# “The impact of the financial tsunami on stock investment behavior: the case of individual investors in Taiwan”


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# The impact of the financial tsunami on stock investment behavior: the case of individual investors in Taiwan


## Abstract

This paper investigates how the financial tsunami changed individual investors' attitudes toward risk and investment behavior in Taiwan. The empirical results show that the global financial crisis greatly impacted investors; more than 50% of investors claim their financial position severely worsened. After 15 months one third of investors had not recovered their financial losses. Generally, the individual investors who went through the financial tsunami became more risk-averse, traded less, and were more inclined to realize losses. In addition, the more severe their financial losses, the more risk-averse the investors became and the less amount they traded.


**Keywords:** financial tsunami, individual investor, attitudes toward risk, investment strategy.
**JEL Classification:** G02, G11.

## Introduction

Global stock markets plummeted on August 8, 2011, amid mounting fears that the world economy was facing a return to recession. It seemed familiar to the market by its resemblances to the 2008 financial tsunami: stocks were plummeting, global economies were slowing, and politicians were scrambling to find solutions. Discussions arise around whether it was a repeat of the financial crisis of 2008. The 2008 global financial tsunami was regarded as one of the greatest catastrophes of the century. It posed a significant threat to the world economic and social development. Whether the plummet of August 2011 represents the second wave of the 2008 financial tsunami remains a debate among economists and market experts, a common opinion is shared among them that financial crises are more likely to happen in the future. How dramatic financial crisis affect investors is accordingly worthy of exploration.

While there have been many discussions about the causes and effects on economies and markets of the 2008 tsunami, the ways in which individuals in the capital market have been affected have not been fully explored. The severe impact may have caused deep and lasting effects on individuals and markets. The findings will be insightful and valuable for the market to deal with potential financial crisis in the future.

This research analyzes the impact of this crisis on personal wealth and investment behavior through a nationwide investigation of individual stock investors in Taiwan. It presents evidence regarding the first large-scale financial crisis of the twenty-first century, and offers analysis regarding its impact on investors. It focuses on investors' attitudes toward risk and investment strategies and changes in their wealth. While wealth can be restored during periods of economic growth, the attitudes and disposition of investors after heavy losses, especially the long-term effects, need additional exploration.

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This research article attempts to answer the following three questions:

1. As a result of the global financial tsunami, how was the individual stock investors' wealth affected?
2. After the financial tsunami, have investors' attitudes toward risk and investment behavior changed significantly? How did they change?
3. Do the changes vary due to the severity of investors' losses?

## 1. Lessons from post traumatic stress disorder (PTSD)

Regarding the harm of financial crises, economists usually concentrate on macro-economic issues, and financial scholars focus on financial markets. They are less concerned about the investors and rarely analyze their feelings, attitudes, and dispositions. However, studies on psychological trauma, and in particular post traumatic stress disorder (PTSD) in psychology, provide some clues in terms of the impact of the financial tsunami on individuals.

Psychological trauma refers to dramatic changes in a person's life that turn into psychological issues. A serious trauma may transform into PTSD. As opposed to physical trauma, psychological traumas are not usually fatal; however, painful experiences can become psychological shadows that can result in long-term impact and even physical illness. Many factors can cause psychological trauma, such as war, natural disasters (earthquakes and tsunami), loss of love, death of family members, unemployment, bankruptcy, and long-term poverty. When individual's perceptions and emotions are significantly influenced (e.g. self-doubt, distrust, or insecurity), the negative effects (e.g. fear, anger, and stress) can last for years or even decades (DePrince and Freyd, 2002; Storr, Ialongo, Anthony and Breslau, 2007).

While the incubation period for the financial tsunami was long, its outburst was powerful and fierce, quickly leaving many investors with severe losses. Many people were shocked by the salary reductions, unpaid

leaves, unemployment, and business bankruptcies. Did the global financial crisis lead to psychological trauma and even PTSD? To ascertain this requires professional diagnosis and psychological analysis. This research examines the following question: did investors' attitudes toward risk and investment strategies significantly change after the crisis? Individual investors' emotions, attitudes and behaviors are deeply interwoven with markets; thus it is worthy of exploration. This study will explore this issue by investigating the investors' attitudes toward risk and investment strategies, before and after the financial tsunami.

## 2. Research method and sample structure

A web questionnaire was distributed to individual stock investors in Taiwan. The subjects were randomly selected from the Cyber Panel and IX Survey[1]. Only those who have traded stocks for the past year were allowed to participate in the survey. An e-survey is limited to subjects on the net only. However, we believe this is acceptable because nearly 90% of stock investors in Taiwan are e-stock investors (Kuo, 2010). The survey was conducted in December 2009, about 15 months after the Lehman Brothers bankruptcy. Thus, the time period can be referred to as "after the financial tsunami" in this study.

