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As Wages Increase, Do People Work More or Less? A Wage Frame Effect

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Abstract. In jobs in which workers have the flexibility to decide how much work to supply, such as in the gig economy, the effect of a wage change on work supply can be hard to predict. A wage increase offers workers the opportunity to make more money. At the same time, it allows them to make money faster, so they can enjoy more leisure and do not need to work as much. Economic theory alone does not predict which outcome is more likely to occur, and the empirical evidence is also mixed. This paper provides some psychological insights into this economic problem by showing that the short-term effect of a wage change on work supply depends on how the change is framed. Given a current wage of "work l hours to earn \$$m$," a *pay-change* frame ("work the same l hours and earn \$$M$") facilitates a change in work supply in the same direction as the wage change, whereas a *load-change* frame ("work L hours and earn the same \$$m$") facilitates the opposite change. Hence, if strategically framed, a wage decrease can elicit the same increase in work supply as a wage increase. A set of studies demonstrate this wage frame effect on both actual work performance and expressed willingness to work. The findings from these studies offer a behavioral perspective on a classic labor economics problem, document a novel framing effect for the judgment and decision-making literature, and suggest a nudge strategy that managers and policy makers can use in incentive designs.

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1. Introduction

Charlie drives with Uber part time. Driving with Uber is not exactly fun for Charlie. If it were not for the money, he would rather stay home, playing video games or watching television. If there is a sudden increase in Uber's pay scheme, assuming that everything else in Charlie's life remains unchanged, how will Charlie respond to this change? On one hand, he can think of the wage increase as a great opportunity to earn money. On the other hand, now that the wage has increased, he doesn't need to work as much and can have some free time to do things he really enjoys doing. So will Charlie drive longer or shorter hours for Uber after the wage increase occurs?

Economic theory does not make a clear-cut prediction, and the empirical findings are mixed: work supply seems to change in the same direction as the wage change in some cases (e.g., Carrington 1996, Jenkins et al. 1998, Oettinger 1999, Kuvaas 2006, Cohen et al. 2014, Chen and Sheldon 2015, Farber 2015, Stafford 2015) and in the opposite direction in other cases (e.g., Camerer et al. 1997, Fehr and Goette 2007, Crawford and Meng 2011, Klor et al. 2014, Thakral and Tô 2021, Duong et al. 2022). Nevertheless, companies such as Uber justify "surge pricing" as a strategy for increasing the supply of drivers when demand is high, implying that it believes work supply should change in the same direction as the wage change.

In this paper, we apply a psychological approach to this economic problem. Specifically, we propose that the manner in which a wage change is presented can determine the direction of the work supply change in response to the wage change.

By definition, a wage is a pay rate, which comprises a certain payment over a certain workload (Smitizsky et al. 2021). Thus, a wage change can be presented as either a change in the payment or a change in the workload. For example, imagine that Charlie, our Uber driver who usually drove 30 hours and earned $600 a week, experienced a sudden pay rate increase to $30 per hour. To make sense of the new pay rate, Charlie could tell himself, "From now on, if I drive the same 30 hours, I can earn $900," or "From now on, I can drive 20 hours to earn the same $600." We call the former presentation the *pay-change* frame and the latter the *load-change* frame.

From a financial perspective, Charlie's work supply decision should be affected by the wage change itself and not by the presentation of the wage change. Yet, from a behavioral perspective, we posit that the presentation of the wage change can affect Charlie's work supply decision. In multiattribute decisions, the attribute that carries the change appears more prominent and gains more decision weight than the attribute that remains unchanged (Tversky et al. 1988, 1990; Dunn et al. 2003). Because a wage inherently has two attributes, we expect a pay-change frame of a pay rate increase (decrease) to motivate Charlie to work more (less) and a load-change frame of the same pay rate change to motivate him to work less (more).

Stated formally, we propose that the direction of the work supply change depends on whether the wage change is framed as a pay or load change. We predict that a pay-change frame facilitates a work supply change in the same direction as the wage change, and a load-change frame facilitates a work supply change in the opposite direction. We refer to the difference in the work supply change between the two frames as the *wage frame effect*.

We tested the proposed wage frame effect in a series of studies. In two studies reported in the following sections (Sections 2 and 3), we examine how wage frame affects the work supply change with real work and pay. Specifically, Study 1 demonstrates the effect in a carefully controlled laboratory environment with part-time workers who were hired to perform a highly engaged physical task, whereas Study 2 recruited online gig workers to perform a computer-based task and assessed the generality of the wage frame effect. In several additional studies reported in the Online Appendix, we further explore the internal and external validity of the effect. Later (in Section 4), we discuss how these findings situate the idea of wage frame in the literature and life. Additional details can be found in the Online Appendix. Study materials and data files can be accessed at https://osf.io/mn3ax/.

2. Study 1: The Basic Effect

2.1. Method

2.1.1. Participants. This study was conducted by a research laboratory at the Chinese University of Hong Kong. The research laboratory recruited participants by posting a part-time job advertisement, in colloquial Cantonese, on the mailing list of multiple local large public universities. As a result, all respondents were Cantonese-speaking, full-time students and had roughly the same income level.

The advertisement announced a job opportunity for individual assistants to work for a two-part payment: a flat payment for staying for the entire time and a variable payment based on the amount of work the assistant completed. The operational definition of "wage" in this study as well as in Study 2 was a piece-rate wage, that is, a certain amount of payment for a certain amount of effort. In general, the more work the assistant completed, the more money the assistant earned. One hundred thirty-two Hong Kong residents (105 women and 27 men; average age = 20.65 years; all Cantonese speakers) responded to the advertisement and completed the job.

2.1.2. Procedures. The study instructions were delivered in colloquial Cantonese. Each participant worked one-on-one with the experimenter in a study room. The task was to inflate balloons for other studies at the laboratory.

