Betton et al., 2009).

TENDER OFFERS (+): A tender offer is an offer made directly to the shareholders of the target to sell their shares, bypassing the target's board of directors. As such, it encompasses some aspects of a hostile bid. Even so, majority of tender offers are not opposed by the target board, in contrast to offers classified as hostile. However, the motivation here for a positive relation is the same. That is, higher offer premiums are required to sway the target shareholders to sell, when an agreement is not actively negotiated with the target board and management. The evidence generally shows that offer premiums are higher in tender offers (e.g. Schwert, 2000; Officer, 2003; Moeller et al., 2004 Martynova and Renneboog, 2006), but Betton et al. (2009) find that they are significantly lower. However, in contrast to the SDC classification commonly employed, Betton et al. (2009) classify a slightly larger variety of bids as tender offers, and supplement their classification with news searches.

2.4. Motives behind M&A and reactions to bid announcements

The previous subsection has given a glimpse on the complexity of the price setting in M&A by detailing the multitude of factors entering into price considerations. I continue by presenting the variety of motives why takeovers happen in the first place to further illustrate the complexity of fully rational price setting. I also briefly review the research on shareholder wealth effects from mergers and acquisitions. This research serves as an important baseline in interpretations, when I test how bidder shareholders react to 52-week high driven bids in particular.

2.4.1. Motives behind M&A

Previous research offers many explanations for corporate takeovers, but three motives are currently recognized as the most prominent motivators: the efficiency motive, the agency motive, and the hubris motive (Berkovitch and Narayan, 1993).

According to the efficiency motive, mergers are undertaken to improve the combined efficiency of the participating companies. This can happen through the realization of operative and financial synergies, through at least partial replacement of a less competent target management, or through gaining increased market power and market access (Chatterjee, 1986). The efficiency motive predicts that managers engage in M&A activity only when it results in gains to both target and acquirer shareholders. The division of these gains then depends on the relative bargaining power of the parties.

The agency motive points to managerial self-interest of the acquirer management as the driving force behind transactions. Managers diversify their own portfolios (Amihud and Lev, 1981), use free cash flow to expand the firm and their influence (Jensen, 1986) and acquire assets that increase the firm's dependence on the management (Shleifer and Vishny, 1989). The agency motive predicts that takeovers result in value transfers from acquirer shareholders to acquirer management. Target shareholders are still likely to gain, but combined gains will be negative.

The third motive, suggested by Roll (1986), states that that mergers are fueled by managerial hubris or overconfidence. Roll (1986) suggests that on average, the amount of potential synergies in a takeover is non-existent. Acquirer managers, however, make overly optimistic assumptions about the value of synergies and wish to engage in acquisitions. The most overconfident bidder will win in a bidding contest, and will end up overpaying and thus suffering from the winner's curse. The target shareholders gain what the acquirer shareholders lose, leading to a zero-sum total gain on frictionless markets and to a slightly negative total gain on imperfect markets.

2.4.2. Empirical reactions to bid announcements

In a classical study, Jensen and Ruback (1983) conclude that the total gain from a takeover to both bidder and target stockholders is positive and significant. Subsequent studies using comprehensive samples of acquisitions over the last century come to the same conclusion (see e.g. Jarrel et al., 1988; Andrade et al., 2001; Martynova and Renneboog, 2006). Little disagreement exists about the fact that takeover gains are positive on average, and that most of the gains accrue to target shareholders.

Extant research reports positive target gains for US and European targets alike. Specifically to Europe, UK and Continental European targets gain an average announcement return of 24%

during 1955-1988 (Franks and Harris, 1989), 19% in 1966-1991 (Danbolt, 2004), 13% in 1990-2001 (Goergen and Renneboog, 2004), and 9% in the period 1993-2001 (Martynova and Renneboog, 2006).

Despite the abundance of research, evidence on bidder gains is a little more ambiguous. A typical finding is a small, yet significantly negative announcement return (see e.g. Franks et al., 1991; Healy et al., 1992; Mulherin and Boone, 2000; Andrade et al. 2001) or an effect close to zero (see e.g. Asquith et al., 1983; Loderer and Martin, 1990; Schwert, 2000; Moeller and Schlingemann, 2005). Large bidders as measured by market capitalization (Moeller et al., 2004; Moeller et al., 2005) and those bidding for public targets (Bradley and Sundaram, 2006; Bargeron et al, 2008) experience the most negative returns. In a large sample study of European mergers and acquisitions activity, Martynova and Renneboog (2006) report a bidder announcement return of 0.5%.

2.5. Merger waves

Besides the impact on deal pricing and success, it is hypothesized in this paper that the reference effects of the 52-week high price impact also the clustering of merger activity in waves. This section reviews the current knowledge on merger waves.

Clustering of merger activity in time remains one of the unsolved puzzles in finance. While the aggregate merger activity has had a rising trend over time due for example to economic expansion, merger activity has spiked clearly on several occasions: The early 1900s, the 1920s, the 1960s and late 1980s and 1990s each saw an unprecedented explosion in the number of deals done. The sixth and latest clustering took place during 2004–2007, ending in the economic slowdown caused by the emerging credit crisis. Further, these merger clusters, or merger waves, have coincided with high stock market valuation levels (e.g. Maksimovic and Phillips, 2001; Jovanovic and Rousseau, 2001). Many suggestions have been put forward on the reasons, yet literature remains less than conclusive on the subject.

The first merger waves were predominantly a US phenomenon, with UK accounting for most of the European activity. The wave of the late 1990s marked the first truly international surge in mergers, with also the continental European firms participating eagerly for the first time. The number of US and European deals over the 1990s amounted to 119 035 and 116 925, respectively, bringing the European market for corporate control on par with that of US (Martynova and Renneboog, 2005). For the first time, also an Asian takeover market

emerged. This international trend continued also in the latest wave, suggesting that international waves are the norm in today's globalized economy.

The literature explaining merger clustering comprises neoclassical and behavioral strands. The neoclassical explanations build on the assumption that changes in economic fundamentals motivate many firms to restructure simultaneously. Already in the 1930s, Coase (1937) argues that technological change stimulates mergers. Gort (1969), and more recently Mitchell and Mulherin (1996), propose that merger clustering in time may derive from industry shocks. Industry shocks, including deregulation, technological change, financing innovations, shocks that increase asset complementarity and changes in availability of capital bring about a forced asset reallocation inside an industry, as firms have to adapt in order to survive (e.g. Harford, 1999; Rhodes-Kropf and Robinson, 2004). This view is supported further by evidence from Mulherin and Boone (2000) and Andrade et al. (2001). In line with their own explanation, Mitchell and Mulherin (1996) find that besides time, merger activity clusters also by industry. Further, Jovanovic and Rousseau (2002) suggest models, in which economic and technological change causing increased dispersion in q-ratios lead to waves of firms with high q-ratios taking over firms with low q-ratios. All in all, the neoclassical theories explain merger clustering over time, but shed no light on the coincidence of stock market booms and mergers.

Recent work focuses on the link between market valuation levels and merger activity, dubbed as behavioral explanations. Shleifer and Vishny (2003) argue that managers take advantage of market misvaluations and use the overvalued stock of their firms to buy relatively less-overvalued targets. Rhodes-Kropfh and Viswanathan (2004) propose a slightly different explanation. They purport that from a target's perspective, merger bids tend to look more attractive when the market is overvalued, because target managers cannot accurately distinguish between market-specific and firm-specific components of the overvaluation. Finally, Harford (2005) executes a comparative study of the neoclassical and behavioral motivations of merger waves, and finds evidence in favor of the neoclassical theory, further arguing that sufficient capital liquidity must be present for an industry shock to give rise to a merger wave. He posits that that "the observed relation between high stock market valuations and merger waves has been misattributed to behavioral misvaluation factors", and that "the relation is actually driven by the higher capital liquidity … that accompany an economic expansion".

Baker et al. (2009) sidestep the debate between the neoclassical and behavioral explanations and present a new theory complementing previous explanations. The authors argue that as more targets are trading close to their 52-week highs during bull markets, it is easier for bidders to justify themselves a valuation that corresponds to or exceeds the target 52-week high stock price, which acts as the target investor reference price. Thus, more bids and, consequently, completed deals are likely to occur. The empirical results of Baker et al. (2009) support these predictions and suggest that the 52-week high reference-dependence at least partly explains why merger waves occur.

2.6. European regulation regarding pricing of takeover bids

One of the main hypotheses tested in this study concerns the impact of the 52-week high price on offer pricing of mergers and acquisitions in Europe. To better compare the results with a recent US study of Baker et al. (2009) and across my sample countries, it is worthwhile to document whether the legal frameworks governing takeover bids differ with regard to pricing in Europe and United States, and also across European countries. One major difference exists, namely the mandatory bid rule prevalent nowadays in the European Union. The mandatory bid rule states that when passing a certain ownership threshold, a potential acquirer has to make a mandatory bid for all the remaining shares in the company, for a certain minimum price. Conversely to the legislation in Europe, the takeover regulation in United States does not contain a mandatory bid rule, except in the states of Maine and Pennsylvania.

The origin of the mandatory bid rule lies in the United Kingdom, where already in 1968 the Bank of England introduced the City Code on takeovers in response to perceived abuses in the takeover market (Grant et al., 2009). The role of a mandatory bid rule is to protect the minority from being expropriated in a takeover situation, in which the acquirer would only buy an amount of shares sufficient to gain control with a premium, and then would do as it pleases without a care for the remaining minority owners. Following the increase in the European takeover activity since the 1980s, also other countries began to implement their own forms of mandatory bid rules, loosely following the conventions established in the UK. This development was not simultaneous however, and many of the countries also revised their laws during the 1990s or the 2000s at least once after their initial adoption.

This evolution sparked the European Commission to start drafting a common European takeover legislation. Negotiations proved difficult however, and the idea of harmonized

legislation was abandoned. Instead, the European takeover directive, in force since May 2006, was adopted, bringing the mandatory bid rule to a part of each member state's legislation. Room was left for each individual country to determine by themselves, which threshold should trigger a mandatory bid. Further, the member states may determine the mandatory bid price, with certain restrictions. Most member states have adopted 30% as the threshold after which a mandatory bid has to be made. These thresholds and mandatory offer prices are documented in Table 1. The information is obtained from the 2009 edition of the Mergers and Acquisitions series of the International comparative legal guides.

Table 1:
Mandatory bid regulation in sample countries since 2006

This table lists the mandatory bid thresholds and minimum bid prices for all the countries in my sample, as specified by the local regulation in force since the implementation of the European takeover directive in 2006. For reference, the geographic distribution of the sample is presented in Table 3. The countries are arranged in a decreasing order according to the number of target company observations.

	%-threshold(s)	Minimum bid price
United Kingdom	30	Highest bidder has paid in 12m
France	33	Highest bidder has paid in 12m
Germany	30	Higher of highest bidder has paid in 6m and 3m average
Sweden	30	Highest bidder has paid in 6m
Norway	33	Higher of highest bidder has paid in 6m and market price
Italy	30	Highest bidder has paid in 12m or if not appl., 12m average
Netherlands	50	Highest bidder has paid in 12m
Spain	30	Highest bidder has paid in 12m
Denmark	30	Flexible
Switzerland	33	Higher of 75% bidder has paid in 12m and 2m average
Belgium	30	Higher of highest bidder has paid in 12m and 1m average
Greece	33	Higher of highest bidder has paid in 12m and 6m average
Portugal	33, 50	Flexible
Finland	30, 50	Highest bidder has paid in 6m
Ireland	30	Higher of highest bidder has paid in 6m and market price
Austria	30	Higher of highest bidder has paid in 12m and 6m average
Luxembourg	33	Highest bidder has paid in 12m

As can be seen from the table, most of the regulation after the implementation of the takeover directive has shaped itself after UK, where the minimum bid price in mandatory offers has remained unchanged for some decades already. Generally, there are no minimum bid prices for voluntary offers, that is, for offers made before a mandatory bid threshold is breached.

The first observation from the mandatory bid prices is that in many cases, the wording contains many similarities with the 52-week (=12-month) high price. However, the mandatory

bid rule talks about the highest price the bidder has paid during the period, not about the highest price quoted for the stock. It can still be expected that the mandatory bid rule further directs the attention of both bidders and targets to the price developments preceding the bid, and in most countries, specifically to the 52-week period. No statistics exist about how big a proportion of European takeover activity is comprised of mandatory bids.

Extant research finds significant differences in takeover premiums across European countries (Goergen and Renneboog, 2004; Rossi and Volpin, 2006; Martynova and Renneboog, 2006). However, evidence on direct effects of legislation on takeover premiums is scarce. The first, and to my knowledge, the only ones to directly account for mandatory bid rule in M&A research are Rossi and Volpin (2004), who study international mergers and acquisitions announced between 1991 and 1999 in 49 countries. With a very crude approach, considering that the legislation evolved in many countries continuously through the 1990s, the authors define an indicator variable mapping the presence of a mandatory bid rule in 1995. They also test for the effect of shareholder protection. The authors initially find that both variables have a significant negative effect on premiums. However, this effect disappears once they include country indicator variables for both US and UK, suggesting that they were only capturing a difference between US and UK targets. Martynova and Renneboog (2006) classify targets according to their legal origin, and find statistically significant differences in offer premiums as measured by abnormal returns.

It is not difficult to see why existing research hardly accounts for the existence of the mandatory bid rule. First of all, it should be noted that the regulation remains rather heterogeneous even after the implementation of the takeover directive, making comparison across countries difficult. Further, looking back in time to the period before 2006, the regulation between countries diverged notably more, and to my knowledge, no comprehensive reviews exist on the developments of this legislation across European countries. The information presented here still allows me to perform relatively strong tests on the impact of the mandatory bid rule on psychological reference-dependence. A more comprehensive account would require reviewing the takeover legislation in each country for approximately 15 years preceding the implementation of the EU takeover directive. This is a massive task, however, as most of this information is either not available on the Internet, or only available in the local language. Consequently, it is a task better suited for a paper of its own concentrating on the evolution of the mandatory bid regulation.

3. HYPOTHESES

Prior research has identified a stock's 52-week high price as an important investor reference point. It is a price indicator commonly cited in various financial media, potentially enhancing its salience in investors' minds. Compared to the purchase price of a stock, the 52-week high stock price is also particularly well suited for a study of mergers and acquisitions, as it is a reference point readily available and also common across all investors. This section outlines, how reference-dependence can be expected to manifest itself in mergers and acquisitions activity.

When an acquisition attempt of a sufficient size is made, it comes under the scrutiny of both target and bidder board of directors and shareholders. The key for the ultimate success of an offer is often in the hands of target shareholders. When the target shareholders receive an offer for their shares, they have to either accept or decline it. A central consideration here is, of course, the price offered for the shares. Having established that investors are commonly loss averse, that is, reluctant to realize losses relative to their reference points, it can be expected that target shareholders are unwilling to sell their shares at a price below their reference price, the 52-week high. Target shareholders may be further inclined to benchmark past price levels, because they lack the ability and means to execute a sophisticated financial valuation themselves.

Even without direct share ownership or equity-based compensation, the target management and board are also likely to follow the share price performance closely, and thus be at least partly subject to reference-dependence. An indication of this is that board press releases in response to bids often compare the offer price to past price levels alongside other argumentation. The target board also subjects itself to a potential juridical liability, if it recommends too low an offer price for target shareholders. Covering all the bases, the board may reason that such an argument is hard to prove if the offer price exceeds the highest published price still at hand, the 52-week high.

Next, it is important to understand how the psychology of reference points could play a role in mergers and acquisitions, despite the fact that both parties of the deal commonly employ professional financial advisors, investment bankers, to assist them in negotiations for completing the deal. The investment bankers commonly execute a formal valuation on the target company that acts as a basis for price negotiations. The information discrepancies

between the buyer and the seller, and a number of other considerations besides price that need to be agreed upon in the negotiations mean that a single definite price cannot be set with precision, however. Commonly, the valuations executed by bankers on both sides of the table lead to a range of values that is then negotiated on. The fact that price setting is only a single consideration in a set of complex decisions thus leaves room for psychological influences to impact the price determination process.

Also negotiation tactics may be used to inflict reference-dependence on other parties. Target and acquirer management often engage in negotiations both prior and after an offer is made public and often employ investment bankers to assist them. In the negotiations over price, it is in the interest of the target side to try to argue the price upwards as much as possible. As was pointed out in the literature review, negotiation parties try to anchor the opposing party's view to a favorable position with their argumentation. The investment banker interviews also establish argumentation through past price levels as a common practice, and the year preceding the deal as the usual backward period under review. Thus, the 52-week high price is a natural negotiations argument for the target side, while the buyer side is more likely to use other price measures to try to argue the price down.

Finally, it should be noted that the bidders do not need to be reference-dependent themselves in order for the reference price to matter. If the 52-week high indeed acts as an important reference point for target shareholders, investment bankers as mergers and acquisitions professionals may be aware of this. The bankers may recognize the 52-week high as an important consideration for target shareholders, without being subject to the psychological bias themselves. Thus, they may advice the buyer to bid at a price equal to at least the stock's 52-week high, to ensure that target shareholders agree to sell their shares.

To sum up, the 52-week high can act as an important reference point for target shareholders and board of directors. Through negotiations arguments, the bidder can be anchored to the 52-week high as well, or purely try to ensure success by meeting the critical price level required by target shareholders to sell. In such a situation, it is expected that the offer prices gravitate towards or above the 52-week high stock price. Thus,

Hypothesis 1: There is a positive relation between the offer premium and the 52-week high stock price of a target

Meeting or exceeding the reference point should make loss-averse target shareholders more willing to sell their shares. Thus,

Hypothesis 2: Bid success increases discontinuously when the offer price meets or exceeds the target's 52-week high stock price

If the offer price is strongly driven by a target's 52-week high stock price, bidding for a target whose price has fallen way below the 52-week high is most likely to result in overpaying. Further, not party to the price negotiations themselves, bidder shareholders could be expected to be relatively free of the reference-dependence. Consequently, it can be argued that bidder shareholders should be able to assess the bid and the potential overpayment rationally. Thus,

Hypothesis 3: Bids, where the offer price is driven strongly by the 52-week high psychology, will result in more negative bidder announcement returns than on average

It is always easier for bidder boards to justify themselves and their shareholders an offer that is made at a low premium relative to a target's current market value. If bidding an amount equaling at least a target's 52-week high price is an important consideration, a low premium is most easily achieved when the market is already booming. This is because targets are already more likely to trade close to their 52-week high prices, so surpassing that price may not demand that big of a premium. Consequently, more mergers should happen when many targets trade close to their 52-week highs, that is, when the current value of the market index is close to its 52-week high. To retain the functional form with the previous hypotheses, I invert this prediction to state that the further away the market index's 52-week high is from the current value, the fewer mergers should happen. Thus,

Hypothesis 4: The ratio of the 52-week high value of the market index to its current value is a negative predictor of merger activity

It is rational to expect that investors update their reference points constantly, not only when a new 52-week high is reached. It has been documented in the literature that the disposition effect with respect to purchase price fades away approximately 200 days after the purchase

(Brown et al., 2006). The authors interpret this as evidence that investors update their reference points as new information arrives. Similarly, as investors obtain more and more information about recent price developments, the importance of the 52-week high as a reference point can diminish. Thus,

Hypothesis 5: The effect of the 52-week high on offer premiums is weaker the further away in the past the high has been reached

Despite the impact diminishing over time, the prominent role of the 52-week high in financial media should make it a reference point that is more salient compared to other potential reference points. While purchase prices are not available, research suggests minimum and average prices as other potential reference points. Thus,

Hypothesis 6: The effect of the 52-week high on offer premiums is stronger than that of any other high, minimum or average price during the 52-week period or in the months prior

4. DATA AND METHODS

This section starts with the presentation of the sample selection process and descriptive statistics, and then continues to illustrate the methodology utilized in testing the hypotheses. In addition, exhaustive variable definitions are presented in Appendix B.

4.1. Data

4.1.1. Sample selection

The sample utilized in this study comes from Securities Data Corporation (SDC) Platinum Mergers & Acquisitions and Thomson Datastream databases. I combine data from these sources to create a comprehensive dataset of M&A deals, acquirer and bidder characteristics, potential reference price measures and stock returns.