There were 1,214 valid samples, and the sampling error was below 3%. Of the total samples, males accounted for 54% and females 46%. Most subjects had graduated from universities and colleges (68%), 12% had a master's or higher degree, 20% were senior high and vocational schools graduates; 42% were 30-40 years old, 30% were below 29 years old, and 28% were above 40 years old. In terms of monthly income (excluding investment profits), most had NTD$20,000-40,000 (44%), followed by NTD$40,000-60,000 (23%) and less than NTD$20,000 (22%), and 11% had a monthly income of more than NTD$60,000[2].

## 3. Empirical studies

**3.1. Impact on individuals' wealth.** To roughly understand the investors' losses from the financial tsunami and how much they recovered after 15 months, we ask how did the financial tsunami influence your wealth before and after the financial tsunami of 2008. The options include: almost no loss, little loss, great loss, and serious loss.

According to our analysis, 54.8% of Taiwanese stock investors were significantly influenced when the situation was at its worst (including "great loss" and "serious loss") and only 12.3% of investors claimed "almost no loss". After 15 months, 27.2% investors suggested "great loss", and the percentage was reduced by 8.8%. The investors with "serious loss" were reduced from 18.8% to 5.8%. From these figures we can see that the global financial tsunami in 2008 had a considerable impact on individual stock investors in Taiwan, with half incurring significant losses. After 15 months, 42.6% of the investors claimed their losses had been reduced, 45.2% remained the same, while 12.1% increased (see Table 1). A variable, with 1 representing "almost no loss" and 4 "serious loss", is used to measure the investors' degree of perceived loss. The average number is 2.61 in the worst period, and 2.24 after 15 months in December, 2009. According to the *t* test of paired sample mean difference, the difference is statistically significant at 1% level. It indicates that, on average, Taiwanese stock investors' losses from the financial tsunami was recovered to a significant extent in the end of 2009.

By the test of independence, in Table 2 the findings show that the wealth loss resembled a smile curve with age ranging from worst to best: the losses were less for the investors below 29 years old and above 50 years old. However, after 15 months, loss and age become independent of each other, due to the fact of more recovery for those from 30 to 50 years of age. Their average loss scores reduced from 2.66 and 2.83 to 2.27 and 2.25, respectively. On the other hand, the loss depends on income after the tsunami, demonstrating a negative linear pattern where higher income tends to be associated with less loss. After the tsunami, the average loss score of the highest income group is 2.11, while that of the lowest income group is 2.34. It suggests that those with rich financial support and high incomes were more likely to recover from loss. Noticeably, all average losses of each group for every demographic variable reduced significantly after the financial tsunami.

Table 1. Sample distribution of individual investors due to the financial tsunami

| Panel A | | | | | | |
|---|---|---|---|---|---|---|
| | Samples in various loss degree when in worst | | | | Subtotal | % |
| Samples in various loss degree after tsunami | Almost no loss | Little loss | Great loss | Serious loss | | |
| Almost no loss | 53 | 73 | 28 | 10 | 164 | 15.2% |
| Little loss | 64 | 241 | 209 | 46 | 560 | 51.8% |

[1] Cyber Panel is constructed by InsightXplorer. Quality of the responses of all members can be examined by computer program. If the responses are found to be careless or inconsistent, the membership will be terminated. Thus, generally speaking, the questionnaire quality is satisfactory.
[2] The exchange rate during our data period (2009) was 1USD = 30.35NTD.

Table 1 (cont.). Sample distribution of individual investors due to the financial tsunami

| Panel A | | | | | | |
|---|---|---|---|---|---|---|
| | Samples in various loss degree when in worst | | | | Subtotal | % |
| Samples in various loss degree after tsunami | Almost no loss | Little loss | Great loss | Serious loss | | |
| Great loss | 14 | 42 | 143 | 95 | 294 | 27.2% |
| Serious loss | 2 | 0 | 9 | 52 | 63 | 5.8% |
| Subtotal | 133 | 356 | 389 | 203 | 1081 | 100.0% |
| % | 12.3% | 32.9% | 36.0% | 18.8% | 100.0% | 100.0% |
| Panel B | | | | | | |
| Losses after tsunami | | | | | | |
| Worse | 80 | 42 | 9 | 0 | 131 | 12.1% |
| Better | 0 | 73 | 237 | 151 | 461 | 42.6% |
| No change | 53 | 241 | 143 | 52 | 489 | 45.2% |

Table 2. Wealth loss and the demographic variables during and after the financial tsunami

The numeric represents the average loss. One is for almost no loss, and four is for serious loss. Independent test $\chi^2$ (*P*) is the statistics (*P*-value) of independent test between the wealth loss and the demographic variable correspondently.

