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THE RELATIONSHIP BETWEEN ECONOMIC VALUE OF TIME AND FEELINGS OF TIME PRESSURE

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The issue of time pressure concerns both scholars and the general public. We conducted 2 experiments in which university students (67 participants in Experiment 1, 69 in Experiment 2) were randomly assigned to different economic values of time. Contrary to previous findings, we found that subjective expectations played an important mediating role in the relationship between the economic value of time and feelings of time pressure. If the economic value of time was lower than the participants expected, this negatively affected their perceived time pressure. In contrast, if the economic value was higher than the participants expected, this enhanced their perceived time pressure. We found that the opportunity cost of time perspective was the most applicable of 3 theoretical explanations in explaining the relationship between the economic value of time and time pressure.

Keywords: economic value of time, time pressure, subjective expectations, opportunity cost of time, value heuristic, work compensation.

The concept of time pressure was first investigated by Friedman and Rosenman (1974). Observing patients with heart disease, they identified a specific

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behavioral pattern related to cardiovascular disease, which they called Type A behavior. A key indicator was *time pressure*: These individuals were engaged in an ongoing struggle to obtain an unlimited number of poorly defined things from their environment in the shortest period of time (Conte, Schwenneker, Dew, & Romano, 2001; Friedman & Rosenman, 1974; Goodin, Rice, Bittman, & Saunders, 2005; Gupta & Beehr, 1979; Hendrix, Ovalle, & Troxler, 1985; Kristensen, 1996; Latack, 1986). Time pressure is connected to high activation, that is, an intense physiological and psychological stimulation that occurs even when the actual time pressure is over (Baer & Oldham, 2006; Brosschot, Pieper, & Thayer, 2005; Major, Klein, & Ehrhart, 2002; Siltaloppi, Kinnunen, & Feldt, 2009; Sonnentag, Arbeus, Mahn, & Fritz, 2014; Sonnentag, Kuttler, & Fritz, 2010).

Time pressure has been examined in more depth by scholars in other fields, including economics. According to economic theory, when there is an insufficient supply of a commodity, demand for it will increase and its value will consequently rise. That is, the scarcity of an object will increase its value. However, Dai, Wertenbroch, and Brendl (2008) demonstrated that the opposite can also be true: High-value commodities are also associated with insufficiency. That is, people are likely to perceive an object as scarce if it is highly valued. Dai et al. (2008) and King, Hicks, and Abdelkhalik (2009) named this phenomenon the *value heuristic*. They noted, however, that the value assigned did not refer to an objective value but rather to the subjective value imposed by the people involved. Applying this theory to time, when individuals find the value of time increasing, they become more acutely aware of the scarcity of time. Because of this, they will feel greater stress and anxiety associated with time.

Hamermesh and Lee (2007) also explained time pressure from an economic perspective: the opportunity cost of time. Because becoming wealthier and more experienced implies an increasing *opportunity cost of time*, people feel more stress. Hamermesh and Lee divided the opportunity cost of time into two parts: its economic and experience value (i.e., *direct cost of time*) and the cost of alternative options forgone within a given time period (i.e., *option cost of time*). These authors examined the relationship between household income, work hours (paid and unpaid), and subjective time pressure, using data from Australia, Germany, South Korea, and the United States. They found that even if the time spent in paid and household work was the same, a higher income lead to higher perceived time pressure. Because time is a finite resource, the greater the availability of goods and experiences for purchase with greater financial wealth, the greater will be the sense of time pressure. The opportunity cost of time increases both in terms of the cost of time not spent working as well as the increasing set of options available for people during their free time (DeVoe &

Pfeffer, 2011). The more valuable time becomes, the more reluctant people are to waste it; thus, they feel both greater pressure and greater anxiety.

The third theoretical perspective used to explain time pressure is *work compensation*. According to Parker and DeCotiis (1983), people feel different levels of pressure according to the type of work they do, for example, in particular, strong time pressure and anxiety in highly paid jobs. Results of studies of the relationship between paid work and happiness show that people with high incomes usually have a strong work ethic and feel considerable time pressure (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2006). Work compensation is closely related to job type (Jacobs & Gerson, 2004): The greater one's responsibility, the stronger is one's perception of time pressure and, consequently, the larger the monetary reward, which is a kind of compensation for the pressure.

