AARHUS UNIVERSITY

Cover sheet

This is the accepted manuscript (post-print version) of the article.

The content in the accepted manuscript version is identical to the final published version, although typography and layout may differ.

How to cite this publication

Please cite the final published version:

Damgaard, M. T., & Sydnor, J. (2019). Applying for jobs in the lab: The effect of risk attitudes and reference points. Journal of Behavioral and Experimental Economics, 79(April), 165-179.

<https://doi.org/10.1016/j.socec.2019.02.009>

Publication metadata

Title:	Applying for jobs in the lab: The effect of risk attitudes and reference points.
Author(s):	Damgaard, Mette Trier ; Sydnor, Justin.
Journal:	Journal of Behavioral and Experimental Economics
DOI/Link:	10.1016/j.socec.2019.02.009
Document version:	Accepted manuscript (post-print)

General Rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

If the document is published under a Creative Commons license, this applies instead of the general rights.

Applying for jobs in the lab: The effect of risk attitudes and reference points *

Mette T. Damgaard[†]

Justin Sydnor[‡]

Aarhus University

University of Wisconsin

February 6, 2019

Abstract

Applying for jobs resembles entering a lottery, where there is an up-front cost of entering and a large potential award gained with some probability. Reference-dependent models predict that the risk attitudes people have toward these types of lotteries will depend on what reference point they use. In this paper, we consider whether a job-application setting in the laboratory can give rise to strong loss aversion and application avoidance. We test for this in a real-effort experiment where we observe application decisions for a job paying a bonus conditional on different levels of an application fee. We also implement a neutral monetary lottery with the same consequential decisions. Our experimental evidence reveals substantial reluctance to take on risk in job applications, but to an extent similar to that found in lottery entry decisions. We do not find support for application avoidance.

Keywords: Application avoidance, job search, laboratory experiment, loss aversion, reference dependence.

JEL codes: C91, D12, D81, J64.

*We are grateful to the Associate Editor Morten Lau and two anonymous referees for comments and suggestions. We also thank Johannes Abeler, Martin M. Andreassen, Tor Eriksson, Emma von Essen, Leonie Gerhards, Alexander Koch, Julia Nafziger, Anne Peschel, Leonidas Enrique de la Rosa, Erik Ø Sørensen, and seminar participants in Aarhus for comments and fruitful discussions. We thank Anya Samek and Kathryn Carroll for sharing their z-tree code. We thank UC Berkeley for their hospitality and Kyeonghee Kim for research assistance. Damgaard thanks Købmand Ferdinand Sallings Mindefond for financial support.

[†]Corresponding author: Department of Economics and Business Economics, Aarhus University, Fuglesangs Allé 4, 8210 Aarhus V, Denmark, email: mdamgaard@econ.au.dk.

[‡]University of Wisconsin School of Business, 975 University Ave., Madison, WI, email: jsydnor@bus.wisc.edu.

1 Introduction

It is well-known that job-mobility is an important source of wage growth (Topel & Ward 1992) and that turnover is important for overall productivity and allocative efficiency in the labor market (Jovanovic 1979). It is therefore important to understand and reduce barriers to on-the-job search, both for the individual and for society.

Many factors are involved in decisions to search for a job. In addition to psychological factors such as over- and underconfidence, time and risk preferences are also important. For example, risk matters for on-the-job search decisions because switching from one job to another typically is more risky than remaining in an existing job. The risk may arise from lack of information causing uncertainty about available wage offers (Burdett 1978) and uncertainty about the quality of the match and job attributes (Allen et al. 2007). However, even if this information is available, there is an inherent risk associated with job search due to uncertainty about whether a job application will be successful and whether the possible benefit of the new job is worth the up-front effort of applying.

At a basic level one can think of a job application as a simple lottery, in which one pays an entry fee (e.g., time and hassle costs of applying) for a probability of receiving a larger prize (e.g., better job). The nature of risk attitudes for this type of situation, however, may depend on a number of factors, including loss aversion and the reference point one has when making the decision (Kahneman & Tversky 1979, 1992, Kőszegi & Rabin 2006, 2007). The willingness to pay the fee will be highest if the entire decision can be framed in the gain domain. The willingness to pay will be lower if the reference point is the endowment at the time of the job application, because in that case paying the fee is felt as a loss when the job is not landed. Finally, if the endogenous expectations induced by entering or not entering the lottery serve as the referent (as in Kőszegi & Rabin (2006, 2007)), the person might be very reluctant to pay the entry fee since the lottery poses the possibility of loss sensations. Specifically, expectations-as-a-referent-point when based on the choice-acclimating personal equilibrium concept of Kőszegi & Rabin (2006, 2007) gives the prediction that job seekers try to limit exposure to losses by *not* applying for jobs even when there is little or no cost of applying.¹

¹The choice-acclimating equilibrium in a model with expectation-based reference points and risk neutral consumption utility is similar to the disappointment-aversion models of Bell (1985), Loomes & Sugden (1986, 1987) and Gul (1992).

In this paper we consider whether a job-application setting in the laboratory can cue a natural thought processes associated with loss aversion and ultimately lead to application avoidance (when there are no tangible application costs).² In addition, we consider whether job-application decisions trigger different risk attitudes than a more neutral lottery context.

We focus on a "job-application context" because it has features that are likely to trigger strong aversion to losses for a number of reasons. First, the probability of winning is typically tied to one's own past performance and effort. van Dijk et al. (1999) present evidence suggesting that disappointment is intensified when people have exerted effort in anticipation of a desired outcome (regardless of whether the effort increases the probability of the outcome). In our experiment, we introduce some of the same ideas by linking the probability of getting a new job to performance in a previous real effort work round.³ Furthermore, job applications are typically realized with substantial delay, and hence there may be more scope for expectation-based reference points and the possibility of loss sensations (Kőszegi & Rabin 2006, 2007). In our experiment, we therefore also introduce a time delay between the time when the application decision is made and when the applicant learns the outcome. Finally, job applications involve an application cost that can be conceptually separated from other gains quite easily.

While a laboratory experiment necessarily abstracts from many important issues with real-world job applications, an advantage of the laboratory experiment is that we can directly observe search *decisions* and not just search *outcomes* as is often the case in field work. In addition, the lab experiment allows us to isolate the effect of risk preferences by stripping out other factors influencing job search such as overconfidence and underconfidence about one's chances of getting the job. In other words, we create an environment where *beliefs* about the probability of getting the job are fixed.

Subjects in the "job-application context" in our experiment are asked to work at a non-competitive effort task to earn money. Using a price list method, we then elicit their willingness to pay an "application fee" to apply for a new and better paid job. We explicitly inform subjects of their probability of getting the new job and that the probability depends on whether they were "high"

²Gill & Prowse (2012) also study the effect of loss aversion in a work environment in the lab, but whereas Gill & Prowse (2012) study the effect of loss aversion on *effort* choices, we study the effect on *application decisions*.

³A notable difference between our experimental setting and the situations studied in van Dijk et al. (1999) is that subjects in our experiment are not aware of the possible good outcome at the time when they put in the effort. We choose this design in order to ensure that the monetary application fee fully captures the application costs and hence allow us to measure the application costs.

or “low” performers in a first work round.⁴ An important reason for having a work round *before* subjects make their application decision, is to generate the feeling that the application fee is paid from the subjects’ earned money. We experimentally vary the probability of getting the job for both low and high performers to explore whether the probability of the good outcome affects the willingness to pay for entry. Finally, all subjects perform the same effort task in the second and last work round, regardless of whether they got the new job. Everyone is paid the same piece-rate for their efforts, but subjects who get the new job are also paid a fixed salary of \$5 on top of their piece-rate earnings.

To test whether the context of a job application triggers a meaningfully different thought process compared to neutral financial lottery tasks, we also implement a randomization between the job-application context and a neutral lottery context with the same consequential decision.⁵ Keeping the work rounds as in the application context, subjects in the neutral lottery context indicate their willingness to pay to enter a lottery for a prize of \$5 rather than their willingness to pay to apply for a new job.

Our main finding is that the results do not support the more extreme predictions of application avoidance from expectations-as-a-reference-point based on the choice-acclimating personal equilibrium in Kőszegi & Rabin (2007). That is, we do not see a large number of subjects avoiding entry altogether. However, our experiment reveals that people *are* substantially risk averse in their application decisions, especially for intermediate probabilities of success. The aggregate results are most easily rationalized by a model of reference-dependent preferences with the reference point equal to the endowment at the time when the decision is made. However, we caution that at the individual level we do not find strong support for any of the models considered. In particular, we do not see a clear pattern in the individual level correlation between the observed outcome variable and that implied by elicited risk and loss aversion measures for any of the reference-points

⁴Several studies have found a negative correlation between tournament entry and risk aversion (Balafoutas et al. 2012, Dohmen & Falk 2011, Bartling et al. 2009, Eriksson, Teyssier & Villeval 2009). However, in tournament entry experiments, the exact probability of winning is unknown to both the experimenter and the subjects at the time of the entry decision. Tournament entry decisions could therefore be susceptible to ambiguity aversion making it difficult to identify the effect of risk attitudes on entry decisions. We avoid this issue by explicitly specifying the probability of winning before subjects decide whether to apply for the job.