| | Mean score | | | Independent test $\chi^2$ (*P*) | |
|---|---|---|---|---|---|
| | When worst | After tsunami | *P*-value of mean difference | When worst | After tsunami |
| Gender | | | | 1.669 (0.644) | 1.150 (0.765) |
| Male | 2.62 | 2.22 | 0.000 | | |
| Female | 2.61 | 2.25 | 0.000 | | |
| Monthly income | | | | 9.165 (0.422) | 44.326 (0.000) |
| Below NTD$30000 | 2.60 | 2.34 | 0.000 | | |
| $30,001-40,000 | 2.65 | 2.16 | 0.000 | | |
| $40,001-50,000 | 2.68 | 2.15 | 0.000 | | |
| Above $50,001 | 2.52 | 2.11 | 0.000 | | |
| Education | | | | 10.655 (0.100) | 8.661 (0.194) |
| Senior high and below | 2.55 | 2.28 | 0.000 | | |
| Undergraduate | 2.64 | 2.25 | 0.000 | | |
| Graduate and above | 2.55 | 2.11 | 0.000 | | |
| Age | | | | 33.842 (0.000) | 5.290 (0.808) |
| Below 29 | 2.42 | 2.18 | 0.000 | | |
| 30-39 | 2.66 | 2.27 | 0.000 | | |
| 40-49 | 2.83 | 2.25 | 0.000 | | |
| Above 50 | 2.54 | 2.25 | 0.001 | | |

**3.2. Changes of attitudes toward risk and investment strategies.** Serious trauma tends to exert considerable influence on thought, emotion, and behavior. In this section, this study examines whether and how the financial tsunami influenced investors, especially their attitudes toward risk and investment strategies.

*3.2.1. Change of attitudes toward risk.* Many findings show that investors become more tolerant of risk after the market rises, and less risk tolerant when it falls (MacKillop, 2003; Yao, Hanna and Lindamood, 2004; Shefrin, 2000; Grable, Lytton and O'Neill, 2004). For example, after the 1987 stock market crash, investors became less willing to invest in the stock market because their risk tolerance fell dramatically (Clarke and Statman, 1998). Although the losses from the 2008 financial tsunami seemed to be much eased by the end of 2009, the severe shock changed attitudes and behavior patterns may not have eased, depend on the findings of psychological trauma (DePrince and Freyd, 2002; Storr et al., 2007). It is likely that the insecurity and danger following investors' losses remain in their minds and impact their attitudes toward risk. We propose the following hypothesis:

*H1: After going through the financial tsunami, investors' attitudes toward risk became more conservative.*

According to the results of empirical analysis, 41.6% of investors were willing to take risks before

the financial tsunami, but only 27.9% were afterwards, a decrease of 13.7%. Similarly, 27.7% of investors were unwilling to take risks before the financial tsunami and 35.1% were unwilling after the crisis, an increase of 7.4%. That is, the investors willing to take risks before the financial tsunami were greater than those unwilling by 13.7%, but those unwilling to take risks were more than those willing to take risks by more than 7.4% after the financial tsunami. After the financial tsunami, 46.72% of investors remained in the same degree of risk attitude as before, while 32.84% became more conservative, which was 1.6 times more than those who became more active (20.44%) (see Table 3). This finding suggests that an investor's attitudes changes from activeness to conservativeness.

To measure the willingness of risk taking, this study assigns scores from 1 to 5 to measure the willingness of investor's risk taking: 1 indicates "strongly unwilling to take risk" and 5 indicates "strongly willing to take risk" accordingly. The findings show that the average willingness of taking risk before the financial tsunami was 3.09, and the willingness reduced to 2.85 after the financial tsunami. By the *t* test of mean differences of paired samples, the average willingness of taking risk was significantly lower than before at the 1% level. Hypothesis 1 is empirically supported.

The findings show that investors become more conservative across all subgroups of gender, age, income, and education. Before the financial tsunami, male investors in the prime of life with high incomes and high education were more active; the statistics of independent test are significant (see Table 4). However, after the financial tsunami, attitudes toward risk became independent across all the demographic variables, except education. It suggests that compared to the variance before the tsunami, most investors came to a roughly same level of conservativeness.

Table 3. Individual stock investors' changes in attitudes toward risk

| Panel A | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Samples in various risk attitude when in worst | | | | | Subtotal | % |
| Samples in various risk attitude degree after tsunami | Strongly unwilling | Unwilling | Neutral | Willing | Strongly willing | | |
| Strongly unwilling | 43 | 20 | 25 | 23 | 5 | 116 | 10.7% |
| Unwilling | 42 | 72 | 58 | 85 | 7 | 264 | 24.4% |
| Neutral | 22 | 57 | 207 | 96 | 17 | 399 | 36.9% |
| Willing | 11 | 29 | 42 | 167 | 19 | 268 | 24.8% |
| Strongly willing | 2 | 1 | 0 | 15 | 16 | 34 | 3.1% |
| Subtotal | 120 | 179 | 332 | 386 | 64 | 1081 | 100.0% |
| % | 11.1% | 16.6% | 30.7% | 35.7% | 5.9% | 100.0 | 100.0% |
| Panel B | | | | | | | |
| Risk attitude after tsunami | | | | | | | |
| More conservative | 0 | 20 | 83 | 204 | 48 | 355 | 32.84% |
| More active | 77 | 87 | 42 | 15 | 0 | 221 | 20.44% |
| Unchanged | 43 | 72 | 207 | 167 | 16 | 505 | 46.72% |