SDC is a widely-used data source for information on M&A activity. The database covers both public and private firms involved in an (attempted) acquisition of at least 5% ownership of a target company. Although not exhaustive, it is still viewed as the standard source for especially European transactions by both academics and business professionals alike.

Thomson Datastream includes information on a wide array of financial instruments, and it is often used especially for obtaining time series data.

To be included in the final sample, a bid has to satisfy the following conditions:

1. The bid announcement is made before the end of year 2008. I include 2008 as the cutoff point in order to obtain the financials for the financial year ending prior to the bid, no matter the reporting period.
2. The bid is not classified as a recapitalization, repurchase, a rumor, or solicited by the target. A target actively searching for a bidder might be in a worse bargaining position what comes to offer price, and thus it would be more likely that it would have to accept a bid price below the 52-week high, regardless of psychological considerations
3. The target is a company, whose primary nation region is classified as Western Europe or Europe in SDC (the target is incorporated there). This includes Norway and Switzerland in addition to the original EU-15 countries. It is customary to exclude transactions made by Eastern European companies, as the relatively less developed institutions and capital markets in such countries might otherwise disrupt the results
4. The target is a public firm
5. The offer price of a deal is known
6. The transaction includes (an attempted) change in control of the target entity. To exclude deals intending to buy a minority participation, I require that the acquirer is attempting to acquire at least 50% of target shares in the offer or the amount of shares acquired in the offer is unknown. This excludes also gradual acquisitions resulting in full control, but where only minor stakes are acquired at a time. This still includes offers that did not succeed
7. Target stock price data from Datastream is available for the 365 days preceding the 30 days before a bid is made, that is, a 52-week high stock price can be calculated

These criteria result in a sample of 3037 observations. I further exclude bids from the period 1986-1996, 28 in total. Even combined, they amount to only third of the bids taking place in year 1997 alone. It is apparent that this is due to SDC not really covering European offer prices systematically prior to 1997, and thus I deem it reasonable to focus on the period 1997–2008. This leaves me with a sample of 3009 takeover bids.

Despite their common origin, transaction data sourced from SDC cannot be directly complemented with financial data from Datastream. Initially, SDC provides Datastream codes for less than half of the companies. The rest of the companies have to be matched using various company identifiers, such as SEDOL (mainly), but also tickers and CUSIP codes. As a last resort I attempt to search the missing companies manually by their name. From Datastream I obtain both the daily closing prices and trading volumes required for calculating the reference price measures, and the financials for target and bidder companies. The financials are only available for a subset of the deals.

As offer prices are now available from SDC, calculating offer premiums requires only identification of suitable base prices, with which the offer prices are scaled. A theoretically correct measure for such a base price would be the target's pre-offer price that the bidder uses on evaluating how much it should pay. As this is largely impossible to observe accurately, literature commonly selects a target stock price anywhere between three months and two weeks preceding the bid. This price is then deemed to be mostly free of market anticipation of the offer. Following Baker et al. (2009), I use the target stock price from 30 days prior to the bid announcement date as the base price. Appendix B presents the formulas and short descriptions for offer premium as well as for all the other variables used in this study.

In addition to the offer premium, also the main independent variable 52-week high is scaled by the target stock price 30 days prior to the announcement. This is done also for other target reference price measures. Consequently, the main independent variable is actually the 52-week high premium, that is, premium of the 52-week high compared to the 30-days lagged price. For simplicity, I refer to the 52-week high premium as the 52-week high price in the results discussion. The purpose of scaling both the dependent and the main independent variable with a common factor is to eliminate heteroskedasticity that would otherwise result from comparing the different prices in a raw form.

Baker et al. (2009) also include an inverse of the 30-day lagged price in most of their regression specifications. This done to account for the possibility that investors and boards would not themselves think in terms of 30-day lagged price, which might lead to a measurement error resulting in spurious positive correlation. Importantly, offer price literature usually does not include such a control. I run all the regressions both including and excluding the variable, but find no material impact on the results. As an offer premium determinant, the

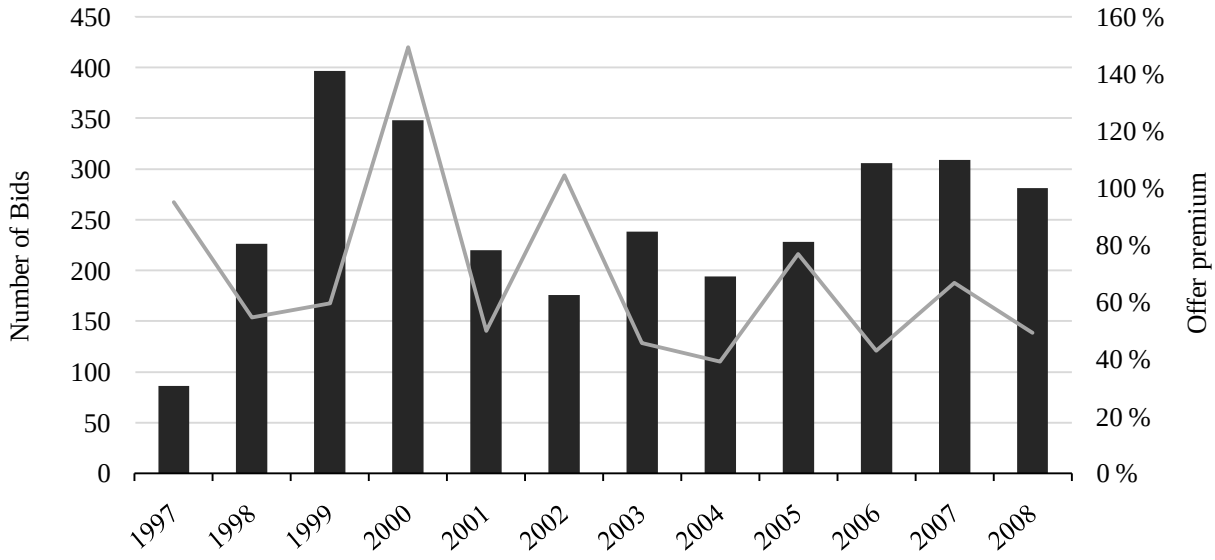
term is statistically highly significant with a coefficient close to zero. In other regressions it is not statistically significant. I decree not to use the variable, and thus do not present it in the regression results.

4.1.2. Descriptive statistics

Figure 2 shows the distribution of the sample bids over time and the average offer premium for each year. The number of bids in 1997 is less than a third of that in any of the other years. From then on, activity climbs steadily: the merger waves are clearly apparent at the turn of the century and during 2006-2007. The average offer price peaks at the year 2000, possibly reflecting the huge premiums paid with stock in the dot-com boom. There is a declining trend in the average offer premium towards the end of the sample period.

Figure 2:
Sample distribution over time

This figure shows the distribution of the takeover bids over time in the full sample. The columns correspond to the vertical axis on the left and represent the number of takeover bids. The line corresponds to the vertical axis on the right and represents the average offer premium. For complete definitions of all the variables, see Appendix B.



What is clearly apparent from Figure 2, is the astonishingly high level the of the offer premium on average, 69.44% to be exact (see Table 2). A closer examination reveals that the average is drawn up by several extremely high values. The median of 23.38% seems to reflect a reasonable approximation, however, and is also in line with the typical premium range of 20–30% that came up in the interviews. The extreme values most likely represent data entry errors, or errors in matching certain companies across the two financial databases. As it

cannot be said with certainty that all of the extreme values are outliers, I resort to winsorising the dependent variable. After the winsorisation, the average of 30% is well in line with the previous studies of Betton et al. (2008, 2009) and Baker et al. (2009), and also with the interview indications. Also the main independent variable 52-week high is winsorised at 5% level, and all the other continuous independent variables at 1% level.

Table 2:
Summary measures

This table presents means, medians, standard deviations, and the winsorisation cut-off percentiles for the main variables used in this study. All the statistics presented are prior to winsorisation. The upper portion presents the summary measures of offer premiums and target 52-week high prices for the full sample, that is, for those bids for whom data on offer price and target stock price development for the period [-395;-30] is available. For these 3009 bids deal characteristics are also shown. The lower portion presents information on targets and acquirers, respectively. These summary measures of financial information are from the smaller part of the full sample, for which additional data is available. For complete definitions of all the variables, see Appendix B.

Key variables	Avg	Md	Std.d. (%)	5%	95%	N
Offer premium (%)	69.44	23.38	635.15	-25.48	121.70	3009
Target 52HI (%)	65.58	20.83	197.18	0.00	250.29	3009
Deal characteristics					% of total	N
Form of payment: cash					50.02	1505
Form of payment: stock					12.10	364
Deals completed					65.60	1974
Tender offer					63.28	1904
Deal attitude: hostile					4.52	136
Financial buyer					12.99	391
Horizontal merger					40.51	1219
Target characteristics	Avg	Md	Std.d. (%)	1%	99%	N
Run-up (%)	7.15	4.40	28.18	-49.82	65.23	3009
M/B	2.05	1.59	2425.34	-3.46	21.88	2677
Market capitalization ($m)	1055.14	96.18	4.86E+05	1.33	17261.55	2987
Amihud illiquidity	698.40	4.52	2.19E+06	3.58E-06	4425.89	3009
ROA (%)	2.35	4.69	28.51	-73.58	34.05	2690
Returns volatility (%)	2.72	2.26	1.82	0.66	9.51	3009
Acquirer characteristics	Avg	Md	Std.d. (%)	1%	99%	N
M/B	4.75	2.25	2437.43	-2.25	56.18	1223
Market capitalization ($m)	7694.63	847.09	2.27E+06	5.05	95333.58	1318
Toehold size	12.21	0.00	24.53	0.00	97.09	3009
$CAR_{-3,+3}$ (%)	-0.74	-0.37	8.71	-31.71	21.77	995
ROA (%)	4.92	5.76	17.81	-44.75	35.45	1258

The motive for winsorising is also apparent in descriptive statistics for the other variables. For example, for more than 1% of targets and acquirers, the market-to-book ratios are actually

negative due to negative book values. Also the upper 1% of the market-to-book ratios seems high. Another surprising fact is that toehold ownerships at announcement seem to range up to 98%, despite one of the sampling criteria being that the acquirer is intending to buy at least 50% of the target in the transaction. A toehold of 50% or more can be found in a bit more than 5% of the observations. The offer price literature generally takes toehold figures as given, and thus I resort to winsorising toeholds alongside the other variables.

From Table 2 it can also be seen that targets are on average smaller than acquirers, have a lower return-on-assets, and lower valuation ratios. This observation supports the market-timing theories of Shleifer and Vishny (2003) and Rhodes-Kropf et al. (2004), and is also consistent with the literature of poorly-performing firms becoming targets (e.g. Healy et al, 1992). Finally, tender offers account for more than 60% of the sample, considerably more than the typical figure of 20–30% in either European M&A samples (e.g. Martynova, 2006) or in the US samples focused on offer prices (e.g. Betton et al., 2008, 2009; Baker et al., 2009). This could be due to offer price coverage being limited more towards completed deals, as there is a significant positive link between deal success and tender offers (see Section 5.3. for analysis on determinants of deal success).

Table 3 shows the geographic distribution of the sample. As was obvious also in the description of merger activity over time in Section 2.5., almost half of the sample bids are made on targets based in UK. All in all, the European takeover engine is clearly evident in the sample, with UK, France, and Germany accounting for 64% of targets and 55% of acquirers. However, with 6.7% and not far ahead of Sweden, the number of German targets is surprisingly low. The Scandinavian takeover market is sizeable, comprising 15% of all targets. Although not reported on the table, 30% of the deals are cross-border. Of the acquirers outside of the developed Europe, United States accounts for 58% of the bids.

Table 3:
Geographic distribution of the sample

This table shows how the target and bidder firms in the full sample are distributed geographically. The sample selection process is described in Section 4.1.1. The distribution of targets is presented on the left, while the distribution of acquirers is presented on the right. For each country, each panel first shows the number of bids, followed by the relative share and the cumulative share of all bids. As most of the tests on this paper concentrate on target company considerations, the countries are arranged in a decreasing order according to the number of target company observations.

Table 3 (cont.):
Geographic distribution of the sample

	Target			Acquirer		
	N	%	Cum. %	N	%	Cum. %
United Kingdom	1368	45.5	45.5	1122	37.3	37.3
France	369	12.3	57.7	326	10.8	48.1
Germany	202	6.7	64.4	194	6.4	54.6
Sweden	167	5.6	70.0	139	4.6	59.2
Norway	152	5.1	75.0	96	3.2	62.4
Italy	132	4.4	79.4	135	4.5	66.9
Netherlands	125	4.2	83.6	124	4.1	71.0
Spain	84	2.8	86.4	89	3.0	73.9
Denmark	71	2.4	88.7	64	2.1	76.1
Switzerland	62	2.1	90.8	63	2.1	78.2
Belgium	57	1.9	94.5	59	2.0	81.4
Greece	54	1.8	92.6	38	1.3	79.4
Portugal	43	1.4	97.3	40	1.3	83.8
Finland	41	1.4	95.8	32	1.1	82.5
Ireland-Rep	41	1.4	98.6	39	1.3	85.1
Austria	28	0.9	99.6	21	0.7	85.8
Luxembourg	13	0.4	100.0	27	0.9	86.7
Other	0	0.0	100.0	401	13.3	100.0
Total	3009	100.0	100.0	3009	100.0	100.0

I continue by plotting a histogram of the differences between offer prices and target 52-week high prices, presented in Figure 3. The median and the mode of this distribution are both equal to 0, the value signifying an offer price exactly equal to the 52-week high stock price.

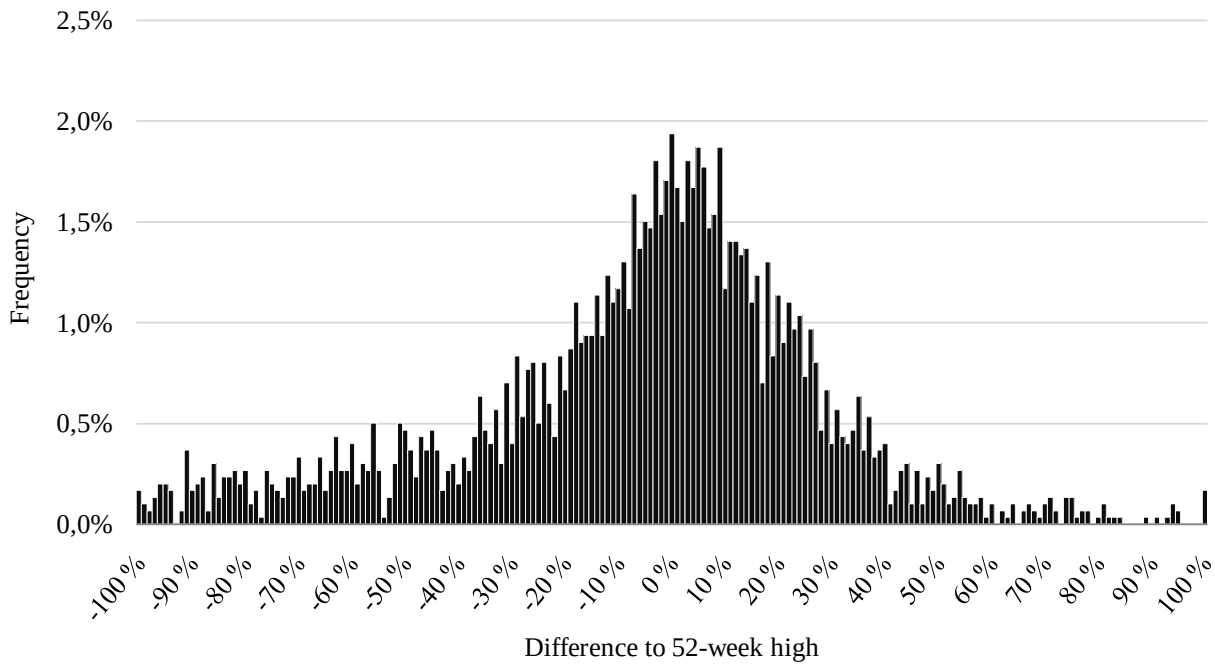
Comparing to Baker et al. (2009), the distribution is much flatter. Although the mode is exactly equal to the 52-week high stock price, the difference to other bins nearby is not that big. For example, while the mode-bin contains 58 observations, the 9%-bin has an almost equal amount of 56 observations. With a frequency below 2%, the mode bin is remarkably smaller than the frequency of 8% reported by Baker et al. (2009).

33% of all observations lie within a range of 10% on both sides of the 52-week high stock price, while 55% of all observations lie in the range of 20%. Around the 52-week high, the observations are skewed a bit to the left: within a range of 10% from the 52-week high, there are 1.8%-units more observations on the positive side, and within a range of 20%, 3.8%-units more. This might reflect the fact that if bidders know that the 52-week high is a significant threshold, they might as well decide to bid a bit above it to ensure the offer success.

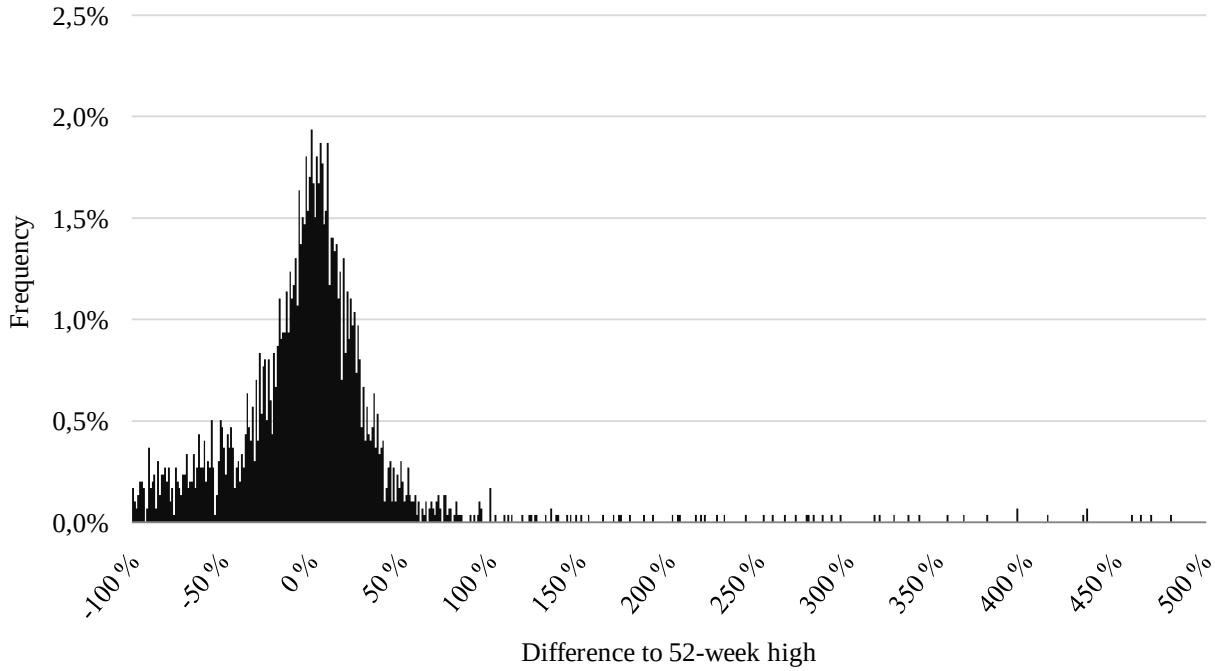
Figure 3:
Histograms of offer pricing

This figure depicts the distribution of the percentage difference between offer prices and target 52-week high prices. Panel A graphs differences from -100% to 100%, while panel B expands the range on the positive side up to 500%. The classes on the horizontal axes represent the percentage difference, while the vertical axes record the frequencies for each class. The median and mode of the differences are both equal to 0%. For complete definitions of all the variables, see Appendix B.

Panel A: Range of differences [-100%;100%]



Panel B: Range of differences [-100%; 500%]



In Panel B of Figure 3 I extend the range of x-axis to cover differences up to 500%. Now, potential data entry errors and errors in matching firms between different financial databases are clearly apparent, some offer prices rising hundreds of percents above the 52-week highs. It is also evident that there are a bunch of arbitrarily small values in the lower tail. It can be assumed that such data points are either aforementioned errors or represent firms forced to sell, for example firms facing financial distress. These observations from Figure 3 further motivate the winsorising of the variables. All in all, it still appears that the offer prices are distributed somewhat around the 52-week high, giving further incentives for testing the hypotheses.