Before each scheduled session, the laboratory manager (i.e., the experimenter) reminded the assistant (i.e., the participant) to wear exercise shoes, that is, no flip-flops, heels, or inflexible dress shoes. Upon the assistant's arrival, the laboratory manager first explained the basics of the job: the task was to inflate empty balloons with a foot-operated pump, and the assistant was required to fill each balloon with 50 pumps and count aloud while pumping.[1] The laboratory manager showed the assistant how to perform the task (Figure 1). After that, the assistant was required to try using the balloons and tools in the same manner as the laboratory manger so that the assistant could perform the task fluently when the compensated work sessions began. This hands-on training was a necessary procedure to ensure that all participants performed the same physical task. As a result, an ostensibly complicated balloon-pumping task was actually a simple foot-stomping exercise. Because of the minimal speed–accuracy trade-off in foot stomping, the number of balloons a participant completed was a direct and efficient measure of work supply.

After the training, there were two compensated work sessions, each lasting 15 minutes, with a two-minute mandatory break in between. Before session 1, the laboratory manager announced a pay rate (e.g., "HK$4 per 10 balloons") and gave the assistant a big box of balloons. The laboratory manager made it clear that it was impossible for anybody to finish the entire box, so the assistant should freely decide how many balloons to complete, and the assistant would be paid accordingly. When working on the balloons, the assistant could speed up,

Figure 1. (Color online) An Illustration of the Balloon Pumping Task in Study 1

Notes. To ensure that the balloon-pumping task was essentially a foot-stomping exercise, the laboratory manager showed the assistant how to perform the task before the work sessions, including a full demonstration. In the demonstration, the laboratory manager always stayed close to the balloons with one foot on the pump and one hand holding the nozzle of the pump. He grabbed a new balloon with his free hand, inserted the nozzle into the balloon and held the balloon securely with both hands while pumping and counting. When approaching the last pump, he took one hand off the balloon to grab a stick/holder. On the last pump, he pushed the holder around the tail of the balloon to secure it. After that, he let go of the balloon without letting go of the nozzle, and smoothly moved onto a new balloon. The laboratory manager made it clear to the assistant that the assistant should feel free to stand or sit when pumping, whichever the assistant found more comfortable, and that the assistant could use either foot or switch feet whenever the assistant wanted.

slow down, or take a break whenever the assistant wanted.

During the work sessions, the laboratory manager monitored the assistant and recorded work performance on a sheet of paper but did not talk to the assistant. After session 1, the laboratory manager informed the assistant of the number of balloons completed and the assistant's total earnings for session 1. This procedure was designed to eliminate possible confusion about the pay scheme before the manipulation occurred (e.g., one might mistakenly believe one got paid for every 10 balloons rather than for each balloon). If the assistant showed any confusion, the laboratory manager clarified it promptly. At the end of the break, the laboratory manager announced a change in the pay rate, which contained the wage frame manipulation and let the assistant proceed to session 2. Session 2 used the same experimental procedures as session 1 other than the change in the wage. At the end, the assistant was compensated based on the assistant's performance in both sessions and was debriefed about the study.[2]

2.1.3. Experimental Design. The study adopted a 2 (direction of wage change: wage increase versus decrease) $\times$ 2 (wage frame: load versus pay change) between-subjects factorial design. The wage increase and decrease conditions shared the same overall rate but had the opposite direction of change; thus, the pay rate in all conditions was fully crossed.

The wage frame manipulation was communicated as follows: In the wage increase conditions, the pay rate increased from "HK$4 per 10 balloons" to either "HK$4 per 5 balloons" (the load-change frame) or "HK$8 per 10 balloons" (the pay-change frame). In the wage decrease conditions, the pay rate decreased from "HK$4 per 5 balloons" to either "HK$4 per 10 balloons" (the load-change frame) or "HK$2 per 5 balloons" (the pay-change frame). As pretested (and confirmed by the study results), the average person can pump many more than 5 or 10 balloons in 15 minutes, so it was unlikely that assistants adopted the number in the wage information as a performance target (e.g., five balloons in a session).

All participants were randomly assigned to one of the four conditions, and the experimenter (i.e., the laboratory manager) tracked the amount of time the participant (i.e., the assistant) spent on each balloon and the total number of balloons completed throughout each session.

