

A Taiwan Strait Conflict Simulation Model

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This paper proposes a simulation model to better understand the likelihood of conflict. It applies cognitive bias to an expected utility model to provide more specific option outcomes. The Taiwan Strait provides the case study, however, any possible conflict scenario can be used. The results show a diminished probability of conflict in the Taiwan Strait.

Keywords: *China, Taiwan, conflict, prospect theory, risk, formal theory*

1. INTRODUCTION

The purpose of this research paper is to utilize the evaluative phase of prospect theory and determine if it can provide a better explanation than rational choice theory, of possible Taiwan Strait scenarios and of China's potential decisions under risk. There is a definitional difference between risk and uncertainty. If 1 and 0 represent certainty, then uncertainty is the area between a probability of 1 and 0, where the probabilities associated with the outcomes are assumed not to be known. Decisions under risk are a choice between prospects or gambles, where the probabilities associated with the outcomes are assumed to be known (Kahneman and Tversky 1979; Tversky and Fox 2000: 96). The models are complex in order to show how they could deal with social complexity issues on other scenarios outside of the Taiwan Strait issue. Therefore, although the Taiwan Strait problem may present a straightforward solution, other conflict scenarios may not offer such a clear solution without the analyst first dissecting the likelihoods of outcomes given situational restraints. Additionally, by breaking down the decision process to its individual steps the analyst can later apply a process tracing technique to understand how other policy developments fail or succeed without losing themselves in empirical data. This paper uses a known and widely understood policy problem, the Taiwan Strait, to present a simulation model that can then be applied to other less understood policy challenges.

By comparing an expected utility model with a prospect theory model, this research will determine which model performs best. That will be determined by which models' results show a stronger propensity for the actor's preference order, or even a change in the preference order. This paper will assume that the actor is a rational unitary actor, even though it is well known that the scenarios depicted in these models would not be decided upon by one person.

In addition, this paper will attempt to show that in hypothetical situations the application of prospect theory can yield better explanatory and predictive results when compared to the rational choice based expected utility model alone. The basis for this argument is that rational choice theory does not account for cognitive distortions in the face of risk. With regards to the case study of the China-Taiwan issue, this paper does not profess to predict China's behavior. Instead, through the application of expected utility theory and prospect theory to historical and hypothetical scenarios this paper will examine how China's leaders might evaluate their options. By applying the evaluative phase of prospect theory, this paper