4.2. Methods

Here I present a summary of the different methods employed in this study. More weight is given to presentation of more complex topics, such as Gaussian kernel regression.

4.2.1. Winsorising

Winsorising means transforming a variable so, that x% of observations at the tail(s) of a distribution are converted to reflect the x% value. Thus, the smallest values are set to equal the xth percentile and the largest values are set to equal the (100-x)th percentile. Winsorising is generally used, when there is no complete certainty about whether the tail values are caused purely by randomness or are true outliers. Winsorisation can be done on one or both tails of a distribution, depending where potential outliers are expected to be located. Winsorised estimators are generally more robust to outliers than their unwinsorised counterparts. Due to the relatively large amount of potential extreme outliers, I winsorise both the dependent variable offer premium and the main independent variable 52-week high at 5% level on both sides. All other continuous independent variables are winsorised at 1% level on both sides.

4.2.2. RESET-test

The Ramsey Regression Equation Specification Error Test, or RESET, is a general test for potential errors in a functional form of a regression specification (Ramsey, 1969). Specifically, the RESET-test is an F-test of differences in R-squared under linearity versus non-linearity assumptions. For a model, which is properly specified in functional form, non-linear transformations of the fitted values should not be useful in predicting the dependent variable. I employ the RESET-test alongside Gaussian kernel regression to test for potential non-linearity in the relation between offer premium and the 52-week high price.

4.2.3. Gaussian kernel regression

Kernel regression is a form of non-parametric regression, and one of the most widely used non-parametric regression estimators developed. In contrast to parametric techniques, which impose a specific parametric form for the regression relation, non-parametric regression techniques are used for estimating a regression plot without making assumptions about the shape of the relation. This section covers only the basics of the method required for understanding this study. For an interested reader, for example Eubank (1988), Müller (1988), and Härdle (1990) all provide a fully-detailed description of the methodology.

Kernel regression is a type of locally weighted regression. It is a way of estimating a regression through a smoothing procedure, fitting a function of independent variables locally and in a moving fashion, similarly to how a moving average is computed for a time-series (Cleveland and Devlin, 1988). Kernel regression is based on the idea of finding the local conditional expectation of the dependent variable Y with respect to an independent variable X. In essence, this means that the most likely location for each predicted value in the regression curve is calculated based on the surrounding observations inside a certain bandwidth. The term Gaussian comes from the fact that the error terms are assumed to be normally distributed. The local fitting of a kernel regression allows for a much wider class of regression relations to be fitted than what usual parametric functions, such as polynomials, allow.

Although formal tests exist, graphical inspection is often viewed as the most powerful way for detecting non-linearity in data. This is because tests often have the power to detect only specific forms of non-linearity, but not others. In contrast, if one does not beforehand have a certain idea about the nature of non-linearity, non-parametric regression effectively lets one check for all kinds of systematic errors. Also scatter plots and residual plots are commonly employed forms of graphical inspection, but sometimes the sheer amount and dispersion of the data makes it hard to discern the shape of the underlying relation. This is where kernel regression is especially useful. For example, Cleveland and Devlin (1988) and Altman (1992) advocate the power of kernel regression in exploring the non-linearity in data, and argue that it provides a powerful, relatively easy-to-understand tool for model checking and model building in parametric regression. In this study I employ Gaussian kernel regression alongside the RESET-test to both detect non-linearity and to triangulate a suitable model specification to fit the data.

4.2.4. Piecewise linear regression

When analyzing a relation between two variables, dependent Y, and explanatory X, it may be apparent that for different ranges of X, different linear relations occur. In such a case, an OLS model may not provide an adequate description, and a non-linear model may not be appropriate either. Piecewise liner regression allows multiple linear models to fit the data for different ranges of X. The different linear models are separated by breakpoints, that is, specific values of X, where the slope of the function changes. Typically the values of the breakpoints are not known before the analysis and also need to be estimated. Based on the analysis on the non-linearity in the data, I employ piecewise linear regressions to account for the effect of the 52-week high on offer premium getting weaker, when the pre-bid prices are farther away from the 52-week high.

4.2.5. Probit regression

Probit analysis is a type of regression that can be used, when the dependent variable is a binary one (0/1), for example, the outcome of a merger bid that can register either as a failure or success. The marginal effects of probit analysis can be interpreted as probabilities. I use probit analysis to assess to what extent surpassing the 52-week high stock price influences offer success.

4.2.6. Instrumental variables estimation – 2-stage least squares

The 2-stage least squares regression (2SLS) is a form of instrumental variables estimation and commonly employed when the values of an independent variable are assumed to be caused at least partly by the values of the dependent variable. In such a case it is said that the model's variables are mutually dependent, and that the independent variable in question is endogenous. Other variables in the model, whose values are determined purely outside the model, are called exogenous. An instrument is a variable that is not correlated with the dependent variable and is correlated with the endogenous explanatory variable. In this thesis, endogeneity is not a problem as such, but the 2-stage least squares is employed first to isolate the component of offer premium that is driven by the 52-week high, and then to assess how bidder shareholders react to such psychology-driven bids. The principles of the method are still the same.

As the name implies, the 2SLS method includes two successive applications of OLS regression. The first stage involves regressing the endogenous variable on an instrument and

all the exogenous variables from the original model. In this thesis, I first regress the offer premium on the 52-week high and the control variables. In the second stage, the original model is estimated, replacing the values of the endogenous independent variable with the predicted values from the first stage. Specifically, I regress bidder cumulative abnormal returns on the offer premium instrumented by the 52-week high, obtained from the first stage. This allows me to assess how bidder shareholders react particularly to 52-week high driven bids, and to compare these estimates to how the bidder shareholders react to higher offer premiums on average. Finally, it should be noted that the two stages should not be executed outright by hand, as the technique requires a small correction for the standard errors generated.

4.2.7. Event study methodology

To assess the impact that the 52-week high psychology may potentially have on the wealth of acquirer shareholders, I first need a measure for the acquirer share price reaction to the announcement of mergers in general. For this purpose, an event study approach is utilized. The methodology presented here follows a standard approach based on the paper of Brown and Warner (1985).

To assess the impact of an acquisition announcement on share prices, I need to isolate the component of the returns that has been caused by the announcement from the total daily returns. This is called an abnormal return (AR), defined as the difference between a stock's realized return (r_t) and its benchmark return for a given day. The benchmark return is simply the expected return for a stock on a given day, assuming that no event would have taken place.

To calculate the expected returns for each stock, I need to estimate the parameters α and β for each individual stock, the constant α standing for the return not explained by the market movements, and β measuring the sensitivity of returns to the market movements. The parameters are calculated by regressing each company's daily returns against the benchmark index's returns over a clean period starting 330 days before and ending 30 days before merger announcement. This regression specification, presented in Equation 1, is called the market model.

$$r_{i,t} = \alpha_i + r_{m,t} * \beta_i \quad (1)$$

The parameter $r_{i,t}$ is a stock's realized logarithmic total return for day t, and $r_{m,t}$ is the corresponding benchmark index's logarithmic total return. As benchmark indexes I utilize the country-specific all-share indexes of the main stock exchange of a bidder's country of origin, if available, and otherwise the country-specific indexes closest to an all-share index.

Next, the parameters α and β are utilized to calculate the daily abnormal returns for a given target company i on a given day t, as presented in Equation 2.

$$AR_{i,t} = r_{i,t} - (\alpha_i + r_{m,t} * \beta_i) \quad (2)$$

Finally, the daily abnormal returns are cumulated across the event windows [-T;+T], as presented in Equation 3. This is done to adjust for potential leakage of information or slow adjustment of prices to announcement information. I calculate the cumulative abnormal returns (CARs) both for a three-day window [-1;+1], and for a seven-day window [-3;+3] around the event day.

$$CAR^{i}_{-T;T} = \sum_{t=-T}^{T} AR_{i,t} \quad (3)$$

5. RESULTS

This section discusses the empirical findings of my thesis. I start by summarizing the results from the investment bank interviews. The rest of the section presents the regression results based on the data sample. Hypotheses are tested one by one, and the findings discussed in their respective subsections.

5.1. Investment bank interviews

Psychological reference considerations potentially have a huge impact on the division of gains between transaction parties in mergers and acquisitions. Being a new strand of M&A research, doubts naturally arise about the validity of the regression specifications and results arising from data mining instead of true impact of investor psychology. In order to make my analysis more robust, it thus pays to collect some anecdotal evidence on the potential impact of psychology from the experts dealing with mergers and acquisitions on a day-to-day basis.

The motivation for the interviews comes from the fact that if the impact of 52-week high is as prominent on European M&A activity as in the United States, financial advisors should be aware of the phenomenon. Further, should the role of psychology be different in Europe than in the United States, bankers with international experience might be aware of this difference and able to shed some light on the reasons.

I conduct a small series totaling 4 interviews in the major investment banks present in Finland and dealing predominantly with public targets. I target bankers with long track records in M&A activity, and preferably some international experience. Each of the bankers interviewed has been working for more than 10 years in the industry. The interviews turn out conducive to my hypotheses. General observations about the pricing process are already implemented in the literature review, specifically in Section 2.3. The rest of this section sums up the results from the interviews with respect to the impact of psychology. More details on the interview process and the questions presented to the bankers can be found in Appendix C.

5.1.1. Why past prices matter

There are some indications of backward-looking observable directly in investment bank behavior. The development of a target's stock price is routinely a part of the sell-side investment banking material and in price negotiations argumentation is often tied to past price levels. Further, when the target board reacts to a takeover bid, the offer price is often compared to past price levels in press releases. In their empirical study, Baker et al. (2009) also find that reference-dependence on past prices has a significant impact on many aspects of M&A activity. Reliance on past price levels in valuation suggests a deviation from the rational efficient market hypothesis. It is the purpose of these interviews to find out what the investment bankers themselves see as the main rationale for looking back.

When asked directly the motivation for why past price developments seem to figure into various aspects of transactions, the investment bankers list three different reasons. First, a prominent reason for looking back is the mandatory bid regulation. By law, for example the highest price paid by the acquirer during a period preceding the bid may factor in to the bid price (see Section 2.6 for further discussion on regulation). Second, past price levels are employed as a negotiations argument. The bankers view short-term market prices as noisy, and subject to disruptions. As an extreme example, it is noted that event-driven hedge funds can be causing disruption on purpose. Consequently, past price levels can be used as a true or

imaginary selling argument in trying to convince the other party that the current market price is incorrect or not representative of the true value. Third, the impact of psychology is also recognized directly: a belief that the loss in value of holdings is only temporary and will revert in the future, and reluctance to sell at a loss compared to past price levels are both identified as major drivers in investor behavior.

5.1.2. Which past prices matter

What comes to the length of the relevant backward horizon, the period of 12 months is seen as a customary evaluation period also by the bankers. Three factors are viewed to have an impact on the length of the horizon case by case. First one is the mandatory bid rule, regulation of each individual country stipulating a minimum price based on a certain backward period. Setting regulation aside, the length of the backward-looking horizon is said to depend on the recent market environment and on building the investment story. In a less volatile environment, generally a shorter time span is employed, whereas in a more uncertain environment the estimates are based on longer periods in the past. Market is seen a bit as overreacting: in a bear market, the (sell-side) bankers argue the valuation upwards, and in a bull market (buy-side) bankers argue it downwards. As discussed in Section 2.2., this seems to also be pointing to a negotiation tactic, where individuals pick self-serving comparison groups in trying to promote their own cause. True enough, the bankers themselves also recognize their roles as sales persons, and admit that argumentation is constructed to favor the side they are currently working on. Finally, it is noted that with less liquid stocks, longer backward horizons are more important, as the prices of such stocks are more prone to short-term disruptions.

I also ask the bankers to compare different measures of past price development against each other. Three bankers view the 52-week high as the most important, while the fourth finds the 3-month average to be most informative due to it accounting for both liquidity and any short-term market disruptions. The interviewees state that it is impossible to quantify the relative importance of different price indicators numerically, yet it is noted that the differences are not big and the importance of different measures can vary case by case. It is also noted that very short periods are generally not that informative, as a single earnings announcement can have such a large impact on prices. On the other hand, periods longer than 12 months tend to contain too much noise. Finally, it is observed that with less liquid stocks, average prices are likely to be more informative than highs and lows.

5.1.3. Other observations

The interviews also offer an alternative explanation for the argumentation in press releases building on past price development. It is noted that even though bankers execute a complex valuation, argumentation released to the public often takes a simplified form. Instead of a valuation model with dozens of variables, the key message has to be condensed to a brief, easy-to-understand form. Seeing a press release arguing that the bid was deemed too low in comparison to a past price maximum can thus also be explained as simplifying, not as the decision being based solely on past instead of future.

Further, as a catalyst for launching a bid, or gained during the process in due diligence, the potential buyer often has some private information on the target. Similarly, the target board may have future plans hatching, as of yet unannounced to the public. As this information cannot be published, the argumentation has to rely on other grounds instead. The argumentation through past price levels can thus also be an indication of private information instead of reference-dependence. The interviews do not completely discredit the psychology-based explanation in this case either: a single banker reported that there were a couple of cases during the bear market of 2008, in which the target's board and major owners decreed that looking back, the price range under discussion was not high enough and thus no transaction was completed. Although these discussions appear informal and it is unclear whether the message was publicly communicated to the shareholders, this is still important evidence on how boards think, and that in principle the observed argumentation in shareholder communications could also reflect reference-dependence.

The bankers further note that in stock-for-stock deals it is especially common to benchmark the development of acquirer and target stock prices during a period preceding the deal. It is easier to look back in such a situation, than get the acquirer and target representatives to agree on the future development of the prices of both stocks.

What comes to comparing the pricing conventions of their own and other Nordic or international banks, the bankers see no distinctions. There might have been differences 15 years ago, but nowadays all the Nordic investment banks have employees with backgrounds in the large multinational banks, making the Nordic banking services compare well with the international standards. This increase in standards has been partly brought about also by highly-demanding, large global buyers emerging in the Nordic takeover market. Similar

pricing conventions would also suggest that there is similar room for psychology to have an effect across different countries.

At the end of the interviews, I explain the bankers directly the hypothesis of the psychology of the 52-week high influencing offer pricing and other aspects of M&A. Three out of four bankers acknowledge immediately that it appears a viable consideration, two of them hinting that such a psychological matter has been a consideration also in real-life cases. Neither does the fourth banker reject the idea out of hand, but views illiquidity a much more prominent reason for looking back. An interviewee also notes that the impact of investor psychology is really prominent, and may in the end be a stronger determinant of offer prices than the wisdom of the investment banks.

5.1.4. Relevance of results for this study

All in all, the results from the interviews do back up my hypotheses. Reference-dependence and investor loss aversion are recognized to impact pricing considerations. The consistent use of past price levels as negotiation arguments also tells that bankers believe that such tactics do work, that is, that such arguments may anchor the opposition's view to a favorable level. The bankers are reluctant to compare the importance of past price development to other pricing considerations, but do not generally recognize it among the most important factors. This is well in line with expectations, as this thesis does not attempt to argue that offer pricing is based only on psychology, but that on average psychology does have an impact. The 12-month period is viewed as customary for backward evaluation, and the 52-week high as somewhat more important than other indicators of price development.

Discussing the general price formation process with the investment bankers, as presented in Section 2.3., also yields other unexpected evidence on three types of reference-dependence. First, it is noted that most public companies have been approached by potential acquirers at least once at some point in the past. Such approaches may not have led to an understanding, and thus may not have become public, as in general acquirers do not want to engage in hostile bids. However, even informal offers have often left the board of directors an indication of the company's value. These past indications of value are then used when evaluating an acquirer's offer in the present. Second, the importance of purchase price as an important reference point is verified also in an M&A context. The interviewees note that when determining a suitable price, the purchase prices of major owners are often benchmarked to make it more certain that

the major owners agree to sell. Finally, as a completely new prediction, it is stated that it is often hard to succeed with an offer premium that is below the level that has been recently paid in the market. This is a totally new reference point consideration in the literature, and unique to a mergers and acquisitions context.

Based on the interviews, it does appear that reference-dependence plays a role in mergers and acquisitions activity. The following subsections more formally test for different predictions based on reference-dependence in my data.

5.2. Impact on offer premiums

The basic tests of 52-week high reference-dependence are executed by regressing the offer premiums on the 52-week high prices and control variables. If the 52-week high acts as an important reference point, the bidders may increase the bid prices to encourage target shareholders to sell, or may themselves be anchored to that level as a proxy for target value. In either case, a positive relation between the offer premiums and target 52-week highs is expected.

I first examine the shape of the relation between offer premiums and 52-week highs for possible non-linearity to arrive at a correct model specification. Next, I run the regressions, gradually adding control variables suggested by the offer price literature. The latter subsections test for differences in effect magnitude in various subsamples and across the sample countries.

5.2.1. Inspecting non-linearity

In the most basic form, the offer premium is regressed on the target 52-week high as specified in Equation 4.

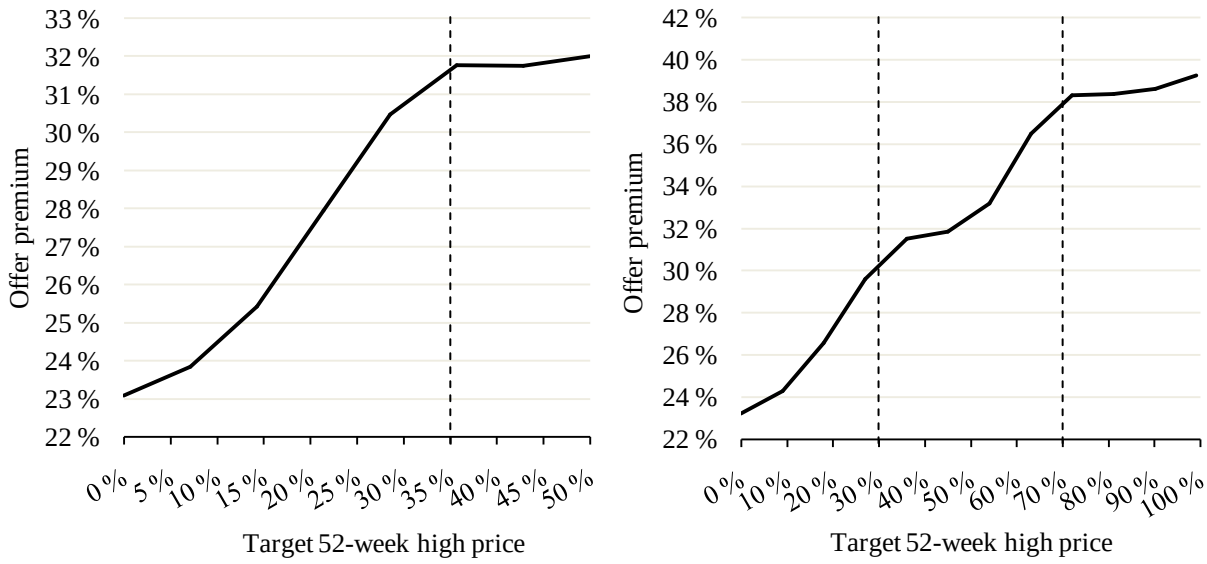
$$\text{Offer premium}_i = \alpha + \text{Target 52HI}_i * \beta + \varepsilon_i \quad (4)$$

When running the regressions, it is instantly apparent that there is a statistically significant relation between offer premiums and target 52-week high prices. Before proceeding any further with the tests, I deem it important to examine the shape of this relation for potential non-linearity. Indeed, a RESET-test executed on the specification rejects the null hypothesis of a correct functional specification with a highly significant F-value of 9.02.

To get a clearer picture of the non-linearity, I run Gaussian kernel regressions of the offer premium on the target 52-week high stock price, as specified in Equation 4. Gaussian kernel regression is a form of non-parametric regression used for detection of non-linearity and model building (see Section 4.2.3. for a review). The Gaussian kernel plots are presented in Figure 4.

Figure 4:
Examining possible non-linearity

The figures below present the best fit graph of the relation between offer premiums and target 52-week high prices. The graphs are fitted using Gaussian kernel regression. The graph on the left restricts the 52-week high prices to a range of [0%;50%], while the graph on the right expands this range to cover values up to 100%. The dashed lines indicate the designated breakpoints 35% and 70% for the piecewise regressions. For complete definitions of all the variables, see Appendix B.