⁵Our neutral lottery context is inspired by the large literature studying the effect of disappointment aversion or loss aversion in the lab using lottery choices (Kahneman & Tversky 1979, 1992, Abdellaoui et al. 2007, Sonsino 2008, Tanaka et al. 2010, among others) or portfolio-allocation choices (Choi et al. 2007). However, we keep the setting as comparable as possible to the job-application context

analyzed.

Second, we find almost identical patterns of entry decisions regardless of the contextual framing. This suggests that some of the dynamics at play in job-application decisions might be related to fundamental attitudes towards financial risk that are not specific to job-application situations. Our results in both contextual framings are also in line with those of the existing literature finding substantial aversion to losses (Abdellaoui et al. 2007, Choi et al. 2007, Sonsino 2008, Tanaka et al. 2010, Harbaugh et al. 2010, among others) and rapid reference-point adjustment (Sprenger 2015, Song 2016) in the lab. This is despite the fact that our design embeds an otherwise standard lottery choice in a more elaborate contextual framing where the attractiveness of the lottery depends on how individuals perform in a real effort task. While one must be cautious in extrapolating these results to situations outside the lab, they are at least suggestive that understanding risk attitudes over neutral lotteries may provide useful information regarding how people think about the risk inherent in job applications.

Our experiment is designed to highlight the ways in which risk attitudes can affect entry decisions, and to do so purposely abstracts from many crucially important factors of real-world application and entry decisions. It is likely that in many situations other concerns, such as the degree of confidence people have in their chances of being hired or winning a tournament, are much more important factors in decision making.⁶ Nonetheless, we believe that understanding how risk attitudes can shape entry decisions is a useful contribution. In particular, future work in applied settings may find it useful to explore if variation across people in their risk attitudes and the way they frame these situations can explain some of the heterogeneity in application and entry decisions.

Our experimental setting resembles an on-the-job search decision. Although several people have argued that risk matters for job mobility (March & Simon 1958, Tom et al. 2007, Allen et al. 2007), the theoretical models of on-the-job search typically assume risk neutrality (Burdett 1978, Burdett & Mortensen 1998, Shimer 2006, among others) and few papers have investigated the effect of risk attitudes on job mobility empirically. An exception is van Huizen & Alessie (2016) who show that experimentally elicited risk measures are negatively related to job mobility in the field.⁷ Our results complement these findings and suggest risk attitudes play an important role in

⁶Several papers study the effect of confidence on entry decisions in tournaments (Camerer & Lovo 1999, Bartling et al. 2009, Dohmen & Falk 2011, among others) or lotteries framed as job search (Falk et al. 2006).

⁷van Huizen & Alessie (2016) also present suggestive evidence that when considering *both voluntary and involuntary* search decisions this result is driven by low job acceptance rather than reduced application behavior. A notable difference to our setting is that we consider only *voluntary* job application decisions in the lab.

job applications and may provide an additional explanation for low job mobility.⁸

The remainder of the paper is organized as follows. Section 2 describes the experimental design, and section 3 presents our theoretical framework and hypotheses. The experimental implementation and a balance check are provided in section 4. Results are discussed in section 5, with concluding comments in section 6.

2 Experimental design

Our experiment was designed with the aim of studying the role of reference-dependent risk attitudes in a job-application context and to facilitate a comparison with a lottery-choice context.

When participants entered the lab, they were informed that they would receive a \$5 show-up payment in addition to any earnings accumulated during the experiment. Subjects were also told that the experiment consisted of three parts: Part 1 and 3 involved a “simulated work environment” for which they would be able to earn money, and in Part 2 they would be asked to “answer questions about themselves and their preferences over options that could increase their payoff”. Figure 1 gives an overview of the timing and tasks in the experiment. Instructions were identical across all treatments until the end of Part 1, and instructions only differed i) between Part 1 and 2 where subjects were informed about the possibility to apply for a job (or enter a lottery), and ii) between Part 2 and 3 where the outcome of the application (lottery) was revealed.⁹

Figure 1: Experiment timing

⁸While our setting is on-the-job search, the results complement recent papers (considering the search decisions of unemployed workers) arguing that loss aversion may provide an explanation for the negative duration dependence in the hazard rate out of unemployment (DellaVigna et al. 2017, Damgaard 2017).

⁹The full experimental instructions are available in the online appendix.

2.1 Parts 1 and 3: The effort task

The two work rounds and the practice round involved the same real effort task. We used the number-adding task proposed by Niederle & Vesterlund (2007) which asks subjects to add as many sets of five two-digit numbers as possible in 5 minutes.¹⁰ The task is easy to explain, requires no previous experience, and generates variability in performance partly due to skill and partly due to effort (Cason et al. 2010). There is relatively little learning in the task, and learning is mostly confined to the first round (Niederle & Vesterlund 2007). We therefore included a non-incentivized practice round to reduce learning effects and allow subjects to become familiar with the task.

The calibration of the work task was similar to Niederle & Vesterlund (2007), i.e., subjects worked for 5 minutes and were paid a piece-rate of \$0.5 per correct answer with no penalties for wrong answers. Participants were not allowed to use a calculator, but were allowed to use the provided pen and scratch paper. The numbers were randomly drawn before the experiment, and all subjects were given the same sets of two-digit numbers in the same order. This gave us control over the difficulty of the problems. After entering an answer, a subject was told whether the answer was correct before getting a new set of five two-digit numbers. At the end of the 5 minute interval subjects were informed of the total number of correct answers they had provided in that round. Subjects were paid for both work rounds at the end of the experiment.

2.2 Treatment information and application (lottery entry) decisions

After completing Part 1, subjects were provided with information about the upcoming parts of the experiment. In particular, they were reminded that Part 3 would involve the same number-adding task with the same piece-rate payment. This was to ensure that all subjects had the same information about the remaining parts.

2.2.1 Treatment information

To explore the role of loss aversion for different probabilities of application success, we implemented an experiment with treatment variation along two dimensions: the context and the probability environment (see Table 1). The sample was split evenly across the four treatments.

¹⁰The number-adding task has been used widely in the literature on tournament entry (Bartling et al. 2009, Eriksson, Poulsen & Villeval 2009, Cason et al. 2010, Niederle et al. 2013, among others).

Table 1: Treatment variations

	Job treatments	Lottery treatments
Low probability environment $p_L = 15\%$ and $p_H = 40\%$	JOB_L	LOT_L
High probability environment $p_L = 40\%$ and $p_H = 65\%$	JOB_H	LOT_H

In the job treatments (JOB_L and JOB_H), we framed a choice of whether to enter a lottery as a job-application decision (see Figure 2). After obtaining the general information about the upcoming parts, subjects in the job treatments were told that they had the “option to apply for a new job” in Part 3 and that the probability of getting the “new” job depended on whether they were classified as “high performers” or “low performers” based on their answers in Part 1. Subjects were told that the new job involved the same task and piece-rate payment as the “old” job, but in addition the “new” job would pay a fixed salary of \$5. They were also told that if they did not apply or get the new job, they would continue to work in the old job.

Subjects were also told that everyone who had provided at least 13 correct answers were classified as high performers and that this meant that approximately half the subjects in the room would be classified as high performers.¹¹ If they applied, high performers would get the new job with probability p_H , and low performers, who provided fewer than 13 correct answers, would get the job with probability p_L . All subjects in the job treatments were told the values of p_H and p_L specific to their treatment. For example, in JOB_L subjects were told that, if they applied, low performers (the below-median performers) had a $p_L = 15\%$ chance of getting the job and high performers (the above-median performers) had a $p_H = 40\%$ chance of getting the job. In addition, subjects were told whether they were a high or low performer and hence their specific probability of getting the job. This was to avoid mis-predictions of probabilities, for example due to overconfidence or underconfidence in one’s own ability.¹²

In the lottery treatments (LOT_L and LOT_H), we used a lottery context instead of the job-

¹¹The threshold level of correct answers was initially set to 10, the median number of correct answers reported in Niederle & Vesterlund (2007) in the comparable piece-rate treatment. After the first three sessions the threshold was re-calibrated to 13 to better reflect the median in our setting. In our analysis of the results we pool data from all sessions, but results are very similar if we drop the first three sessions from the analysis.

