

Some Types of Probabilistic Rewards Increase Worker Motivation

Adrian R. Camilleri (University of Technology Sydney)

Katarina Dankova (University of East Anglia)

Ananta Neelim (University of Tasmania)

Jose Maria Ortiz (Middlesex London)

Why Care About This Topic?

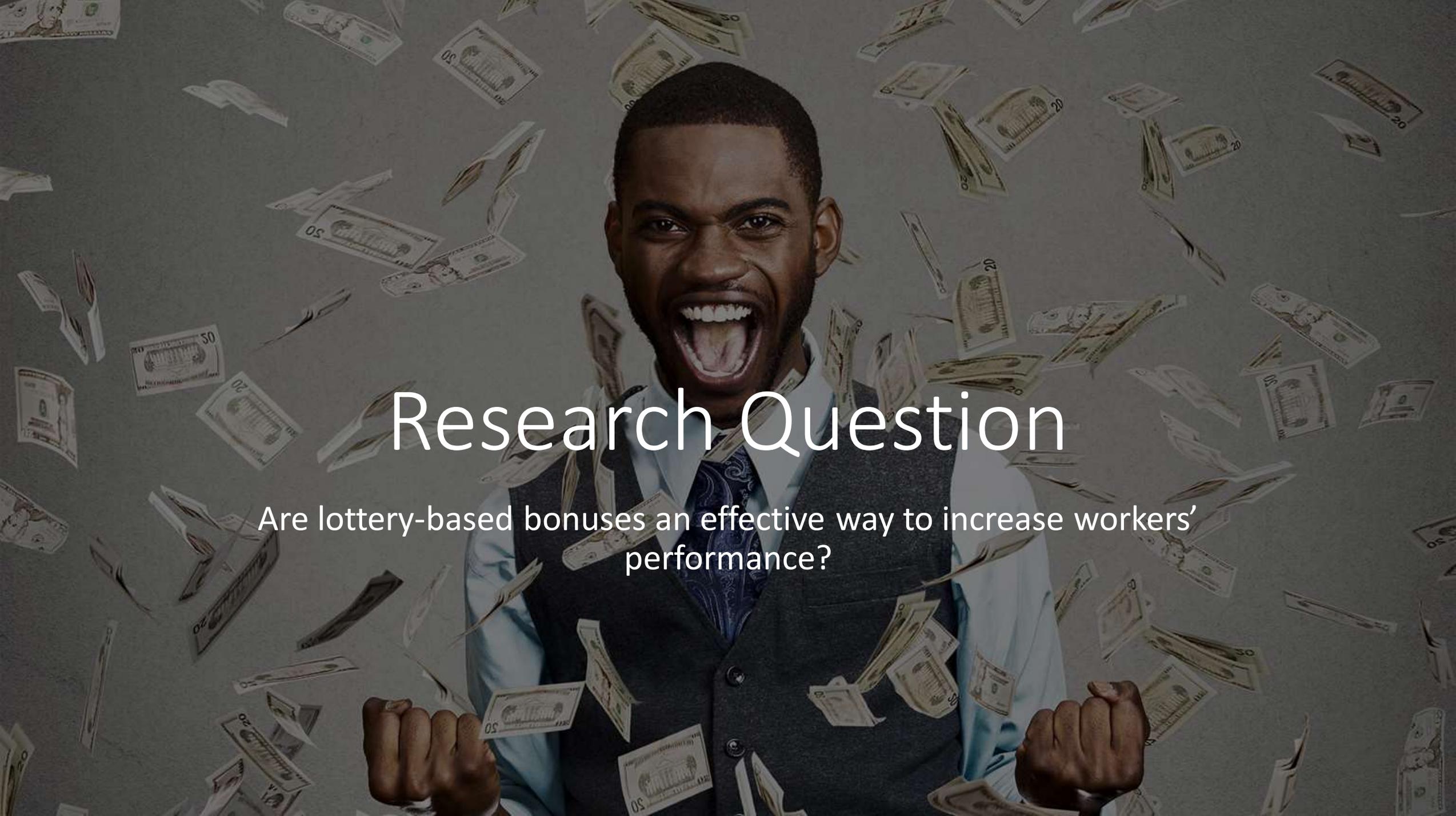
- Understanding worker motivation is fundamental to the success of organizations (Kanfer & Chen, 2016; Kanfer, Frese, & Johnson, 2017).
- This is because the degree of worker motivation is associated with the quantity and quality of work, which in turn affects organizational performance (Bonner & Sprinkle, 2002).
- In line with such importance, labour makes up at least 70% of the average organizations' costs (Blinder, 2011).