How Time Pressure Relates to the Economic Value of Time

DeVoe and Pfeffer (2011) found that, whether from the perspective of opportunity cost or from the value heuristic effect, feelings of time pressure were directly proportional to the economic value of time. This proportional relationship was unaffected by individual characteristics and job differences. That is, no matter what kind of paid work individuals undertake, their feelings of time pressure will rise when the value of time increases.

DeVoe and Pfeffer (2011) asked participants to record details of a business event at computer workstations within 30 minutes. Although participants completed the same task, one group charged US$1.50 per minute for their time whereas the other group charged only US$0.15 per minute. After participants finished the task, the researchers measured their feelings of time pressure. The results showed clear differences between the two groups: Those charging US$1.50 per minute demonstrated significantly higher perceived time pressure than did those charging US$0.15 per minute. DeVoe and Pfeffer concluded that the economic value of time had a positive effect on perceived time pressure, that is, the higher the value of time, the stronger the time pressure felt.

However, DeVoe and Pfeffer (2011) did not clearly verify which theoretical perspective explained the increase in the participants' perceived time pressure. We adopted an approach similar to that of DeVoe and Pfeffer in conducting two experimental studies. Our aim was to accomplish the following goals: (a) compare participants' pretest and posttest levels of time pressure, and discuss the relationship between individual time pressure and the economic value of time; (b) determine and verify the most accurate and effective of the three theoretical explanations for perceived time pressure.

Study 1

Method

Participants. Participants were 67 university students who were recruited from the Xianlin campus of Nanjing University. They comprised 33 men and 34 women, ranging in age from 19 to 22 years (M = 20.57, SD = 1.36). At this time, we tried to keep the study objectives secret, so that participants' knowledge of the purpose would not affect the result. Therefore, in our recruiting advertisement we described the study as being about team cooperation: Participants would discuss a topic and their interpersonal interaction during the discussion would be observed. We did not disclose that participants would be paid.

Procedure. We invited participants to take part in a discussion and decision-making event. To ensure the experiment's fidelity and to eliminate distractions, such as discussions via the Internet, we organized face-to-face discussions in preference to online ones. Before the experiment began, we informed participants that we would use a surveillance video recorder to record and classify their real-time reactions during the experiment, so that although the video recorder was not actually working, they believed that it was. The experiment then proceeded in six steps. We collected and kept all participants' time-keeping devices, such as cell phones and watches. Next, we measured the level of time pressure felt by each of the participants, who then entered a laboratory and signed a form to confirm that they consented to be videotaped throughout the discussion process. (At this point those students who were unwilling to be recorded had the choice to quit the experiment.) Participants discussed and made decisions about a given topic. The discussions were carried out without group leaders. After the group discussions, each participant went to an interview room for an individual interview. At this stage, they were given a payment sheet to let them know the economic value of time. While they were waiting for support staff to bring them the payment, we asked participants a series of irrelevant questions, such as how they felt during the discussion. To ensure that participants fully understood the information provided on the value of time, the staff member asked them to read the payment sheet carefully and sign it if they understood it. Participants were then asked to fill in the same time pressure measurement form again. Finally, staff returned their cell phones and other belongings, explained to them the real goal of the study, and paid them for their time. All participants were paid the same amount ¥10 (about US$1.50).

Materials.

Time pressure measurement form. We used the time pressure measurement form designed by DeVoe and Pfeffer (2011), which assesses current experienced time pressure and comprises seven items. Sample items are "I feel pressed for time today," "I feel rushed today," "Compared to yesterday, I feel more stressed about

my time," and "I feel like I don't have enough time". Items were rated on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The internal consistency of this scale is very high (Cronbach's $\alpha = .95$), and it is strongly correlated with Hamermesh and Lee's (2007) single-item measure of time pressure ($r = .54$, $p < .001$), which shows high convergent validity (DeVoe & Pfeffer, 2011). Moreover, factor analysis results indicated that the one-factor structure component loadings of each item were all greater than .70, thus showing a close relationship with time pressure (DeVoe & Pfeffer, 2011).