Table 4. Taiwanese stock investors' change of risk attitude

The numeric represents the risk attitude. One is for strongly unwilling to take risk, and five is for strongly willing to take risk. Independent test $\chi^2$ (*P*) is the statistics (*P*-value) of independent test between the risk attitude and the demographic variable correspondently.

| | Mean score | | | Independent test $\chi^2$ (*P*) | |
|---|---|---|---|---|---|
| | When worst | After tsunami | *P*-value of mean difference | When worst | After tsunami |
| Gender | | | | 12.129 (0.016) | 10.382 (0.034) |
| Male | 3.16 | 2.90 | 0.000 | | |
| Female | 3.01 | 2.80 | 0.000 | | |
| Monthly income | | | | 32.596 (0.001) | 15.943 (0.194) |
| Below NTD$30000 | 2.93 | 2.79 | 0.019 | | |
| $30,001-40,000 | 3.18 | 2.88 | 0.001 | | |
| $40,001-50,000 | 3.24 | 2.91 | 0.001 | | |
| Above $50,001 | 3.29 | 3.04 | 0.000 | | |
| Education | | | | 45.081 (0.000) | 26.036 (0.000) |

Table 4 (cont.). Taiwanese stock investors' change of risk attitude

| | Mean score | | | Independent test $\chi^2$ (*P*) | |
|---|---|---|---|---|---|
| | When worst | After tsunami | *P*-value of mean difference | When worst | After tsunami |
| Senior high and below | 2.64 | 2.54 | 0.235 | | |
| Undergraduate | 3.19 | 2.93 | 0.000 | | |
| Graduate and above | 3.29 | 2.95 | 0.001 | | |
| Age | | | | 20.853 (0.053) | 9.262 (0.680) |
| Below 29 | 3.02 | 2.85 | 0.009 | | |
| 30-39 | 3.13 | 2.90 | 0.000 | | |
| 40-49 | 3.19 | 2.79 | 0.000 | | |
| Above 50 | 2.87 | 2.77 | 0.469 | | |

*3.2.2. Impact on diversification.* According to the analysis above, individual investors' risk preference became significantly more conservative. Did investment strategies also change due to the tsunami? To answer this question, an analysis of the diversification of stock holding, turnover, and the disposition of stop-losses was conducted.

According to the modern investment theory, diversification reduces risk. Studies demonstrate that a diversified portfolio of stocks can effectively reduce the unsystematic risk with more than 40 stocks (Statman, 1987) or 120 stocks (Statman, 2002). However, nowadays investors can easily diversify stocks by holding funds; it seems unnecessary to hold many stocks to reduce risk. Moreover, the modern portfolio theory assumes zero transaction cost, which is not the case in practice. In fact, investors bear a pretty high cost to hold a diversified portfolio. It is time-consuming work in collecting and analyzing information, as well as managing their portfolio. According to Kuo and Kuo's survey (2006), most Taiwanese stock investors consider holding a small stock portfolio to be the optimal diversification. They found that 91.2% subjects show the ideal number of stock holdings to be five or fewer (Kuo and Kuo, 2006). Besides, Shefrin and Statman (2000) suggest that investors use hierarchical asset allocation strategies to avoid loss and pursue profits at the same time. For example, investors keep insurance, funds, and stocks in their portfolio so as to reduce risk through insurance and funds while pursuing returns from stock investments. Thus investors do not necessarily consider holding a large stock portfolio an advantage as a diversification strategy. Especially since the 2008 financial tsunami was a systemic crisis, diversification did not help to avoid losses. Based on the high transaction cost of keeping a diversified portfolio, plus limited benefit perceived by investors, we propose they would decrease the stocks held after the tsunami.

*H2: After going through the financial tsunami, the size of investors' stock holdings decreases.*

According to the empirical analysis, individual investors keep very limited number of stocks in their portfolio. On average each investor held 4.9 stocks before the financial tsunami and 4.7 stocks afterwards, far less than scholars' suggestions. Nearly 80% investors keep only 5 stocks on average both before and after the financial tsunami (see Table 5). If we look at the average size of all demographical subgroups, we find particularly that female and younger investors with lower income and lower education hold the fewest stocks. Age reveals the highest discriminatory power on the size of stock holding. Before the financial tsunami, investors over 50 years old on average held 7.32 stocks while those below 29 years old only had 4 stocks. After the tsunami, their holdings shrank to 6.57 stocks and 3.79 stocks respectively. All subgroups showed a decrease in their portfolio sizes after the tsunami, but most decreases were insignificant. Only two subgroups reached statistical significance, namely, male investors and those with middle monthly income of NTD$30,000-40,000. Before the financial tsunami, male investors had an average of 5.19 stocks, and after the financial tsunami, they held significantly smaller portfolios with 4.85 stocks (female investors remained at 4.6 stocks). Investors with monthly incomes of NTD$30,000-40,000 had on average reduced their stock holding from 4.58 to 4.11 stocks (see Table 6). The potential reason of lack of statistical significance might be due to the fact that the portfolio size has been very limited before; there was not much room to reduce further.