How To Motivate Employees?

- The most common way for an organization to elicit worker motivation and performance is through financial compensation in the form of incentives and rewards.
 - According to agency theory (Eisenhardt, 1989), worker effort begins at zero and increases monotonically with the size of the financial compensation offered.
- Consistent with this prediction, several meta-analyses have confirmed that there is a positive association between financial compensation and worker performance (Condy, Clark, & Stolovitch, 2003; Garbers & Konradt, 2014; Jenkins, Mitra, Gupta, & Shaw, 1998; Weibel, Rost, & Osterloh, 2009; Wiersma, 1992).

How To Motivate Employees?

- There are different types of compensation (Bonner et al., 2000):
 - Forms of guaranteed compensation (e.g., salary);
 - Forms of variable compensation (e.g., bonuses);
 - Forms of equity compensation (e.g., stock options).
- Major theories of motivation such as expectancy theory (Van Eerde & Thierry, 1996; Vroom, 1964) and agency theory (Eisenhardt, 1989) predict that performance-related pay should increase worker output compared to flat wages, which empirical research supports (Lazear, 2000).
 - The number of organizations using performance-related pay has increased over time (Bentley MacLeod & Parent; Lemieux, MacLeod, & Parent, 2009; Mercer, 2018; PayScale, 2018).

A man in a light blue shirt, dark vest, and patterned tie is shown from the chest up, celebrating with his mouth wide open and fists clenched. He is surrounded by a heavy rain of falling US dollar bills, including 20 and 50 dollar bills. The background is a dark, textured grey.

Research Question

Are lottery-based bonuses an effective way to increase workers' performance?

Are Probabilistic Rewards Motivating?

- Yes!
- Many people engage in gambling, particularly in the form of lotteries, despite its negative expected value (Clotfelter & Cook, 1999).
- There has also been a huge growth in probabilistic and gambling elements in mobile and online games (James, O'malley, & Tunney, 2017).
- According to a 2016 Gallup poll, 49% of all U.S. adults say they have played the state lottery and 64% have gambled in the past 12 months (Auter, 2016).

Are Probabilistic Rewards Motivating?

- In the financial context:
 - Prize-linked saving accounts, which offer a chance to win a large prize as a function of deposit amount, produces more savings than interest of the same expected value (Filiz-Ozbay, Guryan, Hyndman, Kearney, & Ozbay, 2015; Guillén & Tschoegl, 2002).
- In the consumption context:
 - Offering probabilistic price promotions (e.g., “1% chance it’s free”) increases the likelihood of and number of purchases than comparable fixed price promotions (Lee, Morewedge, Hochman, & Ariely, 2019; Mazar, Shampanier, & Ariely, 2017).

Are Probabilistic Rewards Motivating?

- In the pro-social context:
 - Chances to win lottery prizes increases the amount of recycling compared to baseline (Diamond & Loewy, 1991; Luyben & Cummings, 1981; Maki, Burns, Ha, & Rothman, 2016).
 - Lotteries increase the amount of donations to charity (Landry, Lange, List, Price, & Rupp, 2006).

Are Probabilistic Rewards Motivating?

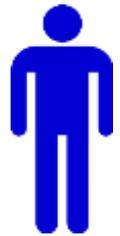
- In the health context:
 - *Some* evidence that offering a lottery-based reward contingent on meeting a specific weight goal produces greater weight loss compared to a monthly weigh-in control group (Volpp, John, et al., 2008) although this result failed to replicate in a workplace context (Patel, et al., 2016).
 - *Some* evidence that offering a lottery-based reward can improve adherence to medication and home-monitoring schedules (Kimmel, et al., 2016; Kimmel, et al., 2012; Sen, et al., 2014; Volpp, Loewenstein, et al., 2008).
 - Lotteries have also been used successfully to increase physical activity (Patel, et al., 2018) and gym attendance (van der Swaluw, et al., 2018a, 2018b).

Why Are Probabilistic Rewards Motivating?