Leaderless group discussion topics. Before the experiment, we used the Internet to make a list of discussion topics. From the 10 topics that we identified as being the most popular, we chose six. These topics did not involve morality, the law, or personal privacy. During the experiment, we chose a topic randomly for participants to discuss.

Payment scheme documentation. We prepared two payment schemes, with the only difference being the economic value of time. Under the first scheme, as the economic value of time was ¥0.15 (about US$0.02) per minute, and the effective interaction time was 30 minutes, the resulting pay was ¥4.50 (about US$0.70). We set the economic value of time at ¥1.50 (about US$0.20) per minute, under the second scheme, yielding a total payment of ¥45 (about US$7). After the discussion, participants were given a payment randomly chosen from one of the schemes, and, thus, were divided into either a low-time-value or a high-time-value group.

Results

Because the time pressure measurement form was used to measure participants' perceived time pressure at the time of its administration, the effect of the pretest level of time pressure on the results of the posttest measure of time pressure (at the time of payment at the end of the experiment) must be taken into account and controlled for. Thus, we measured participants' pretest level of perceived time pressure and then the relationship between individual time pressure and the economic value of time was assessed by comparing the two levels of time pressure. Participants whose time was valued at ¥1.50 per minute felt no greater time pressure ($M = 28.06$, $SD = 12.47$) than did those who were paid at a rate of ¥0.15 per minute ($M = 27.15$, $SD = 11.10$) before the experiment ($t = 0.317$, $df = 65$, $p = .752$). There remained no significant difference between the time pressure felt by participants who were paid ¥1.50 ($M = 25.91$, $SD = 9.93$) and those who were paid ¥0.15 per minute ($M = 29.94$, $SD = 9.64$) after the experiment ($t = -1.687$, $df = 65$, $p = .096$). This contrasts with the results of DeVoe and Pfeffer (2011), who found that individuals who had been assigned a higher economic value of time felt greater time pressure than did those who had been assigned a lower economic value of time. However,

significant differences arose in our participant groups when comparing the changes in perceived time pressure during the experiment (t = -2.420, df = 65, $p < .05$). We found that, in terms of changes in individuals' perceived time pressure, participants in the group with a higher economic value of time showed noticeably greater changes than did the group with a lower economic value of time. To further understand the differences between the two groups in terms of time pressure changes, we performed t tests on the time pressure data collected before and after the experiment. For the group with a lower economic value of time, there was no significant difference in level of perceived time pressure before and after the experiment (t = -1.580, df = 33, p = .124). However, there was a noticeable decrease for the group with a higher economic value of time (t = 2.172, df = 32, $p < .05$). Thus, time pressure did not change over the course of the experiment for the low-economic-value-of-time group and fell for the high-economic-value-of-time group.

Discussion

The participants' task was to engage in leaderless group discussions on a given topic, similar to the procedure used in an experiment conducted by DeVoe and Pfeffer (2011). As in their experiment, we informed participants that the final economic value of their time would be calculated according to their responses. (This was not actually the case.) Another similarity was that the two groups were separated by a tenfold difference in the economic value of time. However, the results of DeVoe and Pfeffer were not replicated in our experiment: There was no difference in the level of perceived time pressure between the two groups according to the different economic values of time. The results indicated that a higher economic value of time did not result in greater time pressure but, rather, reduced the level of perceived time pressure in this group.

The final results of our experiment showed a clear influence of participants' original level of time pressure. When we compared the two groups at both pretest and posttest, although we found no differences in their time pressure levels, there were significant differences in their time pressure changes. Furthermore, an increase in the economic value of participants' time lowered their perceived time pressure instead of increasing it. This result indicates that the value heuristic effect was not an effective explanation for participants' feelings of time pressure. Because there is a positive relationship between scarcity and value (King et al., 2009), participants should have felt that time was more scarce when the economic value of time increased; hence, they should have felt increased time pressure. However, our result was the opposite: When the economic value of time was high, participants' perceived time pressure decreased. In addition, as participants were not required to take any responsibility for the work outcomes, the results cannot be explained by the work compensation perspective.

