

# **Cash Is King: Time Preference of Chinese Investors and Cancellation Axiom in the Intertemporal Choice**

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## **Abstract**

*Previous research argued that the cancellation axiom, deriving from the additive assumption and independence assumption, could be violated in the intertemporal choice (Rao & Li, 2011). Nevertheless, Rao and Li's (2011) conclusion was based on the participants' responses who were all university students. The present research was designed to reexamine the cancellation axiom through the intertemporal choice of Chinese professional investors (e.g. stock trader, asset manager), and found that Chinese investors were prone to choosing the immediate smaller utility rather than the delayed larger utility ( ¥1,000,000 now vs. ¥5,000,000 in 10 years), independent of the common elements of the two options (e.g., ¥6,000,000 in 1 year, or -2,000,000 in 11 years). The present findings suggested that the cancellation axiom in intertemporal choice still holds for Chinese investors, implying the domain-specific nature of risk communications, and also reflected a "Cash is King" effect explained by the liquidity preference theory (Keynes, 1936).*

# INTRODUCTION

## Intertemporal choice and DU model

Intertemporal choice -- Decision making concerning tradeoffs among costs and benefits occurring at different times -- are important and ubiquitous (Frederick, Loewenstein, & O'donoghue, 2002). The discounted utility (DU) model proposed by Paul Samuelson continues to be the dominating theory in the intertemporal choice, in which an underlying assumption is that an individual behaves for maximizing the discounted sum of all future utilities. In its general form, the DU model assumed that the value of an option,  $(x; t)$ , is the product of its present utility,  $U(x)$ , and an exponential temporal discounting function,  $F(t)$ , where  $t$  is the time at which  $x$  is acquired. The overall value of a mixed option,  $A = \{(x_1, t_1), (x_2, t_2), \dots\}$ , denoted  $V(A)$ , is simply the sum of these products. That is,  $V(A) = \sum U(x_i)F(t_i)$ . An option  $A$  will be preferred to an option  $B$  if and only if  $V(A) > V(B)$  (Rao & Li, 2011). However, just as mentioned in Rao and Li's (2011) recent research on intertemporal choice, a large body of empirical evidence demonstrate that people systematically violate this theory (Benzion, Rapoport, & Yagil, 1989; Prelec & Loewenstein, 1991; Thaler, 1981).

## Cancellation Axiom and the violation

In terms of intertemporal choice, two assumptions are widely acknowledged, namely the additive assumption and the independence assumption. The two assumptions lead to the cancellation axiom, which states that a preference order between two options with elements in common does not depend on the nature of the common elements. In other words, preference order between two options does not change when any common element was added. This can be vividly shown in the following Table 1, illustrating the multiple-dated outcomes in intertemporal choice:

Table 1. An illustration of the multiple-dated outcomes problems.

	Options	Time 1	Time 2	Time 3
Problem 1	A	a		
	B			b
Problem 1'	A	a	X	
	B		X	b
Problem 2	C	c		
	D			d
Problem 2'	C	c+X		
	D	X		d

In Problem 1 and Problem 1', according to the cancellation axiom, adding a common element 'X' to both of the option A and B at the time 2 won't change the preference orderings, the same is also true with Problem 2 and Problem 2' where X occurs at time 1. Otherwise, the cancellation axiom would be violated if the preference orderings were different between Problem 1 and Problem 1' (or problem 2 and problem 2').

However, according to Rao and Li's (2011) findings, the cancellation axiom in intertemporal choice was violated and they called this finding as "intertemporal-version of Allais paradox".

In their experiment, four questions were employed upon college students (see Table 2). The results demonstrates a significant greater number of choice of option B in Problem 1 compared with the choice of option C in Problem 2 ( $p < 0.001$ ), thus violating the cancellation law.

Table 2. Percentages of choices of problems in Rao and Li's (2011) experiment.

Questions	Options	N (%)
1	A: ¥1,000,000 now and ¥-2,000,000 in 1 year	26 (28.9%)
	B: ¥-2,000,000 in 1 year and ¥5,000,000 in 10 years	64 (71.1%)
2	C: ¥1,000,000 now	69 (76.7%)
	D: ¥5,000,000 in 10 years	21 (23.3%)

### The present research

Nevertheless, Rao and Li's (2011) conclusion was based on the participants' responses who were all university students. Will the violation of the cancellation axiom appear again on professional investors? So far, by the cash flow statement, investors in financial practices are likely to choose the immediate utilities in many cases (A.D., 2011), especially when the cash holding may be a safe choice in a risky economy (Shen, 2013; Manulife ISI, 2013).