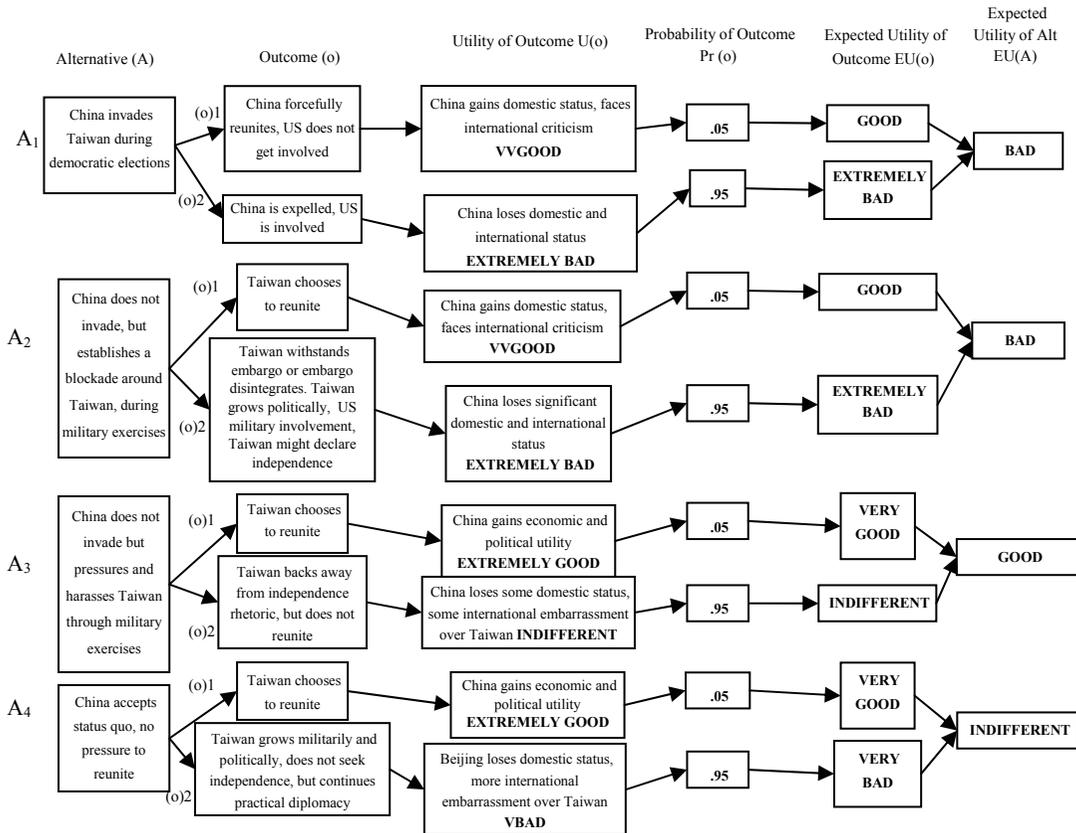


Fig. 1A. Taiwan Straits March 1996.

will attempt to provide insight into the magnitude of the benefits derived from each alternative that is presented in the models.

In order to better account for decision making, it is necessary to look at the rationality of choices under risk in terms of the context within which the choice is made, not just the net gain. This does not mean that the subjective utility model and the prospect theory model are entirely incongruous with each other. For the purpose of modeling the respective historical and hypothetical events and gaining insight into the situation as an observer, it is advantageous to utilize more than one analytical approach. The models used in this study, Fig. 1A through 2B, will consist of subjective utility models and prospect theory models that will illustrate an abstract view of the Taiwan Straits situation in March 1996, and hypothetical present day scenarios.

2. THEORY

Rational choice theory and the expected utility model have been important to analysis of decision making because of their parsimony, rigor, and the benefits of the assumption that actors will always try to maximize their utility (Mintz 1997: 1-2). Rational choice theory

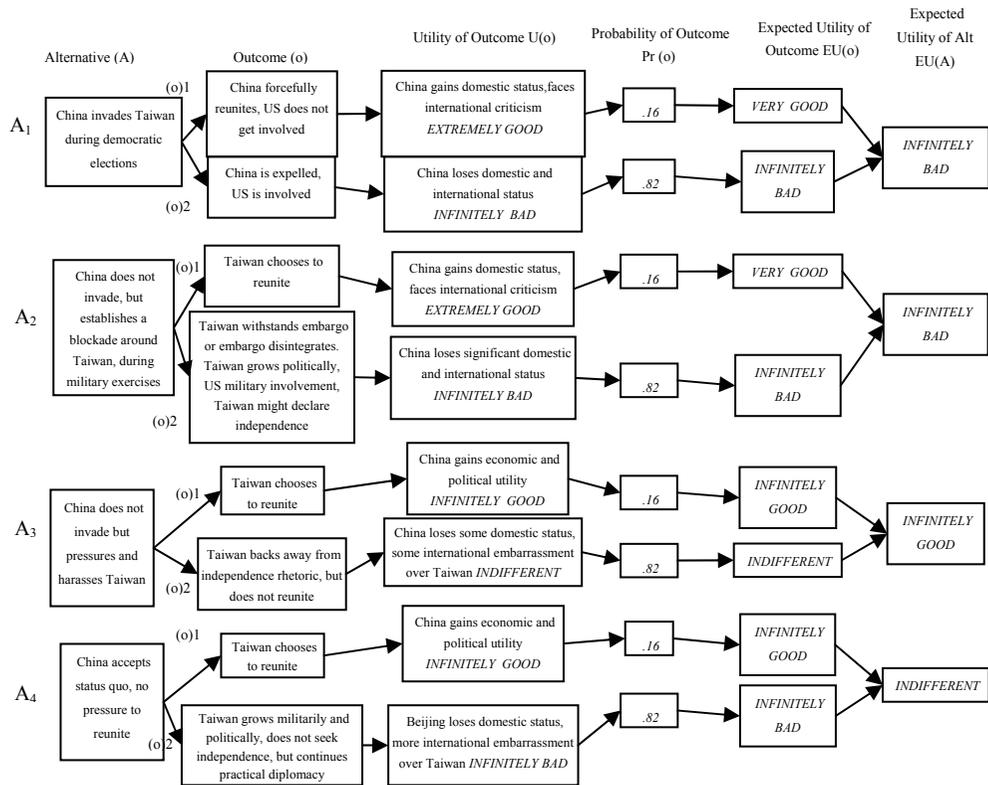


Fig. 1B. Taiwan Straits March 1996 after Prospect Theory.

allows the researcher to create an abstraction of a problem by breaking the problem down to a set of alternatives and a set of outcomes with expected values that can then be compared in order to determine the actor's preference order (Allison 1969; Allison 1971: 29-30). Rational choice is a basic cost-benefit analysis with the purpose of selecting the best option (March 1994: 3). Another benefit to the observer who is trying to analyze real world problems, is that rational choice theory allows for the assumption that a group of decision makers can be observed as a single unitary actor (Green and Shapiro 1994: 15; Morrow 1997: 14).

