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## The impact of numerical superstition on the final digit of stock price

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### ABSTRACT

This paper investigates the extent to which the frequency distribution of the rightmost digit of stock prices is influenced by numerical superstitions. To identify the moderating variables that strengthen the superstition for numbers, we take into account factors including the amount of information, change of tick size, Chinese festivals, and bear market effect. Furthermore, we examine whether the frequency of lucky (unlucky) numbers as the final digit of prices decreases (increases) for firms with higher trading by institutional investors. The results indicate that investors in the Taiwan Stock Exchange tend to avoid number 4. Our results also find that the effects of numerical superstitions on the frequency of the final digit decrease when the amount of information increases. Investors appear to be more likely to avoid unlucky number 4 in the following four conditions: when the tick size becomes smaller, when it is one week before Chinese New Year, when it is the seventh month in the lunar calendar, and when it is in a bear market. We further document that institutional investors are not affected by numerical superstition. Moreover, our results support the notion that informed traders buy and sell more (less) actively the stocks with a lower (higher) frequency of prices ending with 4.

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### 1. Introduction

This paper investigates the extent to which the frequency distribution of the final digit of stock prices is influenced by numerical superstitious beliefs, which are likely to be culturally specific. In Chinese culture, specifically, the pronounced role of superstition affects economic lives. Number 4 is inauspicious because the Mandarin pronunciation of 4 is similar to that the phrase “to die.” In contrast, the pronunciation of number 8 sounds like the word *fa*, which means “to become prosperous or rich.” Therefore, people favor the number 8 and tend to avoid number 4. For example, it is quite common that hotels and hospitals in Taiwan have no fourth floor. People in Taiwan are willing to pay more for a package of 8 tennis balls than 10 (Block & Kramer, 2009). Similarly, Simmons and Schindler (2003) find that in Chinese consumer markets, merchants strongly

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favor prices ending in number 8 and avoid number 4. Thus, in a Chinese retail store, the price X.X8 has been shown to be more likely than the price X.X4.

Given that numerical superstition affects Chinese consumers' behavior, it is likely that prices observed in financial markets are also influenced by superstition. This paper demonstrates how and when investors carry their superstitious beliefs regarding numbers over to their trading using data from the Taiwan Stock Exchange (TWSE), where limit orders prevail, from 2001 to 2013. In particular, we examine whether the frequency distribution of the final digit of the stock price is disproportionate.

To identify the moderating variables that strengthen the superstition for numbers, we further examine the extent to which the amount of information, change of tick size, and Chinese festivals affect the impacts of numerical superstition on prices ending in numbers 8 and 4. Furthermore, we conjecture because market sentiment is more optimistic during a bull market, the impact of superstition regarding unlucky numbers on prices may then be less pronounced. On the other hand, in a bear market, during which stock prices fall, investors may become more inclined to avoid unlucky number 4. Thus, we examine how market conditions affect the frequency of an inauspicious number as the final digit of stock prices. Extant studies indicate that institutional investors are generally considered rational and sophisticated market participants. Therefore, this study investigates whether the frequency of lucky (unlucky) numbers decreases (increases) for firms with higher trading by institutional investors, who are likely to be less superstitious.

The empirical results indicate that the frequency of number 4 is significantly lower than that of number 6 even though both are even numbers and number 5 exerts an equal attraction on 4 and 6. The frequency of number 8 is significantly higher than that of number 2 even though number 0 exerts an equal attraction on 2 and 8. Our results indicate that numerical superstition exists in the TWSE. We further examine whether investors' superstitions affect the offer price for Taiwan's firms going public or raising funds through seasoned equity offerings (SEO). Our results indicate that the percentage of number 4 in the last digit of the offer prices for IPO firms and SEO firms in Taiwan is significantly lower than that of number 6. In contrast, the percentage of number 8 as the last digit of offer prices is significantly greater than that of number 2. It indicates that firms' managers, when setting the last digit of the offer price, either share or cater to investor superstition.

Our results show that the effects of numerical superstition on the rightmost digits of stock prices decrease when the amount of information increases. Investors appear to be more likely to avoid unlucky number 4 when the tick size becomes smaller. We also find that investors choose to price the stocks with less number 4 in trading days one week before Chinese New Year and in a ghost month (the seventh month in the lunar calendar). The results show that investors are more inclined to avoid number 4 in bear markets. Our results also indicate that institutional investors are not affected by numerical superstition. In additional tests, we find that investors who are not guided by superstition tend to issue ask prices ending with 4. Moreover, we document that informed traders prefer to buy or sell the securities more active in superstitious investors' trades.

Our study contributes to the literature in several ways. First, because the loss due to superstition for investors may be large, it is a non-trivial issue as to examine the existence of superstitious beliefs in stock markets and the factors that may affect the impact of superstition on prices.<sup>1</sup> Although there exist prior studies on superstition in stock markets, they do not examine how market condition helps explain the impacts of numerical superstition on the frequency distribution of final digits. The results of this study help fill this gap in the literature. Second, few, if any, studies examine whether institutional investors trade differently when they trade in a stock market in which investors have cultural number preferences. The results of this study provide evidence that institutional investors are not guided by numerical superstition when they trade in stock markets with prevalent numerical superstition exists. Third, we add to the literature on the clientele effects that informed traders prefer the stock of firms that superstitious investors tend to buy. Likewise, future empirical studies with different focuses may adopt the frequency of number 4 in the last digit of stock prices to proxy the extent of investor sophistication or irrationality.

Our results are related to but distinct from [Brown, Chua, and Mitchell \(2002\)](#) or [Brown and Mitchell \(2008\)](#). [Brown et al. \(2002\)](#) use the largest 100 and the smallest 100 firms on the TWSE from 1994 to 1998 to examine investors' superstitious behavior in TWSE. The small sample size may lack representatives. Thus, their results fail to find superstition in TWSE. Moreover, in contrast with [Brown and Mitchell \(2008\)](#), who indicate the A-shares stock market investors prefer stock prices ending in the lucky number, we find that superstitious investors are more inclined to avoid number 4. Mandarin is an official language in Taiwan; however, many people speak Taiwanese in their daily life. Compared to those in the Mandarin and Cantonese, Taiwanese pronunciation of number 4 is the closest to the phrase "to die" but that of number 8 is not as close to the phrase "good fortune" (*fa*).<sup>2</sup> Given the finding of prior studies that traditional culture affects investors' superstition, our results further show the significance of pronunciation approximation in affecting the degree to which investors are superstitious.

The remainder of the paper is organized as follows. Section 2 presents a literature review and the development of our hypotheses. Section 3 provides a description of the sample, variables, and research models. Section 4 reports the results and additional tests, and finally, Section 5 provides a summary and offers concluding remarks.

<sup>1</sup> For example, the loss of returns for superstitious investors who sell stocks at prices between 15 and 50 (NT dollar) ranges from 5% to 16.67%.

<sup>2</sup> According to the Cantonese Romanization Scheme designed by the Linguistic Society of Hong Kong, the respective pronunciations of "fa," which means the prosperity or richness in Mandarin, Taiwanese, and Cantonese are fa1, hoat3 and faat3. The respective pronunciations of number 8 in Mandarin, Taiwanese, and Cantonese are ba1, pat3 and baat3. The words for number 8 in Mandarin and Cantonese are phonetically similar to the word for fa. The respective pronunciations of "death" in Mandarin, Taiwanese, and Cantonese are si3, si4, and sei2. The respective pronunciations of number 4 in Mandarin, Taiwanese, and Cantonese are si4, si4, and sei3. Moreover, the word for number 4 in Taiwanese is phonetically similar to the word meaning "to die."

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