¹²This approach is similar to the one in Gill & Prowse (2012) who also explicitly map the link from performance to the probability of winning a prize before subjects make their choice.

Figure 2: Informational screens about the job-application in the job treatments

OPTION TO APPLY FOR A NEW JOB

You have the option to apply for a new job for the second work round. If you choose to apply, you will learn whether you got the new job after you have completed Part 2 and before the second work task begins in Part 3.

The new job option: The new job is exactly like the old job you have just done, but in addition to earning \$0.50 for each correct calculation, at the new job you also get a fixed salary of \$5. At the new job you get the \$5 salary regardless of how many correct calculations you make and also the earnings for correct calculations.

Application and chance of getting hired: If you are interested in this new job, you will need to submit an application for it. Your chance of getting hired for the new job will depend on whether you were a high or a low performer in the first work round you just completed. There is also an application fee for applying for the new job.

If you apply for the new job and are not selected for it, you will keep the old job for the second work round and earn \$0.50 for each answer you get correct in that round.

OPTION TO APPLY FOR A NEW JOB

If you apply for the new job that pays the additional \$5 salary, you will find out whether you were selected after completing the set of tasks in Part 2, which will take about 10 minutes.

	Performance in first work round	Likelihood that application for new job will be successful
High performers	At least 13 correct answers	65%
Low performers	Less than 13 correct answers	40%

This means that you were a low performer in the first round.

If you choose to apply, your chance of getting the job is 40%.

application context (see Figure 3). After obtaining the general information about the upcoming parts, subjects in the lottery treatments were told that they had the “option to enter a lottery” to win \$5. As in the job treatments, individual specific probability information was provided *before* subjects made their entry choice but unlike in the job treatments, subjects were not informed that the probability of winning was related to their performance. However, for comparability we used the same algorithm to determine all subjects’ probability of winning.

In addition to context, we varied the probability environment to study the effects of different probabilities of the good outcome. In the high probability environment (JOB_H and LOT_H), the probabilities of getting the good outcome were higher for both high and low performers than in the low probability environment (JOB_L and LOT_L), i.e., we varied the size of p_H and p_L as indicated in Table 1.

2.2.2 Application (lottery entry) decisions

Subjects were then asked to make their application (lottery entry) decisions. We elicited their willingness to pay to apply (enter the lottery) using a price-list method. Subjects were presented with different “application fees” (“lottery entry fees”) depending on their individual probability of getting the new job (winning) with fees covering the range from \$0 to approximately the risk neutral level (see Table 2). For each fee, subjects were asked to indicate whether they wanted to apply (enter the lottery). One of the fees on the price-list was randomly chosen as “the [fee] that applied”, and subjects were paid according to their choices in that situation at the end of the session.¹³

Table 2: Application/Entry fees by probability of getting the job

	C1	C2	C3	C4	C5	C6	C7
p=15%	\$0	\$0.05	\$0.1	\$0.2	\$0.3	\$0.4	\$0.5
p=40%	\$0	\$0.2	\$0.4	\$0.8	\$1.2	\$1.6	\$2.0
p=65%	\$0	\$0.3	\$0.6	\$1.2	\$1.8	\$2.4	\$3.0

¹³Subjects were told which fee applied on the screen immediately after the choice screen, and they were made aware of this before making their choices.

Figure 3: Informational screens about lottery in the lottery treatments

OPTION TO ENTER A LOTTERY

You have the option to participate in a lottery. If you choose to participate in the lottery, you will learn whether or not you won the lottery prize after you have completed Part 2 and before the second work task begins in Part 3.

The lottery option: The lottery gives you the chance to win \$5 that will be paid in addition to your other earnings in this session.

Entering the lottery: If you are interested in participating in the lottery, you will need to enter the lottery. There is a fee for entering the lottery.

OK

OPTION TO ENTER A LOTTERY

If you enter the lottery that has the possible prize of an additional \$5, you will find out whether you were selected for the prize after completing the set of tasks in Part 2, which will take about 10 minutes.

If you enter the lottery, your chance of winning the \$5 prize is 40%.

2.3 Part 2: Reference point adjustment and control variables

After making the application (lottery) decisions, there was a waiting period (Part 2) before the outcome of the application (lottery) was revealed. This waiting period was introduced to resemble the waiting period for real job applications and to allow reference points to adjust. Kőszegi & Rabin (2006, 2007) argue that the effect of reference dependence is strongest when the reference point is choice-acclimating, which can occur if there is a time lag between when the choice is made and when uncertainty is resolved. In this respect our design is similar to Buchheim (2012) who also introduces a waiting period between the choice and uncertainty resolution in order to allow the reference point to adjust. However, our waiting period is considerably shorter than the 24 hour waiting period in Buchheim (2012). We choose a shorter waiting period because the results of Sprenger (2015), Song (2016), Buchheim (2012), and Smith (2012) all provide evidence consistent with very rapid adjustment of the reference point, and judging by their findings, a 10 minute lag is more than sufficient to induce adjustment of the reference point. Prior to making the application (lottery entry) decision, subjects in our experiment were told that they would learn the outcome of the application (lottery) in “about 10 minutes” after completing other tasks. Our choice to let subjects work on other tasks during the waiting period is similar to the approach used in Song (2016).

While waiting, we elicited two risk measures (allowing us to relate risk attitudes to the previous literature) as well as some background characteristics (age, gender, and the current grade point average (GPA)). First, we elicited a measure of risk aversion using the method developed by Eckel & Grossman (2002, 2008), where subjects chose between a number of 50-50 gambles involving varying degrees of risk. We implemented the version used in Dave et al. (2010) to have slightly higher stakes and allow for greater variation in risk attitudes than the original version. Subjects chose one of the six gambles in Table 3 and at the end of the session, we randomly selected one person who was paid for the task. The method has the advantage that the task is simple to explain and provides a range for each subject’s coefficient of relative risk aversion (CRRA).¹⁴

In addition, we elicited a measure of loss aversion based on the choice task for loss aversion in Kahneman & Tversky (1992).¹⁵ We used a hypothetical sequential price-list method to elicit

¹⁴The measure of risk aversion is elicited, under the assumption that all outcomes are viewed as gains and given that there is not meaningful probability-weighting over 50% events. We note that although the task is commonly used to measure risk aversion, it could also capture loss aversion if subjects use an expectation-based reference point for the task.

¹⁵We note that while the measure is referred to as a measure of loss aversion, it also picks up risk aversion.

Table 3: Implied risk aversion using Eckel-Grossman task

Choice (50/50 Gamble)	Low payoff	High payoff	Implied CRRA range ^a
Gamble 1	28	28	$3.46 < \rho$
Gamble 2	24	36	$1.16 < \rho < 3.46$
Gamble 3	20	44	$0.71 < \rho < 1.16$
Gamble 4	16	52	$0.50 < \rho < 0.71$
Gamble 5	12	60	$0 < \rho < 0.50$
Gamble 6	2	70	$\rho < 0$

Notes: Coefficient of relative risk aversion. Calculated as the range of ρ in the function $U(x) = x^{1-\rho}/(1-\rho)$ which makes the utility of each gamble on the list equal the utility of the next gamble.

the value x that would make the prospect $(0, \frac{1}{2}; 0, \frac{1}{2})$ as attractive as $(-50, \frac{1}{2}; x, \frac{1}{2})$. First subjects were asked whether they would be willing to play the gamble if $x = 50$. If they said “yes”, the task ended. If they said “no”, they were asked if they would be willing to play the gamble when $x = 100$. Subjects who said “yes” were then shown a new screen with the same question where $x = 70$, while subjects who said “no” were shown a screen with $x = 150$. We follow Kahneman & Tversky (1992) and use θ as a proxy for the loss aversion. The parameter θ is derived from prospect theory and can be interpreted as a measure of how losses are weighted relative to gains. Based on subjects’ choices, we calculate ranges for θ (see Table 4) depending on the minimum value of x for which the gamble was accepted.¹⁶

While incentivized choices are usually preferred over hypothetical choices, we used hypothetical choices for the loss aversion task as it enabled use to implement higher stakes than would otherwise be feasible. Additionally, since subjects had prior earned money and some uncertainty about later earnings, we were not confident ex ante that we would be able to properly manipulate a loss frame at this stage of the experiment.

2.4 Outcome of the application (lottery) and last work round

After Part 2, subjects who applied in job treatments were informed about whether they got the new job, and subjects in the lottery treatments who entered the lottery were told whether they won. All subjects then worked in Part 3.

¹⁶The measure is derived under the assumptions of linearity in utility curvature and no meaningful probability weighting over 50% events.