2.2. Results and Discussion

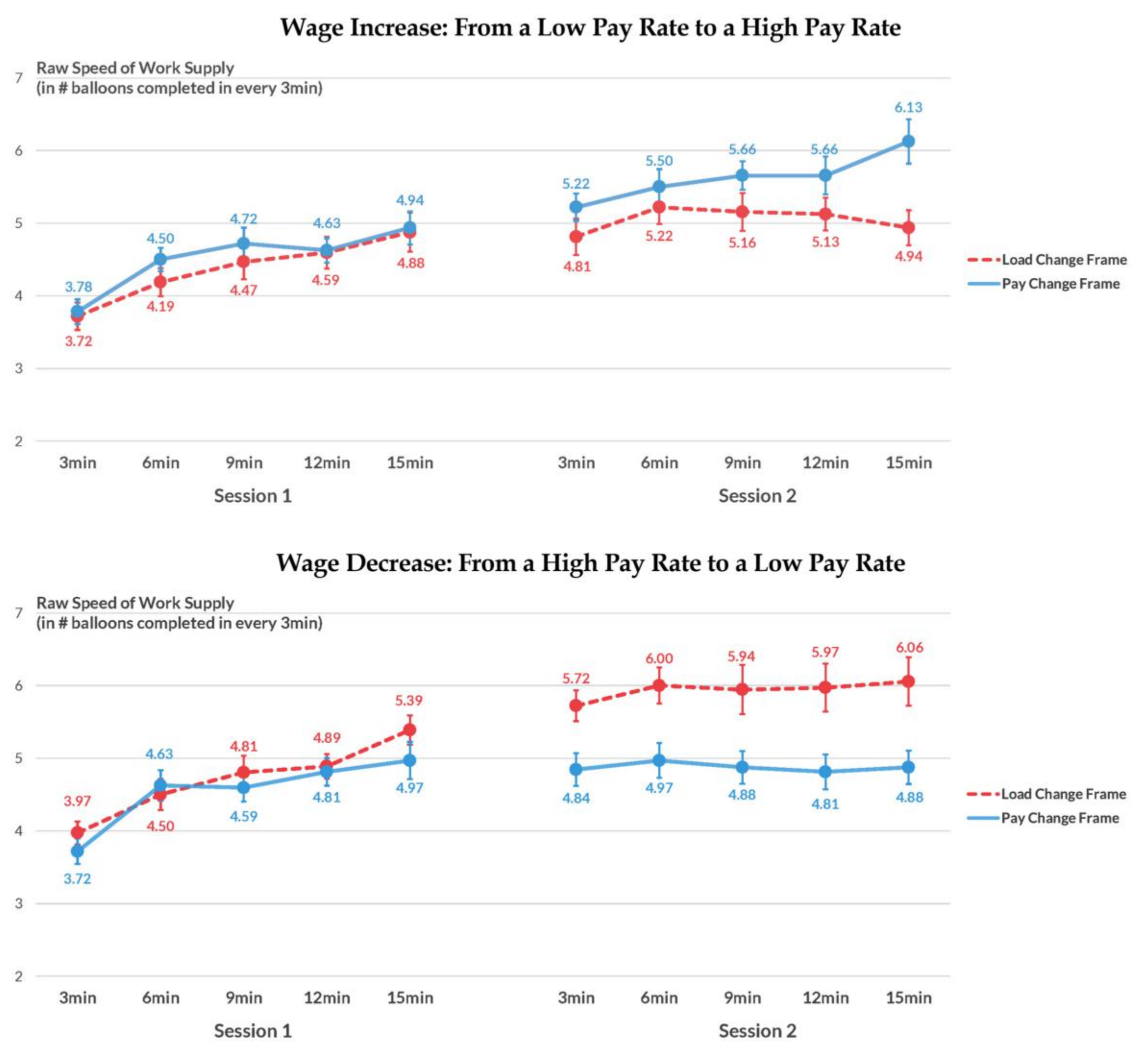
2.2.1. Predictions Revisited. We denoted ΔWS as the change in each individual worker's work supply after the wage change, that is, the difference in work supply between sessions 1 and 2. Then, for each wage change, we averaged ΔWS within each wage frame condition to yield $\Delta WS_{\text{pay-change}}$ and $\Delta WS_{\text{load-change}}$, that is, the effects of the pay- and load-change frames on the work supply change after a given wage change. Finally, we defined the wage frame effect, WF, as the difference between $\Delta WS_{\text{pay-change}}$ and $\Delta WS_{\text{load-change}}$ of the same wage change. In other words, the wage frame effect we hypothesized is a difference in differences.

If workers responded to the presentation of the wage change, then we would expect that different wage frames would not lead to different work supply changes, and $WF = 0$. Meanwhile, a nonzero WF indicates that the wage frame did affect the work supply change. Specifically, we predicted that WF would be positive when the wage change was positive (i.e., in the wage increase conditions) and negative when the wage change was negative (i.e., in the wage decrease conditions).

2.2.2. Work Supply Change. The primary dependent variable in this study was ΔWS at the individual worker level. Figure 2 presents the model-free work performance results. The graphs depict the number of balloons completed within each three-minute interval in each session. Averaging across all participants, we found that performance increased by 18.8 percentage points from sessions 1 to 2, likely representing a practice effect (e.g., improvement in hand–foot coordination). In order to focus on and evaluate the impact from wage frame precisely, we adjusted each individual worker's session 1 work performance by +18.8 percentage points when estimating ΔWS and WF. (Model-free evidence yielded the same conclusions. We report those results in the Online Appendix.)

We found that the workers responded not only to the wage change, but also the presentation of the wage change. In particular, we found a positive wage frame effect of 2.05 balloons per session in the wage increase conditions ($WF_{\text{wage increase}} = +2.05$, standard error ($SE$) = 0.72; $t(62) = 2.85$, $p = 0.006$, 95% confidence interval (CI) = [0.64, 3.46]) and a negative wage frame effect of −4.33 balloons per session in the wage decrease conditions ($WF_{\text{wage decrease}} = -4.33$, $SE = 1.14$; $t(66) = 3.80$, $p < 0.001$, 95% CI = [−6.56, −2.10]). Both results lend support to our propositions. Intriguingly, the wage frame effect appeared to be about twice as strong in the wage decrease conditions as in the wage increase conditions, consistent with other gain–loss asymmetries (Tversky and Kahneman 1992).

Figure 2. (Color online) Work Supply over Time in Study 1



Notes. Graphs depict the average number of balloons completed during every three-minute interval in each session and condition. Session 1 in the wage increase condition and session 2 in the wage decrease condition shared the same low pay rate, whereas session 2 in the wage increase condition and session 1 in the wage decrease condition share the same high pay rate. The wage frame effect appeared robust in both the wage increase and decrease conditions and consistent throughout session 2. Error bars indicate the standard error of the mean for each three-minute interval of each session in each condition.