To not confuse the readers for why the 52HI is in percentage form, it should be once again noted that the reference price measure of 52-week high is scaled by the same 30-days lagged price as the offer premium to alleviate heteroskedasticity. The higher the 52HI is percentage-wise, the lower was the target's pre-bid trading price relative to the 52-week high. Thus, a more accurate description for the variable would be the 52-week high premium, as it is actually the percentage premium of the 52-week high price relative to the 30-days lagged price. However, for simplicity I refer to the 52-week premium simply as the 52-week high price in the results discussion.

In the left graph of Figure 4, I restrict myself to cases, where the 52-week high price is below 50%. I run a Gaussian kernel regression with a bandwidth of 0.08 and 8 estimation points. In

the right graph of Figure 4, I restrict myself to cases, where the 52-week high price is below 100%, and run a Gaussian kernel regression with a bandwidth of 0.08 and 15 estimation points. I do not graph the relation above 100%, because the relation breaks down soon after that threshold.

Graphical inspection verifies the result of the RESET-test: the relation between offer premiums and 52-week high prices is clearly non-linear. Further, the relation seems to be relatively well approximated with 3 separate linear designations. Thus, I employ a piecewise regression specification for most of my analyses. The piecewise specification allows multiple linear relations to be fitted in a single model. Based on Figure 4, I set the breakpoints for my piecewise specification at 52HI values 35% and 70%, as indicated by the dashed lines in Figure 4. Thus, the piecewise specification will utilize a different slope coefficient for the intervals 0%–35%, 35%–70%, and 70%+ of the 52-week high price. This specification is presented in Equation 5. With this specification, the RESET-test gets an F-value of 0.06, and the null hypothesis is not rejected anymore. This suggests that the new specification captures the non-linearity well.

$$\begin{aligned}\text{Offer premium}_i = \alpha + \min(52\text{HI}_i; 35\%) * \beta_1 + \max(0; \min(52\text{HI}_i - 35\%; 70\%)) * \beta_2 \\ + \max(52\text{HI}_i - 75\%; 0) * \beta_3 + \varepsilon_i\end{aligned} \quad (5)$$

Figure 4 suggests that offer premium will rise on average by 1.6%-1.8% when the 52-week high increases by 10%. The higher the 52-week high is relative to the pre-bid price level (that is, the higher the 52-week high premium is), the weaker the impact is on the offer premium. This might reflect the fact that targets with a significant price slide behind them are either forced to sell not to face bankruptcy, or at least are in a terrible negotiation position. Such targets may have to accept even a nominal offer price, as the bidder still brings with it a hope for survival. Faced with a choice of something or nothing, target shareholders may have to accept the fact that the 52-week high is no longer a valid reference point and try to salvage what they can.

5.2.2. Basic regressions

Next, I turn to the basic tests of the impact of the 52-week high on the offer premium, presented in Table 4 below. The first regression is an ordinary least squares one (see Equation 4), and indicates that for a 10% rise in 52HI, the offer premium rises by approximately 0.8%.

The latter regressions employ the piecewise specification (see Equation 5). As has been explained previously, a piecewise regression is like an OLS regression, but allows for different slope coefficients for different ranges of an independent variable.

Table 4:
Impact of 52-week high on offer premium

This table presents the results of regressing the offer premium on the 52-week high price and control variables. The column before the regressions presents the expected sign of the relation between the dependent variable and the independent variable in question. The first regression is an OLS regression following Equation 4, and the rest of the regressions are piecewise regressions in the line of Equation 5. The second and third piecewise regressions control for past target returns, and the third one includes year and country indicator variables to represent fixed effects. For complete definitions of all the variables, see Appendix B. The figures in parentheses represent t-values and are calculated using White's heteroskedasticity-consistent standard errors. The asterisks *, **, and *** represent significance at 10%, 5%, and 1% level, respectively.

	Exp. sign	OLS 1	Piecewise 1	Piecewise 2	Piecewise 3
Target 52HI	+	0.0833***			
		(8.40)			
Target 52HI - 0-35%	+		0.3239***	0.3145***	0.2404***
			(4.39)	(4.07)	(3.53)
Target 52HI - 35-70%	+		0.1775**	0.1708**	0.1373*
			(2.14)	(2.04)	(1.84)
Target 52HI - 70%+	+		0.0233	0.0100	0.0037
			(1.36)	(0.49)	(0.17)
Control for target past returns					
t-1m				-0.0864*	-0.1054**
t-2m				-0.0386	-0.0552
t-3m				0.0007	-0.0149
t-4m				0.0007	-0.0023
t-5m				-0.0060	-0.0092
t-6m				0.0500	0.0431
t-7m				-0.0519	-0.0480
t-8m				0.0123	0.0094
t-9m				-0.0396	-0.0285
t-10m				0.0458	0.0649
t-11m				-0.0378	-0.0267
t-12m				-0.0713	-0.0610
Year and country fixed effects		No	No	No	Yes
Adjusted R-squared		0.0407	0.0492	0.0513	0.0686
N		3009	3009	2986	2986

The piecewise regression 1 shows that the effect is economically much more significant, when the pre-bid prices are closer to the 52-week high price. More than 64% of the deals have 52-week high prices below 35%, and thus fall in this category. In this typical range of 52-week highs, the offer premium increases by 3.2% for every 10% increase in the 52-week high.

As was evident already from the kernel regressions, the effect fades away almost completely, as the 52-week high increases above 70%.

The second and third piecewise regressions also control for the target company's past monthly returns. This is done to make sure that it is not the returns since the 52-week high, but the 52-week high by itself that has an impact on the offer prices. The results persist even after the inclusion of these controls.

The piecewise 3 specification includes year and country indicator variables to account for heterogeneity in the data, but the main inferences are unchanged by the inclusion of these variables. The coefficients are not presented with the results. Controlling for the heterogeneity somewhat lessens the impact of the 52-week high on offer premium in the smallest range of 52-week high prices. This decrease is attributable to the year fixed effects, and might be linked to the effect being weaker in the second half of the sample period, as shown by the subsample regressions later on in this section. Yet, a 2.4% rise in offer premium per 10% increase in 52-week high is still economically highly significant.

Using piecewise specification 2 and the median 52-week high premium, I calculate that the impact of the phenomenon is to increase the consideration offered by $6.3m using median target equity as a proxy, and $69.1m using the average target equity as a proxy[1]. This is economically substantial, and accounts for close to 10% of the total premium paid in a transaction even when calculating with the unwinsorised average from Table 2.

5.2.3. Robustness checks

In Table 5, I further test for the robustness of the model specification. The first regression controls for deal characteristics, the second solely for target characteristics, the third solely for acquirer characteristics, and the fourth finally for all these characteristics combined. Regression 5 is the optimal specification. To determine my control variables, I discuss the pricing process with the investment bankers and carefully benchmark the existing M&A wealth effect and offer price literature. I arrive at a set mainly established by Schwert (2000), Officer (2003), and Betton et al. (2008, 2009). The offer price determination is discussed

[1] Reg. coeff. * Median 52HI * Median (average) target equity at t-30 = 0.3145*0.2083*$96.18m ($1055.14m)

further in Section 2.3., and Appendix B presents both formulas and short descriptions for all of my variables.

The key inferences regarding the effect of the 52-week high are mostly unchanged by the inclusion of the additional control variables. However, now also the coefficient for 52-week high prices in the range 35%–70% becomes statistically insignificant, further indicating that the relation is most robust when targets are trading somewhat closer to their 52-week highs prior to a bid.

The inclusion of acquirer characteristics market-to-book and market capitalization is troublesome, as it more than halves the number of observations available. As can be seen from regression 4 in Table 5, the smaller sample results in some of the explanatory variables belonging in the model becoming statistically insignificant. I check the variance inflation factors, but it is apparent that the problem is not caused by multicollinearity but by the reduced sample size. Consequently, I do not use these variables for further analyses, although especially acquirer market capitalization seems to belong to the model. The optimal model specification is thus presented in regression 5.

What comes to control variables, the results are similar to what is typically found in the offer price literature. Stock deals exhibit smaller offer premiums, consistent with the explanation that shareholders may accept lower offer premiums due to deferred taxes, yet the -5.0–7.8% effect is somewhat large to be explained away only by taxes. Both tender offers and hostile deals have higher offer prices, consistent with bidders having to pay more when the acquisition is not actively backed by the target board. Financial buyers seem to pay less, probably due to lack of synergies, and horizontal acquirers seem to pay more, probably due to

Table 5:
Further robustness checks and comparison to other offer premium determinants

This table presents the results of regressing the offer premium on the 52-week high price, and introduces more control variables to check for the robustness of the piecewise specification utilized in Table 4. The column before the regressions presents the expected sign of the relation between the dependent variable and the independent variable in question. Piecewise 1 regression controls for transaction level characteristics, piecewise 2 regression controls for target characteristics, and piecewise 3 regression controls for acquirer characteristics. Finally, piecewise 4 controls for all these factors simultaneously and piecewise 5 is the optimal specification. All the regressions follow the specification in Equation 5 but for control variables. For complete definitions of all the variables, see Appendix B. The figures in parentheses represent t-values and are calculated using White's heteroskedasticity-consistent standard errors. The asterisks *, **, and *** represent significance at 10%, 5%, and 1% level, respectively.

Table 5 (cont.):
Further robustness checks and comparison to other offer premium determinants

	Exp. sign	Piecew. 1	Piecew. 2	Piecew. 3	Piecew. 4	Piecew. 5
Target 52HI - 0-35%	+	0.3024***	0.2669***	0.3613***	0.2454***	0.2506***
		(4.58)	(4.32)	(3.42)	(2.86)	(4.05)
Target 52HI - 35-70%	+	0.1437*	0.1060	0.1348	0.0985	0.0966
		(1.93)	(1.53)	(1.10)	(0.88)	(1.40)
Target 52HI - 70%+	+	0.0086	0.0233	0.0364	0.0023	0.0255
		(0.39)	(1.13)	(0.97)	(0.07)	(1.24)
Deal characteristics						
Form of payment: cash	+ / -	-0.0065			0.0025	0.0030
		(-0.49)			(0.12)	(0.24)
Form of payment: stock	+ / -	-0.0775***			-0.0333	-0.0496**
		(-3.76)			(-1.29)	(-2.51)
Attitude: hostile	+	0.0040			0.1039***	0.0658**
		(0.13)			(2.76)	(2.35)
Tender offer	+	0.0462***			0.0307	0.0144
		(3.58)			(1.53)	(1.19)
Financial buyer	-	-0.0461**			0.0619	-0.0494***
		(-2.42)			(0.35)	(-2.79)
Multiple bidders	+	0.0445**			0.0235	0.0523***
		(2.31)			(1.27)	(2.86)
Horizontal merger	+ / -	0.0405***			0.0550***	0.0449***
		(3.12)			(2.95)	(3.73)
Target characteristics						
Run-up	+		0.8658***		0.8621***	0.8551***
			(25.95)		(16.22)	(25.55)
M/B	+ / -		-0.0002		-0.0011	-0.0003
			(-0.12)		(-0.40)	(-0.19)
Mcap	+ / -		-0.0085***		-0.0316***	-0.0094***
			(-2.58)		(-4.55)	(-2.78)
Amihud illiquidity	+ / -		-5.0E-05***		-5.4E-05**	-4.6E-05***
			(-4.72)		(-2.53)	(-4.35)
Acquirer characteristics						
M/B	+			-0.0018	-0.0004	
				(-1.45)	(-0.34)	
Mcap	+ / -			0.0149***	0.0271***	
				(3.21)	(4.58)	
Toehold size	-			-0.1219***	-0.0885**	-0.0673***
				(-2.75)	(-2.03)	(-2.74)
Control for target past returns		Yes	Yes	Yes	Yes	Yes
Adjusted R-squared		0.0629	0.2534	0.0370	0.2538	0.2642
N		2986	2661	1215	1084	2661

higher than average synergy potential. As expected, competitive bidding also results in higher offer premiums.

Target run-up has a significant positive effect on offer premium, $1 run-up increasing the offer premium by more than $0.85. To verify that this does not reflect only offer anticipation,

I define offer mark-up as the offer price scaled by the closing price of the day before announcement, and regress it on target run-up in an unreported test. The statistically significant positive relation verifies the findings of Betton et al. (2008, 2009) that the run-up is evidence of new information coming out instead of pure information leakage as argued by Schwert (1996), and that the variable should be included in the model.

Small targets receive more, consistent with them either being more valuable to acquirer or harder to value accurately. Large bidders pay more, broadly consistent with agency and hubris. Offer premiums also decrease in acquirer toehold size, as predicted by theory. In addition, offer premiums increase in target liquidity, consistent with Betton et al. (2009). The result for liquidity holds for both liquidity variables, Penny stock and Amihud illiquidity ratio, although only regressions with the Amihud illiquidity ratio are shown. Although unreported, the results are largely unchanged by the inclusion of year and country indicator variables. Compared to Table 4, the control variables now capture most of the heterogeneity, and the inclusion of fixed effects reduces the coefficient for 52-week high prices below 35% only a bit, to 0.2172. Similarly to the previous subsection, I calculate the economic effect from this estimate as $4.4m ($47.7m) for a median (average) deal.

Instead of utilizing a full set of control variables as established in literature, Baker et al. (2009) use some of the common variables but also introduce some arbitrary financial characteristics not generally used in modern offer price literature. These variables are target and acquirer return-on-assets and target returns volatility. Importantly, the investment bank interviews also indicate that volatility prior to a bid may have an impact on the length of backward horizon utilized when determining the bid price, because short-term prices are prone to disruptions. As it includes both a firm-specific and a market-specific component, target volatility acts as an important control for yet another alternative explanation for looking backwards. In unreported results I include both target volatility and acquirer and target return-on-assets in the model, but the terms are neither statistically significant nor improve the explanatory power of the model. The 52-week high coefficients are not impacted by the inclusion of these variables either.

All in all, it appears that the control variables do not diminish the effect of the 52-week high on the offer premium. Specifically, inclusion of neither liquidity nor target volatility, as

suggested by the investment bank interviews, impacts the effect strength. The effect remains both statistically and economically significant across all the regressions.

5.2.4. Effect magnitude across subsamples

In Table 6 I examine the 52-week high effect in different subsamples. The differences inside the subsamples are modeled using interaction variables. That is, the original, baseline variables are multiplied by the respective indicator variables, and these new variables are then included in the model alongside the original variables. The coefficients for the interaction categories can then be interpreted as differences in slope coefficients between the baseline and the interaction categories.

For 52-week high prices below 35%, reference-dependence seems somewhat stronger for both tender offers and hostile deals, although the differences are not statistically significant. A tender offer effectively bypasses target management, and a hostile approach tries to convince the target shareholders to act against the wishes of the board. Thus, the higher result can reflect the fact that the reference point is particularly important for target shareholders, as opposed to target board or management.

The effect is somewhat stronger than average in cash deals, whereas in stock deals the effect is considerably weaker, as is the case also in deals where the acquirer is a financial buyer. For a financial buyer, it may not be viable to bid up into the 52-week high, as there is no synergy potential giving more potential upside for the deal. Ljunqgqvist and Wilhelm (2005) offer an alternative explanation. They state that given their regular participation in the IPO process, financial buyers such as venture capitalists may be less influenced by behavioral biases. This explanation could apply also to an M&A context, and is consistent with the evidence that experience attenuates but does not eliminate behavioral biases completely.

Across all the subsamples, the impact of 52-week high on offer prices is strongest, when multiple bidders are competing for the same target. When faced with a tough competitive situation, a bidder may have an incentive to more eagerly bid at or above the psychological reference point, to both deter competition with a high offer and to secure target shareholder acceptance. As implied by the hypotheses, the effect is also somewhat stronger in completed deals than deals that failed for 52-week high prices below 35%. However, this difference is not statistically significant. The actual impact of the 52-week high reference-dependence on deal success will be analyzed more thoroughly in Section 5.3.

Next I inspect how mandatory bid regulation affects the effect strength. Specifically, subsample 7 tests for differences in the effect before and after the implementation of the EU takeover directive enforcing mandatory bid regulation in May 2006. At a first glance, it appears that the effect is actually somewhat weaker after the implementation, but the difference is not statistically significant. However, the next subsample regression reveals that the decline in 52-week high effect over time is actually a general trend, as the effect is significantly weaker in the second half of the sample period. A possible explanation offered to this by the interviews is the rise of active investment, and related increased involvement of more rational professional investors also in takeover matters. Finally, as the period after 2002 has marked continuation in the mandatory bid regulation becoming more wide-spread and simultaneously the 52-week high effect has become weaker, it further seems that the results presented in this paper do not arise out regulation.

Finally, I concentrate only on the period after the implementation of the takeover directive, and group the countries to those, whose mandatory bid price is the highest price paid by the bidder in the 12 months preceding the announcement, and to those that have a different mandatory bid price. Again, I find no difference in the effect magnitude between the categories. In unreported results, I rerun the regressions for the whole sample period, but the inferences are unchanged. Summing up, mandatory bid regulation does not seem to have an impact on the effect strength.

Next, I test for finer predictions. The interviews suggest distorted short-term prices caused by stock illiquidity as an alternative explanation for benchmarking past prices. Should the 52-week high then enter the pricing considerations at least partly through such a rational reason, the effect should be much more prominent in illiquid stocks. In subsample 10 I divide my sample into two parts, the liquid and the illiquid, based on the median Amihud illiquidity ratio. Contrary to predictions, the effect is actually weaker in the illiquid than liquid stocks, although the difference is not statistically significant. In unreported tests, I re-run the regressions for robustness, now comparing the stocks with the 30% lowest Amihud illiquidity ratios to those with the 30% highest ratios, and also executing the regression with my second liquidity variable, penny stock. Still, I find no significant differences. It appears that price disruptions caused by illiquidity cannot discount the psychology-based explanation.

Table 6:
Effect magnitude in different subsamples

This table compares the impact of the 52-week high on the offer premium in various subsamples using interaction variables. The coefficients for the interaction categories show the differences in the slope coefficients between the baseline and the interaction categories. The t-values for the interaction categories show whether the differences between the categories are significant. The first subsample compares tender offers against other offers, the second subsample compares hostile offers against friendly offers, and the third subsample compares stock offers against cash offers. The fourth subsample compares transactions made by a financial buyer against other offers, the fifth subsample compares deals with multiple bidders against deals with only a single bidder, and the sixth subsample compares completed deals against failed ones. For full definitions of all the variables, see Appendix B. The figures in parentheses represent t-values and are calculated using White's heteroskedasticity-consistent standard errors. The asterisks *, **, and *** represent significance at 10%, 5%, and 1% level, respectively.

	Subsample 1	Subsample 2	Subsample 3	Subsample 4	Subsample 5	Subsample 6
Baseline category	*Other offers*	*Friendly deals*	*Paid in cash*	*Other buyer*	*Single bidder*	*Failed deals*
Target 52HI - 0-35%	0.2300***	0.2972***	0.4643***	0.3280***	0.2605***	0.2358***
	(2.81)	(4.71)	(5.48)	(5.11)	(4.10)	(2.77)
Target 52HI - 35-70%	0.0390	0.1639**	0.0941	0.1402*	0.1810**	-0.0786
	(0.32)	(2.15)	(0.93)	(1.78)	(2.33)	(-0.64)
Target 52HI - 70%+	0.0228	0.0159	0.0383	0.0120	0.0176	0.0619*
	(0.73)	(0.83)	(1.51)	(0.61)	(0.90)	(1.95)
Interaction category	*Tender offers*	*Hostile deals*	*Paid in stock*	*Financial buyer*	*Multiple bidders*	*Completed deals*
Target 52HI - 0-35%	0.1160	0.1167	-0.3375***	-0.2036*	0.4459***	0.0911
	(1.39)	(0.59)	(-2.65)	(-1.68)	(3.34)	(1.07)
Target 52HI - 35-70%	0.1691	-0.2792	0.2418	0.0623	-0.2778	0.3633**
	(1.13)	(-0.79)	(1.10)	(0.28)	(-1.08)	(2.41)
Target 52HI - 70%+	-0.0088	0.0335	-0.1040**	0.0527	-0.0095	-0.0699*
	(-0.23)	(0.30)	(-2.06)	(0.84)	(-0.13)	(-1.80)
Adjusted R-squared	0.0532	0.0484	0.0675	0.0496	0.0526	0.0553
N	3009	3009	1869	3009	3009	3009

Table 6 (cont.):
Effect magnitude in different subsamples

This table compares the impact of the 52-week high on the offer premium in various subsamples using interaction variables. The coefficients for the interaction categories show the differences in the slope coefficients between the baseline and the interaction categories. The t-values for the interaction categories show whether the differences between the categories are significant. The seventh subsample compares effect strength after the implementation of the EU takeover directive against the period prior to implementation. The eighth subsample compares the second half of the sample period against the first half, that is, bids made in 2003 and after to those made prior to 2003. The ninth subsample compares deals in countries where the mandatory bid price is something else against deals in countries where the mandatory bid price is the 52-week high paid by the acquirer, in the period after the implementation of the EU takeover directive. The tenth subsample compares targets with low stock liquidity against targets with high stock liquidity, the eleventh subsample compares stock swaps against other offers, and the twelfth subsample finally compares targets with high returns volatility against targets with low returns volatility. For full definitions of all the variables, see Appendix B. The figures in parentheses represent t-values and are calculated using White's heteroskedasticity-consistent standard errors. The asterisks *, **, and *** represent significance at 10%, 5%, and 1% level, respectively.