Table 4: Implied loss aversion proxy θ for loss aversion task

	Minimum x accepted, x^{min}	Implied θ
Gamble 1	\$50	$\theta < 1$
Gamble 2	\$70	$1 < \theta < 1.4$
Gamble 3	\$100	$1.4 < \theta < 2.0$
Gamble 4	\$150	$2.0 < \theta < 3.0$
	None accepted	$\theta > 3$

Notes: θ is given by $\frac{x}{50}$. The upper bound of each interval is given by $\frac{x^{min}}{50}$ where x^{min} is the minimum value of x for which the subject is willing to take on the gamble and the lower bound of each interval is determined by the upper bound of the previous interval.

3 Theoretical framework and hypotheses

This section formulates hypotheses in terms of our main outcome variable from the experiment which is the willingness to pay to apply (enter the lottery) relative to the expected value of applying (entering the lottery). We denote the willingness to pay by f_{X_i} where $X \in \{JOB, LOT\}$ indicates the context and $i \in \{L, H\}$ is a subscript for the probability environment. We use EV to denote the expected value and our main outcome variable is then $\frac{f_{X_i}}{EV}$. Thus, $\frac{f_{X_i}}{EV} = 1$ is the choice implied by risk neutrality, whereas $\frac{f_{X_i}}{EV} < 1$ indicates that a person has a lower willingness to take on risk than under risk neutrality. By observing when subjects switch from applying (entering) to not applying (not entering), we obtain implied intervals for f_{X_i} with our point estimate given by the mid-point of this interval. If a subject always chooses to apply (enter), we assign the expected value, and if a subject always chooses not to apply (enter), we set f_{X_i} to 0.¹⁷

3.1 Theoretical framework

When choosing whether to apply, the potential job applicant chooses whether to incur a small application cost to get a chance of obtaining a higher future income. More formally, let the lottery A (apply) involve an “application fee” f and a probability p of winning the bonus s , and let D (don’t apply) denote the degenerate lottery that involves a certain outcome of earned income with no possibility of the bonus. Further, let W denote earnings that are not influenced by the outcome of the application. The choice of whether to apply is a choice between the lottery A and the certain

¹⁷Table A1 and A2 consider alternative specifications as robustness checks.

outcome D .

An individual's preferences determine how he evaluates these two prospects and hence the fee f that makes him indifferent between A and D . Referent-dependent theories predict that people might be excessively risk averse when applying for jobs depending on how the reference point is determined. As shown below, such predictions arise if the application decision is evaluated in isolation from other decisions such that the application fee is considered a “loss”, or (even more strongly) if the reference point is determined by expectations as in Kőszegi & Rabin (2006, 2007). The framework of Kőszegi & Rabin (2006, 2007) allows us to consider both reference-points determined by wealth at various stages of the experiment and reference-points determined by expectations. We consider three formulations of the reference point: i) it is determined by the initial wealth of the subject when entering the lab ii) it is determined by wealth at the time of the application decision, and iii) it is determined by endogenous expectations, i.e. for the application gamble A the reference point is determined by rational expectations about the outcome of A , while for the certain outcome D the reference point is equal to the outcome of D . Using the terminology of Kőszegi & Rabin (2007), the reference point is thus *choice-acclimating* in our case with expectations-as-a-reference-point.

Using the notation in Kőszegi & Rabin (2007), an outcome x is valued as

$$u(x|r) = m(x) + \mu(m(x) - m(r)), \quad (1)$$

where the first term is the standard “consumption utility” and the second term captures “gain-loss” utility associated with comparing the outcome x to the reference point r . To simplify the exposition, and following much of the discussion in Kőszegi & Rabin (2007) around small-value lotteries, we consider the case of linear consumption utility, i.e. $m(x) = x$, and a piece-wise linear gain-loss utility function of the form

$$\mu(m(x) - m(r)) = \begin{cases} \eta(m(x) - m(r)) & \text{for } m(x) \geq m(r) \\ \eta\lambda(m(x) - m(r)) & \text{for } m(x) < m(r), \end{cases} \quad (2)$$

where $\eta > 0$ is the weight on gain-loss utility and $\lambda > 1$ introduces loss aversion. We next consider the predictions of the three specifications of the reference point in turn.

3.2 Reference point equal to initial wealth

Let W_I denote the initial wealth of a subject when entering the lab, then $r = W_I$ when evaluating A and D . This implies that the expected utility of applying is $U(A|r = W_I) = W_I + W_L + ps - f + \eta(W_L + ps - f)$, where W_L denotes earnings accumulated in the lab until the application decision is made (i.e. the show-up fee and piece-rate earnings).¹⁸ The expected utility of not applying is $U(D|r = W_I) = W_I + W_L + \eta W_L$. Note that in this case the expected earnings from the application decision is integrated with other earnings in the experiment and enters in the expected utility expressions in the same way. The individual is indifferent between A and D when $U(A|r = W_I) = U(D|r = W_I)$, which implicitly defines the willingness to pay to apply when the reference point is equal to initial wealth. We denote the implied willingness to pay by f^{W_I} and it follows that $f^{W_I} = ps \equiv EV$. Hence, this case provides the same predictions as expected utility theory with the assumption of risk neutrality - namely that subjects are willing to pay the expected value EV .

3.3 Reference point equal to wealth at the time of the application decision

In this case, the applicant considers the application decision in isolation from other earnings (inside and outside of the lab), and the application cost is therefore considered a potential loss. Formally, we let $r = W_I + W_L$ for both A and D , and the expected utility of applying is $U(A|r = W_I + W_L) = W_I + W_L + ps - f + \eta(p(s - f) - (1 - p)\lambda f)$, while $U(D|r = W_I + W_L) = W_I + W_L$. The willingness to pay to apply is $f^{W_I + W_L} = \frac{1 + \eta}{1 + \eta(p + (1 - p)\lambda)} ps$ and the predicted ratio of the willingness to pay over the expected value is $\frac{f^{W_I + W_L}}{EV} = \frac{1 + \eta}{1 + \eta(p + (1 - p)\lambda)} < 1$, as $p + (1 - p)\lambda > 1$ by definition. Assuming the reference point is equal to wealth at the time of the application decision is consistent with some formulations of original prospect theory, but is also consistent with Kőszegi & Rabin (2007) framework for expectations-based reference points. Specifically, the reference-point assumption here is equivalent to assuming that the reference point is determined by (unacclimatizing) expectations and solving using the preferred personal equilibrium concept of Kőszegi & Rabin (2007). Technical details are provided in the supplementary appendix.

¹⁸This assumes that $f < W_L + ps$.

3.4 Reference point equal to expectations of each prospect

In the final case, the reference point is determined by the rational expectations of the outcome of each prospect. That is we follow Kőszegi & Rabin (2007) and solve for the choice-acclimating personal equilibrium. While Kőszegi & Rabin (2007) use stochastic reference points, with linear gain-loss utility this can be simplified to assuming that the reference point is the expected value of the chosen prospect.¹⁹ That is applying is evaluated using the reference point $r = W_I + W_L - f + ps$ giving an expected utility of A equal to $U(A|W_I + W_L - f + ps) = W_I + W_L + ps - f + \eta(ps(1 - p) - (1 - p)\lambda ps)$. Not applying is evaluated using the reference point $r = W_I + W_L$, which implies that the expected utility of D is $U(D|r = W_I + W_L) = W_I + W_L$. In this case, $f^E = (1 - \eta(\lambda - 1)(1 - p))ps$ and $\frac{f^E}{EV} = (1 - \eta(\lambda - 1)(1 - p)) < 1$.

3.5 Hypotheses

Figure 4 shows that given the usual estimates $\lambda = 3$ and $\eta = 1$, the willingness to pay for applying is lowest when the reference point is equal to expectations (dashed line) and highest when it is equal to the initial wealth (solid line). Notably, the expectation-based reference point predicts that for low probabilities of getting the job, the willingness to pay to apply is negative. Thus, the model makes the surprising prediction that because of the potential pain of losses people would forgo entering a lottery with only positive possible outcomes - even if there is no entry fee.²⁰ The case with the reference point equal to wealth at the time of the application (dotted line) is between the two other cases. Hence, the willingness to pay crucially depends on how the reference point is specified. In particular, it depends on whether the expected earnings from applying are integrated with other earnings in the experiment (as when the reference point is determined by initial wealth) or if the cost of applying and/or the expected outcome from applying is seen as a potential loss (as in the two other cases).

We hypothesize that the job-application context triggers an expectation-based reference point (dashed line), because the probability of winning is explicitly tied to past performance and hence

¹⁹With this simplification and the assumption of risk neutrality in consumption utility, the model is similar to the disappointment-aversion models of Bell (1985), Loomes & Sugden (1986, 1987) and Gul (1992).

²⁰As pointed out by Masatlioglu & Raymond (2016) the choice-acclimating personal equilibrium predictions of Kőszegi & Rabin (2007) and the predictions of disappointment-aversion models cannot necessarily be distinguished from other models of risk attitudes when the parameter of loss aversion λ is bounded between 0 and 2. However, the stark prediction of no entry even for a zero entry fee arises precisely when λ is outside this range.