The results seem to fit with the opportunity cost perspective. However, participants were not informed that they would be paid until the end of the experiment, before the second measure for perceived time pressure. Therefore, when participants received the payment scheme information and learned that they would receive monetary compensation for their time spent in the laboratory, this knowledge alleviated their worry about wasting time in the experiment. As the increase in the economic value of time counteracted the time pressure caused by this feeling of wasting time (i.e., there was an inhibitory function), the results showed that the increased economic value of time reduced participants' perceived time pressure. In contrast, low economic value of time was not strong enough to relieve the feelings of high time pressure; thus, there was no obvious change in participants' perceived time pressure in this group.

However, there remains an outstanding question. Both groups learned at the same time that they would receive monetary compensation, which would overrule the worry of wasted time (i.e., the inhibitory function). The question is why high economic value of time successfully relieved participants' perceived time pressure, when our results showed that low economic value of time seemed to increase participants' perceived time pressure, but without reaching a significant level.

We obtained a possible answer to this question by studying the postexperiment interviews with participants. In these interviews, almost all participants commented that they were surprised when they learned about the payment. Furthermore, the students in the high-economic-value-of-time group expressed even more surprise and happiness at learning that the payment would be as much as ¥45. Conversely, almost all members of the low-economic-value-of-time group said that they felt disappointed when they were informed of the ¥4.50 payment. They felt that this did not compensate for the amount of time they spent, that is, they did not feel that the payment was high enough to make up for the time cost of participating in the experiment. Thus, we surmised that another hidden factor was interacting with the opportunity cost of time, a factor that we identified as *individual expectations*. When the economic value of time reached or surpassed participants' expectations, they felt satisfied. Because they were compensated for the time they spent, their perceived time pressure decreased. In contrast, when the economic value of time did not meet participants' expectations, their satisfaction was replaced by disappointment. Thus, we reasoned that people's perceived time pressure will increase when they feel that they have not been adequately compensated for their time.

Therefore, we predicted that an individual's expectations of the economic value of time will be the decisive factor in his or her level of perceived time pressure. If, however, two economic values of time are set, with both the higher and lower values reaching or surpassing individuals' expectations, we wanted to

explore how these two values would affect individuals' perceived time pressure. This was the purpose of our second experiment. We wished to establish whether or not the results would align with DeVoe and Pfeffer's (2011) finding that high economic value of time results in strong feelings of time pressure. The hypothesis we formed was as follows: When the economic value of time reaches or surpasses an individual's expectations, a higher economic value of time will have an enhanced effect on perceived time pressure.

Study 2

Method

Participants. In the follow-up study, 69 university students were recruited while from the Gulou campus of Nanjing University as participants, comprising 30 men and 39 women ranging in age from 19 to 23 years (M = 21.03, SD = 1.74). As before, when recruiting, we tried to avoid the students learning of the experiment's true purpose, in case this knowledge affected the results. Thus, in our recruiting advertisement we described the study as an investigation of different ways of thinking: Participants would undertake tests to enable the researchers to study their individual way of thinking and processing information. We did, however, disclose that participants would be paid for the experiment.

Procedure. Participants completed the main part of the experiment seated at computers, following a set of procedures that we had designed. Once the experiment started, the computer screen was fixed in full-screen mode so that participants could not change tasks. This allowed them to focus fully on the task. The main part of the experiment consisted of five steps. We first asked participants a question to ascertain their expectations of the economic value of time: "If the experiment lasts for 1 hour, how much do you expect your payment to be?" We then measured participants' level of time pressure using the form designed by DeVoe and Pfeffer (2011), as in Study 1. We instructed participants to solve mathematics problems involving numbers less than 100, and made up of addition, subtraction, multiplication, and division. They did this for 30 minutes. Participants could not use electronic devices such as calculators, and only when the correct answer was given could the participant proceed to the next question. After participants had finished doing the mathematics exercises, the payment information was presented, including total time spent, the payment per minute, and total payment. When the experiment was over, we again measured participants' perceived time pressure.