	Subsample 7	Subsample 8	Subsample 9	Subsample 10	Subsample 11	Subsample 12
Baseline category	*Before directive*	*1st half of sample*	*52-week high*	*Liquid targets*	*Other deals*	*Low volatility*
Target 52HI - 0-35%	0.3203***	0.3584***	0.3300***	0.3383***	0.2966***	0.3666***
	(4.81)	(5.10)	(2.66)	(4.59)	(4.64)	(4.74)
Target 52HI - 35-70%	0.1965**	0.2207**	0.0798	0.1947*	0.1783**	0.1002
	(2.29)	(2.28)	(0.50)	(1.80)	(2.26)	(0.72)
Target 52HI - 70%+	0.0062	0.0037	0.0303	-0.0466	0.0246	0.1399
	(0.28)	(0.15)	(0.80)	(-1.51)	(1.25)	(1.60)
Interaction category	*After directive*	*2nd half of sample*	*Other mandat. price*	*Illiquid targets*	*Stock swaps*	*High volatility*
Target 52HI - 0-35%	-0.0722	-0.1447*	0.0390	-0.0793	0.0460	-0.1123
	(-0.78)	(-1.79)	(0.22)	(-0.99)	(0.38)	(-1.39)
Target 52HI - 35-70%	-0.1757	-0.1754	-0.3628	-0.0543	-0.2141	0.0767
	(-1.07)	(-1.21)	(-1.16)	(-0.37)	(-0.95)	(0.47)
Target 52HI - 70%+	0.0436	0.0302	0.1204	0.0983**	-0.0923	-0.1212
	(1.06)	(0.80)	(1.36)	(2.54)	(-1.46)	(-1.35)
Adjusted R-squared	0.0501	0.0539	0.0410	0.0509	0.0516	0.0501
N	3009	3009	792	3009	3009	3009

The interviews also report a second occasion, stock swaps, where looking back is especially prominent. This is because reaching an understanding between transaction parties about the likely future development of both the acquirer's and the target's stock price is especially difficult. The results show that for small ranges of 52-week high prices, the effect is actually a bit stronger in stock swaps. Again, this difference is not statistically significant however, and the increase in effect magnitude is minuscule compared to the overall impact of the 52-week high present also outside of stock swaps.

Subsample 12 tests for the last prediction of the interviews that volatility may have an impact on the length of the backward horizon utilized in price setting. I divide the sample into two parts based on median target volatility. I find no statistically significant differences in effect strength, and contrary to predictions, the coefficient for 52-week high prices below 35% is actually lower for targets with high volatility. As with Subsample 10, in unreported results I repeat the regression comparing targets with the 30% lowest volatility against those with the 30% highest volatility, but the results persist. Thus, none of the alternative explanations offered by the interviews seem to discount the psychology-based explanation.

5.2.5. Cross-country variation

It has been established that the 52-week high stock price of the target has a significant positive impact on offer premiums, robust both to control variables and alternative explanations offered by the investment bank interviews. I now turn to examine how the 52-week high effect varies across different sample countries. However, it should be remembered that besides the largest countries, the number of observations in most of the sample countries is rather limited (see Table 3 for a sample split by country), and thus the coefficients for the smaller countries are more prone to exhibit random variation than the coefficients based on regressions on the full sample. One at a time, each country is compared against the rest of the sample using interaction variables similar to the subsamples in the previous subsection. The results are presented in Table 7 below.

It can be seen that the values for the baseline coefficients are relatively similar across all the regressions, namely 0.274–0.337 for 52-week high prices below 35%, 0.113–0.179 for 52-week high prices between 35% and 70%, and 0.005–0.027 for 52-week high prices greater than 70%. All the baseline coefficients for 52-week highs below 35% are statistically

significant, as are most of the coefficients for 52-week highs between 35% and 70%. All the coefficients for 52-week highs above 70% are statistically insignificant.

All in all, there is relatively little statistically significant variation across the sample countries. UK, France, Germany, Sweden, and Norway account for 75% of all observations and show relatively little variation. I discount the fact that there are small differences in effect strength for 52-week high prices above 70% for some countries, as neither the previous tests, nor the baseline regression coefficients show a statistically significant effect on those levels.

For low levels of 52-week high prices, Italy has a large negative coefficient, implying actually a strongly negative overall effect. Such a negative coefficient does not have a sensible economic interpretation, however. In contrast, both Netherlands and Austria have large positive coefficients for low levels of 52-week high prices, indicating that a $1 increase in 52-week high in these countries actually translates on average to a $1 or higher increase in the offer price. These opposite results cannot be explained away by the post-takeover directive mandatory bid regulation, as each of these countries has the same mandatory bid price of highest price the acquirer has paid during the 12 months before a bid.

Finally, for the range of 35%–70% of 52-week high, Switzerland seems to have an especially strong effect. Closer inspection reveals that the slope in this area is comprised of only 4 observations, and as such the reliability of the result is highly questionable.

I also examine the Italian observations more closely, and find that although there are a high number of winsorised observations, the negative coefficient does not appear to be caused by any single value alone. Next, I set the piecewise model aside, and run a simple linear regression on the Italian observations, as specified in Equation 4. I obtain a coefficient of 0.2493 with a highly significant t-value of 3.03. A RESET-test run on this model does not reject the null hypothesis that the linear specification is appropriate. Thus, it appears that the piecewise model constructed on the complete sample may not be entirely appropriate for each individual country. However, there are no theoretical grounds to expect that the effect of the 52-week high would weaken faster or slower as prices decline from that level in any specific country, or that there would be different mechanisms in investors updating their reference points. A quick test run on the largest sample countries verifies that a RESET-test rejects the linear specification for each. Thus, it still appears that the most likely explanation for the negative piecewise coefficient in Italy is randomness inherent in the small subsample.

Table 7:
Effect magnitude in different countries

This table compares the impact of the 52-week high on the offer premium in various country subsamples. Each country is compared against the rest of the sample with interaction variables. The countries are the origin countries of the targets, and listed in a decreasing order according to the number of observations. The coefficients for the interaction categories show the differences in the slope coefficients between the baseline and the interaction categories. The t-values for the interaction categories show whether the differences between the categories are significant. As the differences are modeled with interaction variables, each regression utilizes the full sample of 3009 observations. For full definitions of all the variables, see Appendix B. The figures in parentheses represent t-values and are calculated using White's heteroskedasticity-consistent standard errors. The asterisks *, **, and *** represent significance at 10%, 5%, and 1% level, respectively.

	Baseline category			Interaction category		
	HI35	HI35-70	HI70+	HI35	HI70	HI70+
United Kingdom	0.2786***	0.1265	0.0127	0.0518	0.0481	0.0057
	(3.82)	(1.25)	(0.46)	(0.64)	(0.33)	(0.15)
France	0.2899***	0.1517*	0.0268	0.1076	-0.0262	-0.0683
	(4.53)	(1.93)	(1.33)	(0.86)	(-0.11)	(-1.22)
Germany	0.3180***	0.1663**	0.0078	-0.2465	-0.2163	0.1570*
	(5.03)	(2.16)	(0.40)	(-1.56)	(-0.77)	(1.91)
Sweden	0.2884***	0.1783**	0.0053	0.2348	-0.3902	0.1557**
	(4.57)	(2.31)	(0.27)	(1.33)	(-1.38)	(2.27)
Norway	0.2987***	0.1622**	0.0251	0.0576	-0.1699	-0.1390*
	(4.74)	(2.12)	(1.30)	(0.32)	(-0.55)	(-1.74)
Italy	0.3371***	0.1132	0.0171	-0.6096***	0.3233	0.4671
	(5.35)	(1.50)	(0.90)	(-3.34)	(0.70)	(1.55)
Netherlands	0.2742***	0.1785**	0.0179	0.5868***	-0.5879	-0.0259
	(4.35)	(2.36)	(0.94)	(3.08)	(-1.49)	(-0.24)
Spain	0.2932***	0.1568**	0.0193	0.2797	-0.0584	-0.2386
	(4.67)	(2.08)	(1.02)	(1.20)	(-0.12)	(-1.23)
Denmark	0.3111***	0.1380*	0.0202	-0.2767	0.5692	-0.3000
	(4.95)	(1.83)	(1.07)	(-1.20)	(1.24)	(-1.58)
Switzerland	0.3069***	0.1383*	0.0193	-0.5005	1.0893*	-0.3782
	(4.91)	(1.84)	(1.02)	(-1.42)	(1.71)	(-1.16)
Belgium	0.3066***	0.1549**	0.0136	-0.2570	-0.3398	0.2995*
	(4.89)	(2.06)	(0.72)	(-0.89)	(-0.65)	(1.82)
Greece	0.3086***	0.1512**	0.0229	-0.5774	-0.6595	-0.0312
	(4.96)	(2.03)	(1.20)	(-1.53)	(-0.96)	(-0.24)
Portugal	0.3023***	0.1504**	0.0164	0.0337	-0.0982	0.1866
	(4.83)	(2.01)	(0.87)	(0.10)	(-0.13)	(0.84)
Finland	0.3059***	0.1405*	0.0175	-0.2843	0.3839	0.5175
	(4.90)	(1.88)	(0.93)	(-0.71)	(0.46)	(1.27)
Ireland-Rep	0.3030***	0.1490**	0.0153	-0.0291	0.0784	0.1056
	(4.83)	(1.99)	(0.81)	(-0.09)	(0.13)	(0.71)
Austria	0.2994***	0.1460**	0.0180	0.9858*	-0.5060	0.3584
	(4.80)	(1.96)	(0.95)	(1.82)	(-0.55)	(0.97)
Luxembourg	0.3032***	0.1467**	0.0181	-0.6107	1.1794	-0.2255
	(4.86)	(1.96)	(0.96)	(-0.63)	(0.88)	(-0.61)

5.2.6. Summary of impact on offer premiums

To briefly sum up, the results strongly support the first hypothesis that the psychology of the 52-week high has a positive effect on offer premiums. The results persist with a robust set of control variables, and even though the effect strength seems to have diminished over time, it still remains economically highly significant also on the second half of my sample period. The results do not appear to arise out of mandatory bid regulation, and neither do various alternative explanations offered by the practitioner interviews for the role of past prices diminish the role of the 52-week high. I find relatively little variation in effect strength across the largest sample countries, and where variation exists, it again cannot be explained by differences in mandatory bid regulation.

5.3. Impact on deal success

The previous tests establish a robust link between offer premiums and target 52-week high stock prices. The wide literature on disposition effect has shown a tendency of investors to sell stocks that have gained value and hold on to stocks that have lost value relative to a reference point. Consequently, if the 52-week high acts as an important investor reference point, meeting or exceeding this reference price should induce target shareholders to sell, and have a noticeable effect not only on offer premiums, but on deal success as well.

To assess the impact of reference considerations on deal success, I employ a probit specification, defined in Equation 6. The dependent variable is now an indicator variable that equals 1, if the deal went through, and 0 otherwise. To test for the effect of surpassing the reference point, I further define a second indicator variable that is equal to 1 if the offer price is equal or greater than the 52-week high and 0 otherwise. I present the marginal effects from these regressions in Table 8 below. The coefficients can be interpreted as marginal changes in probability of deal success for infinitesimal changes in the independent variables. The z-scores are included in Appendix D for reference.

$$\mathrm{PR}(\mathrm{Success}_i) = \alpha + \mathrm{Offer\ premium}_i * \beta_1 + (\mathrm{Offer\ premium} \geq \mathrm{Target\ 52HI})_i * \beta_2 + \varepsilon_i \qquad (6)$$

The first probit regression regresses the offer success on offer premium and the indicator variable of offer price being greater than the target 52-week high price. The indicator variable is highly significant, and shows that surpassing the 52-week high threshold level increases the probit index (z-score) by 0.19. Running the marginal effects makes this easier to understand.

The marginal effects show that bypassing the 52-week high level increases the probability of the deal succeeding by 6.96%. Surprisingly, offer premium in linear form does not factor significantly into the offer success.

Although not reported, the past return for the month preceding the clean period is a positive and statistically significant predictor of deal success in all of the regressions. This may reflect information leakage or the markets anticipating the most likely acquisitions even before the start of my clean period of 30 days preceding the bid. Alternatively, good information coming out preceding the bid may increase the bidder's willingness to pursue the target even further.

Regression 2 introduces the full set of control variables, as established in Section 5.2.3. The effect of the 52-week high indicator persists. The control variable results are largely unsurprising, besides the fact that now, even more strangely, offer premium seems to have a negative effect on deal success.

Tender offers are more likely to succeed while hostile deals are significantly less likely to succeed. This indicates that opposition by target board is a significant deterrent of deal success, as also tender offers bypass the board but are not actively opposed by it. Deals with financial buyers may be more likely to succeed because there is less uncertainty about the value of the targets, synergies not being the main negotiations point. Thus, an agreement between negotiation parties may be reached more easily. Also with target run-up, the positive result can reflect either the fact that markets anticipate more strongly the most likely acquisitions, which are by definition also most likely to succeed, or that positive information coming out prior to a bid makes the target more lucrative for an acquirer to pursue.

Deals with multiple bidders are less likely to succeed. However, it has to be remembered that SDC does not record the outcomes of takeover contests, but of single bids. Thus, this result most likely reflects the fact that while one bidder wins, other bidders lose. The impact of acquirer toeholds is also negative and significant. Toeholds deter competition by making it unattractive for rivals to bid and thus lead to lower offer premiums. This may simply lead target shareholders to decline offers they view as too low. Alternatively, the result may reflect the fact that toehold bidders are more willing than average to be on the losing side in a competitive bid, because the rival then has to purchase the toehold often at a substantial premium. With stock deals, the buyer may have more leeway for bargaining, because the upper limit on what it can bid is often more loose than the absolute upper limit imposed by the

Table 8:
Impact of 52-week high on deal success, marginal effects

This table presents marginal effects from probit regressions. The z-scores are presented in Appendix D. The dependent variable is an indicator variable representing deal success, and reference effects are estimated with an indicator marking whether the offer price is equal or greater than 52-week high. The column before the regressions presents the expected sign between the dependent variable and the independent variable in question. Models 1 and 2 introduce offer premium in a linear form, while models 3 and 4 use various polynomials to determine the shape of the relation. Model 3 introduces other control variables, and model 4 further adds the fixed effects. For definitions of all variables, see Appendix B. The figures in parentheses represent z-values. The asterisks *, **, and *** represent significance at 10%, 5%, and 1% level, respectively.

	Exp. sign	Probit 1	Probit 2	Probit 3	Probit 4
Offer premium	+	0.0200	-0.1284***	-0.1561*	-0.1330*
		(0.70)	(-3.43)	(-1.89)	(-1.72)
Offer premium^2	+ / -			0.0917	0.0091
				(0.88)	(0.09)
Offer premium^3	+ / -			0.4351**	0.3794**
				(2.39)	(2.29)
Offer premium^4	+ / -			-0.4362***	-0.3229**
				(-3.01)	(-2.43)
Offer premium > Target 52HI	+	0.0696***	0.0607**	0.0537**	0.0474*
		(3.27)	(2.30)	(1.99)	(1.78)
Deal characteristics					
Form of payment: cash	+ / -		0.0112	0.0085	0.0306
			(0.48)	(0.36)	(1.33)
Form of payment: stock	+ / -		0.1072***	0.1073***	0.0919***
			(3.14)	(3.12)	(2.80)
Attitude: hostile	-		-0.4735***	-0.4739***	-0.5048***
			(-9.46)	(-9.41)	(-10.47)
Tender offer	+ / -		0.4628***	0.4556***	0.4609***
			(19.85)	(19.41)	(19.37)
Financial buyer	+ / -		0.0998***	0.0968***	0.0627*
			(3.01)	(2.91)	(1.90)
Multiple bidders	-		-0.4210***	-0.4315***	-0.4211***
			(-12.50)	(-12.64)	(-12.68)
Horizontal merger	+ / -		0.0315	0.0270	0.0259
			(1.40)	(1.20)	(1.19)
Target characteristics					
Run-up	+ / -		0.3658***	0.3337***	0.2673***
			(5.26)	(4.68)	(3.89)
M/B	+ / -		-0.0021	-0.0019	
			(-0.66)	(-0.60)	
Mcap	+ / -		0.0099	0.0103*	0.0241***
			(1.61)	(1.65)	(4.11)
Amihud illiquidity	+ / -		7.68E-06	1.02E05	
			(0.40)	(0.53)	
Acquirer characteristics					
Toehold size	+		-1.0329***	-1.0337***	-1.0007***
			(-18.25)	(-18.23)	(-18.12)
Control for target past returns		Yes	Yes	Yes	Yes
Year and country fixed effects		No	No	No	Yes
Pseudo R-squared		0.0094	0.3314	0.3362	0.3741
N		2986	2986	2851	2851

availability of cash. The positive result for stock deals can also reflect investor preference for deferred taxes.

In regression 3, I allow for a non-linear relation between the success probability and offer premium. In regression 4, I add country and year indicator variables and to arrive at an optimal specification also drop the statistically insignificant variables target liquidity and market-to-book ratio that do not add to the explanatory power of the model. Including the latter two variables has no effect on the inferences, besides reducing the pseudo R-squared. The 52-week high effect comes through even after the inclusion of the indicator variables. Statistical significance drops, but the effect remains significant at 10%-level.

In regressions 3 and 4, the third and fourth powers of offer premium are statistically significant. I look into literature for potential explanations for this effect. Literature employing SDC offer prices instead of abnormal returns has not specifically concentrated on offer success. Betton et al. (2009) group bids into takeover contests, and study the determinants of initial bidder winning. They do not include offer premiums into the specification, however. Walkling (1985) studies determinants of tender offer success, and notes that previous research has often found an insignificant relation between bid premiums and offer success. However, he shows that this is a problem attributable to not measuring premiums correctly, that is, not taking into account information leakage and market anticipation of the offer. This should not be a problem here, however, as I define offer premium relative to a price 30 days prior to offer announcement.

Thus, it can be that the result with the offer premium arises from the extreme values prevalent in the variable, which acts also as the motivation for winsorising it. Motivated by the statistically significant and negative fourth power term, I look at the success rate of offers in the winsorised 5% upper tail of offer premiums to see whether the result arises from unsuccessful deals with high offer premiums that are potential outliers. At 48%, the success rate for the upper tail is well below the average success rate of 66% for the whole sample, and may well explain at least part of the strange behavior. In an unreported regression, I drop the winsorised observations from the upper tail of offer premium distribution. This does not affect key inferences, but results in the linear term for the offer premium becoming positive and significant by itself and in the absence of control variables, as defined in probit regression 1. Using the specification in probit regression 4, all of the offer premium measures now become

statistically insignificant besides the third power, which is still borderline significant with a t-value of 1.65. This is now roughly in line with Baker et al. (2009), who find all the offer premium measures to be statistically insignificant with control variables.

All in all, it appears that the impact of the 52-week high reference point on deal success is both statistically and economically significant. Using specification 4 as a proxy for the effect magnitude, the results imply that with a sample size of 2851 on the analysis, 135 bids[2] in my sample failed or were completed solely because the bids were on one side of the reference point and not the other.