Figure 4: Willingness to pay to apply

Notes: We assume $s = 5$ and $W = 15$ (the sum of the show-up fee and expected earnings from the work rounds if subjects provide 10 correct answers per round). We use the standard calibration of $\lambda = 3$ and $\eta = 1$. We let $r = E$ denote the case where the reference point is equal to expectations.

effort in the first work round. In addition, we have build in a waiting period for adjustment of the reference point and made the fee payable from earned money. Hence, our first two hypotheses are:

Hypothesis 1. *Subjects are not willing to pay to apply for the new job when $p = 0.15$ and $p = 0.40$. Hence, $\frac{f_{JOB_L}}{EV} = 0$.*

Hypothesis 2. *The ratio of the willingness to pay to the expected value of the new job is lower than can be rationalized by standard risk preferences (as represented by $r = W_I$), and in particular $E\left(\frac{f_{JOB_i}}{EV}\right) < 1$ for $i \in \{L, H\}$.*

Furthermore, since the context of the work tasks and the lottery decision is kept more separate in the lottery treatments, we hypothesize that subjects are less likely to use an expectation-based reference point in the lottery treatments than in the job treatments, i.e.:

Hypothesis 3. *The ratio of the willingness to pay to the expected value of the good outcome is lower in the job treatments than in the lottery treatments, i.e., $E\left(\frac{f_{JOB_i}}{EV}\right) < E\left(\frac{f_{LOT_i}}{EV}\right)$ for $i \in \{L, H\}$.*

Finally, as illustrated in Panel B of Figure 4, the ratio of the willingness to pay and the expected value is greater for $p = 65\%$ than $p = 15\%$, both when the reference point is equal to wealth at the time of the application decision and when it is equal to expectations. Hence, we hypothesize that:

Hypothesis 4. *The ratio of the willingness to pay to the expected value of the new job is smaller in the low than in the high probability environment, i.e., $E\left(\frac{f_{JOB_L}}{EV}\right) < E\left(\frac{f_{JOB_H}}{EV}\right)$.*

4 Experimental procedures and balance check

We have observations from a total of 159 subjects from 10 experimental sessions run at The BRITE Lab at the University of Wisconsin-Madison in March and April 2015. Participants were students at University of Wisconsin-Madison and were recruited through the Sona Experiment Management System. No subject participated in more than one treatment, and we used a within-session randomization. The experiment was computerized using z-Tree (Fischbacher 2007) and lasted about 45 minutes. Subjects on average earned \$21.52 including a \$5 show-up payment.

We achieve a reasonable balance in the sample across treatments (see Table 5), but females appear overrepresented in the high probability treatments JOB_H and LOT_H , and some subjects in LOT_H appear to have been very high performers on the work task, driving up the average number of correct answers in both Part 1 and Part 3. However, at the same time we also had a higher proportion of low performers in LOT_H . Subjects on average got approximately 11.5 correct answers in Part 1 and one less correct answer in Part 3.

The choices made by our pool of subjects in the two elicitation tasks suggests a rather typical pattern of risk attitudes. Our results for the Eckel-Grossman task resemble those in Dave et al. (2010), and most subjects are found to have a CRRA coefficient of between 0.74 and 1.16. Only 7.6% of subjects have a CRRA coefficient greater than 3.46 in the Eckel-Grossman task.

Table 7 shows the elicited intervals for our proxy for loss aversion, θ . About 22% of the subjects are found not to be loss averse. The choices of all other subjects display some degree of loss aversion. Fixing θ at the midpoint of the intervals and bounding the upper and lower intervals at $\theta = 3$ and $\theta = 1$, respectively, the mean value of θ is 2.07 with a standard deviation of 0.830. In a comparable setting, Kahneman & Tversky (1992) find an average θ of 2.02. Our average estimate of θ corresponds to an average λ in the Kőszegi & Rabin (2007) model of about 3.13.²¹ This value is quite close to estimates from other studies (e.g. $\tilde{\lambda} = 3.41$ in Sprenger (2015)) and is in line with the usual benchmark of $\lambda = 3$, which implies that losses are weighted about twice as

²¹Prospect theory abstracts from consumption utility but it is easy to show that with linear consumption utility, expectation-based reference points, and $\eta = 1$, then $\lambda = 2\theta - 1$.

Table 5: Descriptive statistics and balance test

	Descriptive statistics (means)					Balance tests (p-values)	
	Full Sample	JOB_L	JOB_H	LOT_L	LOT_H	JOB vs. LOT	L vs. H
Female ^b	0.57 (0.50)	0.45 (0.50)	0.64 (0.49)	0.55 (0.50)	0.68 (0.47)	0.37	0.05
GPA ^a	3.46 (0.38)	3.46 (0.37)	3.46 (0.46)	3.46 (0.36)	3.44 (0.34)	0.61	0.98
Correct in practice round ^a	4.40 (2.38)	4.43 (2.06)	3.58 (1.78)	4.33 (2.55)	5.24 (2.83)	0.18	0.88
Correct in Part 1 ^a	11.52 (3.89)	11.41 (3.87)	11.19 (2.63)	11.38 (4.32)	12.11 (4.47)	0.87	0.90
Correct in Part 3 ^a	10.58 (4.18)	10.34 (3.48)	10.08 (3.23)	10.21 (4.39)	11.78 (5.29)	0.62	0.41
% low performers ^b	0.58 (0.50)	0.57 (0.50)	0.53 (0.51)	0.60 (0.50)	0.62 (0.49)	0.46	0.94
N	159	44	36	42	37	159	159

Notes: The table reports means and standard deviations in brackets for descriptive statistics. For the balance tests we report the p-values. ^a A two sample MannWhitney test is used to test for differences. ^b A Chi2 test is used to test for differences. The balance tests are done for the pooled job treatments (JOB) vs. the pooled lottery treatments (LOT) and for the pooled low probability (L) vs. pooled high probability (H) environment treatments.

Table 6: Implied risk aversion elicited by the Eckel-Grossman measure

Choice (50/50 Gamble)	Low payoff	High payoff	CRRA range ^a	Percentage of subjects	
				Dave et al. (2010)	This study
Gamble 1	28	28	$3.46 < \rho$	10.7	7.6
Gamble 2	24	36	$1.16 < \rho < 3.46$	11.2	19.5
Gamble 3	20	44	$0.71 < \rho < 1.16$	39.2	34.0
Gamble 4	16	52	$0.50 < \rho < 0.71$	16.8	16.4
Gamble 5	12	60	$0 < \rho < 0.50$	11.5	15.1
Gamble 6	2	70	$\rho < 0$	10.7	7.6

Notes: Coefficient of relative risk aversion. Calculated as the range of ρ in the function $U(x) = x^{1-\rho}/(1-\rho)$ which makes the utility of each gamble on the list equal the utility of the next gamble. Fixing ρ at the mid-point of the intervals and the upper and lower bounds at $\rho = 3.46$ and $\rho = 0$, respectively, the mean value of ρ is 1.166 (with a standard deviation of .9784).

much as gains of the same size.

Table 7: Elicitation of loss aversion

	Minimum x accepted, x^{min}	Implied θ^a	Percentage of subjects
Gamble 1	\$50	No loss aversion	22.01
Gamble 2	\$70	$1 < \theta < 1.4$	11.95
Gamble 3	\$100	$1.4 < \theta < 2.0$	14.47
Gamble 4	\$150	$2.0 < \theta < 3.0$	18.24
	None accepted	$\theta > 3$	33.33

Notes: θ is given by $\frac{x}{50}$. The upper bound of each interval is given by $\frac{x^{min}}{50}$, where x^{min} is the minimum value of x for which the subject is willing to take on the gamble, and the lower bound of each interval is determined by the upper bound of the previous interval.

5 Results

In contrast to the predictions with an expectation-based reference point based on a choice-acclimating personal equilibrium, we do not find many subjects avoiding application (entry) when there is no application fee. Only two subjects have a willingness to pay to enter of zero (both in the LOT_L), and our main outcome variable $\frac{f_{X_i}}{EV}$ is significantly different from zero in all treatments.

Result 1. *The majority of subjects are willing to pay a positive amount for the opportunity to apply.*

However, we find substantial unwillingness to take on risk across all treatments, and our main outcome variable $\frac{f_{X_i}}{EV}$ is significantly below unity in all treatments (see Table 8). This is also seen in Figure 5 for different probability and performance levels, as the average willingness to pay is considerably below the expected value.²² Therefore, we report the following result which is consistent with Hypothesis 2.