Criticisms of rational choice theory arose out of the fact that people do not always behave according to rational choice tenets. Rational choice does not account for human limitations and limited resources that the unitary actor or group of decision makers must deal with. Realistically, actors are not likely to have full access to all of the necessary information. These factors, combined with time and cognitive limitations, will cause the actors to exhibit bounded rationality and satisficing (Morrow 1989: 207; Simon 1985; Simon 1955). Therefore, actors may not seem as though they are always trying to maximize their utility, something that contradicts a core assumption of rational choice theory and utility theory (Kanner 2001: 10). Decisions that vary may be the result of different decision heuristics and therefore require the use of an evaluation process that can account for how different people make different decisions that result in sub-optimal outcomes (Allison and Zelikow 1999: 52-53; Simon 1985). Furthermore, rational choice theory does not take into account the effects

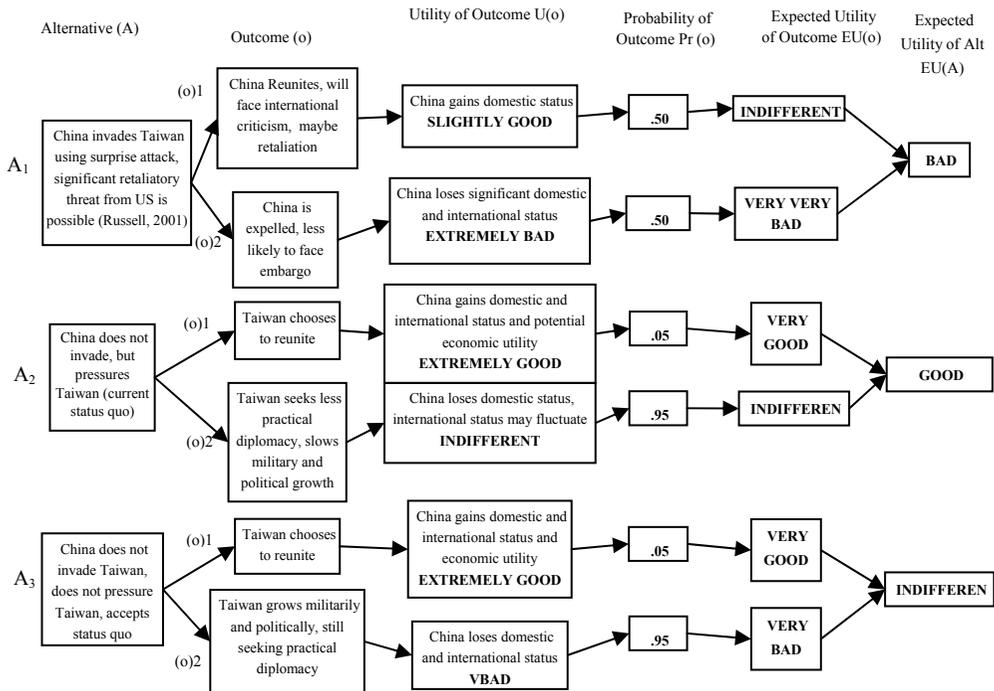


Fig. 2A. Present Day.

of risk on the decision maker or the fact that risk propensity changes amongst decision makers (McDermott 1998: 2).

When the choices to be made entail uncertainty, those choices then contain an element of risk. In those situations, such as in gambling, it is necessary to take probabilities into account. The expected value of a good is the value that we attach to the good, multiplied by the probability that we will actually get the good. Bernoulli understood that people’s behavior violates the expected utility principle, and he was the first to develop a cognitive approach to the idea that there is a systematic bias in decision making (McDermott 1998: 16).