Next, we evaluated the separate effects of the pay- and load-change frames. We observed that, when the wage increased, work supply also increased if the wage increase was communicated in the pay-change frame ($\Delta WS_{\text{increase, pay-change}} = +1.36$, $SE = 0.50$; $t(31) = 2.70$, $p = 0.01$, 95% CI = [0.37, 2.35]) but directionally decreased if it was communicated in the load-change frame ($\Delta WS_{\text{increase, load-change}} = -0.69$, $SE = 0.51$; $t(31) = -1.35$, $p = 0.19$, 95% CI = [−1.70, 0.32]). Similarly, when the wage decreased, work supply also decreased if the wage decrease was communicated in the pay-change frame ($\Delta WS_{\text{decrease, pay-change}} = -2.60$, $SE = 0.83$; $t(31) = 3.15$, $p = 0.004$, 95% CI = [−4.22, −0.98]) but increased if it was communicated in the load-change frame ($\Delta WS_{\text{decrease, load-change}} = +1.72$, $SE = 0.78$; $t(35) = 2.20$, $p = 0.03$, 95% CI = [0.19, 3.25]). Put differently, the wage decrease, if framed strategically, generated almost the same work supply increase as did the wage increase ($\Delta WS_{\text{decrease, load-change}} = +1.72$ versus $\Delta WS_{\text{increase, pay-change}} = +1.36$). Together, these results lend support to our theoretical propositions that the pay-change frame facilitates a work supply change in the same direction as the wage change, and the load-change frame facilitates a work supply change in the opposite direction.

When evaluating the separate effects of the pay- and load-change frames, we noticed that the absolute work supply in session 1 was roughly the same in all conditions even though the assistant enjoyed a higher pay rate in some conditions. We suspect this result may be due to scope insensitivity (Hsee and Rottenstreich 2004); that is, at the beginning, the balloon-pumping workers could not evaluate how good or bad their pay rate was (Hsee et al. 2009, Morewedge et al. 2009). Then, in session 2, they became sensitive to the magnitude of their pay rate as the old pay rate rendered the new pay rate evaluable (Ariely et al. 2003, Shen and Hsee 2017; see Hsee and Zhang 2010 for a review). That said, as with our observation of gain–loss asymmetry in the wage frame effect, this observation is intriguing but not central to our propositions.

2.2.3. Work Supply Speed. To explore whether the wage frame had a sustained impact on the work supply change, we focus on session 2. If the impact of the wage frame were transient, then we should have observed a noticeable difference in work supply between the two wage-frame conditions in the first interval of session 2, and the difference should have diminished in subsequent intervals. What we observed, however, was that the wage frame caused a systematic difference throughout session 2 in both the wage increase and decrease conditions ($WF_{\text{increase}} = +2.91$, $SE = 1.52$; $t(62) = 1.91$, $p = 0.06$, 95% CI = [−0.07, 5.89]; $WF_{\text{decrease}} = -5.32$, $SE = 1.60$; $t(66) = 3.32$, $p = 0.001$, 95% CI = [−8.46, −2.18]), including a significant and strong effect at the end of the session (the fifth three-minute interval in session 2: $WF_{S2P5,\text{ increase}} = +1.19$, $SE = 0.39$; $t(62) = -3.06$, $p = 0.003$, 95% CI = [0.43, 1.95]; $WF_{S2P5,\text{ decrease}} = -1.18$, $SE = 0.40$; $t(66) = 2.98$, $p = 0.004$, 95% CI = [−1.96, −0.40]). Thus, we conclude that the impact of wage frame on the work supply change was robust and consistent throughout the session.

2.2.4. Summary. Study 1 shows that workers respond to not only the wage change, but also the presentation of the wage change. When a new wage is framed as a pay change, work supply changes in the same direction as the wage change; when a new wage is framed as a load change, work supply changes in the opposite direction. The findings in Study 1 further suggest that, before communicating a wage change, incentive designers should be mindful about the selection of its wage frame. For example, a wage decrease, if communicated in the load-change frame, can generate almost the same boost in work supply as an equivalent wage increase communicated in the pay-change frame. Incentive designers can tailor the wage frame they use to the situation and firm goals. For example, instead of firing workers after a minimum wage increase, the firm could use a load-change frame to nudge workers to work less.[3]

3. Study 2: Two Complementary Tests, One Wage Frame Effect

Study 2 extends the wage frame effect in three directions. First, it examines the wage frame effect with a different worker population and a less controlled setting than the laboratory in Study 1. In particular, Study 2 uses the fact that Amazon's Mechanical Turk (MTurk) is a real labor market in which we can investigate the work supply preferences of real workers. Because MTurk workers can freely decide how much work to supply at any point, this labor market not only offers diversity in initial work supply preferences but also grants workers the flexibility to adjust their work supply at any time in response to a wage change—precisely the conditions necessary for the effect we study. We expected to observe the wage frame effect in this labor market, too.

Second, Study 2 expands the scope of examination of the new wage design. One might wonder whether the wage frame effect depends on the numerical cues embedded in the new wage and further expect the effect to vary with the numerical cues or disappear when numbers are removed. In Study 1 the numbers (e.g., five balloons) in the wage design were set much lower than the work any worker would reasonably supply in one session (e.g., 30 balloons). To complement Study 1 in which numbers were too low to be feasible performance goals, Study 2A employs numbers that are too high to be feasible performance goals, whereas Study 2B employs numbers that are within the feasible range and can serve as a reasonable performance goal. We expected to observe the wage frame effect in both tests. In a follow-up, we further investigated a wage change that could be described verbally, hence containing no numerical cues, with the same work task as in the main studies to conclude our examination of the new wage design.

Third, Study 2 explores an additional test of the wage frame effect. In Study 1, we randomly assigned workers to the wage frame conditions *after* they completed the first session, thereby minimizing noise before the wage-change/wage-frame manipulation. Theoretically, however, we should be able to replicate the wage frame effect in an alternative design: the wage frame manipulation occurs *before* workers start the first session such that the initial pay rate differs between wage frame conditions. Then, the wage-change manipulation occurs, and the final pay rates are identical. In Studies 2A and 2B, we added a second load-change frame condition that had the same final pay rate as the pay-change frame condition. In each study, our primary test compares the two standard wage frames (with the same initial pay rate), and our secondary test compares the same pay-change frame with the second load-change frame (with the same final pay rate). We expected to observe the wage frame effect in both tests.

3.1. Method

3.1.1. Participants. Across Studies 2A and 2B, 524 MTurk workers (240 women and 284 men; average age = 37.65 years; all English speakers in the United States) completed our work contract; 489 successfully followed the study instructions and passed the attention checks. Importantly, we did not observe meaningful differences in work attrition across the wage frame conditions in any of the studies. (For more details on attrition, see the Online Appendix.)