As an emerging-market country, China has recently grown up to be the second largest economy ("GDP Ranking," 2012), and Chinese investors and their investment in its domestic industry and the rest of the world have played an important role in promoting the world economic growth (Clegg & Voss, 2012; "GDP Ranking," 2012). Specifically, Chinese investors' attachment to the cash or the short-term investment leaves an impressive record in the global market (Yuk, 2013; Manulife ISI, 2013). Therefore, this study was designed to investigate how Chinese investors behave in such an intertemporal choice by reexamining the validity of the cancellation axiom through intertemporal choice among the specific group of people. We predict that such a paradox did not exist among Chinese investors. That was, Chinese investors' preference for the immediate smaller gain over later larger gain would remain stable in decision making over time, regardless of the common elements of the two options.

## METHOD

To form a stark contrast, the experimental questions and the procedure we adopted was quite similar to the Rao and Li’s (2011) previous experiment design. When designing these questions, we took the multiple outcomes in intertemporal choice into account. An option  $O [x1, t1; x2, t2; \dots ; xn, tn]$  is a contract that yields outcome  $x_i$  with a delay of  $t_i$  units of time.

Ninety four Chinese investors (13 females, aged from 30 to 60 years), were invited to participate in our interview, all of them were CEO, company manager, stock trader, or professional investor, and each of them own an individual asset of more than 3 million RMB. Before interview, they were all informed that it was just a pure academic experiment to find out their decision making and preferences when facing intertemporal choice, their private information wouldn’t be leaked out when the survey was completed. Each of them got a small gift as a reward after they finished our questionnaire.

The materials used in this study are as followed:

**Question 1:** A: ¥1,000,000 now

B: ¥5,000,000 in 10 years

**Question 2:** A: ¥1,000,000 now and -2,000,000 in 1 year

B: ¥-2,000,000 in 1 year and ¥5,000,000 in 10 years

**Question 3:** A: ¥1,000,000 now and ¥6,000,000 in 1 year

B: ¥6,000,000 in 1 year and ¥5,000,000 in 10 years

**Question 4:** A: ¥1,000,000 now and -2,000,000 in 11 years

B: ¥-2,000,000 in 11 years and ¥5,000,000 in 10 years

## RESULTS

As shown in Table 3, 84% of the participants chose A in Question 1 and 44.7% of the participants chose A in Question 2. A McNemar test revealed that a significantly less participants chose option A in Question 2 compared with those who chose option A in Question 1 ( $\chi^2 = 28.8, p < 0.001$ ).

Table 3. The percentages of choices of questions in the current experiment.

Questions	Options	N (%)
1	A: ¥1,000,000 now	79 (84%)
	B: ¥5,000,000 in 10 years	15 (16%)
2	A: ¥1,000,000 now and -2,000,000 in 1 year	42 (44.7%)
	B: ¥-2,000,000 in 1 year and ¥5,000,000 in 10 years	52 (55.3%)
3	A: ¥1,000,000 now and 6,000,000 in 1 year	66 (70.2%)
	B: ¥6,000,000 in 1 year and ¥5,000,000 in 10 years	28 (29.8%)

4	A: ¥1, 000, 000now and -2,000,000 in 11 years	63 (67%)
	B: ¥-2,000,000 in 11 years and ¥5,000,000 in 10 years	31 (33%)

However, a Chi-square test of the two options in Question 2 revealed that the difference between the percentages of two options was not significant ( $\chi^2 = 1.064, p = 0.302$ ), indicating that in Question 2 the participants' preferences were indifferent between the option A and option B. Such indifference could be expressed by the DU model as:

$$F(\text{now})u(1,000,000) + F(1\text{year})u(-2,000,000) \approx F(1\text{year})u(-2,000,000) + F(10\text{ years})u(5,000,000).$$

Given that Question 1 was obtained by removing “¥-2,000,000 in 1 year” from both options of Question 2, such a pattern of preference contradicted the cancellation axiom implying that if two options had a common element, the preference order induced by other components of the option would be independent of the common element. This contradiction can be demonstrated by putting the experimental data into the DU model. Considering Question 1 and Question 2 with the cancellation axiom, with  $u(0)=0$ , the first preference implied that:  $F(\text{now})u(1,000,000) > F(10\text{ years})u(5,000,000)$ , where  $>$  represents the strict preference of the individual's choice. While the second preference implies that:  $F(\text{now})u(1,000,000) + F(1\text{year})u(-2,000,000) \approx F(1\text{ year})u(-2,000,000) + F(10\text{ years})u(5,000,000)$ ; Subtracting  $F(1\text{ year})u(-2,000,000)$  from both sides, we have  $F(\text{now})u(1,000,000) \approx F(10\text{ years})u(5,000,000)$ , which contradicts the first pattern of preference, thus it weakly leads to the violation of the cancellation axiom. This experiment result was, to some extent, consistent with the Rao and Li's (2011) argument that cancellation axiom was violated.