5.4. Impact on bidder shareholder wealth

Research has established the role of price maximums as potential reference points and the 52-week high as a particularly salient candidate. Research on disposition effect has shown that reference points matter to the investors owning the stock, in this case the target stockholders. By following the stock price actively, also other parties such as target board, management, and financial advisors may become anchored to past price measures. Finally, the target side may try to anchor this past price level also on the bidder side's minds in price negotiations. However, bidder stockholders are seemingly outside of this sphere of influence. Although they may exert an effort to value the target's stock themselves, bidder stockholders can be expected to be relatively free of this reference-dependence. Thus, they should be able to assess bid prices more rationally, and react to psychology-induced overpayment.

To assess the reactions of bidder shareholders, I compute the bidder cumulative abnormal returns as described in Section 4.2.7. As benchmark indexes, I utilize the all-share indexes of the national stock exchanges, or their closest counterparts. For tests concentrating on target considerations, it has been enough for the target to be incorporated in Europe. To clean out the European effect, I now further exclude bidders that come from outside of Europe.

I first regress cumulative abnormal returns on offer premiums using an ordinary least squares specification, as presented in Equation 7. The results are presented in Table 9. The impact of offer premium on the abnormal returns is negative, but significant only at 10%-level. Of

[2] Impact on deal success * number of deals in analysis = 0.0474 * 2851 = 135

course, higher offer premiums do not necessarily, by themselves, mean that a bidder is paying too much, but that it has spotted a valuable enough target for a high premium to be justified.

$$\mathrm{CAR}^{i}_{-3;+3} = \text{Offer premium}_{i} * \beta_1 + \varepsilon_{i} \quad (7)$$

Table 9:
Impact of 52-week high driven bids on bidder shareholder wealth

This table presents the regression results for bidder reactions to 52-week high driven bidding. The dependent variable is the cumulative abnormal return for the period [-3;3] relative to offer announcement. The column before the regressions presents the expected sign of the relation between the dependent variable and the independent variable in question. The first and third regression are ordinary least squares regressions, while the second one and the fourth one are 2-stage least squares regressions. The two-stage least squares specifications instrument for offer premium using Target 52HI. I run the regressions first as is, and a second time with control variables. For definitions of all the variables, see Appendix B. The figures in parentheses represent t-values and are calculated using White's heteroskedasticity-consistent standard errors. The asterisks *, **, and *** represent significance at 10%, 5%, and 1% level, respectively.

	Exp sign.	OLS 1	2SLS - 1	OLS 2	2SLS - 2
Offer premium	-	-0.0130*	-0.3932**	-0.0202**	-0.3719*
		(-1.79)	(-2.35)	(-2.48)	(-1.73)
Deal characteristics					
Form of payment: stock	+			-0.0057	-0.0302*
				(-0.94)	(-1.70)
Attitude: hostile	+ / -			-0.0235**	0.0069
				(-2.16)	(0.27)
Financial buyer	+ / -			-0.0146	-0.0128
				(-0.37)	(-0.19)
Multiple bidders	-			-0.0048	-0.0118
				(-0.59)	(-0.82)
Horizontal merger	+ / -			-0.0065	0.0089
				(-1.26)	(0.71)
Target characteristics					
Run-up	+ / -			0.0372**	0.3404*
				(2.28)	(1.88)
Mcap	+ / -			-0.0020	-0.0085*
				(-0.19)	(-1.90)
Amihud illiquidity	+ / -			-1.04E-06	-1.35E-05
				(-0.59)	(-1.15)
Acquirer characteristics					
Toehold size	+			0.0168	-0.0127
				(1.52)	(-0.49)
Control for target past returns		No	No	Yes	Yes
Adjusted R-squared		0.0022	-	0.0412	-
N		995	995	988	988

Next I turn to a two-stage least squares specification. Two-stage least squares is commonly employed, when variables in the model are endogenous, mutually dependent. However, that is

not the case here. Instead, the technique is employed to isolate the component of offer premium that is driven by the 52-week high. In particular, I use Equation 4 as the first stage regression. Bidder cumulative abnormal returns are then regressed on the new variable obtained from the first stage regression to assess how bidder shareholders react specifically to offer price being driven upwards by reference-dependence. I run the regressions first as is, and a second time with control variables. As control variables, and thus also as independent variables for the first stage regression in addition to the instrument 52-week high, I employ all the statistically significant determinants of offer premiums, as established in piecewise specification 5 in Table 5.

Regression 2 in Table 9 shows the results for the basic 2SLS specification. Bidder shareholders react significantly more negatively to an increase in the offer premium driven by reference-dependence than to an increase in the offer premium on average. For a 10% increase in the component of offer premium driven by the 52-week high, the bidder shareholders suffer a 3.9% abnormal loss. Regressions 3 and 4 repeat the first two regressions with control variables. The main inferences about the impact of the reference-dependence are once again unchanged by the inclusion of the controls, although the statistical significance of the 52-week high component decreases to 10%-level. In unreported results, I repeat the tests with 3-day cumulative abnormal returns. The results are similar to those with 7-day CARs, with a smaller and less significant coefficient for the instrumented offer premium.

To assess the economic impact of these results, I utilize the coefficient from the second 2-stage least squares regression in Table 9 and the coefficient from OLS regression 1 in Table 4. I infer that for every 10% increase in the target 52-week high, the bidder shareholders suffer a -0.31% abnormal return, or on average (median) a $23.84m ($2.62m) loss[3]. This is now a second estimate for the magnitude of the value transfer from bidder to target shareholders. In comparison to the estimates presented in Section 5.2., this is now a transfer for an average 52-week high effect, that is, this estimate does not account for the fact that the effect on offer premiums is stronger for the 52-week high prices below 35%. As the effect is approximately two to three times as strong with lower levels of 52-week high, multiplying this value transfer

[3] 10% * Marginal impact of 52HI on offer prem. * Impact of 52HI-component on bidder CARs * Bidder Mcap = 10% * 8.33% * -37.19% * $7,694.63m ($847.09m)

by two to three actually brings it relatively close to the previous estimates. Thus, bidder shareholders appear to notice the psychology-induced overpayment relatively accurately.

5.5. Impact on clustering of merger activity in time

The previous tests have focused on the impact that reference-dependence may exhibit on the level of individual deals. Here, reference-dependence is hypothesized to have an impact also on clustering of merger activity in time, and thus contributing to the merger wave puzzle. When the markets are trading close to their 52-week highs, also more targets are likely to trade close to their 52-week highs. Consequently, it becomes easier for bidders to satisfy the 52-week high reference point with reasonable offer premiums, and more mergers are predicted to take place.

I obtain the dependent variable of the monthly number of deals in Europe from SDC. It is scaled by the total number of listed firms in Europe in each month to account for the number of firms increasing over time. The predictive power of the 52-week high on merger activity is measured using the specification presented in Equation 8.

$$\text{Merger activity}_t = \alpha + \text{Market } 52\text{HI}_t * \beta_1 + \varepsilon_t \quad (8)$$

The market index is the FTSE All share index. It is the generally utilized single benchmark index in European M&A studies (see e.g. Martynova and Renneboog, 2006), as European takeover activity has its roots in UK (see Section 2.5. for a review), and UK accounts for approximately half of the deals in Europe even today. Further, no daily data generally exists for the country indexes of the smaller countries before the turn of the century. As merger waves are not such a frequent phenomenon, it is important to have a longer sample period than the 21st century only. It should also be noted that in contrast to the quarterly measure for merger activity used by Baker et al. (2009), I am able to construct a monthly measure of merger activity using SDC. Further, my measure of merger activity contains only deals where the target firms are public. This should allow me to sharpen up the tests somewhat.

The results from the regressions are presented in Table 10. The first regression tests the basic prediction that the ratio of market 52-week high to its current value is a negative predictor of monthly merger activity. However, the coincidence of merger waves with high market valuations is widely documented in the literature. Thus, in regression 2 I include the book-to-

market valuation levels of the European market as additional explanatory variables, obtained from portfolios constructed by Kenneth French. As no average is provided, I include the valuation levels of both high and low book-to-market portfolios. Removing either one of the book-to-market level variables has no material impact on results. Market 52HI remains significant despite the inclusion of these controls, and thus it appears that it is also the psychology associated with the 52-week high that is driving merger activity, not only high valuations themselves.

Table 10:
Impact of 52-week high on clustering of merger activity in time

This table presents the results of regressing the monthly merger activity on the market 52-week high value and control variables. The regressions are executed with the ordinary least squares method, following Equation 8. The dependent variable is a monthly measure of European merger activity scaled by the number of listed firms in Europe. The column before the regressions presents the expected sign of the relation between the dependent variable and the independent variable in question. The first regression tests the basic relation between merger activity and market 52-week high. The second regression controls for market valuation levels, the third regression also controls for past market returns, and the fourth for availability of external financing using the credit spread as a proxy. For definitions of all the variables, see Appendix B. The figures in parentheses represent t-values and are calculated using White's heteroskedasticity-consistent standard errors. The asterisks *, **, and *** represent significance at 10%, 5%, and 1% level, respectively.

	Exp. sign	OLS 1	OLS 2	OLS 3	OLS 4
Market 52HI	-	-0.0294**	-0.0480***	-0.0476***	-0.0480***
		(-2.45)	(-4.83)	(-3.76)	(-3.85)
FF HI portfolio B/M level	-		-0.0005**	-0.0005**	-0.0005**
			(-2.57)	(-2.42)	(-2.35)
FF LO portfolio B/M level	-		-0.0007	-0.0008	-0.0010
			(-1.23)	(-1.31)	(-1.58)
Credit spread	-				-0.0016***
					(-2.84)
Control for market past returns					
t-1m				-0.0069	0.0225
t-2m				-0.0091	0.0218
t-3m				0.0107	0.0219
t-4m				0.0001	0.0215
t-5m				0.0008	0.0213
t-6m				-0.0073	0.0211
t-7m				0.0022	0.0210
t-8m				0.0210	0.0208
t-9m				0.0244	0.0210
t-10m				0.0128	0.0206
t-11m				0.0320	0.0204*
t-12m				-0.0068	0.0203
Adjusted R-squared		0.0188	0.4592	0.4386	0.4551
N		262	250	250	250

Regression 3 controls for past monthly returns. Once again, it appears that it is specifically the role of 52-week high that is driving the results, and not high or low returns during that period. Harford (2005) finds that the inclusion of capital liquidity controls discredits the theories of market-timing hypotheses as causes of merger waves. Further, the investment banker interviews suggest the increased availability of external finance during bull markets as an alternative to psychology as a merger wave catalyst. Thus, in line with Harford (2005), I include the credit spread between corporate bonds and the central bank overnight rate as a control variable in regression 4. As expected, the credit spread is a significant negative predictor of merger activity. However, it does not eliminate the impact of the 52-week high.

To sum up, the results support the hypothesis. Reference-dependence appears to have a statistically and economically significant impact on the clustering of merger activity. Using regression 4 as a proxy, I calculate that a 10% increase in the 52-week high relative to current market value will lead to -0.00480 drop in the scaled merger activity, equivalent to a portion of 12.7% (13.2%) of the average (median) rate of merger activity, or on average (median) 15 (12) deals a month. All in all, it appears that reference-dependence can be seen directing aggregate merger activity, and explaining part of the puzzle of the coincidence of market valuations and merger waves. In contrast to Harford (2005), the results do not discount the other behavioral theories, as the book-to-market level remains a statistically significant predictor also after the inclusion of credit spread. Thus, psychology does not explain the whole puzzle, but seems to be an important piece in it.

5.6. Comparison of 52-week high to other potential reference points

As alternatives to purchase prices as investor reference points, behavioral finance generally suggests extreme values and average prices. This is based on research on human learning and memory, which has shown that instead of a continuous description of events, people tend to remember averages and novel details. The 52-week high has the potential to act as a particularly important investor reference point due to being often reported in various financial media alongside current prices.

This section examines how the 52-week high compares to other reference point candidates constructed from various time periods prior to a bid. The comparisons are most easily done by reverting back to the tests on the impact of reference points on offer premiums. I start by inspecting how the effect of 52-week high on offer premiums varies depending on how long

ago in the past the high has been reached. Next, I directly compare the 52-week high to various other reference point candidates. Finally, I utilize simulation to establish that the results presented here do not arise simply from serial correlation or model misspecification.

5.6.1. Impact of time on effect magnitude

Previous research shows that the disposition effect related to purchase prices tends to fade away in time, probably due to investors updating their reference points. Consequently, it makes sense to control for the impact of time elapsed since the 52-week high was reached on the magnitude of the effect it exerts on offer premiums.

In addition to the 52-week high, I now regress the offer premium on the logarithm of the number of days between the date when the 52-week high was reached and the beginning of the clean period increased with one. The number of days appears log-normally distributed, and the number one is added to comply with the domain of the logarithm. I also include an interaction variable between the main explanatory variable and time to gain insight on how the effect varies in time. These regressions are presented in Table 11.

The first regression implements the time variables in the OLS specification of Equation 4. The results suggest that as a whole, time interaction occurs. Surprisingly, there is strong multicollinearity present, but not much can be done about it. Now the coefficient for the 52-week high alone shows the effect magnitude if the 52-week high was reached exactly before the bid, or in this case just before the start of the 30-day clean period. In such a case, a 10% increase in the 52-week high will increase the offer premium by 3.58%. This effect falls to just 0.52% if the high was reached exactly a year before[4]. This result further motivates the comparison of different reference point candidates in the next subsection, as it is evident that also local maxima for shorter periods than 52 weeks must have some explanatory power.

In regression 2, I also control for target past returns, with little effect on the results. In regression 3 I add the full set of control variables as established in Section 5.2.3. This makes both the interaction term and the baseline coefficient statistically insignificant. Again, inspection of variance inflation factors shows that there is a problem with multicollinearity arising from the interaction term. Thus, the interaction term becoming insignificant is most

[4] Coefficient (days elapsed=0) - Interaction coefficient * ln (days elapsed) = 0.3578 - 0.0519 * ln(365) = 0.0516

likely due to increased multicollinearity: First, the number of observations decreases as target characteristics are introduced, and second, all in all a dozen new variables are introduced in a specification already troubled with multicollinearity. Thus, the interaction effect cannot be discounted, although it becomes statistically insignificant.

Table 11:
Impact of time on 52-week high salience

This table again regresses the offer premium on the 52-week high, but now introducing various measures of time-dependence. All the regressions include the control variable Time since 52HI, which is the logarithm of number of days elapsed between the date the 52-week high was reached and the beginning of the clean period increased with 1. The column before the regressions presents the expected sign of the relation between the dependent variable and the independent variable in question. The first regression introduces the basic interaction term between 52-week high and time. The second regression also controls for target past returns, while the third regression introduces the full set of control variables, as established in Section 5.2.3. The fourth regression introduces interactions to the piecewise specification. For full definitions of all the variables, see Appendix B. The figures in parentheses represent t-values and are calculated using White's heteroskedasticity-consistent standard errors. The asterisks *, **, and *** represent significance at 10%, 5%, and 1% level, respectively.

	Exp. sign	OLS 1	OLS 2	OLS 3	Piecewise 1
Target 52HI	+	0.3578**	0.3449**	0.2366	
		(2.44)	(2.15)	(1.55)	
Target 52HI - 0-35%	+				0.3998
					(1.29)
Target 52HI - 35-70%	+				0.9651
					(1.19)
Target 52HI - 70%+	+				-0.2184
					(-0.56)
Time since 52HI	+ / -	0.0236***	0.0218***	0.0163***	0.0174***
		(5.35)	(4.76)	(3.83)	(2.80)
Time interact:					
Target 52HI	-	-0.0519**	-0.0515*	-0.0316	
		(-2.04)	(-1.82)	(-1.17)	
Target 52HI - 0-35%	-				-0.0467
					(-0.80)
Target 52HI - 35-70%	-				-0.1373
					(-0.94)
Target 52HI - 70%+	-				0.0414
					(0.61)
Control for target past returns		No	Yes	Yes	No
Control for deal, target and acquirer char.		No	No	Yes	No
Adjusted R-squared		0.0489	0.0493	0.2632	0.0507
N		3009	2986	2661	3009

Regression 4 introduces the time interactions to the piecewise specification. However, here multicollinearity is a real problem even without the control variables. With values ranging from 100 to more than 1000, the variance inflation factors skyrocket by the inclusion of these

multiple interactions. If I discount the statistical significance and multicollinearity problems for a moment, I can calculate that for targets with 52-week high prices below 35%, the effect is a 4.00% increase in offer premium for every 10% increase in the 52-week high for highs reached before the beginning of the clean period, declining to a 1.24% increase in offer premium when the high was reached 365 days before.

As there did not appear to be any serious problems with multicollinearity with the interaction specifications in the previous subsections, I look closer into the potential causes here. The tests executed in the next subsection show that price maxima from shorter periods than the 52 weeks have a stronger impact on offer premiums than the 52-week high does. This hints to the fact that the non-linearity as a basis for the piecewise model might be caused partly by relatively less time being elapsed from reaching 52-week high prices below 35%. This is also intuitive: when less time has been elapsed from reaching the high, it is less likely that the pre-bid stock price has fallen far away from the 52-week high level. True enough, at the beginning of the clean period, the average (median) number of days elapsed from reaching the reference point is 131 (84) days for 52-week high prices below 35%. For 52-week high prices between 35–70% and 70%+, these figures are 270 (309) days and 307 (332) days, respectively. It is likely that this contributes to the multicollinearity at least in the piecewise specification.

I conclude that although partly masked by multicollinearity, there appears to be an interaction effect between the 52-week high and time. The strength of the interaction effect is surprising: although 52-week highs matter even if reached exactly a year before, the 52-week highs reached close to offer announcement have a remarkably greater impact on offer premiums. Based on these results, it is even more pivotal to compare the 52-week high to other reference price candidates. Consequently, in the next subsection I examine the different reference price measures more closely.

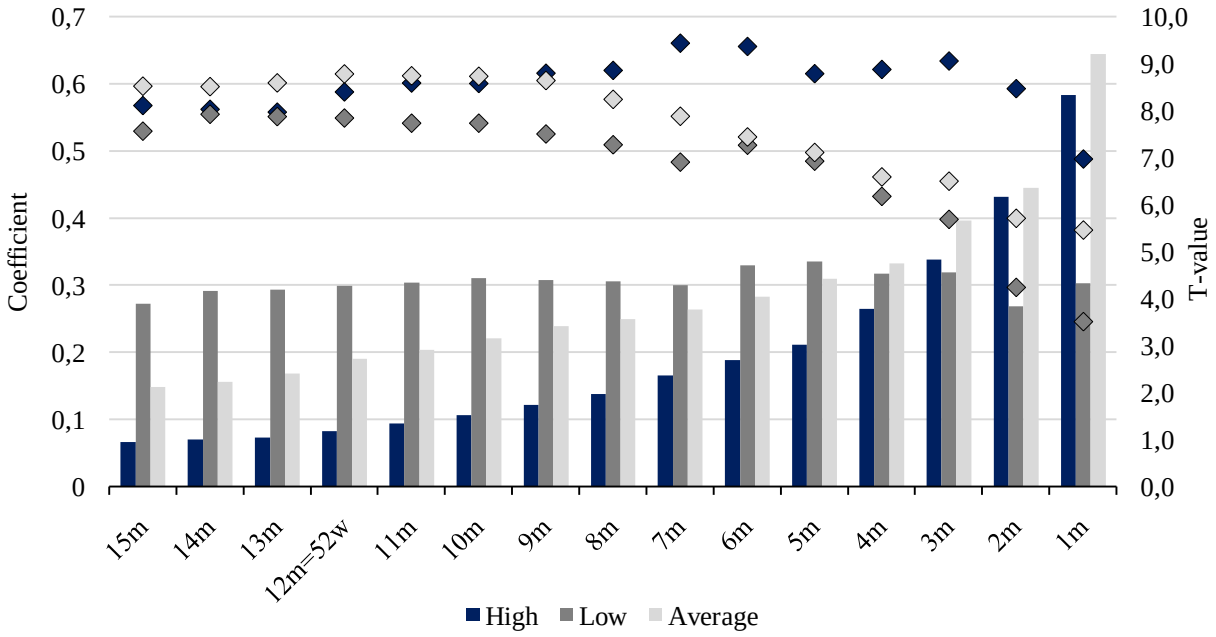
5.6.2. Direct comparison of different reference measures

To compare different reference price measures against each other, I regress offer premiums on each reference price measure separately, in line with Equation 4. Due to partially overlapping time periods, all the reference price measures are highly correlated with each other. Thus, the different reference price measures cannot be included in a single model, but separate regressions must be run. Further, the interpretation can only tell what the best proxy for the

true investor reference point is, not the relative effects of various price measures. Similarly to the 52-week high, I construct reference price measures for highest, lowest, and volume-weighted average prices for all the periods from 1 to 15 months. The results from the separate regressions are presented in Figure 5.