Table 5. The distribution of stock holdings

| | Before financial tsunami | | After financial tsunami | |
|---|---|---|---|---|
| Holding size | Sample | % | Sample | % |
| 2 or less | 378 | 35.9 | 429 | 40.5 |
| 3-5 | 453 | 43.0 | 405 | 38.3 |
| 6-10 | 148 | 14.0 | 154 | 14.6 |
| 11 or more | 75 | 7.1 | 70 | 6.6 |
| Total | 1054 | 100.0 | 1058 | 100.0 |

Table 6. Average number of stock holdings

The numeric represents the average number of stock holdings. Independent test $\chi^2$ ($P$) is the statistics ($P$-value) of independent test between the holding size and the demographic variable correspondently.

| | Mean score | | | Independent test $\chi^2$ ($P$) | |
|---|---|---|---|---|---|
| | When worst | After tsunami | $P$-value of mean difference | When worst | After tsunami |
| Gender | | | | 14.222 (0.003) | 1.824 (0.610) |
| Male | 5.19 | 4.85 | 0.020 | | |
| Female | 4.60 | 4.55 | 0.868 | | |
| Monthly income | | | | 69.655 (0.000) | 46.594 (0.000) |
| Below NTD$30000 | 4.35 | 4.13 | 0.357 | | |
| $30,001-40,000 | 4.58 | 4.11 | 0.011 | | |
| $40,001-50,000 | 5.01 | 4.81 | 0.307 | | |
| Above $50,001 | 6.57 | 6.43 | 0.632 | | |
| Education | | | | 19.373 (0.004) | 14.200 (0.027) |
| Senior high and below | 4.50 | 4.28 | 0.665 | | |
| Undergraduate | 4.93 | 4.75 | 0.209 | | |
| Graduate and above | 5.58 | 5.23 | 0.156 | | |
| Age | | | | 80.041 (0.000) | 65.317 (0.000) |
| Below 29 | 4.00 | 3.79 | 0.356 | | |
| 30-39 | 4.64 | 4.60 | 0.894 | | |
| 40-49 | 5.90 | 5.58 | 0.118 | | |
| Above 50 | 7.32 | 6.57 | 0.115 | | |

*3.2.3. Impact on trading turnover.* In the stock market, overtrading seems quite common, and many scholars suggest that it is partly due to the investors' overconfidence, which makes them trade actively and yields a low rate of return (Odean, 1998; Gervais and Odean, 2001; Barber and Odean, 2000, 2001; Odean, 1999). Statman and Thorley (2006) indicate that high returns bring about over-confidence and over-trading, due to self-attribution error and underestimation of risk. That is, high returns lead investors to become overconfident and produce overtrading. In the opposite case, investors may reduce trading when facing poor returns and soaring risk. As previously shown the financial tsunami produced bad losses for most investors and created high risk. It reduced investors' confidence. Therefore, hypothesis 3 is proposed:

*H3: After going through the financial tsunami, investors' trading frequency is reduced.*

Before the financial tsunami, Taiwanese stock investors made an average of 5.94 transactions monthly, and 27.9% of them traded more than 5 times per month. After the financial tsunami, average trading frequency was reduced to 5.39 times with 25.1% investors trading more than 5 times per month. Using a $t$-test of pair-sample mean differences, the reduction was statistically significant (see Table 7). That is, going through the financial tsunami, investors traded less actively. Hypothesis 3 was empirically supported.

Through demographic analysis, it seems likely that male investors with high income, more than 40 years old and high education, either before or after the financial tsunami, traded more. Most of the demographic subgroups show a decrease pattern in trading, especially those of male, medium income, college level, aged between 30 and 49 (see Table 8). Noticeably in terms of income, investors with monthly incomes of more than NTD$ 50,000 traded the most (8.19 times) before the financial tsunami, and traded even more actively after the financial tsunami (8.29 times) though the finding was not statistically significant. Regarding age, the subgroup of 40-49 years old was the most active before the financial tsunami, but reduced quite a lot and yielded the first place to those aged over 50. In short, after the financial tsunami, higher-income and older investors trade more, though the findings lacked statistical significance.