Furthermore, we compared the Question1 with Question 3 and 4, among 84% of the participants choosing option A in Question 1, 70.2% of the participants choosing option A in Question 3, and 67% of the participants also choosing option A in question 4. This result revealed that the majority of the participants in both Question 1 and 3 chose option A, and also the majority of the participants in both Question 1 and 4 chose option A. Chi-square tests showed that participants' preference for option A to option B in each of the three Questions are all significant (Q1: $\chi^2 = 43.57$ , Q2:  $\chi^2 = 15.36$ , Q3:  $\chi^2 = 10.89$ , all  $p < 0.001$ ), although McNemar tests illustrated the significant difference between percentages of option A and B comparing Question 1 with Question 3 ( $\chi^2 = 5.33, p = 0.021$ ) and with Question 4 ( $\chi^2 = 7.50, p = 0.006$ ).

Since Question 3 and question 4 is derived from question 1 by adding the common item “¥6,000,000 in 1 year” and “¥-2,000,000 in 11 year” to both option A and B in Question 3 and Question 4 respectively. These results contradicted the results of experiment in Rao and Li's previous study. And it could vividly illustrate the cancellation axiom by putting the data into DU model: Considering Question 1, the preference order implies that  $F(\text{now})u(1,000,000) > F(10\text{ years})u(5,000,000)$ , where  $>$  represents strict preference of the individual's choice. Combining Question 3 and Question 4, by adding the common item “¥6,000,000 in 1 year” and “¥-2,000,000 in 11 year” to both sides, we have:

$$F(\text{now})u(1,000,000) + F(1\text{year})u(6,000,000) > F(1\text{ year})(6,000,000) + F(10\text{ years})u(5,000,000); \tag{1}$$

$$F(\text{now}) u(1,000,000) + F(11 \text{ year}) u(-2,000,000) > F(11 \text{ year})(-2,000,000) + F(10 \text{ years}) u(5,000,000); \quad (2)$$

The above two inequalities were consistent with the experimental data in table 3. However, the above two comparisons presented two different results, conclusions from the first comparison between Question 1 and Question 2 supported Rao and Li's (2011) argument, while the second one between Question 1, Question 3 and Question 4 disproved it. But if we made a further analysis of Question 2, such a difference could be eliminated. In Question 2, the percentage of choice for option A is 44.7%, for B is 55.3%. Chi-square test revealed that the participants were indifferent between the two options. Roughly speaking, the two options could be treated as equal to each other when measuring the preference orderings. So if they are equal, they can't be used as a strong evidence to support the violation of the cancellation axiom. Therefore, we could ignore Question 2, remaining Question 1, 3 and 4 to evidence our argument that cancellation axiom still held in Chinese investors. One way to explain Question 2 is that we can treat the participants' indifferent preference as a random aberration or a subtle abnormal occurrence caused by some random factors or errors or some trivial defects of the question design.

## DISCUSSION

Despite of a little divergency in the analysis above, the current results undoubtedly validated the Cancellation Axiom in the intertemporal choice, which was consistent with our prediction that the intertemporal-version Allais paradox did not exist among Chinese investors, thus it refuted the argument that the cancellation axiom was violated.

The results also reflected that the majority of Chinese investors prefer the immediate gain to the delayed gain, though the immediate gain is smaller than the delayed gain. Such a phenomenon may be explained by "Time Preference" (Frederick, et al., 2002), which refers to the preference for immediate but smaller outcome rather than the larger but later outcome. For example, 84%, 70.2%, and 67% of the participants in question 1, 3 and 4 respectively chose the option A which meant the immediate utilities.