Figure 5:
Comparison of different reference measures

This table compiles the regression results from the offer premium being regressed on different reference price measures. The regressions are similar to Equation 4, only varying the reference point measure used in place of the 52-week high. The columns correspond to the left axis, and represent regression coefficients from individual regressions. The diamond-shaped markers correspond to the right axis, and represent t-values for the reference price coefficients from the corresponding regressions. The t-values are calculated using White's heteroskedasticity-consistent standard errors. The color blue represents regressions of different maxima reference point measures, dark grey represents different minima reference point measures, and light grey represents different volume-weighted average price measures. All the reference point coefficients are statistically significant at 1%-level. For definitions of all the variables, see Appendix B. The calculation principles for different reference point measures can be found under the variable Target 52HI.



From the results shown in Figure 5, it can be seen that all the reference price measures are highly statistically significant. Assessing the economic impact, the importance of both maximum and average prices increases the shorter the period under review, while the importance of minimum prices stays relatively constant. As the coefficients for the minima are relatively constant, the importance of maximum prices increasing in shorter periods may draw up the importance of average prices as well, them being roughly an average of the

maximum and minimum prices. This would fit the fact that the coefficients for maximum and average prices seem to increase almost in lockstep.

Surprisingly, average prices seem to act as better proxies for the true investor reference point than the maxima. Investors seem to update their reference points constantly, and as such their reference-dependence seems to be best described by the 1-month average price, although closely followed by the 1-month high price. However, this does not exclude the possibility that the true investor reference point is solely a function of the maximum and minimum price, which roughly corresponds to the average. Finally, it is immediately evident that the 52-week high price does not have any special role compared to other reference price candidates. The general trends observable here extend to both sides of the 52-week period, without the specific period of 52 weeks making any notable exception to results. This result does not arise from how the 52-week period is specified either, as the 11-month reference measures have no special role either.

At a first glance, the fact that also minimum prices up to some degree act as reference points that increase offer premiums may seem somewhat counterintuitive. However, due to potential leakage of information about a prospective bid, the reference price periods in this study are defined to end 30 days prior to an offer announcement. Although such information leakage usually results in rising prices, at times it can also lead to a decline in the target share price, when a bid is perceived as harmful for a target's prospects. Alternatively, even in the absence of any leakage the share price may decline in the 30 days prior to a bid, an extreme example being a target facing trouble such as financial distress. In my sample, the closing price on the day before the bid announcement is below the 52-week (1-month) low in 5.4% (15.1%) of observations. If the target share price declines due to information leakage, it is easy to see that the previous low prices such as 1-month low may represent the objective stand-alone market price of a target price relatively well, and thus act as reference levels, as bids only very rarely succeed at a price below the prevailing market price. For cases, where the decline is not caused by information leakage, the interpretation is a bit hazier. It is still viable to expect that especially for investors facing a price decline in their share price, also previous low prices might act as a component of their reference-dependence, although their loss averseness is even more strongly linked to average and high prices, as shown above.

The investment bank interviews suggest that for less liquid stocks, average prices may dominate maxima and minima as price indicators. This is because of potential short-term price disruptions caused by illiquidity. I repeat the regressions for liquid stocks based on the median and 30th percentile of the Amihud illiquidity ratio. The relative ordering of the different reference measures persists, but for the 30th percentile regressions the average and high prices do not surpass the low prices until the period of one month. Yet again, the rational argument of bankers correcting for short-term price disruptions cannot discount the psychology-based explanation.

These findings do not invalidate my tests however. First of all, the coefficients for maximum prices are relatively similar to those of averages especially for shorter periods. Second, as established in the previous subsection, the non-linear relation between offer premiums and the 52-week high partly captures the effect of time. This is because the lower range of 52-week high prices which I have mostly used as indicative of the effect strength has been reached closer in time than the upper range. As the median time elapsed from reaching the 52-week high is 84 days for 52-week high prices below 35%, the results roughly correspond to a 3-month maximum, and as such act as a conservative estimate for the impact of reference-dependence on offer premiums. Finally, these findings persist in the other test specifications as well, the 1-month average and 1-month high price exhibiting the strongest effect on all aspects of mergers and acquisitions.

5.6.3. Verification of results by simulation

Because the coefficients associated with both maximum and average prices seem to increase almost linearly the shorter the period under review, a doubt naturally arises that the results are actually driven by serial correlation of stock prices, or the scaling of both the dependent and the independent variable with the same 30-days lagged price. However, it should be noted that the offer price literature generally utilizes variables such as target run-up, which are scaled by the same lagged price as offer premiums on the other side of the equation (see e.g. Eckbo, 2009).

To explore this potential caveat in model specification, I simulate 1000 observations of stock prices with Geometric Brownian Motion and randomize offer markups to obtain offer prices. I then define the reference price measures from the simulations exactly as I do with my real sample, and calculate correlation coefficients between the offer premiums and reference price

measures. Finally, I replicate these 1000 observation simulations 1000 times to stabilize the correlation estimates.

The simulations further back the validity of the model specification. The simulated correlations are all close to zero, and at best, the simulations explain less than 1.3% of the observed correlations. The simulated correlation coefficients alongside further details on the simulation process are presented in Appendix E.

6. SUMMARY AND CONLUSIONS

Behavioral finance has shown the importance of psychological reference points for investor behavior in various contexts. This paper establishes a link between reference-dependence and the largest economic transaction existing, mergers and acquisitions. Using a sample of European deals allows me to test for the impact of reference considerations on various aspects of merger activity. My main explanatory variable is a stock's 52-week high price, which has received particular attention in the literature as an alternative, potentially salient reference point besides the purchase price. I present strong evidence supporting reference-dependence, but find no special role for the 52-week period. This section summarizes my main findings and finally draws the conclusions.

6.1. Summary of results

The main findings of this paper are summarized in Table 12 below. All in all, I present strong evidence on the impact of reference-dependence on mergers and acquisitions activity. The results suggest that reference-dependence leads to higher offer premiums, influences deal success, is rationally assessed by the bidder shareholders as value-destructive, and also influences clustering of merger activity in time. The results persist after controlling for several alternative explanations suggested by the practitioner interviews.

For a typical deal, a 10% increase in target 52-week high will increase offer premiums by 2.2%–2.5%. The effect is stronger for deals with multiple bidders, suggesting that competition may make bidders more willing to meet this reference point to secure target shareholder acceptance. The effect is weaker for financial buyers, which can be due to them taking part in deals more often, and experience attenuating the psychological bias on the buyer side. The effect is also weaker in deals where the method of payment is stock, and on the second half of the sample period. Despite the decline, the effect strength remains economically significant

also in the recent years. There are no statistically significant differences in effect strength across the largest sample countries. The effect is significantly stronger in Netherlands and Austria, while in Italy the effect is actually negative. The differences cannot be explained by the mandatory bid regulation induced by the European takeover directive. The negative effect in Italy appears to be caused by the noise inherent in the small number of observations making the piecewise model inadequate for the comparison.

Table 12:
Summary of results

This table presents a summary of the main findings of this study. I present the hypotheses one by one on the left and related findings on the right.

Hypothesis	Evidence
H1: There is a positive relation between the offer premium and the 52-week high stock price of a target	Strong support. For a typical deal, where the target price prior to a bid has not fallen very far from the 52-week high, a 10% increase in the 52-week high will increase offer premiums by 2.2-2.5%. The effect is stronger for deals with multiple bidders, and weaker in stock deals, deals with financial buyers, and on the second half of the sample period. No significant differences are found between the largest sample countries.
H2: Bid success increases discontinuously when the offer price meets or exceeds the target's 52-week high stock price	Semi-strong support. Surpassing the 52-week high price increases the deal success by 4.7%-5.4%. However, after adding year and country fixed effects, the statistical significance of the result decreases to 10%-level.
H3: Bids, where the offer price is driven strongly by the 52-week high psychology, will result in more negative bidder announcement returns than on average	Semi-strong support. Bids driven by the 52-week high have a considerably more negative impact on bidder shareholder wealth than deals on average. However, after adding the control variables, the statistical significance of the result decreases to 10%-level.
H4: The ratio of the 52-week high value of the market index to its current value is a negative predictor of merger activity	Strong support. A 10% increase in market 52-week high relative to current market value decreases the monthly number of deals taking place in Europe by 15, or 12.7% of the average rate of activity, and thus contributes to clustering of merger activity in waves.
H5: The effect of the 52-week high on offer premiums is weaker the further away in the past the high has been reached	Semi-strong support. Strong time interaction seems to be occurring, but it becomes statistically insignificant after the inclusion of control variables and is insignificant also in the piecewise specification. However, this is most likely due to multicollinearity.
H6: The effect of the 52-week high on offer premiums is stronger than that of any other high, minimum or average price during the 52-week period or in the months prior	Contrary evidence found. The period of 52 weeks has no special significance, while the 1m average and 1m high prices serve as the best single proxies for investor reference-dependence.

I test for several predictions suggested by investment bank interviews as rational reasons for why past price development might matter in a bid situation. However, I find no differences in effect magnitude in deals with less liquid target stocks, in stock swap deals, or in deals involving targets with high price volatility. The relation between offer premiums and target 52-week high prices does not appear to arise out of mandatory bid regulation either: I find no statistically significant differences in effect magnitude either in the period after the adoption of the European takeover directive, or in the subsample of countries whose mandatory bid price is not the 52-week high paid by the acquirer. Finally, as the latter tests indicate, the best single proxies for the true investor reference point appear to be a stock's 1-month average and 1-month high prices, which do not even closely represent the mandatory bid prices of the majority of the sample countries. I conclude that it is not regulation, but psychology that is driving the results.

Besides offer premiums, reference-dependence affects other aspects of mergers and acquisitions as well. Meeting or exceeding the 52-week high reference price is found to increase the bid success discontinuously, by 4.7%–5.4%. Bidder shareholders are found to be less influenced by reference-dependence on target stock prices themselves, and to react negatively to psychology-induced overpayment. On average, a 10% increase in a target's 52-week high translates to a -0.31% bidder abnormal return. Finally, besides single deals, the level of the market 52-week relative to current market value is found to be a significant negative predictor of overall merger activity, a 10% increase in market 52-week high relative to current valuation decreasing the monthly number of deals in Europe by 15, or 12.7% of the average rate of merger activity. Thus, the 52-week high is found to be contributing in part also to the puzzle of the clustering of merger activity in time.

Opposite to predictions, the 52-week period as such is found to have no special importance for investors. Surprisingly, investors are found to have "short memories", their reference-dependence being best described by the 1-month average price followed by the 1-month high price. The effects of reference-dependence are stronger for reference measures based on shorter time periods, and as such, my tests act as conservative estimates or lower limits for the true reference-dependence.

What comes to offer premiums and bid success, my results are very similar to the findings of Baker et al. (2009), despite the fact that in my sample a clearly smaller percentage of the offer

prices exactly equal to the 52-week high. I carefully benchmark the offer price literature and discuss the price determinants with investment bankers, and introduce a more robust set of control variables than that employed by Baker et al (2009), yet find little differences. As noted above, the similarity of the European results documented here to those found in United States also point to mandatory bid regulation having no discernible impact on the results, as such regulation does not generally exist in the United States. Further, the customary annual reporting period in European companies does not appear to intensify investor focus on the 52-week period.

The main difference to the US results is that the shareholders of European bidders seem to react substantially more negatively to psychology-induced overpayment, the effect being 50% stronger in the regression with control variables. This may indicate that the shareholders in Europe are on average more aware of such psychology-induced payment happening. Why this should be the case is unclear, however. Finally, I also refine the tests for clustering of merger activity in time by constructing a monthly instead of a quarterly measure of merger activity. I also control for the availability of external finance as suggested by the investment bank interviews, and which Harford finds to erase the impact of other behavioral theories. This additional variable acts as a statistically significant predictor of merger activity, but does not discredit the impact of the 52-week high.

The credibility of these results is boosted by anecdotes from investment bank interviews and simulations to verify that the results do not arise out of serial correlation or model misspecification. The bankers recognize the impact of psychology and loss aversion on investor behavior and state that they are sometimes taken into account in price setting. The interviews also give evidence on reference-dependence in three additional fronts: First, when evaluating a bid price, target boards benchmark price indications from previous acquirer approaches. Second, when evaluating what should be paid, the investment bankers run an analysis on the purchase prices of large owners. Third, it is noted that it is generally difficult for a bid to succeed with a premium that is lower than what has been recently paid in the market.

I control for alternative explanations suggested by the investment bankers for the role of past prices, but find no impact on effect magnitude. Further, it should be noted that the bankers in unison fail to predict the result that reference measures from shorter time periods matter more,

even though a single banker finds average prices and shorter periods as most useful past price indicators for reasons other than psychology. Broadly, this can indicate that the primary channel why reference points matter is the reference-dependence of target stockholders or board of directors, not the negotiation arguments constructed by the bankers anchoring the buy-side to a higher price.

Finally, the bankers state that it often does not make sense to look at price development from very short time periods, because a single earnings announcement can have such a huge impact on how investors perceive the target company. In this study, these short periods are at least partially eliminated, as the reference price periods are defined to end 30 days prior to offer announcement to allow for any information leakage. Turning this last argument around may then also explain why reference prices from shorter periods seem to matter more: as argued also by Kliger and Kudryavtsev (2008), investors may update their reference points following earnings announcements and other firm-specific events. Thus, even though the time interaction regressions show that the 52-week high has an impact even if reached a full year before the bid, in general investors appear to review their reference points relatively often, leaving a smaller role for prices further back in the past.

6.2. Conclusions and suggestions for further research

My results contribute to the behavioral finance literature in three ways. First, the results add to the small sphere of evidence on the impact of reference-dependence on mergers and acquisitions activity, a new strand in M&A research. Second, besides adding credibility to the results, the anecdotal evidence from the practitioner interviews expands the understanding on how reference-dependence manifests itself in mergers and acquisitions. Third, my results reaffirm the importance of the 52-week high as a reference point, but show that in general the 52-week period has no special role. Thus, the significance of the 52-week high seems to be mostly based on it acting as a proxy for the true reference point, and investor reference-dependence seems to be best described by the 1-month average price, followed by the 1-month high price.

The evidence on the importance of the 1-month average price is somewhat in line with Baucells et al. (2008), who with their unique test specification are the only ones to conduct a direct comparison of the relative effects of different reference point candidates. The authors find that besides purchase price, the reference-dependence of their test subjects is best

described by the current price and the average price, with a small role for the highest price, and lowest price having almost no impact. The result is also broadly consistent with Kliger and Kudryavtsev (2008), who show that investors update their reference points following surprise information in earnings announcements, which broadly implies that reference prices from shorter periods may matter more.

Besides statistical significance, the impact of psychology is highly economically significant as well. From the different tests I estimate the average (median) value transfer due to psychology to be more than $47m ($4m). Further, besides the value transfer in deals that succeed, reference-dependence actually inhibits transactions from being completed at all. From the 2851 deals used in the analysis, 135 succeeded or failed solely because the bid price was on one side of the reference point and not the other. Finally, a 10% increase in the market 52-week high relative to its current value is found to decrease the number of monthly deals in Europe on average by 15. Thus, markets trading close to their 52-week high level seems to contribute significantly to the formation of merger waves as well. As pointed out, these estimates are likely to represent the lower range of true reference effects, because of other reference point candidates appearing to have an even stronger economic impact than the 52-week high.

These finding are particularly important for bidder firms and their shareholders, as the bidder abnormal returns observed at announcement are generally negative or close to zero. I interpret the part of offer premiums driven upwards by the reference-dependence as pure overpayment, and the reactions of the bidder shareholders seem to verify this. Thus, at least part of the acquirer value destruction generally observed may be related to psychology. These results suggest that to maximize shareholder value, acquirers should strive to initiate the bid when the short-term average price of the target is relatively low. Strategic waiting may pay off: if an acquirer believes that the target share price will drop in the near future, or if the price has peaked in the near past, the value transfer can be reduced by waiting before initiating the bid. Waiting for a month or so should not critically increase the risk of the target being acquired by another suitor either. To maximize the consideration offered, targets should act conversely, and try to boost their short-term price if a bid is evident. In the extreme, this suggests that targets might actually benefit from information leaking to the markets prior to the announcement of a bid.

Running an analysis of reference-dependence on investor purchase prices, specifically those of large owners, presents a fertile avenue for future research. Such prices are hard to obtain, but could still provide an important robustness check for the argumentation presented here. In addition, the possibility of average premiums paid on the market acting as a reference level should be inspected, although specifying the relevant average is likely to be complicated. Another potential direction is to further examine the role and relative influence of reference-dependence in the formation of merger waves in a framework including also industry shocks. This would better put to context the economic implications on the overall merger market as well.

Finally, it might be valuable to try to assess, why the effects of reference-dependence seem to decrease in the recent years. This might help bidders to understand, how the value transfer can be minimized. The interviews suggest increased investor sophistication as a potential explanation for the decline in effect strength over time. If this is the case, bidders seem to have little means to minimize the impact of psychology themselves, as actively educating target shareholders seems somewhat impossible. With the increasing availability of more and more powerful analysis software, the effect magnitude could be expected to continue to decline in the future as well. Such a decline would still be slow, and in the modern, fast-changing environment waiting for such a decline to happen before making a bid is, of course, not viable.

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APPENDIX A: MERGERS AND ACQUISITIONS TERMINOLOGY

This appendix presents the key mergers and acquisitions terminology for a reader less familiar with the subject.

ACQUIRER: A company that is buying another company in a takeover or is seen as initiating the bid. Used interchangeably with the terms bidder and buy-side.

ACQUISITION: Purchase of a controlling interest in a firm, generally via a tender offer for target shares. Used interchangeably with the terms merger and takeover.

BID: Refers to an approach made on a target company or its shareholders to purchase a controlling interest in the company. In this study the term bid is used interchangeably with the term offer.

BIDDER: A company that is buying another company in a takeover or is seen as initiating the bid. Used interchangeably with the terms acquirer and buy-side.

BUY-SIDE: A company that is buying another company in a takeover or is seen as initiating the bid. Used interchangeably with the terms acquirer and bidder.

HOSTILE BID: An acquisition attempt that is opposed by the target board.

M&A: A common abbreviation used for mergers and acquisitions.

MERGER: Strictly speaking the term merger reflects the fact that two companies are combined more or less as equals, but it is nowadays used as a general term for discussing changes of control in a company. In this study the term merger is used interchangeably with the terms acquisition and takeover.

OFFER: Refers to an approach made on a target company or its shareholders to purchase a controlling interest in the company. In this study the term offer is used interchangeably with the term bid.

OFFER PREMIUM: The part of consideration offered for a target company in an acquisition that is over and above the market price prevailing prior to offer announcement. Due to leakage of information, a target company's market price immediately prior to an offer tends to reflect anticipation of the offer premium. For this reason, this study defines offer premium relative to the price 30 days prior to an offer announcement instead of utilizing the closing price of the day before the bid.

SELL-SIDE: Refers to a company that another company is trying to acquire. Used interchangeably with the term target.

TAKEOVER**:** Strictly speaking the term takeover refers to buying a controlling interest in a target company, more or less against the will of the target board or management. In this study the term takeover is used interchangeably with the terms merger and acquisition.

TARGET: Refers to a company that another company is trying to acquire. Used interchangeably with the term sell-side.

TENDER OFFER: Represents a specific mechanism for acquiring a company, where a public offer is made for all the owners of the company. The offer is made straight to the target shareholders therefore bypassing the target board.