Result 2. *The willingness to pay to apply for the job or enter the lottery is significantly below the risk neutral level.*

²²The difference between high and low performers is comparable in situations where they face the same probability of the good outcome, i.e., for $p = 40\%$. Using a MannWhitney test, we find that high performers have a significantly higher willingness to pay for risk than low performers (p-value=0.0054). This holds in both contextual frames, but the effect of being a low performer disappears when we control for personal characteristics and in particular when controlling for the number of correct answers in Part 1. These results are available on request.

Table 8: Willingness to pay to apply (enter) relative to expected value of applying (entering), $\frac{f_{X_i}}{EV}$, by treatment

	Outcome variable		Hypothesis 2		Hypothesis 4	
	$\frac{f_{X_i}}{EV}$		$H_0 : E\left(\frac{f_{X_L}}{EV}\right) = 1$	$H_0 : E\left(\frac{f_{X_H}}{EV}\right) = 1$	$H_0 : E\left(\frac{f_{X_H}}{EV}\right) = E\left(\frac{f_{X_L}}{EV}\right)$	
	L	H	t-test	t-test	MannWhitney	t-test
JOB	0.74 (0.35)	0.61 (0.28)	-4.72 (< 0.01)	-8.33 (< 0.01)	2.27 (0.02)	1.80 (0.04)
LOT	0.82 (0.24)	0.60 (0.27)	-4.59 (< 0.01)	-8.86 (< 0.01)	3.70 (< 0.01)	3.78 (< 0.01)
Hypothesis 3 $H_0 : E(f_{JOB_i}) = E(f_{LOT_i})$						
MannWhitney	-1.01 (0.31)	0.45 (0.88)				
t-test	-1.23 (0.22)	0.19 (0.85)				

Notes: The table reports means and standard deviations in brackets for $\frac{f_{X_i}}{EV}$ where $X \in \{JOB, LOT\}$ and $i \in \{L, H\}$. f_{X_i} is calculated as mid-point of the fee interval where the subject switched from apply (enter) to do not apply (enter). If the subject always chooses apply/enter, we let $f_{X_i} = EV = 5p$. If the subject always chooses do not apply (enter), we let $f_{X_i} = 0$. Eight observations are excluded due to multiple switch points. For the two sample MannWhitney test and the one-sided t-test, the table reports the test statistics (z and t respectively) and the p-values in brackets.

In terms of Hypothesis 3, which conjectures a treatment effect of the contextual framing, we find that $\frac{f_{X_i}}{EV}$ is 0.74 in JOB_L and slightly higher at 0.82 in LOT_L . The difference is in the expected direction but not statistically significant. For JOB_H and LOT_H the difference is in the opposite direction and not significant. These results also hold for alternative specifications of f_{X_i} (see Appendix Table A1). The results are also visible in Figure 5 where there are no differences between the job and lottery treatments.²³ Hence, we have the following result:

Result 3. *There is no effect of the job treatments compared to the lottery treatments on the average willingness to pay to enter.*

Next we turn to Hypothesis 4, which predicts a treatment effect of the probability environment.

²³This holds both for subjects classified as high performers, and subjects classified as low performers, as well as across all probability levels, and the results are confirmed using MannWhitney tests of differences in the distributions of the willingness to pay across the two settings. As seen in Appendix Table A3, the results also hold in a reduced form regression with treatment dummies and subject characteristics.

Figure 5: Willingness to pay f_{X_i}

Notes: f_{X_i} is calculated as mid-point of the fee interval where the subject switched from apply (enter) to do not apply (enter). If the subject always chooses apply (enter), then we assign the expected value of applying, i.e., $EV = 5p$. If the subject always choose don't apply (don't enter), we let $f_{X_i} = 0$. Eight observations are excluded due to multiple switch points.

We find that the average of $\frac{f_{JOB_L}}{EV}$ is 0.74, which is greater than the average of $\frac{f_{JOB_H}}{EV}$ equal to 0.61. This is **not** consistent with Hypothesis 4 and suggests that behavior on average is closer to risk neutrality in the low probability environment than in the high probability environment. Similarly, for the lottery treatment the average $\frac{f_{LOT_L}}{EV}$ equals 0.82 whereas the average $\frac{f_{LOT_H}}{EV}$ equals 0.60. Again, the difference is not in the expected direction and it is statistically significant using both MannWhitney tests and t-tests.²⁴ The result is also illustrated in Figure 5 where the willingness to pay to take on risk is further away from risk neutrality the higher the probability level. Hence, contrary Hypothesis 4, we find that:

Result 4. *There is greater unwillingness to take on risk for relatively large probabilities of winning than for low probabilities of winning.*

²⁴The results can be confirmed in a regression analysis and are largely robust to inclusion of individual level characteristics. However, the effect is marginally insignificant for JOB_H when including control variables. See Appendix Table A3.

Since the application (entry) fees depend on the probability of winning, it is necessary to verify that the result is not an artifact of this feature of our design. If subjects do not pay attention to the information provided, they might choose to switch from apply (enter) to not apply (not enter) at the same place on the list regardless of the probability of the good outcome and hence the fees presented to them. Figure A1 in the appendix shows that this is not the case. In addition, alternative specifications of $\frac{f_{X_i}}{EV}$ yield similar results as those presented in Table 8 with effects going in the same direction and mostly remaining statistically significant (see Appendix Table A1). We note that a possible explanation for the observed pattern could be probability weighting as included in prospect theory (Kahneman & Tversky 1992).

The results presented so far provide evidence of significant reluctance to take on risk and hence rejects both risk neutrality and reference dependence with linear utility and a reference point equal to initial wealth. In addition, we do not find support for the more extreme predictions of complete refusal to take on low probability risk, which may be implied by expectation-based reference points based on a choice-acclimating equilibrium. However, the results do not answer whether standard risk aversion could account for the observed behavior or if our results are better rationalized by application costs being viewed as a potential loss (as with a reference point equal to the wealth at the time of decision making) or by an expectation-based reference point with a more modest coefficient of loss aversion. Figure 6 addresses this question by showing the average of individual level application fee “choices” that would be implied by the risk and loss aversion measures elicited during the experiment and the model assumptions relative to the expected value. We show the implied ratio for different reference point specifications and contrast the result with the average ratio observed in the application task. Since we find no treatment effect of the job vs. lottery setting, we pool observations.

When the probability of the good outcome is $p = 15\%$, the aggregate results are closest to those implied by standard risk aversion as captured by the case where the reference point is equal to initial wealth W_I . However, overall and when the probability of the good outcome is $p = 40\%$ or $p = 65\%$ the aggregate effects seem better captured by reference dependent preferences with the reference point equal to the endowment at the time of the application decision. The figure also illustrate that the predictions with the reference point determined by expectations are too extreme (for $p = 15\%$ and $p = 40\%$) to be supported by the aggregate patterns in the data. However, at the individual level it is less clear that any of the models alone explains the data well. Table 9 shows the correlation between the implied and the observed $\frac{f_{X_i}}{EV}$ and no clear pattern emerges. The general

Figure 6: $\frac{f_{X_i}}{EV}$ observed in the application task and implied by the elicited parameter values

Notes: Observed f_{X_i} is calculated as mid-point of the fee interval where the subject switched from apply (enter) to do not apply (enter). If the subject always chooses apply (enter), then we assign the expected value of applying, i.e., $EV = 5p$. If the subject always choose don't apply (don't enter), we let $f_{X_i} = 0$. Eight observations are excluded due to multiple switch points. Implied f_{X_i} is imputed by the best option available in the experiment given the preference parameters and the model given by equation (1) where we assume $m(x) = x^{1-\rho}/(1-\rho)$, linear gain-loss utility as in equation (2) with $\eta = 1$ and $\lambda = 2\theta - 1$ where θ and ρ are set to the mid-point of the elicited intervals. That is we interpret ρ as the curvature in $m(\cdot)$. We let $r = E$ denote the case where the reference point is equal to expectations.

lack of correlation between the implied and observed values may be due to a number of reasons, such as low variation in the fees included in the price list, a noisy loss aversion measure due to the non-incentivized elicitation method (Schlag et al. 2015)²⁵, and the subtle issue in our setting that the willingness to pay for the job/lottery may be shaped by both loss aversion coefficient and also the reference point the person has. Another potential source of variation that may lower the individual-level correlations here is variation in how people frame the entry decision. Our aggregate results suggest that a framing of the reference point as wealth at the time of the decision is likely the best fit overall. However, at the individual level it is likely that there is variation across people with some looking more like “reference point is initial wealth” and some more like

²⁵We note that when considering the correlation between the risk measures (with or without controls, Tables A3 and A4, respectively), we find that correlations have the expected sign but correlation between the elicited risk measures and the application choice is insignificant. However, the correlation between θ and ρ is statistically significant even though θ was not incentivized. Other studies have also found limited individual level correlation between risk measures elicited using different tasks (Isaac & James 2000, Kruse & Thompson 2003, Eckel & Wilson 2004, Anderson & Mellor 2009, Dulleck et al. 2015) and loss aversion have been found in both studies using hypothetical (Kahneman & Tversky 1992) and incentivized tasks (Harbaugh et al. 2010).