Another possible explanation to this phenomenon may be a traditional psychological effect in Chinese culture, which was paraphrased by the proverb "Cash is King". According to the Manulife ISI (2013), as in other Asian markets, investors in China tend to hold a high percentage (34) of their assets in cash that are equivalent to about 36 months' worth of personal income on average, the highest of all markets surveyed. Since all the participants in our experiment are professional investors, they are keenly aware of the risk and return of investment. In our experimental questions, option B gives the participants a bigger sum of money but in a very later time, and they can't get money instantly, while the delayed time means uncertainty and risk; To reduce the risk, most of them chose option A, thus the "Cash is King" effect is obviously embodied in the participants. This phenomenon can be best explained by the liquidity preference theory proposed by John Maynard Keynes (1936).

From the perspective of economics, the well-known liquidity preference theory states that

people hold money out of three motives, they are (i) transaction motive, (ii) precautionary motive, and (iii) speculative motive (Keynes, 1936; Paul, 1965). According to Keynes, he did suggest that these three categories formed an exhaustive set and that all other reasons for holding money (e.g. the income motive or the business motive) are merely sub- categories of these three major divisions.

On the firm level, holding more cash means that the firm is more capable of meeting operating expenditures or maturing liabilities. Recent works in macroeconomics have shown that cash flow is an important predictor of investment, and suggest that cash flows are useful in interpreting earnings and assessing firm viability. Other researches also suggest that cash holdings of firms is regarded as the main classification variable to separate firms into financially constrained and unconstrained categories and that high cash reserves increase the ability of firms to undertake profitable investment opportunities. Strong evidences also show that cash stands as an effective device for firms, mainly during the crisis period. (Noteboom, 2012; Simon & Charles, 1995; Mark & Hung, 2003; Arslan , Florackis & Ozkan,2006). These may in large extent account for the reason why so many institutional investors in eastern Asia tend to hold a higher proportion of their asset in cash after the 2008 financial crisis.

Previous studies suggest that factors such as age, life experience and income level have significant impact on intertemporal decision making (Liu, Aaker, 2007; Green, Myerson, Ostażewski, 1999), which may offer some insights into the time preference of these investors. On the contrary, the participants in Rao and Li's (2011) experiment were all university student, they were inexperienced in investment and did not have such professional perception such as risk, return, cash and liquidity and so on. No wonder that most of the students chose the seemingly larger gain option. In addition, age and income appear to interact in determining the impulsivity of decision making by adults (Green, Myerson, Lichtman, Rosen, Fry, 1996). That was, those professionals and students who had different ages and income levels, hereby reacted to the experimental questions in different depths or were unequally sensitive to intertemporal decisions.

A doubt arose that the difference between percentages of option A and B in Question 1 and Question 3 was significant, and that is also true with Question 1 and Question 4. This meant that there was a significant preference change when participants were making a decision between option A and option B in Question 1, 3, and 4. According to our knowledge, what could partly account for such a significant difference may be the immediacy effect proposed by Strotz (1955), which states that preferences reverses as an equal amount of time delay is added to the options. One hypothesis worth thinking is that the differences may be caused by the differences between the common elements "6,000,000 in 1 year" in Question 3 and "¥-2,000,000 in 11 years" in Question 4. Given that the cancellation axiom has stated the preference order does not depend on the nature of the common element, the present results does not run counter to the axiom, and the different common elements may generate slightly different influence on the participants' preference level (not the preference order).

All in all, the present research suggested that the cancellation axiom, which evolved in the fields of intertemporal choice and risk communication (Pollatsek & Tversky, 1970), still worked well in the intertemporal choice, and so far there was no any new theory that could account for

the full violation. But we have noticed that a number of attribute-based models have offered some insights into the explanation of the observed violation, such as the similarity-induced time preferences model (Rubinstein, 2003), the equate-to-differentiate model (Li, 2004), and the trade-off model (Scholten & Read, 2010).

In contrast to our study, Rao and Li's previous experimental subjects were all university students who only represented students' decision making. Meanwhile, considering that our experimental subjects were all professional investors, such a limitation may also be exerted in our experiment, i.e. the subjects were only the representative of Chinese investors, they did not represent the choice made by, say, junior employees, immigrant workers, engineers, professors and people from other careers. Therefore more types of subjects should be taken into account to examine the axiom.

## CONCLUSION

Our present study has (i) reconfirmed the validity of cancellation axiom in intertemporal choice among Chinese investor, (ii) demonstrated a time preference phenomenon on Chinese investors who appear to prefer an immediate but smaller reward to the delayed but larger reward. The cancellation axiom of intertemporal choice in multiple fields of economics should be concerned in future directions.

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