Comparison of Post-SARS Arrival Recovery Patterns

Chi-Kuo Mao, Cherng G. Ding, Hsiu-Yu Lee
Institute of Business and Management
National Chiao Tung University, Taiwan
ckmao@mail.nctu.edu.tw

1. Introduction

Severe acute respiratory syndrome (SARS) is a new and readily transmissible disease, the discovery and spread of which created a tourism crisis in parts of Asia in 2003 [Henderson 2003]. The World Health Organization (WHO) issued a global SARS alert on March 12, 2003. As the disease continued to spread rapidly, WHO issued an emergency travel advisory on March 15 the same year; such advisories have been extremely rare in the history of WHO. The disease spread rapidly since largely through the medium of international travel to more than 20 countries, including Canada, China, Hong Kong, Singapore, Taiwan and Vietnam, causing panic worldwide. Governments placed restrictions of varying stringency on domestic travel, appealing to both businesses and individuals to keep unnecessary travel and meetings to the minimum. Besides the fear of being infected, the quarantine and isolation measures also caused the voluntary curtailment of international travel to affected areas. The SARS epidemic, therefore, had a severe negative impact on the global travel and tourism industry.

Japan and Hong Kong (including Macao) are the two main sources of tourist arrivals for Taiwan. According to the reported by Taiwan Tourism Bureau (TTB), in 2003, within one month after the outbreak of SARS epidemic, the number of inbound arrivals from Japan and Hong Kong had fallen by 78% and 62% respectively [TTB 2004]. Nevertheless, after the epidemic was successfully contained, the recovery statuses of Japan and Hong Kong tourist arrivals are significantly different. The arrivals of Hong Kong travelers rebounded almost immediately to roughly the same level as before the SARS epidemic, however, the arrivals of Japanese travelers rebounded slowly. Thus, the recovery pattern apparently exhibited a sudden, discontinuous change.

This study uses the cusp model from catastrophe theory to describe and explain this kind of phenomenon and the mechanisms, in the hope to achieve a more in-depth, more precise analysis and to understand the process whereby a quantitative change process results in a sudden qualitative change. In the real world, it is often difficult to obtain the kinds of data that allow the application of catastrophe theory to provide a clearer

explanation of sudden change. Literature also offers few examples of using real-world data for empirical study of catastrophe theory. The sudden change in the number of tourist arrivals from Japan and from Hong Kong following the SARS epidemic in Taiwan, and the gradual recovery that followed the ending of the epidemic, provides a marvelous opportunity to use real-world data to verify the practical usefulness of catastrophe theory.

2. The Impact of SARS on Arrivals from Japan and from Hong Kong

As shown in Fig. 1, during April to July 2003 (the SARS outbreak period in Taiwan), both the numbers of tourist arrivals from Japan and Hong Kong to Taiwan fell to historic lows. Following the epidemic, however, the recovery patterns of these two markets were dramatically different. The Hong Kong tourist arrivals recovered almost immediately. By contrast, the Japanese tourist arrivals did not recover to pre-SARS levels until more than a year after Taiwan was officially removed from the list of SARS affected areas. Both recovery patterns exhibit sudden change, and not underlying continuous dynamic, which represents obviously catastrophic events. Thus, the application of catastrophe theory to this study will help us in particular to visualize the structure of such discontinuities more clearly.

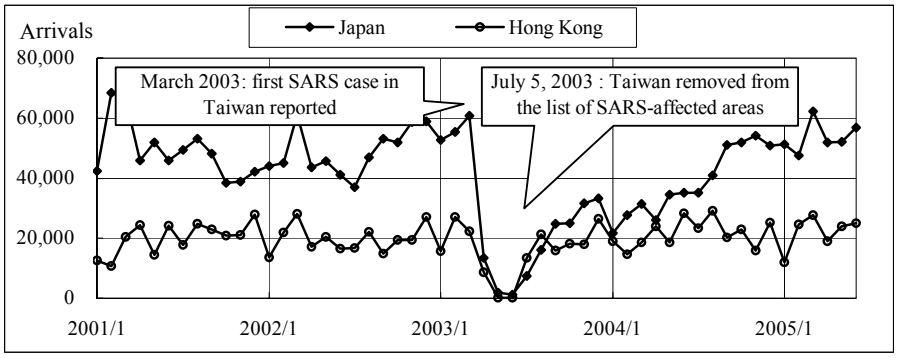

Figure 1. Changes in the Number of Tourist Arrivals from Japan and Hong Kong for the Pre-and-Post-SARS period