- Uncertainty increases excitement and, irrespective of the outcome, it is pleasant to resolve the uncertainty (Ruan, Hsee, & Lu, 2018).
- People tend to overweight small probabilities (Kahneman and Tversky, 1979; Quiggin, 1982; Tversky and Kahneman, 1992).
- People are optimistic when judging whether uncertain outcomes will be resolved in their favor despite what knowledgeable forecasts, logic, and experience suggests (Simmons and Nelson 2006; Norton, Frost, and Ariely 2007; Goldsmith and Amir 2010; Shen, Fishbach, and Hsee 2015).

Hypothesis 1

- Probabilistic rewards (vs. non-probabilistic rewards with the same expected value) will increase motivation to work and performance.



	1	2	3	4	5	6	7	8	9	10
										
10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
										
										
\$10	\$20	\$30	\$40	\$50	\$60	\$70	\$80	\$90	\$100	
										

10% chance of \$100 bonus, played 10 times:

- EV = 100

\$100 bonus:

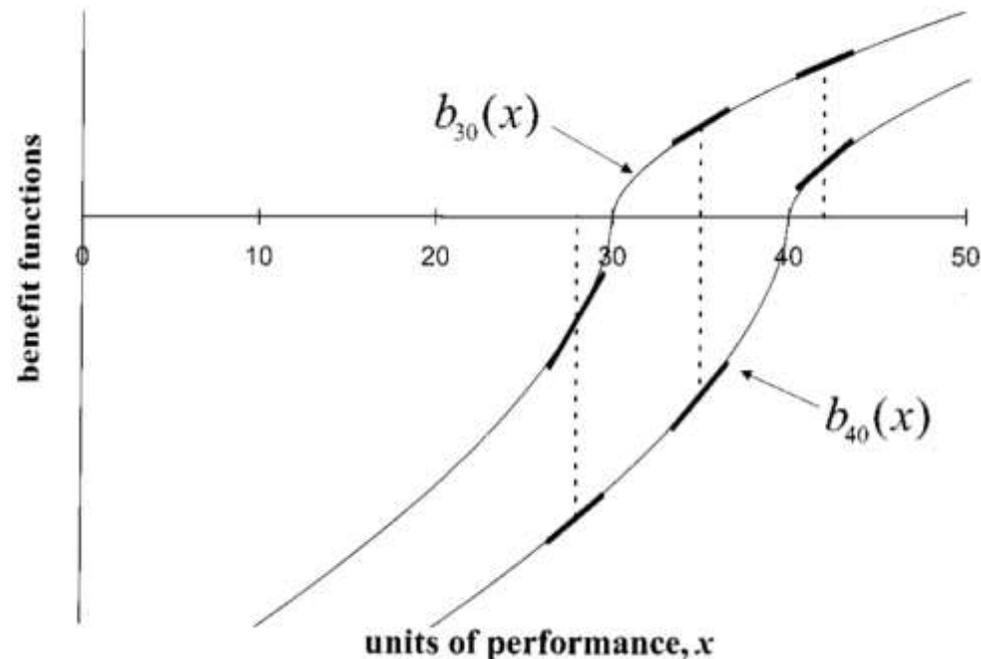
- EV = 100

Are Goals Important?

- Yes!
- According to goal setting theory, incentives increase acceptance of difficult goals, thus increasing performance (Locke, Lathan, & Erez, 1998).
- The goal gradient hypothesis states that effort and motivation increase as one gets closer to completing a goal (Hull, 1932).
 - This principle has been shown to apply to consumer behavior in reward programs, including the finding that even the illusion of progress toward a goal or, in this case, a reward can increase purchases (Kivetz, Urminsky, and Zheng, 2006).

Are Goals Important?

- Goals can serve as reference points and systematically alter the value of outcomes as described by the psychological principles in Prospect Theory's value function (Heath, Larrick, and Wu, 1999):
 - Outcomes that are just below or just above a reference point are evaluated differently.



Hypothesis 2

- Probabilistic rewards will be more effective when work contributes to the accumulation of tickets in a private lottery than when work triggers participation in repeated low-probability lotteries.



	1	2	3	4	5	6	7	8	9	10
10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	

10% chance of \$100 bonus, played 10 times:

- EV = 100

100% chance of \$100 bonus:

- EV = 100

Experiment 1

Experiment 1 - Method

- Lab experiment conducted in Z-tree.
- 115 participants (52 males and 63 females) recruited from the University of East Anglia undergraduate pool.
- 4 treatments in a completely within-subject design:
 - We analyze only the first incentive scheme people were allocated to because learning led to ceiling effects.