3.1.2. Design. In an online computer program, workers submitted food orders by selecting all food items on a web page. They earned points by submitting orders, and they could freely choose how many orders to submit. All workers went through two five-minute work sessions with a 30-second break in between, and a change in the point scheme occurred during the break. Table 1 summarizes the point schemes in Study 2.

3.1.3. Procedures. For simplicity, we report the full procedures for the pay-change frame condition in Study 2A. All conditions in Studies 2A and 2B share experimental procedures unless otherwise noted.

3.1.3.1. Recruitment and Training. To avoid unobservable self-selection in the initial stage, we recruited workers via a generic advertisement for a computer-based job. All workers were required to use a computer or laptop with a mouse to respond to our recruitment advertisement; no tablets or other mobile devices were allowed. After completing the unrelated survey, all were given an opportunity to earn a separate payment by taking on a different task: "By working on this task, you will receive some points, and all points will be exchanged into an additional bonus at the rate of ten points to one cent at the end of the study. This study will take a few minutes. You don't have to work on it if you don't want to. But once you start working on it, you need to stay until the end." Those who accepted our work contract became our workers.

First, our workers received training on how to complete the task: "You will work on a job that asks you to place food orders. One order includes 16 food items. Once you check all 16 food items on the page, the system will submit your order automatically." To familiarize themselves with the task, the workers completed two trial orders (Figure 3). In both the training and work sessions, the system displayed the order count after each order was submitted.

As in Study 1, we made sure that the physical requirement of the task—to click the computer mouse repeatedly—was simple enough to both avoid accuracy–speed trade-offs and minimize individual variance across workers. As a result, the number of orders a participant completed was a direct and efficient measure of work supply.

3.1.3.2. Work Sessions. Workers first read that they had five minutes to place orders at whatever speed they wanted. They were also reminded of the work contract they accepted, namely, that they could not leave the system or work on another computer-based job at the same time.

Then, the workers received the point scheme, "90 orders and 1800 points" (this information varied by condition; see Table 1), and started session 1. After five minutes, the session ended, and the workers took a mandatory 30-second break. As in Study 1, during the break, the workers saw a summary of their session 1 work performance and then received a new point scheme for session 2, "90 orders and 2400 points" (this information varied by condition; see Table 1).

3.2. Results and Discussion

3.2.1. Work Supply Change. The task in Study 2 was essentially a mouse-clicking finger exercise, so we took the same approach as in Study 1 to account for the baseline performance change when estimating ΔWS and WF in each study. Also as in Study 1, the dependent variable was ΔWS at the individual-worker level, and we examined WF as the difference in ΔWS between the pay-change frame and the relevant load-change frame condition.

Studies 2A and 2B included different numerical cues in the wage information. However, we gathered similar observations across the two studies. In Study 2A,

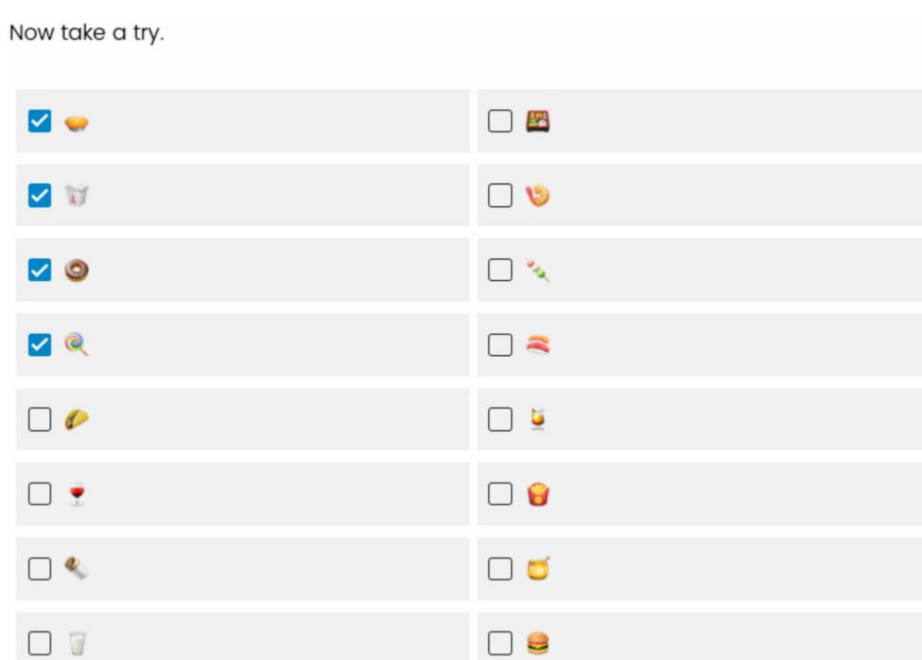
Table 1. The Design of All Conditions in Study 2

	Session 1	Session 2
Study 2A (N = 227)		
Pay-change frame	90 orders and 1,800 points	90 orders and 2,400 points
Load-change frame	90 orders and 1,800 points	68 orders and 1,800 points
Load-change frame 2	120 orders and 2,400 points	90 orders and 2,400 points
Study 2B (N = 376)		
Pay-change frame	30 orders and 600 points	30 orders and 800 points
Load-change frame	30 orders and 600 points	23 orders and 600 points
Load-change frame 2	40 orders and 800 points	30 orders and 800 points