3. Application of the Catastrophe Theory

Catastrophe theory describes the qualitatively different discontinuities in a given system that can be completely specified by one or more state variables and is driven by one or more independent control variables [Thom 1975]. The cusp catastrophe model is the most parsimonious elementary catastrophe. It is a mostly applied and pragmatic model due to its relative simple model building effort and its convenience of visual apprehension. Many catastrophe phenomena in the real world can be studied and analyzed using the cusp catastrophe model if a binary state variable and two control variables are defined. In this model, the control variables are ordinary quantified continuous variables, while the system state is a discrete variable with binary solution (0 for the state before change and 1 for the state after change). Theoretical and empirical evidence have established that cusp catastrophic systems exhibit a unique set of

symptoms. Those symptoms include: modality, the occurrence of thresholds, the existence of sudden jumps, hysteresis and divergence. Cusp model without hysteresis effect is an exception in the cusp catastrophe system [Mao 2003].

3.1 Confirmation of Catastrophe Phenomenon

One recent study [Mao et al. 2006] did use statistical tests to verify the monthly mean of inbound arrivals in Taiwan from Hong Kong and Japan during the pre-through-post SARS periods meets the cusp catastrophe model. We use the data on inbound arrivals from Japan and Hong Kong over the period of January 2001 through June 2005. We classify the data into four stages for comparison purpose. Stage 1 is the pre-SARS period (January 2001 ~ March 2003); stage 2 is the SARS-outbreak period (April 2003 ~ July 2003); stage 3 is the post-SARS period (August 2003 ~ August 2004) and stage 4 is the follow-up period (September 2004 ~ June 2005). Regression analysis with dummy variables that represent different stages is used to test the modality effects.

The statistical analysis indicated that mean tourist arrival from Hong Kong did not exhibit significant difference between stages 1, 3, and 4, while that in stage 2 (the SARS outbreak period) was significantly different from the other three stages. The results have verified that the system state had binary solution, a characteristic of catastrophe system. Further examination of the presence/absence of hysteresis effect shows that the mean tourist arrivals from Japan in stage 1 and stage 4 did not show significant difference, but that in stage 2 was significantly different from stage 1 and stage 4, and the mean arrival in stage 3 was significantly higher than that in stage 2, but not comparable to the stage 1 level (the pre-SARS period), indicating the presence of hysteresis in the recovery process. In contrast, the mean tourist arrival from Hong Kong in the post-SARS period had been recovered to the pre-SARS level without hysteresis.

A comparative graph is given in Fig. 2 to reflect the test results. It is clear that the inbound arrivals from Japan exhibited binary modality and hysteresis, which are typical characteristics of a cusp catastrophe model; the inbound arrivals from Hong Kong also exhibited binary modality, but were free of hysteresis phenomenon, which is the feature of a cusp catastrophe without hysteresis. The impacts of SARS on the Japan and Hong Kong inbound markets can be well interpreted by the catastrophe theory.