Table 7. Individual stock investors' monthly trading frequency

| | Before financial tsunami | | After financial tsunami | |
|---|---|---|---|---|
| Trading frequency | Sample | % | Sample | % |
| 2 or less | 494 | 48.0 | 549 | 53.5 |
| 3-5 | 248 | 24.1 | 220 | 21.4 |
| 6-10 | 157 | 15.2 | 145 | 14.1 |
| 11 or more | 131 | 12.7 | 113 | 11.0 |
| Total | 1030 | 100.0 | 1027 | 100.0 |

Table 8. Individual stock investors' monthly trading frequency: demographical analysis

The numeric represents the monthly trading frequency. Independent test $\chi^2$ (*P*) is the statistics (P value) of independent test between the trading frequency and the demographic variable correspondently.

| | Mean score | | | Independent test $\chi^2$ (*P*) | |
|---|---|---|---|---|---|
| | When worst | After tsunami | P-value of mean difference | When worst | After tsunami |
| Gender | | | | 8.740 (0.033) | 3.236 (0.357) |
| Male | 6.58 | 5.86 | 0.018 | | |
| Female | 5.16 | 4.82 | 0.259 | | |
| Monthly income | | | | 25.289 (0.003) | 20.277 (0.016) |
| Below NTD$30000 | 4.60 | 4.60 | 0.996 | | |
| $30,001-40,000 | 6.59 | 4.95 | 0.001 | | |
| $40,001-50,000 | 5.19 | 4.23 | 0.020 | | |
| Above $50,001 | 8.19 | 8.29 | 0.874 | | |
| Education | | | | 5.285 (0.508) | 2.318 (0.888) |
| Senior high and below | 5.53 | 5.29 | 0.603 | | |
| Undergraduate | 5.92 | 5.35 | 0.026 | | |
| Graduate and above | 6.73 | 5.57 | 0.195 | | |
| Age | | | | 25.132 (0.003) | 21.957 (0.009) |
| Below 29 | 4.46 | 4.96 | 0.133 | | |
| 30-39 | 5.46 | 4.50 | 0.000 | | |
| 40-49 | 8.47 | 6.93 | 0.031 | | |
| Above 50 | 7.85 | 7.92 | 0.933 | | |

*3.2.4. Impact on the stop-loss.* Stop-loss or loss realization has been discussed or debated a great deal. Some argue that it is unnecessary to maintain any stop losses, since the market is efficient, while others suggest that stopping losses is important to avoiding deterioration. However, it is believed that the market is not easy to put into effect, since people are averse to losses. However, according to the hypothesis of snake bite effect, people tend to be more risk-averse following a loss (Thaler and Johnson, 1990). The pain of a big loss (the snake bite) leads people to more willingly realize a loss in order to avoid a potentially bigger loss when they perceive rising risk. That is, when risk rises, investors are more inclined to stop losses. The financial tsunami caused serious losses to investors, and their attitudes toward risk became more conservative as previously reported. Therefore, hypothesis 4 is proposed as follows:

*H4: After going through the financial tsunami, investors are more willing to stop losses.*

According to the results of the question in questionnaire, "Regarding the stop-loss strategy, if you have, say, 5 stocks in loss, how many of them on average would you put the stop-loss strategy into effect?" The findings suggest that not many individual investors would execute stop-loss plans. Before the financial tsunami, out of five losing stocks, investors execute stop-loss plans on only 1.54 stocks (31% stop loss rate); only 20.3% investors would stop 3 or more losing out of five. After the financial tsunami, the corresponding proportion of investors increased to 25.5%, and averaged 1.68 stocks that they implemented stop-loss plans out of five losing stocks (34% stop loss rate). The difference is statistically significant (*P*-value = 0.001). In other words, after the financial tsunami, investors were more active in executing stop-loss plans (see Table 9). Hypothesis 4 is empirically supported.

Investors are more active in stopping or realizing losses after the financial tsunami in all demographic subgroups of gender, income, education, and age; half of them are statistically significant. The subgroups showing the highest stop-loss rates after the financial tsunami include those above 50 years old, they made stop-losses on 1.9 stocks out of 5 stocks (the average stop-loss rate of 38.0%), low educational levels (36.2%), females (34.6%), and those with monthly incomes above NTD$50,000 (34.4%) (see Table 10).

Table 9. Individual stock investors' execution of stop-loss plans

| Stop-loss rate | Before financial tsunami | | After financial tsunami | |
|---|---|---|---|---|
| | Sample | % | Sample | % |
| 0 | 295 | 27.3 | 266 | 24.6 |

Table 9 (cont.). Individual stock investors' execution of stop-loss plans

| Stop-loss rate | Before financial tsunami | | After financial tsunami | |
|---|---|---|---|---|
| | Sample | % | Sample | % |
| 20% | 257 | 23.8 | 279 | 25.8 |
| 40% | 309 | 28.6 | 261 | 24.1 |
| 60% | 142 | 13.1 | 153 | 14.2 |
| Above 80% | 78 | 7.2 | 122 | 11.3 |
| Total | 1081 | 100.0 | 1081 | 100.0 |
| Average stop-lossed stocks out of five stocks (average stop-loss rate) | 1.54 (31%) | | 1.68 (34%) | |

Table 10. Average stop-lossed stocks out of five stocks

The numeric represents the average loss. One means the number of 5 stocks in loss you would put the stop-loss strategy into effect. Independent test $\chi^2$ ($P$) is the statistics ($P$-value) of independent test between the average stop-lossed stocks of 5 stocks and the demographic variable correspondently.