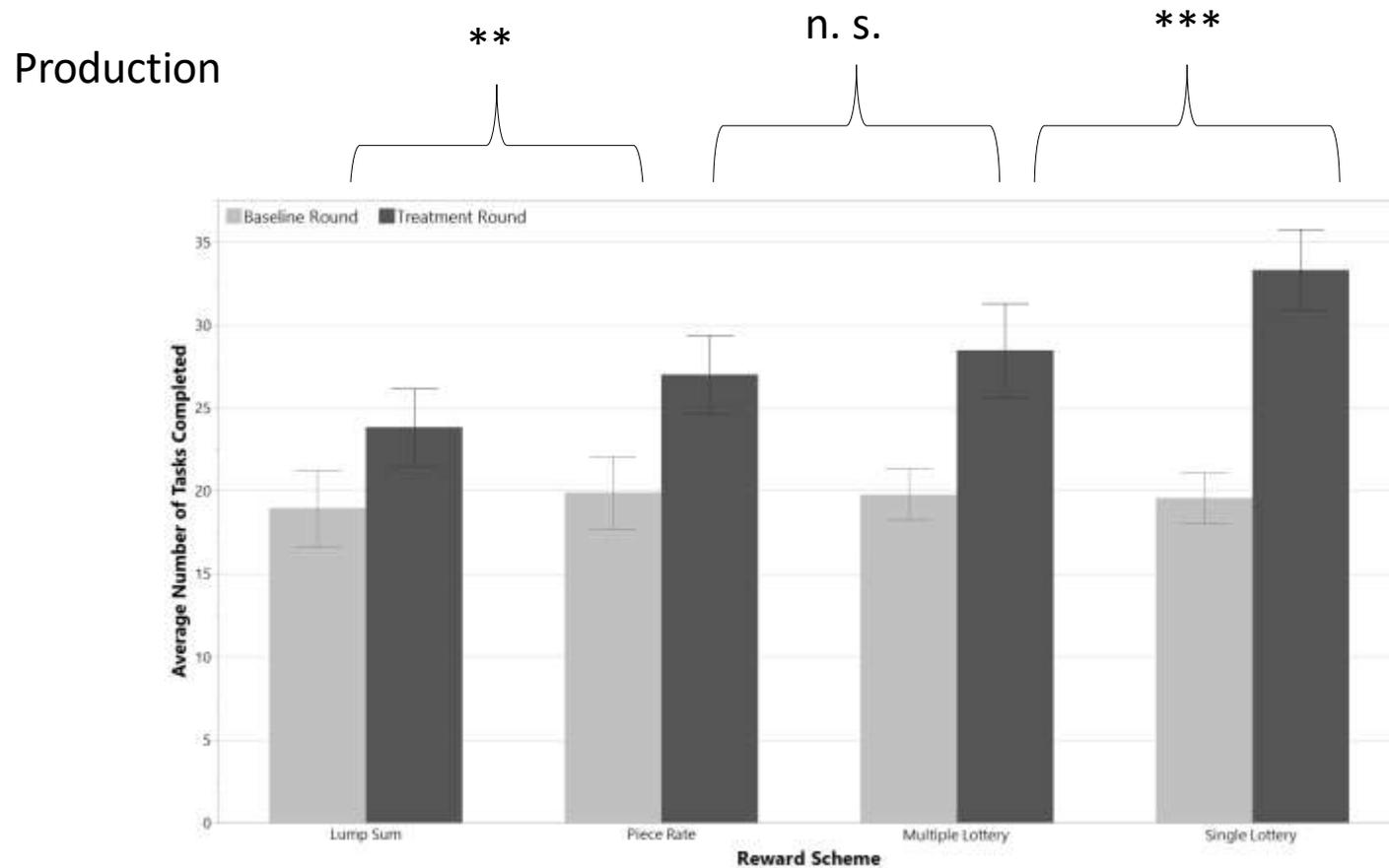
Experiment 1 - Method

- Task:
 - Slider task (Gill & Prowse, 2012).
 - Each slider set at 50 = 1 unit of production.
 - Goal to get the bonus = 28 units of production.
- Procedure:
 - Practice round (not incentivized).
 - Ability round (piece-rate pay, 5 cents per unit of production).
 - Work rounds (Piece-rate + bonus depending on treatment) for 2 minutes each.