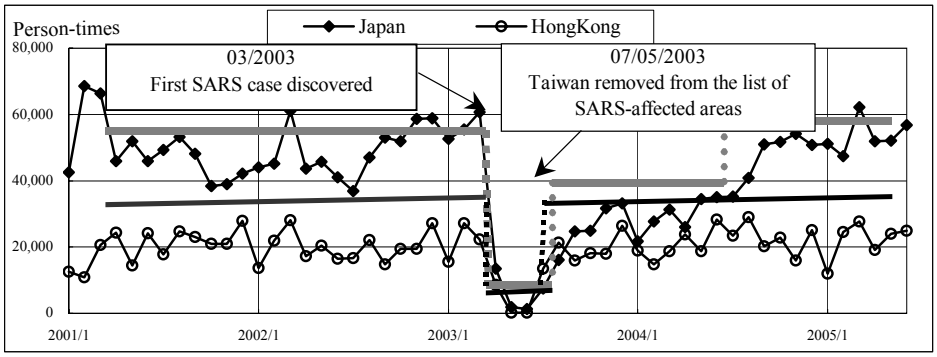

Figure 2. Comparison of Post-SARS Recovery Patterns of Inbound Arrivals from Japan and Hong Kong

3.2 Hysteresis Effect

(1) Inbound arrivals from Hong Kong

As shown in Fig. 2, tourists from Hong Kong rebounded immediately to the pre-SARS level after Taiwan was removed from the list of SARS-affected areas. The recovery pattern was conspicuously free of hysteresis phenomenon as compared to the Japanese market. It could be attributed to the fact that Hong Kong was also a SARS-affected area and its epidemic situation was more severe than that of Taiwan. Thus once travel alert to Taiwan was removed (the reason for "not coming" was removed), Hong Kong tourists would not "feel" unsafe to travel to Taiwan. Therefore, Hong Kong tourists immediately switched from "not coming" to "coming", where the change between the states was entirely conditional upon the presence/absence of "epidemic" without any lagging. As shown in Fig. 3a, assuming P_1 is the potential tourist's psychological level of security, when SARS outbreak happened, market state would undergo sudden change at P_2—P_2', upon which tourists who originally would "come" decided "not coming". But once the travel alert was lifted, the "not coming" state would revert back to "coming" at P_4—P_4'. Regardless where P_1 was located, the point of sudden change (P_2) and recovery point (P_4) were at the same critical point of catastrophe (corresponding threshold). That is, the "not coming" state would return to "coming" state at the same critical point without lagging. Since the recovery of individual tourists from Hong Kong did not show hysteresis, that of the overall Hong Kong market was free of hysteresis as well (as shown in Fig. 3b).

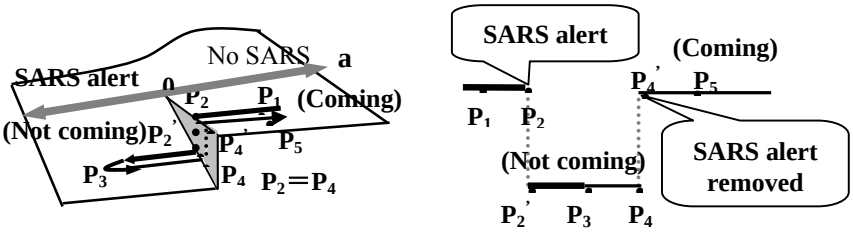

Fig.3a Individual tourist recovery pattern

Fig.3b Overall market recovery pattern

Figure 3. Post-SARS Recovery Pattern of Inbound Arrivals from Hong Kong

(2) Inbound arrivals from Japan

Japanese tourists tend to have a high preference for safe and passive activities [Pizam & Jeong 1996] [Pizam et al. 1997]. The Japanese as a whole tend to be more cautious and the country did not have any report of SARS cases while the epidemic spread in Asia. Thus Japanese tourists were more alert and sensitive to this subject. Consequently after Taiwan was removed from the list of SARS-affected areas (the reason for "not coming" was removed), the Japanese tourists were still hesitant to travel to Taiwan based on their cautious evaluation of the environmental security issue (risk of being infected). Thus for Japanese tourists, there were two control factors for the system state of "coming" and "not coming" - the "epidemic status factor" and the "psychological

factor." The "psychological factor" reflects the degree of tourist's self-defense towards SARS epidemic. If the tourists have a strong sense of self-defense, they will be more conservative in the evaluation of travel risk, and the time to recover to "coming" from "not coming" will be prolonged. In short, the sense of self-defense and the delay in recovery are positively related.