“expectations based on choice-acclimating personal equilibrium”.

Table 9: Spearman rank correlation coefficients for observed and implied $\frac{f^{max}}{EV}$

	$r = W_I$	$r = w_I + W_L$	$r = E$
Total	0.24***	0.06	0.05
p=15%	0.08	0.10	0.25*
p=40%	0.01	-0.02	-0.06
p=65%	0.12	0.41**	0.39**

Notes: Table reports pairwise correlation coefficients. *** significant at 1% level of significance, ** significant at 5% level of significance, and * significant at 10% level of significance. See Table 8 for a definition of $\frac{f^{max}}{EV}$.

6 Conclusion

This paper documents that people are substantially risk averse in their job application decisions, especially for intermediate probabilities of success. We also provide some suggestive support that the aggregate level of risk aversion displayed in job application decisions is more consistent with reference-dependent theories predicting substantial risk aversion than with standard risk attitudes displayed over purely “gain-framed” decisions. However, we also do not find support for application avoidance which is one of the more extreme predictions of reference-dependent theories when the reference point is determined by expectations and the equilibrium is based on the concept of a choice-acclimating personal equilibrium.

We find no differences in choices across the job application context and neutral lottery context. This suggests that for our task the contextual framing does not alter choices, possibly because some of the dynamics at play in job entry decisions are related to fundamental attitudes toward financial risk which are not specific to job-application situations.

Of course, it is important to keep the nature of our experiment in mind when extrapolating to application decisions outside of the lab. While our experiment shows how risk attitudes can influence job application decisions, it is likely that other factors such as overconfidence or underconfidence are much more important factors for job application decisions. Nonetheless, we believe that understanding how loss aversion can shape the attitudes toward applying for a new job is a useful contribution.

References

- Abdellaoui, M., Bleichrodt, H. & Paraschiv, C. (2007), 'Loss aversion under prospect theory: A parameter-free measurement', *Management Science* **53**(10), 1659–1674.
- Allen, D. G., Renna, R. W., Moffitt, K. R. & Vardaman, J. M. (2007), 'Risky business: The role of risk in voluntary turnover decisions', *Human Resource Management Review* **17**(3), 305–318.
- Anderson, L. R. & Mellor, J. M. (2009), 'Are risk preferences stable? comparing an experimental measure with a validated survey-based measure', *Journal of Risk and Uncertainty* **39**(2), 137–160.
- Balafoutas, L., Kerschbamer, R. & Sutter, M. (2012), 'Distributional preferences and competitive behavior', *Journal of Economic Behavior and Organization* **83**, 125–135.
- Bartling, B., Fehr, E., Marechal, M. A. & Schunk, D. (2009), 'Egalitarianism and competitiveness', *American Economic Review: Papers & Proceedings* **99**(2), 93–98.
- Bell, D. E. (1985), 'Disappointment in decision making under uncertainty', *Operations Research* **33**(1), 1–27.
- Buchheim, L. (2012), Do lagged expectations determine reference points?, in 'Expectations and Economic Choices: Essays on Projection Bias, Expectation-Based Reference Points, and the Emergence of Extreme Political Systems', Ludwig-Maximilians-Universität München.
- Burdett, K. (1978), 'A theory of employee job search and quit rates', *American Economic Review* **68**(1), 212–220.
- Burdett, K. & Mortensen, D. T. (1998), 'Wage differentials, employer size, and unemployment', *International Economic Review* **39**(2), 257–273.
- Camerer, C. & Lovallo, D. (1999), 'Overconfidence and excess entry: An experimental approach', *American Economic Review* **89**(1), 306–318.
- Cason, T. N., Masters, W. A. & Sheremeta, R. M. (2010), 'Entry into winner-take-all and proportional-prize contests: An experimental study', *Journal of Public Economics* **94**, 604–611.
- Choi, S., Fisman, R., Gale, D. & Kariv, S. (2007), 'Consistency and heterogeneity of individual behavior under uncertainty', *American Economic Review* **97**(5), 1921–1938.

- Damgaard, M. T. (2017), ‘Labor market search effort with reference-dependent preferences’, *Economics Letters* **156**, 99–101.
- Dave, C., Eckel, C. C., Johnson, C. A. & Rojas, C. (2010), ‘Eliciting risk preferences: When is simple better?’, *Journal of Risk and Uncertainty* **41**, 219–243.
- DellaVigna, S., Lindner, A., Reizer, B. & Schmieder, J. F. (2017), ‘Reference-dependent job search: Evidence from Hungary’, *Quarterly Journal of Economics* **132**(4), 1969–2018.
- Dohmen, T. & Falk, A. (2011), ‘Performance pay and multidimensional sorting: Productivity, preferences, and gender’, *American Economic Review* **101**, 556–590.
- Dulleck, U., Fooker, J. & Fell, J. (2015), ‘Within-subject intra- and inter-method consistency of two experimental risk attitude elicitation methods’, *German Economic Review* **16**(1), 104–121.
- Eckel, C. C. & Grossman, P. J. (2002), ‘Sex differences and statistical stereotyping in attitudes towards financial risk’, *Evolution and Human Behavior* **23**, 281–295.
- Eckel, C. C. & Grossman, P. J. (2008), ‘Forecasting risk attitudes: An experimental study using actual and forecast gamble choices’, *Journal of Economic Behavior & Organization* **68**, 1–17.
- Eckel, C. C. & Wilson, R. K. (2004), ‘Is trust a risky decision?’, *Journal of Economic Behavior and Organization* **55**(4), 447–465.
- Eriksson, T., Poulsen, A. & Villeval, M. C. (2009), ‘Feedback and incentives: Experimental evidence’, *Labour Economics* **16**, 679–688.
- Eriksson, T., Teyssier, S. & Villeval, M.-C. (2009), ‘Self-selection and the efficiency of tournaments’, *Economic Inquiry* **47**(3), 530–548.
- Falk, A., Huffman, D. & Sunde, U. (2006), Self-confidence and search. IZA Discussion Paper No. 2525.
- Fischbacher, U. (2007), ‘z-tree: Zurich toolbox for ready-made economic experiments’, *Experimental Economics* **10**, 171–178.
- Gill, D. & Prowse, V. (2012), ‘A structural analysis of disappointment aversion in a real effort competition’, *American Economic Review* **102**(1), 469–503.
- Gul, F. (1992), ‘A theory of disappointment aversion’, *Econometrica* **59**(3), 667–686.

- Harbaugh, W. T., Krause, K. & Vesterlund, L. (2010), 'The fourfold pattern of risk attitudes in choice and price tasks', *The Economic Journal* **120**(545), 595–611.
- Isaac, R. M. & James, D. (2000), 'Just who are you calling risk averse?', *Journal of Risk and Uncertainty* **20**(2), 177–187.
- Jovanovic, B. (1979), 'Job matching and the theory of turnover', *Journal of Political Economy* **87**(5), 972–990.
- Kahneman, D. & Tversky, A. (1979), 'Prospect theory: An analysis of decision under risk', *Econometrica* **47**(2), 263–291.
- Kahneman, D. & Tversky, A. (1992), 'Advances in prospect theory: Cumulative representation of uncertainty', *Journal of Risk and Uncertainty* **5**, 297–323.
- Kőszegi, B. & Rabin, M. (2006), 'A model of reference-dependent preferences', *Quarterly Journal of Economics* **121**(4), 1133–1165.
- Kőszegi, B. & Rabin, M. (2007), 'Reference-dependent risk attitudes', *American Economic Review* **97**(4), 1047–1073.
- Kruse, J. B. & Thompson, M. A. (2003), 'Valuing low probability risk: survey and experimental evidence', *Journal of Economic Behavior and Organization* **50**(4), 495–505.
- Loomes, G. & Sugden, R. (1986), 'Disappointment and dynamic consistency in choice under uncertainty', *Review of Economic Studies* **53**(2), 271–282.
- Loomes, G. & Sugden, R. (1987), 'Testing for regret and disappointment in choice under uncertainty', *Economic Journal* **97**, 118–129. Supplement: Conference Papers.
- March, J. G. & Simon, H. A. (1958), *Organizations*, John Wiley, New York.
- Masatlioglu, Y. & Raymond, C. (2016), 'A behavioral analysis of stochastic reference dependence', *American Economic Review* **106**(9), 2760–2782.
- Niederle, M., Segal, C. & Vesterlund, L. (2013), 'How costly is diversity? affirmative action in light of gender differences in competitiveness', *Management Science* **59**(1), 1–16.
- Niederle, M. & Vesterlund, L. (2007), 'Do women shy away from competition? do men compete too much?', *Quarterly Journal of Economics* **122**(3), 1067–1101.