While participants were completing the mathematics problems, the value of a minute of time was displayed continuously in large-sized font on the right-hand side of the screen (e.g., ¥0.30/min). There were two time values, ¥0.30 (about

US$0.04) per minute and ¥3 (about US$0.45) per minute, and these amounts were randomly displayed at a ratio of 1:1. Participants were randomly assigned a time value, which remained the same throughout the experiment, after which the staff explained to them the real purpose of the experiment and gave each participant the same payment of ¥10 (about US$1.50).

Results

Our purpose in this experiment was to determine time pressure differences in circumstances when one group was paid for their time at a higher rate than the other group. Although the value of time was different, both values reached or surpassed participants' expectations. To achieve this, we asked participants how much money they expected to be paid for the 1-hour experiment. The paid experiment duration was 30 minutes, and the lower value of time was ¥0.30 per minute. When this is converted to 1 hour, the lowest amount participants could expect to be paid was ¥18 (about US$2.70). When we compared participants' expectations for the value of time with the designated lower value for time, eight participants had higher expectations than the designated minimum value. Conversely, the other 61 participants' expectations were lower than the minimum value. Therefore, we considered as usable the data from these 61 participants, of whom 22 were men and 39 were women, and 31 were paid for their time at the lower rate and 30 were paid at the higher rate.

As in the first experiment, participants who were paid ¥3 per minute felt no greater time pressure (M = 27.60, SD = 8.99) than did those who were paid at a rate of ¥0.30 (M = 31.06, SD = 8.85) before the experiment (t = 1.517, df = 59, p = .135). Further, there was no significant difference between the two groups' perceived time pressure after the experiment (¥3 per minute: M = 29.57, SD = 8.63; ¥0.30 per minute: M = 30.77, SD = 8.69; t = 0.544, df = 59, p = .588). However, there was a significant difference in time pressure change during the experiment (t = -2.368, df = 59, $p < .05$). The result of a paired t test demonstrated that, for the group with a lower economic value of time, there was no significant difference between time pressure before and after the experiment (t = 0.456, df = 30, p = .651). However, there was a noticeable increase in the group with a higher economic value of time (t = -2.762, df = 29, $p < .01$).

The results are, thus, similar to those we obtained in the first experiment, in that there was no significant change in perceived time pressure for the low-time-value group, whereas perceived time pressure in the high-time-value group changed dramatically. In direct contrast to the result in the first experiment, however, time pressure for the high-time-value group showed a significant increase, not a significant decrease.

Discussion

Results of the second experiment showed that when the value of time was equal to or higher than participants' expected value, both groups experienced different effects in terms of time pressure, in contrast to the results of Experiment 1. The low-time-value group (¥0.30 per minute) showed no obvious change in perceived time pressure before and after the experiment. However, for the high-time-value group (¥3 per minute), perceived time pressure rose significantly. This result is consistent with that of DeVoe and Pfeffer (2011), who found that high economic value of time had an enhanced effect on time pressure.

The discrepancy between the results in the two experiments demonstrates that an individual's expectations of the economic value of time has a significant effect on his or her perceived time pressure. The proposition by DeVoe and Pfeffer (2011) that high economic value of time increases time pressure remains reasonable on the condition that both the high and low time values reach or surpass individuals' expectations. In our second experiment, the results supported our hypothesis that when the economic value of time reaches or surpasses individuals' expectations, high value of time will have an enhanced effect on their perceived time pressure. This result may indicate that the opportunity cost of time perspective is relevant in this case. When the value of time, as set within the experiment, is not significantly different from people's expectations (i.e., the low economic value used in the experiment), they will not experience negative feelings, such as anxiety, disappointment, and anger. They also will not feel distressed about wasting time. Therefore, there will be no observable change in individuals' levels of perceived time pressure. In contrast, when people's time has high economic value (i.e., the high economic value used in the experiment), they will worry that they may have wasted valuable time on previous tasks (e.g., Gupta, Hershey, & Gaur, 2012; Syrek, Apostel, & Antoni, 2013). Alternatively, they may hope to make full use of their time and strive for even greater rewards (e.g., Mohammed & Harrison, 2013). Therefore, no matter which circumstances are experienced by people with a higher economic value of time, their perceived time pressure will increase.