Individual Japanese tourists have different perception of security towards travel risk (factor b); longer b intercept (distance between the psychological level of security and point 0) means higher standard for security. As shown in Fig. 4a, when factor b is at point P, the intercept is shorter, meaning lower security standard; when factor b is at point S, the intercept is longer, meaning higher security standard. The point of sudden jump (drop) also differs for different standards of "feeling safe" (P corresponds to P_1', and S corresponds to S_1'). After Taiwan was removed from the list of SARS-affected areas, the extent of "not coming" state would continue to move to the right side under the "psychological factor", and the depth of extension is positively related to the influence of "psychological factor." For tourists with lower security standard (P), the recovery path to "coming" would reach the hysteresis line faster (shorter Δa). For tourists with higher security standard (S), Δa is longer and it will take them longer to decide to travel to Taiwan after the travel alert has been removed. Such extension effect suggests that "psychological factor" can modify the influence of "epidemic status" factor on the market state to a certain extent. It is exactly the reason why a system possesses the property of cusp catastrophe and the mechanism behind the hysteresis effect.

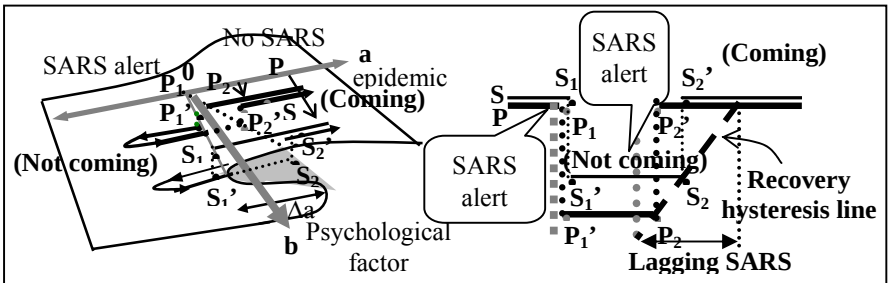

Fig.4a Individual tourist recovery pattern

Fig.4b Overall market recovery pattern

Figure 4. Post-SARS Recovery Pattern of Inbound Arrivals from Japan

Since individual Japanese tourists have different standards for sense of security and their anxiety and self-defense over SARS epidemic differ, the time it takes for each of them to decide to "come" (duration of hysteresis) will vary. As a result, their recovery point (P - P_2' and S - S_2') will deviate from each other. As shown in Fig. 4b, the connection of all recovery points will form a "recovery hysteresis line," which displays a slowly rising slope before the overall Japanese market recovers to the state of "coming." Only when the overall Japanese tourists no longer have any anxiety over the SARS epidemic would the inbound arrivals from Japan return to the pre-SARS level. Thus it can be concluded that "psychological factor" is the basic cause of hysteresis effect in the recovery pattern of Japanese tourists.

4. Application of Study Results and Implications for Tourism Promotion Policy

The inter-transition of a cusp catastrophe system state is determined by two control factors. Thus if we like to restore the system state back to normal after an epidemic like SARS, we can approach it by changing the control factors in the direction conducive to tourists "coming."

It can be seen from the above analysis that the main reasons for the rapid decline in the number of tourist arrivals from Hong Kong during the period of the SARS epidemic were the Taiwan government's temporary suspension of visa-free entry for Hong Kong citizens, the requirement for visitors from Hong Kong to spend ten days in isolation after arriving in Taiwan, and the reduction in the number of flights per day between Hong Kong and Taiwan. However, once Taiwan had been declared a SARS-free zone, the number of tourist arrivals from Hong Kong rapidly climbed back up to around its pre-SARS level. The change in the number of tourist arrivals from Hong Kong was thus attributable entirely to the "epidemic status" factor. Any change in this factor that led to a shortening of the epidemic would push the number of tourist arrivals to recover almost immediately (see Fig. 5a). The implementation of promotional activities could then attract even more Hong Kong tourists to Taiwan. The empirical data for tourist arrivals from Hong Kong supports this model.