we found a significant wage frame effect of 3.29 orders in the primary test (i.e., the comparison between the pay-change frame condition and the standard load-change frame condition; $WF = +3.29$, $SE = 1.49$; $t(112) = 2.21$, $p = 0.029$, 95% CI = [0.37, 6.21]; $\Delta WS_{pay\text{-}change} = +1.56$, $SE = 0.74$; $t(59) = 2.11$, $p = 0.039$, 95% CI = [0.11, 3.00]; $\Delta WS_{load\text{-}change} = -1.73$, $SE = 1.34$; $t(53) = 1.29$, $p = 0.20$, 95% CI = [−4.36, 0.90]). In the secondary test, we observed a directional but not statistically significant wage frame effect of 1.56 orders (secondary $WF = +1.56$, $SE = 1.22$; $t(122) = 1.28$, $p = 0.20$, 95% CI = [−0.83, 3.94]; $\Delta WS_{load\text{-}change\text{-}2} = -0.001$, $SE = 0.95$; $t(63) = 0.001$, $p = 1.00$, 95% CI = [−1.87, 1.87]). Similarly, in Study 2B, we found a marginally significant wage frame effect of 1.75 orders in the primary test ($WF = +1.75$, $SE = 1.04$; $t(217) = 1.69$ $p = 0.093$, 95% CI = [−0.28, 3.78]; $\Delta WS_{pay\text{-}change} = +0.81$, $SE = 0.64$; $t(130) = 1.25$, $p = 0.21$, 95% CI = [−0.45, 2.07]; $\Delta WS_{load\text{-}change} = -0.94$, $SE = 0.83$; $t(87) = 1.14$, $p = 0.26$, 95% CI = [−2.56, 0.68]). In the secondary test, we again observed a directional wage frame effect of 1.06 orders (secondary $WF = +1.06$, $SE = 1.01$; $t(221) = 1.05$, $p = 0.30$, 95% CI = [−0.92, 3.04]; $\Delta WS_{load\text{-}change\text{-}2} = -0.25$, $SE = 0.78$; $t(91) = 0.32$, $p = 0.75$, 95% CI = [−1.78, 1.28]).

As Studies 2A and 2B share identical procedures and their results bore no material difference ($t(485) = 1.37$, $p = 0.171$), we collapsed the two studies and repeated the analyses. As before, we found a robust wage frame effect in the primary test ($WF = +2.29$, $SE = 0.84$; $t(485) = 2.71$, $p = 0.007$, 95% CI = [0.64, 3.95]) and a less robust but directionally consistent effect in the secondary test (secondary $WF = +1.11$, $SE = 0.88$; $t(485) = 1.26$, $p = 0.209$, 95% CI = [−0.62, 2.84]). Notably, in the primary test, participants were treated exactly the same until they received the wage-change and wage frame manipulations

Figure 3. (Color online) An Illustration of the Food Order Task in Studies 2A and 2B



Notes. To ensure that the food-ordering task was essentially a mouse-clicking task, the program told the participants "You will work on a job that asks you to place food orders. One order includes 16 food items. Once you check all 16 food items on the page, the system will submit your order automatically."

together. However, in the secondary test, the wage frame manipulation occurred separately from and before the wage-change manipulation, which we suspect increased its vulnerability to potential issues, such as scope insensitivity in session 1 (see Section 2.2) and other differences, including a wealth difference after session 1 (see Section 4.2).

3.3. The Follow-Up Study: No Numerical Cues

Can the wage frame effect occur completely independently from numerical cues? We explored this possibility in a follow-up study. It adopted identical experimental procedures as those in the main studies except that (a) the task required fewer units of effort (six mouse clicks per order instead of 16) and (b) the raise was more generous (pay rate doubled from two points per order to four points instead of an increase from 1:20 to 1:26.6667). This study focused on the pay- and load-change frames in our primary test. Workers in both conditions received "2 points for each order" in session 1. Then, before session 2, they were told about the raise in their point scheme: in the pay-change frame condition, workers could complete the same number of orders as before and earn *double* the points; in the load-change frame condition, workers could complete *half* the number of orders as before and earn the same number of points. In other words, we described the new wage verbally without any numbers. We also included a no-change control condition in which workers performed the same task but received "2 points for each order" in both sessions. We used this group to construct a performance baseline for model estimation. Two hundred seventy-one MTurk workers (122 women and 149 men; average age = 35.52 years; all English speakers in the United States; AsPredicted #40614) completed our work contract, experienced no technical issues, and passed the attention checks.[4] Here, we focused on these workers, whereas in the Online Appendix, we report work attrition details and robustness checks with different exclusion criteria.

Without numerical cues in either wage frame, we again found a significant wage frame effect of 7.30 orders ($WF = +7.30$, $SE = 2.60$; $t(206) = 2.81$, $p = 0.005$, 95% CI = [2.20, 12.41]; $\Delta WS_{pay\text{-}change} = +5.89$, $SE = 1.54$; $t(110) = 3.82$, $p < 0.001$, 95% CI = [2.87, 8.91]; $\Delta WS_{load\text{-}change} = -1.41$, $SE = 2.15$; $t(96) = 0.65$, $p = 0.514$, 95% CI = [−5.64, 2.81]). In addition, we noticed that the size of the wage frame effect was larger in this study than in both Studies 2A and 2B even though the workers went through similar experimental procedures. The difference may be attributable to the lower effort requirement and higher pay rate or the verbal nature of the wage frame.

Eliminating numerical cues in the wage-change information, this follow-up study demonstrates that the wage frame effect can occur independent of numerical cues. However, we acknowledge that not all wage changes can be described verbally. Nevertheless, a smart incentive design does not have to eliminate numerical cues and can even capitalize on the psychological impact from some specific numerical cues to facilitate the wage frame effect. In Section 4, we discuss this possibility further.

3.4. Summary

As with Study 1, Study 2 also demonstrates the wage frame effect with real work and pay. Whereas Study 1 shows the basic effect, Study 2 extends the effect and assesses its generality via different tests. The findings from these tests suggest that a wage frame can work in a less controlled experimental environment. Additionally, numeric cues in the new wage information operating as performance targets do not appear to drive the effect. In fact, we find that that the wage frame effect sustains whether the new wage information contained numeric cues. Nevertheless, separating the wage change and frame, as the secondary test did, weakened—neither eliminated nor reversed—the impact of the wage frame.