APPENDIX B: VARIABLE DEFINITIONS

This appendix presents a list of all the variables employed in this study. For each variable, I present both a short description and a calculation formula, if applicable. The variables are listed alphabetically. Both offer premiums and reference price measures are winsorised at 5% level because of the high amount of potential extreme outliers. All other continuous independent variables are winsorised at 1% level.

AMIHUD ILLIQUIDITY: A measure for the illiquidity of a target company's stock, as constructed by Amihud (2002). It is calculated from the 52-week period before the beginning of the clean period.

Amihud illiquidity ratio: $\frac{1}{n}\sum \frac{|r_t|}{P_t * VOL_t} * 10^6$

where r_t is the target total return, P_t is the stock price, and VOL_t is the trading volume for day t. N is the number of trading days in the year.

ATTITUDE – HOSTILE: An indicator variable equaling 1, if the offer is flagged as hostile in SDC, 0 otherwise.

$CAR_{-3;+3}$: Acquirer 7-day cumulative abnormal returns. Calculated using the total returns of country-specific all-share indexes as benchmark returns, as described in Section 4.2.7.

CREDIT SPREAD: A measure for the availability of external financing in each month. I define the credit spread as the difference between the average UK corporate debt rate and the UK interbank overnight rate in the first day of each month.

FF HI portfolio B/M level: An index of book-to-market levels for high book-to-market portfolios, calculated from the European index portfolios constructed by Kenneth French.

FF LO portfolio B/M level: An index of book-to-market levels for low book-to-market portfolios, calculated from the European index portfolios constructed by Kenneth French.

FINANCIAL BUYER: An indicator variable equaling 1, if the offer is flagged as LBO in SDC, and 0 otherwise.

FORM OF PAYMENT – CASH: An indicator variable equaling 1, if the offer is financed solely with cash, and 0 otherwise.

FORM OF PAYMENT - STOCK: An indicator variable equaling 1, if the offer is financed solely with stock, and 0 otherwise.

HORIZONTAL MERGER: An indicator variable equaling 1, if the target and acquirer have the same 2-digit SIC code, 0 otherwise.

M/B: The market-to-book ratio of the target or the acquirer in the beginning of the clean period of 30 days prior to a bid. Defined as the total market capitalization in the beginning of the clean period divided by the latest book value of assets widely available, that is, from the financial year preceding the deal.

$$\text{M/B: } \frac{\text{Market capitalization}_{t-30}}{\text{Book value}_{FY-1}}$$

MARKET 52HI: The maximum value of the FTSE All share index from the 52-week period ending before the beginning of the current month. Market 52HI is the main independent variable in the analysis examining the clustering of merger activity in time.

$$\text{Market 52HI: } \frac{I^{Max}_{-13m;-1m}}{I^{End}_{Previou\ s\ month}} - 1$$

where $I^{Max}_{-13m;-1m}$ is the maximum value of the market index in the 52-week high period ending before current month, and $I^{End}_{Previous\ \ month}$ is the index value at the end of the previous month, that is, on the last day of the 52-week period.

MCAP: The natural logarithm of the total market capitalization of the target or acquirer in the beginning of the clean period, that is, 30 days prior to announcement. The variable is obtained from Datastream as a dollar value. I then adjust it for inflation using 2008 as the base year, with the help of Consumer Price Index available from the National Bureau of Labor Statistics.

MERGER ACTIVITY: In order to measure the impact of reference-dependence on the clustering of merger activity in time, I have to generate a measure for the overall merger activity in Europe. I obtain a measure for the number of deals from SDC M&A database,

restricting the target nations in a similar way as in my sample and requiring that targets are publicly traded. I try to obtain bids from as long a period as possible, due to merger waves not being a frequent phenomenon. This leaves me with a total of 262 monthly observations. To make the amount of deals comparable over time, I scale the number of transactions in each month by the amount of active, publicly listed firms in Europe. This is done by first obtaining a list of all the active and non-active firms in the major exchanges of each of the sample countries. Then, for each firm in each country, I try to obtain the market values for the last day of each month in the period for which I have data on the number of deals. If the market value exists, a firm is deemed active for that month. Finally, the monthly measure of merger activity is calculated as:

$$\text{Merger activity}_t: \frac{\text{Number of deals in month}_t}{\text{Number of publicly listed firms in Europe}_t}$$

MULTIPLE BIDDERS: An indicator variable equaling 1, if the number of bidders listed in SDC is more than one, 0 otherwise.

OFFER PREMIUM ≥ TARGET 52HI: An indicator variable equaling 1 if the offer price exceeds the 52-week high price, and 0 otherwise.

PENNY STOCK: A second measure capturing liquidity of target stock, used as an alternative for Amihud illiquidity ratio. An indicator variable equaling 1, if the target stock price 30 days prior to the bid was below $1, 0 otherwise.

RETURNS VOLATILITY: Standard deviation of the logarithmic daily total returns of the target company. It is calculated from the 52-week period before the beginning of the clean period.

ROA: Return-on-assets of target or bidder for the financial year prior to the bid, as obtained from Datastream.

RUN-UP: The change in target stock price between the beginning of the clean period and the offer announcement.

$$\text{Run} - \text{up: } \ln \frac{P_{t-1}}{P_{t-30}}$$

where P_{t-1} and P_{t-30} are target stock prices 1 and 30 days prior to a bid, respectively.

SUCCESS: An indicator variable equaling 1, if SDC classifies the deal as either completed or unconditional, and 0 otherwise.

TARGET 52HI or 52HI: The main independent variable employed in this study. The premium of a target company's 52-week high price relative to the 30-days lagged price. The 52-week high is scaled by the same 30-days lagged price as the offer premium to alleviate heteroskedasticity that would result from comparing these prices in a raw form. In the results discussion, I refer to the 52-week high premium simply as 52-week high price to avoid confusion. The suffixes 0–35%; 35–70% and 70%+ refer to specific ranges of the 52-week high variable, as utilized in the piecewise specifications. All the other reference price measures employing maximum prices are calculated similarly to the 52-week high, only varying the time period.

$$\text{Target 52HI: } \frac{P^{\text{Max}}_{-395;-30}}{P_{t-30}} - 1$$

where $P^{\text{Max}}_{-395;-30}$ is the highest target stock price in the 365 days before the beginning of the 30-day clean period, and P_{t-30} is the last price of the 365-day period.

TARGET 52AVG: A potential reference price candidate, the volume-weighted average price during the 52-week period. All the other reference price measures employing average prices are calculated similarly to the 52-week average, only varying the time period.

$$\text{Target 52AVG: } \frac{\frac{\sum P_t * VO_t}{\sum VO_t}}{P_{-30}} - 1$$

where P_t is the target stock price on day t, VO_t is the trading volume for the corresponding day, and P_{-30} is the last price of the 365-day period. Only values from trading days are included into the calculation.

TARGET 52LO: Potential reference price candidate, the minimum price during the 52-week high period. All the other reference price measures employing minimum prices are calculated similarly to the 52-week low price, only varying the time period.

$$\text{Target 52LO: } \frac{P^{Min}_{-395;-30}}{P_{t-30}} - 1$$

where $P^{Min}_{-395;-30}$ is the lowest target stock price in the 365 days before the beginning of the 30-day clean period, and P_{t-30} is the last price of the 365-day period.

TARGET PAST MONTHLY RETURNS: The monthly total returns for each individual month in the 52-week period preceding the deal, as obtained from Datastream.

TIME SINCE 52HI: The logarithm of number of days elapsed between the date the 52-week high was reached and the beginning of the clean period increased with one. The constant of one is added to the number of days because the logarithm of zero is not defined. Further, I use logarithms, because the number of days appears approximately log-normally distributed.

OFFER PREMIUM: The main dependent variable employed in this study, the premium of offer price relative to the 30-days lagged price. Instead of the closing price of the day before announcement, the offer price is scaled by the 30-days lagged price because of information leakage and anticipation of the deal potentially reflecting in prices.

$$\text{Offer premium: } \frac{P_{Offer}}{P_{t-30}} - 1$$

where P_{Offer} is the offer price, and P_{t-30} is the target stock price 30 days prior to a bid, in the beginning of the clean period.

TENDER OFFER: An indicator variable equaling 1, if the offer is flagged as tender offer in SDC, 0 otherwise.

TOEHOLD SIZE: The percentage amount of target shares owned by the acquirer at offer announcement, as obtained from SDC.

APPENDIX C: INVESTMENT BANKER INTERVIEWS

A total of 4 investment banker interviews were conducted to gather anecdotal evidence to support the statistical relations found in the data. I targeted the four leading investment banking units present in Finland and predominantly dealing with public targets. These units are Nordea Corporate Finance, Danske Bank Corporate Finance, SEB Enskilda Corporate Finance, and Pohjola Corporate Finance. In each bank, a single senior-level director was interviewed. The bankers were chosen based on seniority and international experience, and each of them has worked more than 10 years in the industry. Each banker is currently in a leading role in his own unit. The interviews were conducted at the offices of the respective banks, and lasted around an hour each. All the interviews were recorded for the ease of the interviewer.

The bankers received the questions two days in advance of the interviews to prepare for answering. I told them that I was making a thesis about the impact of the target company's price development preceding a takeover offer on offer pricing. Specifically, the exact topic related to the impact of psychological reference points was not mentioned before the end of the interviews. The questions sent out to the bankers can be found below, translated to English.

Determinants of offer price, buy-side

Suppose you are acting as a buy-side advisor in a takeover situation, and are thinking about a suitable price to offer for the target company.

1. What kind of factors influence the setting of the offer price, how do you come up with a figure? Please evaluate the relative influence of the different factors on a scale of 1-5 (1=only little impact, 5=extremely important)
2. What is the role of the acquirer company / its board of directors in determining the offer price and what is the role of investment bankers?
3. What do you think the acquirer's own view of the value of the target company is based upon?

Determinants of target / reservation price, sell-side

Suppose now that you are sitting on the selling side of the table. Case-specifically, you have thought of either a target price or a reservation price, below which you are not ready to sell.

4. What kind of factors influence the setting of the target price, that is, what are the major differences to thinking about an offer price on the buy-side? Please evaluate the relative influence of the different factors on a scale of 1-5 (1=only little impact, 5=extremely important)
5. What is the role of the target company / its board of directors in determining the target price and what is the role of the investment bankers?
6. What do you think the target's own view of its own value is based upon?

Other banks

7. Do you think that other competing banks in Finland approach the setting of the offer price/target price differently than you do? If so, how?
8. Do you think that the process of price determination is different in the major international banks compared to Finnish / Nordic investment banks? If so, how?

Impact of target's past price development on the offer price

9. Specifically, how does the development of a target's stock price prior to the bid influence the offer price?
10. On a scale 0-5 (0=no impact at all, 5=extremely important), how important determinants of offer price are the following measures of past price development? The measures are listed in a random order
    - Highest price during the year preceding the bid
    - Average price during the year preceding the bid
    - Lowest price during the year preceding the bid
    - Highest price during the 3 months preceding the bid
    - Average price during the 3 months preceding the bid
    - Lowest price during the 3 months preceding the bid
    - Highest price during the 1 month preceding the bid
    - Average price during the 1 month preceding the bid
    - Lowest price during the 1 month preceding the bid
    - Other, which?
11. Based on the previous question: why are the measures with a longer/shorter time period more important?

12. Through which mechanism does the past price development impact the determination of the offer prices?
    - Investment banks view it as important
    - Target / Acquirer board views it as important
    - Target / Acquirer shareholders view it as important
    - Other, which?
13. Why does the past price development have an impact? From a theoretical viewpoint, past prices should not factor in to current decision-making, as all information should already be reflected in current market prices
14. On a scale 0-5 (0=no impact at all, 5=extremely important), how does past price development compare to other determinants of the offer price you mentioned?
15. Graphs and description of a past development are part of a typical sell side pitch book / information memorandum / management presentation, presented or sent to the clients or potential buyers to back up the sell-side claims. Does past price development arise in discussions elsewhere during the negotiations?
16. In addition to the past price development of the target company, how do the market developments prior to the bid influence the offer price? Why?

APPENDIX D: Z-SCORES FOR PROBIT REGRESSIONS

This appendix presents the z-scores from the probit regressions in Section 5.3. For the marginal effects, see Table 8.

Table 13:
Impact of 52-week high on deal success, z-scores

This table presents the z-scores from probit regressions. Marginal effects and results discussion are presented in Section 5.3. The dependent variable is an indicator variable representing deal success, and reference effects are estimated with an indicator marking whether the offer price is equal or greater than 52-week high. The column before the regressions presents the expected sign between the dependent variable and the independent variable in question. Models 1 and 2 introduce offer premium in a linear form, while models 3 and 4 use various polynomials to determine the shape of the relation. Model 3 introduces other control variables, and model 4 further adds the fixed effects. For definitions of all variables, see Appendix B. The figures in parentheses represent z-values. The asterisks *, **, and *** represent significance at 10%, 5%, and 1% level, respectively.

Table 13 (cont.):
Impact of 52-week high on deal success, z-scores

	Exp. sign	Probit 1	Probit 2	Probit 3	Probit 4
Offer premium	+	0.0544	-0.3632***	-0.4425*	-0.3826*
		(0.70)	(-3.43)	(-1.89)	(-1.72)
Offer premium^2	+ / -			0.2598	0.0262
				(0.88)	(0.09)
Offer premium^3	+ / -			1.2331**	1.0916**
				(2.39)	(2.29)
Offer premium^4	+ / -			-1.2361***	-0.9291**
				(-3.01)	(-2.43)
Offer premium > Target 52HI	+	0.1895***	0.1718**	0.1522**	0.1367*
		(3.27)	(2.30)	(1.99)	(1.78)
Deal characteristics					
Form of payment: cash	+ / -		0.0318	0.0242	0.0881
			(0.48)	(0.36)	(1.33)
Form of payment: stock	+ / -		0.3262***	0.3273***	0.2817***
			(3.14)	(3.12)	(2.80)
Attitude: hostile	-		-1.2713***	-1.2724***	-1.3705***
			(-9.46)	(-9.41)	(-10.47)
Tender offer	+ / -		1.3006***	1.2797***	1.3064***
			(19.85)	(19.41)	(19.37)
Financial buyer	+ / -		0.3006***	0.2916***	0.1877*
			(3.01)	(2.91)	(1.90)
Multiple bidders	-		-1.1128***	-1.1428***	-1.1159***
			(-12.50)	(-12.64)	(-12.68)
Horizontal merger	+ / -		0.0896	0.0769	0.0749
			(1.40)	(1.20)	(1.19)
Target characteristics					
Run-up	+ / -		1.0347***	0.9456***	0.7692***
			(5.26)	(4.68)	(3.89)
M/B	+ / -		-0.0061	-0.0055	
			(-0.66)	(-0.60)	
Mcap	+ / -		0.0281	0.0292*	0.0694***
			(1.61)	(1.65)	(4.11)
Amihud illiquidity	+ / -		7.68E-06	1.02E05	
			(0.40)	(0.53)	
Acquirer characteristics					
Toehold size	+		-2.9220***	-2.9292***	-2.8795***
			(-18.25)	(-18.23)	(-18.12)
Control for target past returns		Yes	Yes	Yes	Yes
Year and country fixed effects		No	No	No	Yes
Pseudo R-squared		0.0094	0.3314	0.3362	0.3741
N		2986	2986	2851	2851

APPENDIX E: VERIFICATION OF RESULTS VALIDITY

This appendix describes the simulation model that I use to verify that the results with different reference measures do not arise solely from serial correlation or model misspecification. These tests are motivated by Section 5.6.2., where against predictions the effect of maximum

and average reference price measures increases the shorter the period for which the reference prices are calculated.

In my model, I simulate 1000 observations of stock prices for the period of 485 days before a hypothetical deal announcement (252 trading days a year). I then randomize offer markups to obtain the offer prices, and calculate offer premiums relative to a 30-day lagged price, as I do also with my real sample. I calculate correlation coefficients between offer premiums and the reference price measures, and replicate the 1000 observation simulations 1000 times to obtain stable estimates. The simulated correlation coefficients between the offer premiums and reference price measures indicate that the model specification is valid, and that the results do not arise from problems related to model misspecification or serial correlation.

Specifically,

First stock price $P_{t-485} \sim U(0,100)$. Instead of lognormal distribution, I generate the first stock price from uniform distribution to save processing power in an already heavy model.

Annual volatility $\sigma \sim U(0; 40\%)$.

Daily price changes ΔP (returns) are modeled using Geometric Brownian Motion, as specified in Equation 9. Expected return μ is set to 0, so there is no drift in the model.

$$\Delta P = \mu * \Delta T * P_{ti-1} + \sigma * \sqrt{\Delta T} * P_{ti-1} * \varepsilon_t \quad (9)$$

where $\Delta T = \frac{1}{252}$, P_{ti-1} is the stock price of the day before, and $\varepsilon_t \sim N(0,1)$

The maximum, average, and minimum prices are then calculated for each simulated price sequence for each monthly period from the 1 to 15 months preceding the 30-day clean period before the hypothetical announcement. I see no benefit from simulating the trading volumes, so the average price measures utilized are simple averages instead of the volume-weighted ones computed from the real sample.

Finally, I model a random offer markup relative to the day preceding the announcement as $M \sim U(-20\%; 46.7\%)$, positive on average.

Offer prices are then calculated by multiplying the pre-bid price P_{t-1} by $(1 + M)$.

Finally, I calculate the offer premium as I do it in the thesis, that is, by scaling the offer price with a 30-days lagged price. Offer premiums are specified like this, because in reality there is often a price drift observable already before the offer announcement. Model runs are then replicated 1000 times with a Microsoft Excel data table to arrive at the final average correlations. Both the simulated and observed correlation coefficients are presented in Table 14. It appears that the results do not arise simply out of serial correlation or model misspecification. The simulated correlations are all close to zero, and at best, the simulations explain less than 1.3% of the observed correlations.

Table 14:
Comparison of simulated and observed correlation coefficients

This table compares the observed correlation coefficients from the sample to those obtained by simulation for the different target reference price measures compared in this study. The observed correlations are from the regressions presented in Figure 5, and are calculated using White's heteroskedasticity-consistent standard errors. The simulated correlations are from the simulation model presented in this appendix. From top to bottom, I first present results for high price indicators, then for low price indicators, and finally for volume-weighted average price indicators. For each reference price category, both the observed and simulated correlations are presented. The final line in each category is the percentage of actual, observed correlation that is explained by simulation. It is the absolute value of the simulated correlation coefficient divided by the actual correlation coefficient. The 12-month period corresponds to the 52-week period.

	15m	14m	13m	12m	11m	10m	9m	8m	7m	6m	5m	4m	3m	2m	1m
High prices															
Actual	0.2020	0.2010	0.1997	0.2000	0.2027	0.2042	0.2054	0.1997	0.2078	0.2069	0.1987	0.2002	0.2027	0.2010	0.1836
Simulated	0.0002	-0.0001	-0.0001	-0.0001	0.0001	0.0002	0.0003	0.0002	0.0002	0.0002	-0.0001	-0.0006	-0.0008	-0.0014	-0.0018
Explained by simulation	0.10%	0.07%	0.05%	0.04%	0.04%	0.12%	0.15%	0.10%	0.09%	0.12%	0.04%	0.28%	0.39%	0.72%	1.01%
Low prices															
Actual	0.1844	0.1879	0.1863	0.1929	0.1924	0.1934	0.1887	0.1786	0.1741	0.1786	0.1744	0.1649	0.1673	0.1530	0.1466
Simulated	0.0020	0.0021	0.0021	0.0023	0.0024	0.0023	0.0023	0.0021	0.0019	0.0016	0.0013	0.0014	0.0012	0.0007	-0.0002
Explained by simulation	1.08%	1.11%	1.13%	1.21%	1.23%	1.21%	1.22%	1.20%	1.08%	0.88%	0.75%	0.84%	0.72%	0.47%	0.13%
Average prices															
Actual	0.2107	0.2107	0.2121	0.2124	0.2119	0.2138	0.2114	0.1990	0.1908	0.1852	0.1808	0.1738	0.1735	0.1723	0.1718
Simulated	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0012	0.0011	0.0009	0.0005	0.0001	-0.0003	-0.0010	-0.0011
Explained by simulation	0.64%	0.64%	0.66%	0.68%	0.68%	0.66%	0.65%	0.63%	0.59%	0.47%	0.29%	0.08%	0.17%	0.57%	0.64%