Experiment 1 - Groups

Group	Description	Number of participants (#high; #low)
Lump Sum (LS)	Participants received an additional bonus of 27 if they reach a goal (28 units of production)	30 (16; 14)
Piece Rate (PR)	Participants received an additional bonus of 2.5 each time they produce 7 units, until 28.	29 (13; 16)
Multiple Lottery (ML)	Participants received a 25% chance of winning an additional 10 bonus every time they correctly answered 7 questions (until 28 correct answers). There were potentially up to 4 lotteries played after every set of 7 correct answers.	26 (13; 13)
Single Lottery (SL)	Participants received an additional 25% chance of winning an additional 10 AUD every time they correctly answered 7 questions (until 28 correct answers). There was a single lottery played at the end of the time.	30 (17; 13)

Experiment 1 - Results



Wilcoxon Rank
sum tests

No ability differences across treatments.

Performance: Single Lottery > Multiple Lottery = Piece Rate > Lump Sum

Both H1 and H2 are validated.

Experiment 2

8.63	4.38	2.68
5.72	1.67	7.38
7.32	3.62	1.29
7.02	5.17	1.62

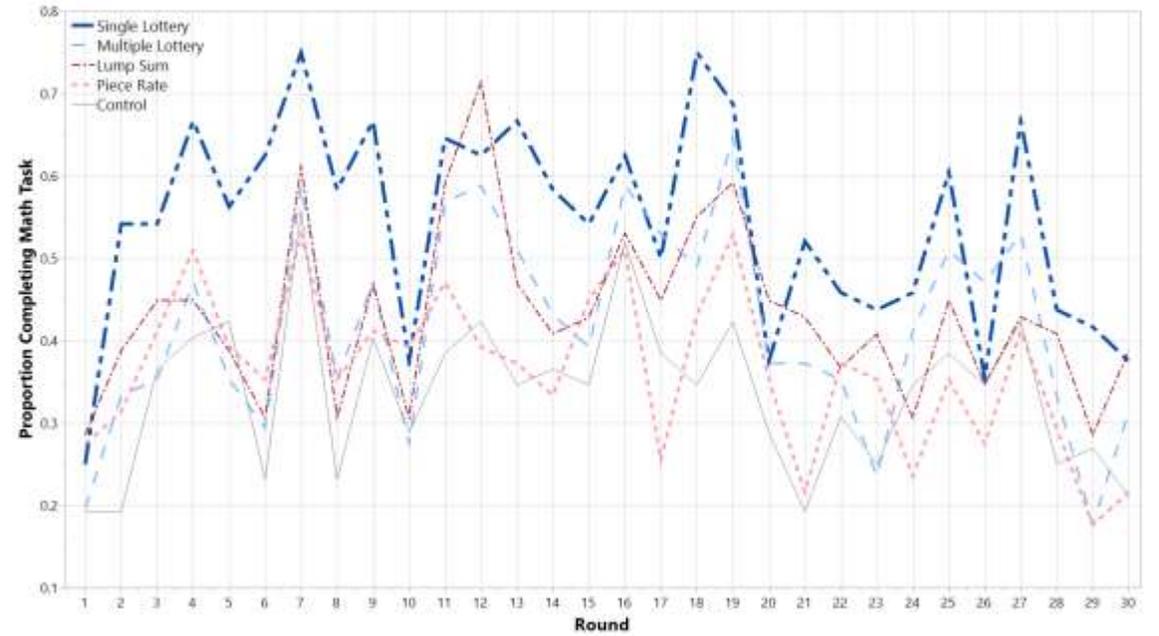
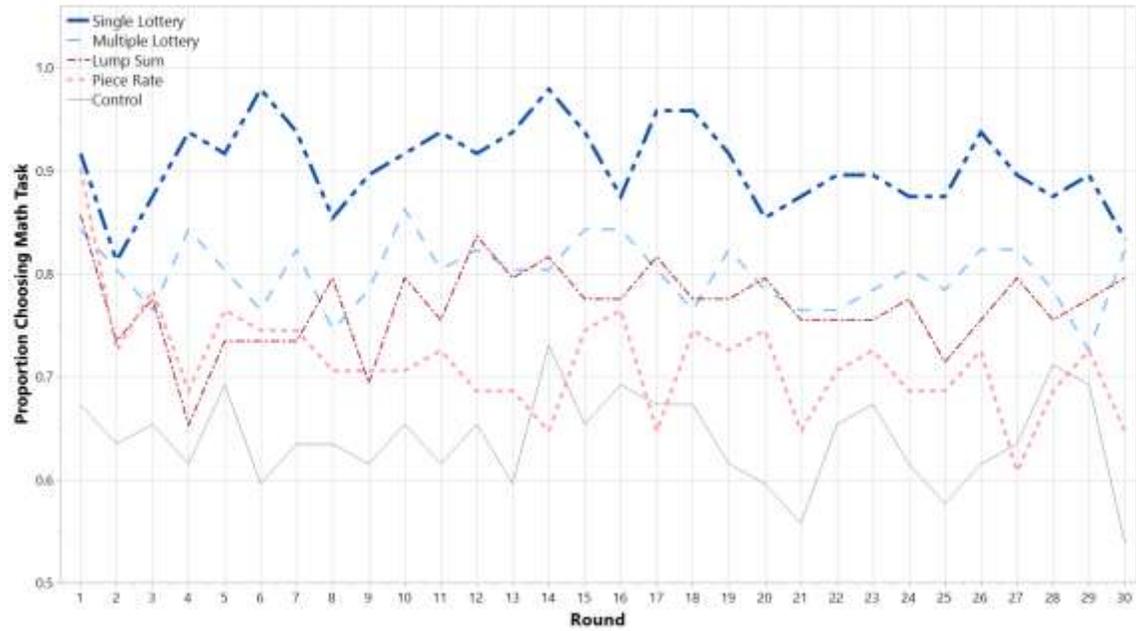
Experiment 2 - Method