- Schlag, K. H., Tremewan, J. & van der Weele, J. J. (2015), 'A penny for your thoughts: a survey of methods for eliciting beliefs', *Experimental Economics* **18**(3), 457-490.
- Shimer, R. (2006), 'On-the-job search and strategic bargaining', *European Economic Review* **50**(811-830).
- Smith, A. (2012), Lagged beliefs and reference-dependent preferences. Working Paper.
- Song, C. (2016), An experiment on reference points and expectations. Working Paper.
- Sonsino, D. (2008), 'Disappointment aversion in internet bidding-decisions', *Theory and Decision* **64**, 363–393.
- Sprenger, C. (2015), 'An endowment effect for risk: Experimental tests of stochastic reference points', *Journal of Political Economy* **123**(6), 1456–1499.
- Tanaka, T., Camerer, C. F. & Nguyen, Q. (2010), 'Risk and time preferences: Linking experimental and household survey data from vietnam', *American Economic Review* **100**(1), 557–71.
- Tom, S. M., Fox, C. R., Trepel, C. & Poldrack, R. A. (2007), 'The neural basis of loss aversion in decision-making under risk', *Science* **315**(5811), 515–518.
- Topel, R. H. & Ward, M. P. (1992), 'Job mobility and the careers of young men', *Quarterly Journal of Economics* **107**(2), 439–479.
- van Dijk, W. W., van der Pligt, J. & Zeelenberg, M. (1999), 'Effort invested in vain: The impact of effort on the intensity of disappointment and regret', *Motivation and Emotion* **23**(3), 203–219.
- van Huizen, T. & Alessie, R. (2016), 'Risk aversion and job mobility'. USE Discussion Paper Series nr: 16-09.

7 Appendix: Figures and tables

Figure A1: Distribution of maximum situation chosen by probability level.

Notes: The bars indicate as a share of all subjects, the highest application (entry) fee at which the subjects chose to apply (enter) by probability level. The application (entry) fees, C1, C2, C3, C4, C5, C6 and C7, depend on the probability level as detailed in Table 2. The value “none” is assigned if the subject never chose to apply (enter the lottery). Eight observations are excluded due to multiple switch points.

Table A1: Upper and lower bound specifications of $\frac{f_{X_i}^{max}}{EV}$

	Outcome variable		Hypothesis 2		Hypothesis 4	
	$\frac{f_{X_i}}{EV}$		$H_0 : E\left(\frac{f_{X_L}}{EV}\right) = 1$	$H_0 : E\left(\frac{f_{X_H}}{EV}\right) = 1$	$H_0 : E\left(\frac{f_{X_H}}{EV}\right) = E\left(\frac{f_{X_L}}{EV}\right)$	
	L	H	t-test	t-test	MannWhitney	t-test
Lower bound specification						
JOB	0.60 (0.31)	0.53 (0.29)	-8.45 (< 0.01)	-9.65 (< 0.01)	1.25 (0.21)	0.92 (0.18)
LOT	0.65 (0.21)	0.52 (0.28)	-10.71 (< 0.01)	-10.33 (< 0.01)	2.55 (0.01)	2.25 (0.01)
Hypothesis 3 $H_0 : E(f_{JOB_i}) = E(f_{LOT_i})$						
MannWhitney	-0.19 (0.85)	0.13 (0.89)				
t-test	-0.85 (0.40)	0.25 (0.80)				
Upper bound specification						
JOB	0.77 (0.33)	0.69 (0.26)	-4.31 (< 0.01)	-7.19 (< 0.01)	2.14 (0.03)	1.28 (0.10)
LOT	0.86 (0.20)	0.68 (0.25)	-4.40 (< 0.01)	-7.47 (< 0.01)	3.33 (< 0.01)	3.29 (< 0.01)
Hypothesis 3 $H_0 : E(f_{JOB_i}) = E(f_{LOT_i})$						
MannWhitney	-0.62 (0.53)	0.09 (0.93)				
t-test	-1.36 (0.18)	0.09 (0.93)				

Notes: The table reports means and standard deviations in brackets for $\frac{f_{X_i}}{EV}$ where $X \in \{JOB, LOT\}$ and $i \in \{L, H\}$. In the lower bound specification f_{X_i} is set to the lower bound of the fee interval where the subject switched from apply (enter) to don't apply (enter). In the upper bound specification it is set to the upper bound of the fee interval. Eight observations are excluded due to multiple switch points. For the two sample MannWhitney test and a one-sided t-test the table reports the test statistics (z and t respectively) and the p-values in brackets.

Table A2: Alternative specifications of $\frac{f_{X_i}^{max}}{EV}$

	Outcome variable		Hypothesis 2		Hypothesis 4	
	$\frac{f_{X_i}}{EV}$		$H_0 : E\left(\frac{f_{X_L}}{EV}\right) = 1$	$H_0 : E\left(\frac{f_{X_H}}{EV}\right) = 1$	$H_0 : E\left(\frac{f_{X_H}}{EV}\right) = E\left(\frac{f_{X_L}}{EV}\right)$	
	L	H	t-test	t-test	MannWhitney	t-test
Broader end groups						
JOB	0.73 (0.37)	0.56 (0.32)	-4.70 (< 0.01)	-8.10 (< 0.01)	2.56 (0.01)	2.10 (0.02)
LOT	0.81 (0.26)	0.56 (0.31)	-4.52 (< 0.01)	-8.44 (< 0.01)	3.83 (< 0.01)	3.76 (< 0.01)
Hypothesis 3 $H_0 : E(f_{JOB_i}) = E(f_{LOT_i})$						
MannWhitney	-0.91 (0.36)	0.14 (0.88)				
t-test	-1.14 (0.13)	0.06 (0.52)				
Dropping middle groups						
JOB	0.85 (0.34)	0.87 (0.25)	-2.49 (< 0.01)	-1.85 (0.04)	1.02 (0.03)	-0.22 (0.41)
LOT	0.98 (0.08)	0.85 (0.30)	-1.00 (0.16)	-1.62 (0.07)	3.11 (< 0.01)	1.42 (0.09)
Hypothesis 3 $H_0 : E(f_{JOB_i}) = E(f_{LOT_i})$						
MannWhitney	-2.24 (0.02)	0.03 (0.97)				
t-test	-2.16 (0.02)	0.14 (0.55)				

Notes: The table reports means and standard deviations in brackets for $\frac{f_{X_i}}{EV}$ where $X \in \{JOB, LOT\}$ and $i \in \{L, H\}$. In the broad-end-group specification, $f_{X_i} = EV$ for the top three choices and $f_{X_i} = 0$ for the bottom three choices shown in Figure A1. In the dropping-middle-groups specification, f_{X_i} is coded as missing for choices 2-5 in Figure A1. Eight observations are excluded due to multiple switch points. For the two sample MannWhitney test and a one-sided t-test the table reports the test statistics (z and t respectively) and the p-values in brackets.

Table A3: Reduced form regressions of the ratio of the maximum willingness to pay to the expected value

	(1)	(2)
<i>JOB_H</i> : Job Framing & High Probability	-0.129* (0.066)	-0.111 (0.067)
<i>LOT_L</i> : Lottery Framing & Low Probability	0.082 (0.064)	0.095 (0.066)
<i>LOT_H</i> : Lottery Framing & High Probability	-0.141** (0.066)	-0.133* (0.069)
Low performer in first round		0.048 (0.070)
Number of correct answers in first work round		0.004 (0.009)
Elicited CRRA utility parameter, ρ		-0.023 (0.026)
Elicited loss aversion parameter, θ		-0.019 (0.031)
Female		-0.034 (0.051)
GPA		0.035 (0.064)
Constant	0.743*** (0.045)	0.619** (0.251)
N	151	151
R^2	0.096	0.116

Notes: Estimated using OLS regressions. Table reports coefficients and standard errors are in brackets. *** significant at 1% level of significance, ** significant at 5% level of significance, and * significant at 10% level of significance. *JOB_L*, high performers and men excluded as reference groups when applicable.

Table A4: Spearman rank correlation coefficients for risk measures

	f^{max}/EV	ρ	θ
$\frac{f^{max}}{EV}$	1.00		
CRRA utility parameter, ρ	-0.12	1.00	
Loss aversion proxy, θ	-0.05	0.28***	1.00

Notes: Table reports pairwise correlation coefficients. *** significant at 1% level of significance, ** significant at 5% level of significance, and * significant at 10% level of significance. See Table 8 for a definition of $\frac{f^{max}}{EV}$.