| | Mean score | | | Independent test $\chi^2$ ($P$) | |
|---|---|---|---|---|---|
| | When worst | After tsunami | $P$-value of mean difference | When worst | After tsunami |
| Gender | | | | 2.688 (0.611) | 2.260 (0.688) |
| Male | 1.51 | 1.63 | 0.020 | | |
| Female | 1.57 | 1.73 | 0.011 | | |
| Monthly income | | | | 13.262 (0.350) | 5.593 (0.935) |
| Below NTD$30000 | 1.57 | 1.67 | 0.177 | | |
| $30,001-40,000 | 1.53 | 1.68 | 0.137 | | |
| $40,001-50,000 | 1.40 | 1.55 | 0.162 | | |
| Above $50,001 | 1.50 | 1.72 | 0.013 | | |
| Education | | | | 7.158 (0.520) | 9.872 (0.274) |
| Senior high and below | 1.60 | 1.81 | 0.018 | | |
| Undergraduate | 1.52 | 1.64 | 0.014 | | |
| Graduate and above | 1.55 | 1.68 | 0.280 | | |
| Age | | | | 7.802 (0.800) | 14.618 (0.263) |
| Below 29 | 1.52 | 1.69 | 0.027 | | |
| 30-39 | 1.53 | 1.63 | 0.093 | | |
| 40-49 | 1.52 | 1.67 | 0.073 | | |
| Above 50 | 1.74 | 1.90 | 0.229 | | |

**3.3. Impact of losses on the attitude toward risk and investment strategies: regression analysis.** According to the analysis above, the financial tsunami significantly influenced individual stock investors' attitudes toward risk and investment behavior. Individual investors became more conservative, trading less, and issuing more stop-losses. Are these changes different with losses? Do the investors with greater losses change more? According to the trauma theory, those who suffer more have more serious trauma. Therefore, this study proposes two more hypotheses, as follows:

*H5: The greater the losses of investors due to the financial tsunami, the more conservative they become afterwards.*

*H6: The greater the losses of investors due to the financial tsunami, the more they change their investment behavior afterwards.*

A two-step regression analysis was used to estimate the influence of losses. The empirical models include the change of attitudes toward risk ($Y_1$) and investment strategies ($Y_2$) as dependent variables, and losses from the financial tsunami on investors ($X$) as the major independent variable. The model is shown as below.

$$Y_1 = f(X, Z), \quad (1)$$

$$Y_2 = g(X, Z, y_1). \quad (2)$$

$Z$ denotes the vector of control variables, including gender, age, education, income, and the optimism toward future economies. The $y_1$ variable in model (2) represents $Y_1$'s error term of model (1). Since risk attitude ($Y_1$) influences many investment behaviors, it is included in the $Y_2$ model. However, according to model (1), there is a significant relation between $Y_1$ and $X$. It is inadequate to put them directly in a model simultaneously. Therefore, this

research adopts a two-step estimation, using the predicted value of model (1), $y_1$, to replace the variable of $Y_1$ in model 2.

Investors' expectations towards the future determines their investment decisions and thus needs to be taken into account when examining individual's investment behaviors. The questionnaire followed the UBS Optimism Index of the United States and EU5 to investigate subjects' optimism on their own investment performance and the prospects of the economy. It consists of three questions regarding personal investment and income stability, and four questions regarding the economy as a whole, as listed in Table A1 in Appendix. To measure the optimism/pessimism of each subject, this study also followed the scoring system of UBS: assigning 2 to strongly optimistic, 1 to slightly optimistic, 0 to neutral, -1 to slightly pessimistic, and -2 to strongly pessimistic. The average score of the first three questions is considered as the subject's optimism score on personal dimension, while the mean score of the last four questions regarding the economy is one's optimism score on economic dimension[1].

If the coefficient of $X$ is significantly positive, the trauma theory is supported. That is, the investors who experience greater losses tend to change their attitudes toward risk and investment strategies more significantly.

According to estimation results of model (1) and model (2), the coefficients of tsunami losses on investors are both significant. The effect of risk attitude ($y_1$) is significantly positive in model 2. In other words, the changes that investors' became more conservative and trading decreased due to the financial tsunami are significantly influenced by their losses. The more serious the loss, the more averse to risk and less active in trading investors became. H5 and H6 are empirically supported (see Table 11).

Regarding changes in attitudes toward risk, in addition to the financial tsunami losses, there is a significant and positive relationship between education and optimism toward economy, which indicates that the decrease of risk-taking willingness due to the financial tsunami is more obvious for those with a lower education and those who are more optimistic.