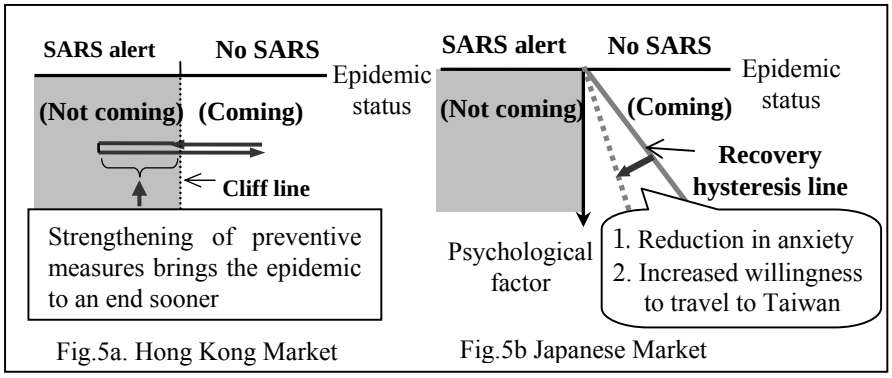

Fig.5a. Hong Kong Market Fig.5b Japanese Market

Figure 5. The Impact of Different Measures on the Recovery Process of the Catastrophe System

With regard to tourist arrivals from Japan, the changes in the number of arrivals were determined by a combination of two factors – epidemic status and psychological factor – acting together. The epidemic factor represents a general condition, while the psychological factor constitutes a special condition. Under these circumstances, the following measures could be adopted to encourage the number of tourist arrivals to recover rapidly to pre-SARS levels:

1. A stepping up of education/publicity regarding to the safety of the overall environment for tourists would mitigate the anxiety over SARS. If, during the period after Taiwan had been removed from the list of SARS-affected areas, but when Japanese tourists were still cautious about visiting Taiwan, the government's efforts should focus more on publicizing the safety of the overall tourist environment in

Taiwan, thereby making people in Japan less concern about SARS and be more willing to come to Taiwan.

2. A strengthening of advertising and promotional campaigns to boost willingness to travel to Taiwan. In order to get Japanese tourists traveling to Taiwan again following the end of the SARS epidemic in Taiwan, the Taiwan government could have stepped up its advertising efforts, working to give Taiwan the image of being an attractive destination for tourists. In addition, special incentive measures could have been introduced to stimulate interest to visit Taiwan. Although Japanese tourists would have remained sensitive to the question of risk, a more rapid recovery in tourist arrivals from Japan could still have been achieved, provided that they were given sufficient incentives.

The synergy created by the two measures outlined above would have led the hysteresis line to become steeper (as shown by the dotted line in Fig. 5b), representing an increase in the speed of tourist arrival recovery. Neither of these measures is a control variable, rather, they are latent factors that influence the qualitative change of control variables. So, they are still capable of causing the system to undergo qualitative change that is beneficial and meets the policy objectives earlier than would otherwise have been the case. If effective use is made of such measures, it should be possible to achieve managerial objectives in an efficient manner. It is to be hoped that the results of the present study will provide a useful reference for the formulation of response measures and marketing strategy in the event of a similar epidemic occurring in the future.

5. Conclusions and Recommendations

Although the 2003 SARS epidemic lasted for only a few months, it had a serious negative impact not only on the international tourism industry but also on the global economy as a whole. The spread of the SARS epidemic to Taiwan led to an almost immediate decline in the number of tourist arrivals from Japan and Hong Kong. Their pattern of recovery displayed after the epidemic had been brought under control was significantly different. It is readily apparent that the changes in the number of tourist arrivals from Japan and Hong Kong constitute sudden change, and that catastrophe theory can therefore be used to analyze and explain this change.