4. General Discussion

As wages increase, do people work more or less? In this research, we drew inspiration from the psychology literature to work on this classic labor economics puzzle. In the two studies reported in this paper, we demonstrate that the wage frame can alter the work supply decision; a pay-change frame facilitates a work supply change in the same direction as the wage change, and a load-change frame facilitates a work supply change in the opposite direction as the wage change. We examined this wage frame effect with real work and pay among experiment participants. In additional studies (all reported in the Online Appendix), we measured work supply intention, and we replicated the wage frame effect in natural work settings. For example, in a preregistered study, we interviewed MTurk workers about their actual work situations (e.g., current hours per week, household income) and then asked about their willingness to work (number of hours per week) if MTurk doubled their pay rate; we presented the new pay rate in either a pay- or load-change frame (additional study 1: $n = 989$, AsPredicted #30183). Replicating the previous findings, we find that, controlling for individual differences (e.g., current hours per week, household income), the pay-change frame generated 7.18 more hours of intended work per week than did the load-change frame. In another preregistered study involving MTurk workers, we replicated the wage frame effect in wage decrease conditions as well as wage increase conditions (additional study 1 follow-up: $n = 748$, AsPredicted #30674).

Next, we discuss our views on the psychology that may drive the wage frame effect and several theoretical stretches concerning the ecological validity of the effect. Finally, we reflect on how the idea of wage frame relates to the literature and life.

4.1. Psychological Insights into the Wage Frame Effect

The work supply problem has its roots in the tension between money and leisure. A basic tenet of labor economics is that, if a worker works more, the worker makes more money but has less leisure and vice versa. Thus, for any given pay rate, a worker sets the work supply so that the worker earns enough money for the level of life quality the worker desires (i.e., consumption, which is assumed to require only money and not time) yet reserving enough free time for the activities the worker enjoys. But this balance between money and leisure may shift when a wage change occurs, holding other economic variables, such as consumption prices, constant.

To make the work supply decision more predictable, we consider a way to ease the tension between money and leisure. Cognitive psychology research shows that changes can attract attention (Yantis and Jonides 1984, Franconeri and Simons 2003), induce deliberation (Houston and Sherman 1995), and hence gain decision weight (Tversky 1972, Hodges 1997, Schkade and Kahneman 1998, Dunn et al. 2003). As a wage frame features either payment (money) or workload (leisure) as the change attribute, that attribute can appear more prominent and activate a decision weight shift. That is, after a wage change, workers may place more weight on money if the wage change is in the pay-change frame and on leisure if it is in the load-change frame. Future research in cognitive psychology and neuroscience may investigate how this attribute shifting process operates in the brain and examine causal relationships among wage frame, attribute weight shift, and work supply.

Some other psychological mechanisms, though not directly relevant to the fundamental tension between money and leisure, also offer practical suggestions for strategic incentive designs. For example, workers may have an innate tendency to match numbers, especially significant or round numbers (Pope and Simonsohn 2011). We suggest that managers can capitalize on this tendency when selecting the number configuration in the wage frame. As another example, subtle communication cues can suggest social norms (Schultz et al. 2007). For additional discussion of alternative mechanisms, see the Online Appendix.

4.2. Thoughts on Ecological Validity

How can we generalize the wage frame effect to the world? One open question is about the impact of wage frames in the long run. We first note that our data does not directly speak to long-run impacts. When comparing the effects of different wage frames, our studies always held everything else constant as much as possible, but in the long run, one cannot assume this is the case. In particular, wealth can differ as a direct consequence of the short-run wage frame effect's impact on the amount of work completed. In addition, workers may also encounter multiple wage frames or compare notes with other workers, making the long-run effect harder to predict.

Another question concerns the permanence of the wage change. The studies we report so far focus on generic wage changes, in which the application duration is unspecified. Generic wage changes are common, but transient and permanent wage changes also exist. For example, in surge pricing, a bump in the pay rate is guaranteed for only a short period, and afterward, the pay rate may or may not change back. In other cases, a raise is guaranteed to remain. In a forward-looking labor supply model, the period for which a wage change applies can be critical to the worker's work supply decision, so we conducted an additional investigation into the potential distinct effects of transient and permanent wage changes. Preliminary evidence from a vignette study on willingness to work (additional study 2: $n = 603$, AsPredicted #17273) suggests that the wage frame effect is replicated in both transient and permanent wage changes. We encourage future research to further test different types of wage changes in a natural labor market.[5]

The gig economy is one labor market in which wage frames may be particularly useful. First, gig jobs are inherently short-term jobs, and our research concerns the short-term effect of wage frame on work supply. Second, gig workers, such as Uber drivers and MTurk workers, can freely choose how much work to supply; for example, an Uber driver can decide to drive 10 hours one week and 20 hours the next with no breach of contract. Thus, compared with traditional salaried or hourly employees, gig workers have more flexibility to respond to wage changes. Third, gig managers have the freedom to construct and communicate the pay rate. Most big, established gig economy firms, such as Uber, automatically collect extensive data on their workers, so it is feasible for managers to design wage frames for individual workers. Meanwhile, small businesses (e.g., the laboratory in Study 1) and individual employers (e.g., the researchers conducting MTurk studies in Study 2) often monitor workers' performances closely, and it likely would not require much additional effort to personalize the frame of a pay rate change for each worker. Our findings can also provide some guidelines for inexperienced managers, in big or small businesses, on how to strategically design and effectively communicate incentive schemes.

4.3. Contributions to the Literature and Life

Theoretically, this research not only complements the judgment and decision-making literature on constructed preferences (e.g., Tversky and Kahneman 1981, Soman 2004, Lichtenstein and Slovic 2006, Keren 2011), but also extends it to a novel context: the labor market. Practically, this research suggests that a carefully designed wage frame, as with other behavioral nudge strategies (Thaler and Sunstein 2008), can be both libertarian and paternalistic.