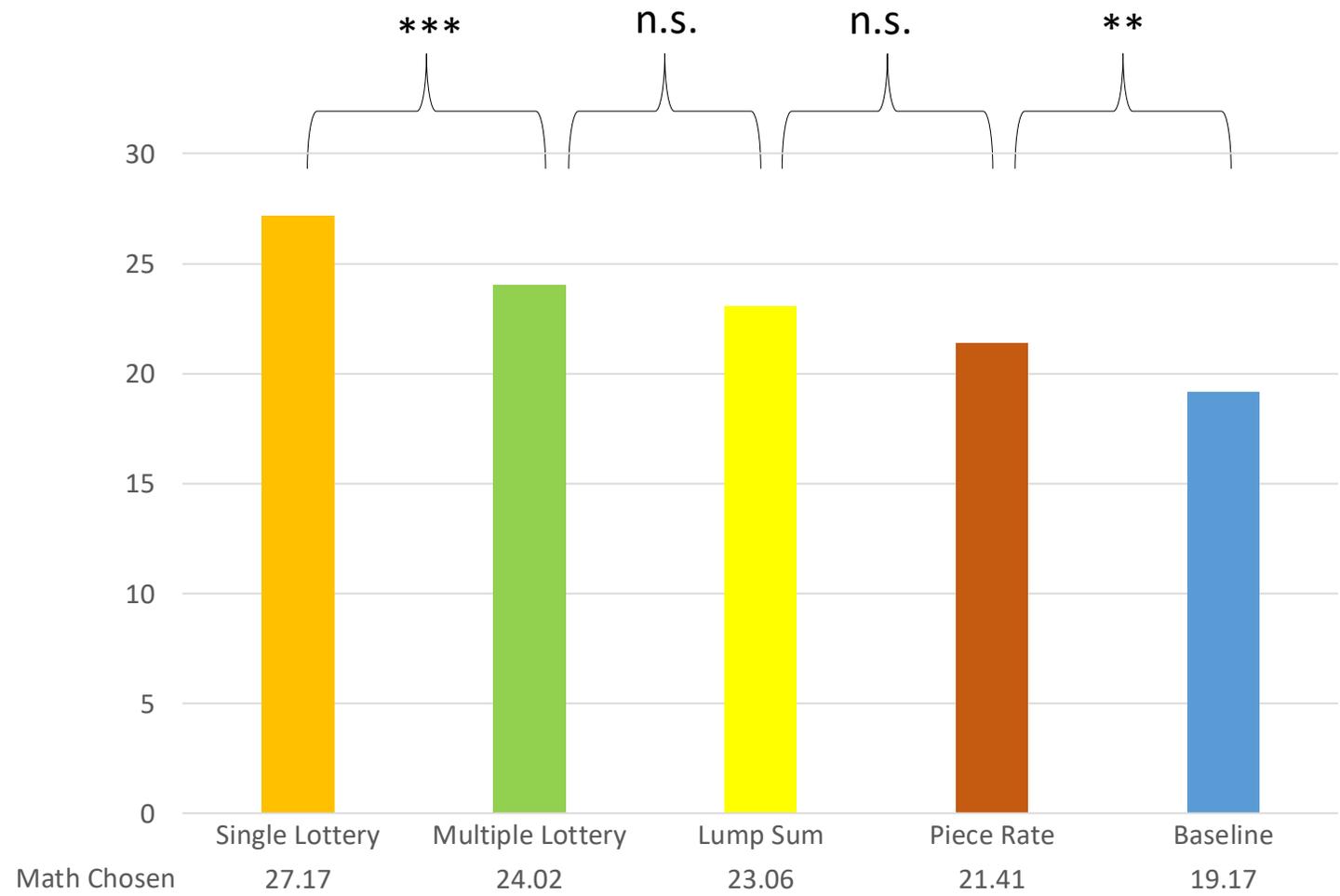
- Online experiment conducted using Qualtrics.
- Participants were 251 Americans (153 males and 98 females) recruited from Amazon's Mechanical Turk (mTurk):
 - Paid \$0.50 plus bonus depending on the treatment and performance.
- Task (Goswami & Urminsky, 2018):
 - 30 rounds.
 - Each round the participant chose between “work” and “leisure”:
 - Work: Work 30-seconds by searching for two numbers that add up to 10 in a 3 x 4 grid containing 12 numbers.
 - Leisure: Relax for 30-seconds while watching a funny advertisement.