General Discussion

Controlling for Participants' Pretest Time Pressure Level

In these studies, we measured participants' real-time perceived time pressure. However, an individual's psychological state is always changing and various stimuli can impact on this state. Further, once a change in psychological state occurs, this state will last for a period of time and the original stimulus will also influence the individual's later state (Zhong & DeVoe, 2010). To eliminate the effects of these confounding factors on the level of the participants' perceived

time pressure, we not only followed very strict experimental procedures but also controlled for the effect of the pretest level of time pressure on the posttest measure of time pressure. Only by comparing the posttest level of perceived time pressure with the pretest level could we truly determine the effect of the economic value of time on perceived time pressure.

Individual Expectations Mediate the Relationship Between Time Value and Time Pressure

We carried out two experiments and found that individuals' expectations of the economic value of time greatly influenced their experience of time pressure, directly determining whether or not their perceived time pressure increased, decreased, or remained the same. When the assigned time value was equal to or less than an individual's expectations, the higher time value had a negative effect on his or her perceived time pressure. That is, when the participants knew that they would be paid more than they had expected for their time, the level of their perceived time pressure decreased. Conversely, when they were paid at a lower rate than they had expected, the level of their perceived time pressure stayed the same or increased.

An explanation for this phenomenon can be provided by Hamermesh and Lee's (2007) two-part opportunity cost of time perspective: When the economic value of time increases, people feel that they must not waste time, consequently, they feel more intense time pressure. Our results showed that when people are economically remunerated, however, their perceived time pressure decreases. That is, people are compensated for their work by having their time economically valued. When the economic value of time is close to or surpasses their expectations, it allays the anxiety brought about by feelings of having wasted time. In contrast, when the economic value of time is lower than they expected, it will enhance anxiety about wasting time, possibly maintaining or increasing feelings of time pressure.

The opportunity cost of time perspective was the most applicable in explaining the results for our examination of the relationship between the economic value of time and people's perceived time pressure. The mediator between these two factors was an individual's subjective expectations of the economic valuation of time. Because the assigned value reached or surpassed individual expectations, participants in the low-time-value group were not dismayed at not reaching their goal, and, as their time was compensated for, their level of perceived time pressure did not change greatly. However, when participants were told that their time had high economic value, they were eager to make full use of it to produce more value, markedly increasing their feelings of time pressure.

Limitation and Directions for Future Research

A limitation in this study is that as all participants were university students, it

is possible that the findings cannot be generalized to the population as a whole, especially people working in specialized areas. Whether or not the participants' perceived feeling of time pressure was directly influenced by the economic value of time, or by their individual expectations as the mediating role, further research needs to be done.

In our experiments, we used the time pressure measurement form designed by DeVoe and Pfeffer (2011). To the best of our knowledge, this measurement form is the only existing one with which the level of individuals' perceived time pressure at the current time can be tested. In contrast, individuals' past behaviors are measured with various other behavioral measurement instruments (e.g., Edwards, Baglioni, & Cooper, 1990; Landy, Rastegary, Thayer, & Colvin, 1991; Wright, McCurdy, & Rogoll, 1992). Therefore, it would be very helpful for future researchers to develop other scales or measure behaviors directly to verify our findings.

Finally, in this study, we took into account the influence of the participants' pretest level of perceived time pressure on the posttest measure of perceived time pressure. A research topic in future studies that would cover new ground is whether or not an individual's original perception of the economic value of time influences his or her level of perceived time pressure.

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