Table 11. Influences of tsunami loss on the changes of attitudes toward risk and investment strategies: two-step regression model analysis

The independent variable "decrease of willingness to take risk" in model (2) is the error term in model (1).

| | Model (1) | | Model (2) | |
|---|---|---|---|---|
| | $Y_1$: Decrease of willingness to take risk | | $Y_2$: Decrease of trading | |
| | Coefficient | P-value | Coefficient | P-value |
| Constant | -0.109 | (0.645) | -1.426 | (0.296) |
| $X$ (tsunami loss) | 0.182 | (0.000) | 0.497 | (0.005) |
| $y_1$ (decrease of willingness to take risk) | | | 0.846 | (0.000) |
| Age | -0.007 | (0.171) | -0.009 | (0.758) |
| Low edu | 0.342 | (0.029) | 0.553 | (0.542) |
| High edu | 0.204 | (0.095) | 0.613 | (0.383) |
| Male | 0.003 | (0.968) | 0.508 | (0.281) |
| Income | -0.010 | (0.779) | 0.135 | (0.531) |
| Optimism toward personal dimension | 0.094 | (0.178) | 0.473 | (0.236) |
| Optimism toward economic dimension | 0.174 | (0.018) | 0.548 | (0.191) |
| Sample | 857 | | 820 | |
| Adjusted $R$-squared | 0.085 | | 0.046 | |
| $F$-statistic ($P$-value) | 10.948 (0.000) | | 5.398 (0.000) | |

## Conclusions

The global financial tsunami of 2008 caused severe losses for investors. Many studies reported its causes and effects but mainly focus on the macro issues, leaving a gap in the research regarding individual stock investors. In a nationwide study of Taiwan's investors, the findings provide a valuable documentation regarding the first large-scale financial tsunami in the twenty-first century. We focus on the issues of how the tsunami changed individual investors' attitudes toward risk and investment behavior.

Due to the fact that nearly 90% of Taiwanese stock investors are e-investors, web investigation is suitable for this study. Therefore, we investigated Taiwanese individual stock investors by randomly sampling on Cyber Panel and IX Survey in December 2009, 15 months after the bankruptcy of Lehman Brothers. There were 1,214 valid samples with the sampling error below 3%.

According to the empirical analysis results, the financial tsunami did generate serious losses on stock investors' wealth, with 54.8% losing signifi-

[1] The measurements of optimism towards the future follows the measurements on UBS Investors Optimism Index in the U.S. and Taiwanese Investors Emotion Index.

cant sums of money. Then, 15 months later, 42.6% investors indicated that the harm was mitigated, 45.2% remained the same, while 12.1% investors reported that harm was increased.

We found that after the financial tsunami, on average, the individual investors' willingness to take risk decreased, trading frequency reduced, and the implementation of stop-loss increased; the number of stock holdings reduced as expected, but insignificantly. Moreover, we demonstrated a significant relation between the loss seriousness and the changes of investing behavior. The more investors lost, the less they appeared willing to take risk and the less stocks they traded.

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## Appendix

Table A1. Questionnaire items regarding attitudes toward risk, investment strategy, and optimism

| Risk attitude and investment behavior | | | | | |
|---|---|---|---|---|---|
| | Before the 2008 financial tsunami | | Currently (Dec. 2009) | | |
| In general, high returns require investors to take high risks. Limited risk brings about limited returns. In the right column, please choose the best descriptions of your attitudes toward risk before and after the financial meltdown. | (1) Strongly unwilling to undertake risk<br>(2) Unwilling to undertake risk (neutral)<br>(3) Willing to undertake risk<br>(4) Strongly willing to undertake risk | | (1) Strongly unwilling to undertake risk<br>(2) Unwilling to undertake risk (neutral)<br>(3) Willing to undertake risk<br>(4) Strongly willing to undertake risk | | |
| On average, how many stocks do you have simultaneously? | _____stocks | | _____stocks | | |
| On average, how many times do you buy or sell stocks in one month? (Buying and selling are independently considered as one time) | _____times | | _____times | | |
| Regarding the stop-loss strategy, if you have, say, 5 stocks in loss, how many of them on average you would put the stop-loss strategy into effect? | □ 0 □ 1 □ 2<br>□ 3 □ 4 □ 5 | | □ 0 □ 1 □ 2<br>□ 3 □ 4 □ 5 | | |
| Optimism | | | | | |
| What is your optimism regarding the following statements? | Strongly optimistic | Slightly optimistic | Neutral | Slightly pessimistic | Strongly pessimistic |
| (1) For three months from now on, you will make it to your personal investment goal. | □ | □ | □ | □ | □ |

Table A1 (cont.). Questionnaire items regarding attitudes toward risk, investment strategy, and optimism

| Optimism | | | | | |
|---|---|---|---|---|---|
| What is your optimism regarding the following statements? | Strongly optimistic | Slightly optimistic | Neutral | Slightly pessimistic | Strongly pessimistic |
| (2) For next year from now on, you will make it to your personal investment goal. | □ | □ | □ | □ | □ |
| (3) For next year from now on, your income can remain the same in the following year. | □ | □ | □ | □ | □ |
| (4) The economy growth for the next half year. | □ | □ | □ | □ | □ |
| (5) Unemployment rate for the next three months. | □ | □ | □ | □ | □ |
| (6) Stock performance for the next three months. | □ | □ | □ | □ | □ |
| (7) The influence of price movement on the stock market for the next three months. | □ | □ | □ | □ | □ |