4.3.1. Constructed Preferences in Multiattribute Decision Making. Our research findings suggest that work preferences can be constructed and even be subject to preference reversals. Previous research finds preference reversals in various decision contexts; examples include the probability of winning and the size of the payoff (e.g., Slovic and Lichtenstein 1968; Lichtenstein and Slovic 1971, 1973), currency and nominal value (e.g., Wertenbroch et al. 2007, Shen and Urminsky 2013), price and quality (e.g., Simonson 1989), cost and usage (e.g., Larrick and Soll 2008, Reyna and Brainerd 2008), and time and money (e.g., Zauberman and Lynch 2005, Smitizsky et al. 2021). These preference reversals are frequently explained by the prominence principle: because the two seemingly equivalent circumstances can mark different attributes as the prominent attribute and the prominent attribute can receive more weight in the decision, changing the prominent attribute can lead to different decisions (Tversky and Thaler 1990, Tversky et al. 1990). In our case, a wage change is either a pay or load change, the change attribute appears prominent, and prominence constructs preference.

4.3.2. Framing in Labor Economics. The idea of the wage frame also makes unique contributions to the labor supply problem in the economics literature. In labor economics, the substitution and income effects make competing predictions about the impact of a wage increase on work supply. A wage increase has two simultaneous consequences that lead to opposing predictions. On one hand, the opportunity cost of leisure increases, so it seems that labor should increase and leisure should decrease (the substitution effect). On the other hand, workers can earn the same income with less labor, so it seems that labor should decrease and leisure should increase (the income effect). Whether the substitution or income effect dominates after any given wage change is not clear. However, if we know the workers' relative decision weights—whether they care more about money or leisure—then we can predict whether they will supply more or less work. This is when framing comes to our aid: the pay-change frame can make money considerations more accessible, leading to the substitution effect, whereas the load-change frame can make leisure considerations more accessible, leading to the income effect. In other words, we believe that framing does not create a new perspective; rather, it provides easy access to an existing perspective.

4.3.3. Nudge in Life. If we can appreciate the idea of a wage frame, then we can see lots of things in the real world that we did not see before. For instance, wage frames may well reconcile the seemingly contradictory findings from New York City's taxi drivers (Camerer et al. 1997) and Uber drivers (Chen and Sheldon 2015). Whereas NYC taxi drivers seemed to work shorter hours on rainy days, Uber drivers apparently worked longer hours at high surge times. However, our findings may provide a plausible explanation for the discrepancy in those results.

Let us consider the wage frame in each case. The NYC taxi drivers could easily have adopted the load-change frame (e.g., "Today, I earned my $200 target income in six hours rather than the usual eight hours") because they had to pay the cab company a fixed daily fee for leasing the cab, and rainy days offered *fast* money. By contrast, Uber drivers received notifications about the wage change in a default frame—conceptually, a pay-change frame—so the surge appeared to offer *good* money. As our research suggests, different wage frames can lead to different work supply decisions after a wage change.

We wish to point out that our wage frame perspective neither disputes nor replaces the mental-accounting perspective in the NYC taxi driver case. In fact, they are complementary. Mental accounting can explain which wage frame is activated; for example, those who had to pay a fixed daily fee for leasing the cab would mentally frame a rainy-day pay rate increase as a load change. Our theory may help explain the rest: from the wage frame, via an attribute weight change, to the work supply decision. In the end, we hope the idea of the wage frame not only puts wages in frame, but also puts the classic labor economics problem in perspective.

Endnotes

[1] The required "counting aloud" procedure did not interfere with work supply because assistants could count faster in their native language than they could pump. As it is quite time-consuming to verbalize 50 numbers in English, non-Cantonese-speaking readers might worry that counting aloud would slow down pumping. However, colloquial Cantonese uses one syllable—often short and crisp—to represent each digit, including 10. Moreover, repetitions in colloquial Cantonese are often counted as "1, 2, 3, 4, 5, 6, 7, 8, 9, 10; 2, 2, 3, 4, 5, 6, 7, 8, 9, 10; 3, 2, 3, 4, 5, 6, 7, 8, 9, 10; 4, 2, 3, 4, 5, 6, 7, 8, 9, 10; 5, 2, 3, 4, 5, 6, 7, 8, 9, 10."

[2] The experimental procedures in this study provided us with a great deal of control over details in the environment (e.g., room temperature) and the task (e.g., how the participant coordinated hands and whether the participant wore work-friendly shoes)—more experimental control than any standard online work environment such as the one we use in Study 2. In addition, because the participant was in a one-on-one session with the experimenter, the experimenter could answer additional questions about the nature of the task and the pay scheme when monitoring performance throughout the session. These factors could accentuate the effects of the wage frame.

[3] As a method, the wage frame can also potentially be used for bad ends, such as labor exploitation. This is a common problem among

other nudge strategies as well (Thaler and Sunstein 2008). We recommend nudging for good.

[4] The attention check pass rate was lower in this study than in the main studies, but most of the failures (49 out of 95) were in the no-change condition. Because we used the same attention checks across all conditions for the sake of consistency, some checks may have been ambiguous to those in the no-change condition. Nevertheless, the performance results for this condition are not qualitatively different when we include those who failed the attention checks. Most importantly, we used data from this condition only to attain a performance baseline. We did not hold a hypothesis for the performance in this condition.

[5] We also tested how a default frame (e.g., "$30 per hour") affects the work supply change. The default frame is the most prevalent wage expression in the labor market. Whereas it might seem that the default frame has no frame, we found that the effect of the default frame on willingness to work was in the same direction as the pay-change frame and different from the effect of the load-change frame. These findings suggest that the default frame may operate via a similar mechanism as a pay-change frame. As the default frame holds the load (per hour) constant and changes the pay ($20 to $30), it is likely a pay-change frame, conceptually speaking. Perhaps no wage change exists without a frame.

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