Experiment 2 - Method

Treatment	Description	Number of participants (#high; #low)
No Goal (NG) (Baseline)	No additional incentives were provided. Participants did not have to reach any goal.	52 (18; 34)
Lump Sum (LS)	Participants received an additional \$1.04 if they correctly answered 24 (out of a total of 30) questions.	49 (16; 33)
Piece Rate (PR)	Participants received an additional \$0.02 each time they correctly answered 3 questions (until 24 correct answers).	51 (15; 33)
Multiple Lottery (ML)	Participants received a 1/8 th chance of winning an additional \$0.16 every time they correctly answered 3 questions (until 24 correct answers). There were potentially up to 8 lotteries played after every set of 3 correct answers.	51 (15; 36)
Single Lottery (SL)	Participants received an additional 1/8 th chance of winning an additional \$0.16 every time they correctly answered 3 questions (until 24 correct answers). There was a single lottery played at the end of 30 rounds.	48 (18; 29)

Experiment 2 - Results

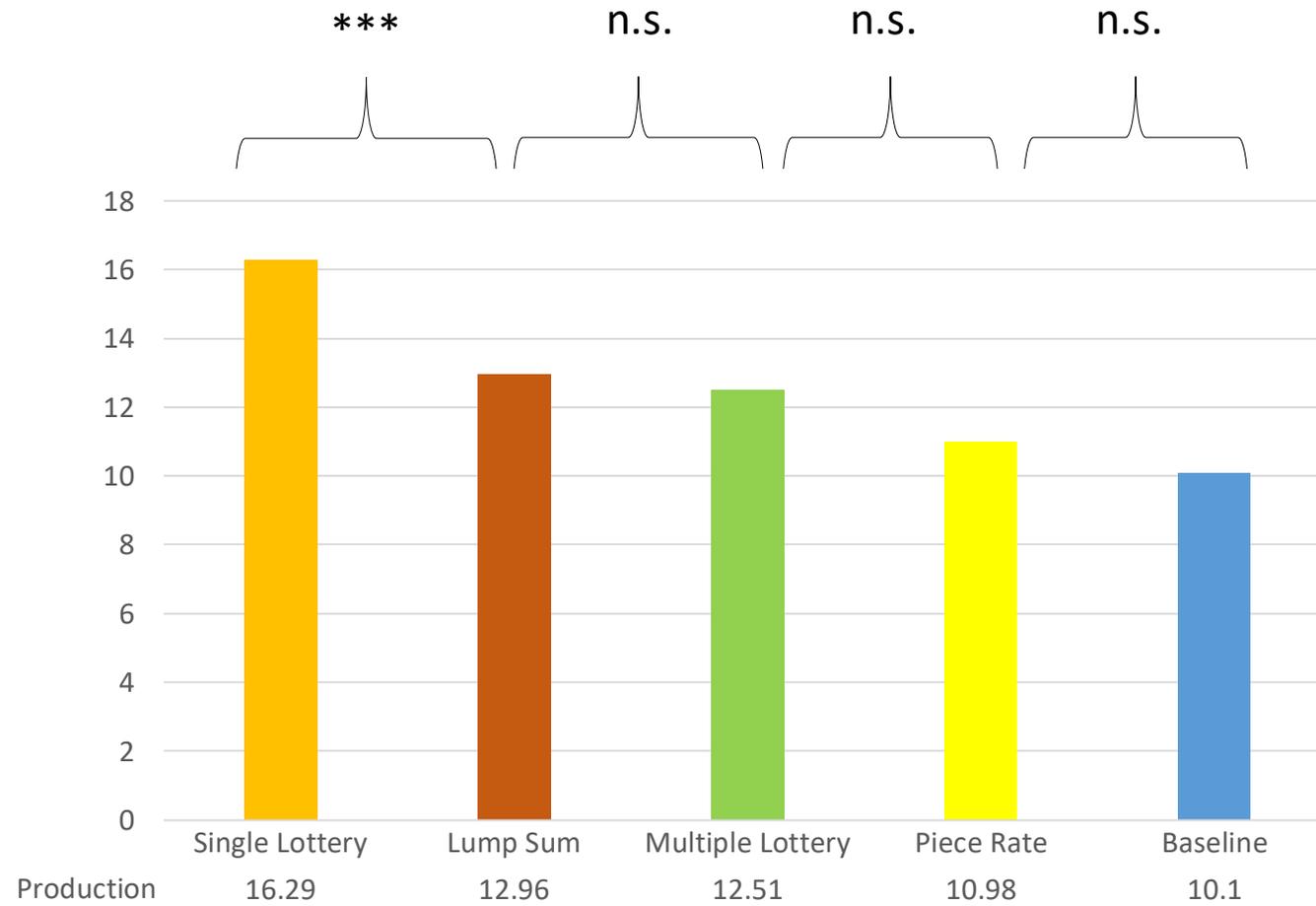




Wilcoxon Rank sum tests

SL > ML = LS = PR > Baseline

.



Wilcoxon Rank
sum tests

SL > ML = LS = PR = Baseline

Regressions

Panel Regression to account for dependence across observations

Dependent Variable: Choice of Math task or
Correct Completion.

- Probit regression

Independent Variables: Treatment dummies.

- No Goal Treatment dropped
- Treatment comparisons presented based on average marginal effects.

SL superior to all the other schemes

- 18pp higher likelihood of choosing math task relative to PR
- 12 pp higher likelihood of choosing math task relative to LS
- 9 pp higher likelihood of choosing math task relative to ML