Hong Kong was itself affected by SARS; the impact of the epidemic was in fact more severe in Hong Kong than in Taiwan. As a result, tourists from Hong Kong were less likely to be discouraged from visiting Taiwan due to the fear of contracting SARS. When Taiwan was removed from the list of SARS-affected areas, the number of tourist arrivals from Hong Kong shot back up to pre-SARS levels almost immediately. In fact, due to aggressive tourism promotion efforts by the Taiwan government, the number of people from Hong Kong visiting Taiwan was soon higher than it had been prior to the SARS epidemic, with no hysteresis effect. By contrast, Japanese tourists have always tended to display a high level of sensitivity with respect to travel risk. As a result, after the SARS epidemic in Taiwan came to an end, the recovery in the number of tourist arrivals from Japan was relatively slow; the number of tourists from Japan visiting Taiwan did not reach the pre-SARS levels until more than a year after Taiwan had been removed from the list of SARS-affected areas. The situation with tourist arrivals from Hong Kong clearly represents a non-classic cusp catastrophe, while the situation in Japan

represents a classic cusp catastrophe. The two models contrast brilliantly with one another, while helping to enrich the model applications in this field.

It can be seen from the above analysis that the main difference in the recovery models displayed by the two markets in the post-SARS period lies in the fact that, in the case of Hong Kong market, a change in the "presence/absence of SARS" factor (for example, by strengthening the measures used to combat the disease, so as to bring the epidemic under control more rapidly) could have caused the number of tourist arrivals to recover more quickly. In the case of the Japan market, besides the "SARS factor", attention would also need to be paid to manipulating the "psychological factor", by educating potential tourists about the safety of the travel environment in Taiwan so as to reduce their fear of SARS, or by stepping up promotional measures and advertising to stimulate greater interest in visiting Taiwan. In this way, the impact of the hysteresis effect could be brought to an end more rapidly, and the recovery in tourist arrivals hastened. If effective use is made of such measures, it should be possible to achieve managerial objectives in an efficient manner. It is to be hoped that the results of the present study will provide a useful reference for the formulation of response measures and "marketing" strategy in the event of a similar epidemic occurring in the future. The significance of catastrophe theory in terms of its relevance for managerial applications lies here.

The main emphasis of this study is on interpreting sudden change in systemic status; the discussion of control factors was limited to preliminary examination of possible factors. Providing that researchers realize in advance that they are dealing with a catastrophe phenomenon, and providing that data are available for both before and after the event in question, the quantification of the control factors need not be an impossible task. Despite the limited scope of the analysis in this study, significant insights have been achieved. Perhaps most significantly, it is possible to find real-world situations in which catastrophe theory can be applied to examine catastrophe theory in a meaningful manner.

References

Henderson, J.C., 2003, *Case Study: Managing a Health-Related Crisis: SARS in Singapore*, Journal of Vacation Marketing 10: 67-77.

Mao, C.K., 2003, *Working Paper, CKM 03-02: The Quantitative Characteristic of the Catastrophe System*, Institute of Business and Management, National Chiao Tung University (Taiwan).

Mao, C.K., Ding, C.G. & Lee, H.Y., 2006, A*n Application of Catastrophe Theory on Interpreting Post-SARS Arrival Recovery Pattern, Proceedings of the Fifth Wuhan International Conference on E-Business* (Wuhan, P.R.C.).

Pizam, A., & Jeong, G., 1996, *Cross-Cultural Tourist Behavior: Perceptions of Korean Tour-Guides*, Tourism Management 17(4): 277-286.

Pizam, A., Verbeke, M., & Steel, L., 1997, *Are All Tourists Alike, Regardless of Nationality? The Perceptions of Dutch Tour-Guides*, Journal of International Hospitality Leisure & Tourism Management 1(1): 19-39.

Taiwan Tourism Bureau (TTB), 2004, *Annual Report on Tourism 2003 Republic of China*, Tourism Bureau (Taipei, R.O.C.).

Thom, R., 1975, *Structural stability and morphogenesis: an outline of a general theory of models,* Benjamin, Reading (Mass.).