ML only marginally better than PR and not different for LS.

H1 is partially validated

H2 is validated.

Differences	Experiment 2			
	Motivation		Performance	
	Diff.	p-val.	Diff.	p-val.
SL vs PR	0.18	0.000*	0.19	0.000*
SL vs LS	0.12	0.007*	0.11	0.038
SL vs ML	0.09	0.034	0.12	0.020
ML vs PR	0.09	0.079	0.07	0.167
ML vs LS	0.03	0.542	-0.01	0.825

Conclusions

- A well-designed probabilistic reward scheme can be more effective at motivating work than more traditional, non-probabilistic bonus schemes.

What scheme to use?

- Single Lottery Probabilistic Reward Scheme to be superior to other forms of Probabilistic Reward Schemes.
 - Strong Reference Points:
 - It creates a strong reference point in terms of the performance required to collect all the lottery tickets, as opposed to many weak reference points as in the Multiple Lottery scheme.
 - Risk Reduction and Elimination:
 - Creates a goal-pursuit framework wherein additional work reduces the uncertainty unlike ML
 - Allows for complete risk elimination (Additional experiment showed that SL when it did not resolve risk by 100% (SL+U) lead to worse outcome than the SL treatment presented).

Conclusions

When should SL probabilistic rewards be used?

- United Airlines wanted to introduce Probabilistic Bonuses in 2018
 - replace automatic modest bonuses for all with a lottery to win large prizes for just a few
- The backlash was swift and powerful.
 - Within a few days of the announcement, United Airlines scrapped the plans.
- We recommend that a SL incentive scheme should not replace existing schemes.
 - Should be layered on top of as a bonus compensation.



United Airlines Pauses Lottery for Bonuses After Employees Rebel Online