Rational choice models do not pay attention to the way a decision maker’s state of nature can shift or how his perception of the state of nature can change, thereby affecting his propensity for risk (Cioffi 1998: 31; Kahneman and Tversky 1979). When a decision maker changes his or her level of risk acceptance they also change the variety of options that they have at their disposal. Looking at the Taiwan Straits situation, we can see that for Beijing to be willing to use force in order to unify with Taiwan, Beijing must also become significantly more risk acceptant. The motivation behind risk acceptance might be traced to issues unrelated to the Taiwan question, making this situation difficult to explain through subjective expected utility theory, as will be explained later (Bueno de Mesquita 2000: 255; Most and Starr 1989: 34).

The issue of risk in decision making is magnified in the realm of international relations and how states decide on their foreign policies (Nicholson 1989: 52; Cioffi 1998: 11-13). Therefore, it is difficult to ignore cognitive approaches and the contributions they offer to analysis of decision making under risk. Human decision makers are unable to act entirely in

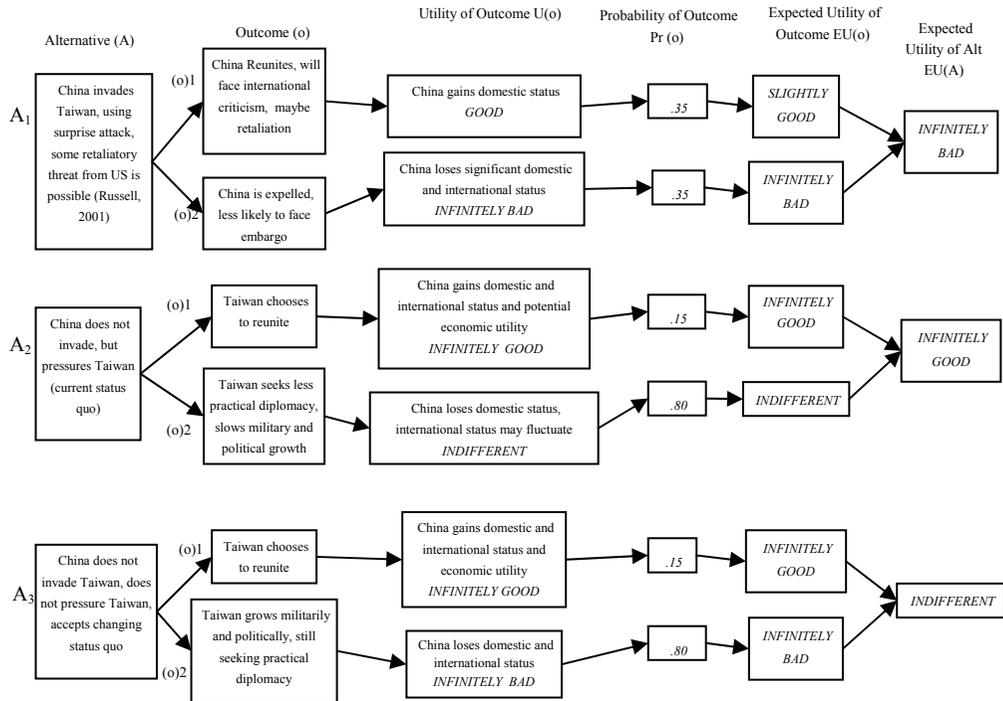


Fig. 2B. Present Day after Prospect Theory

a manner that fits rational choice theory. Emotions, culture, and human cognitive limitations play too large a role in decision making, especially risky decisions, for rational choice theory to be able to explain how people actually behave (Allison 1971: 5-7).

Prospect theory was developed by Kahneman and Tversky as a response to the fact that rational choice based models of decision making could not explain why people behave differently from the way in which normative decision making theories prescribe. Kahneman and Tversky found that peoples' attitudes towards risk did not follow expected utility theory (1979). This was most apparent in situations of risk and uncertainty. Prospect theory argues that individuals evaluate outcomes with respect to deviations from a reference point rather than with respect to net asset levels, thereby making the reference point an important variable.

Expected utility theory states that the probability of each outcome in risky situations is known and individuals weight the utilities of outcomes by the probabilities and choose the highest weighted term. In that sense, Kahneman and Tversky have found expected utility theory to be empirically incorrect (McDermott 1998: 15-20). The descriptive foundations of prospect theory are as follows: 1) people think about gains and losses around the reference point or their aspiration level, rather than net assets, 2) individuals are risk-averse with regards to gains (concave) and risk-acceptant with regards to losses (convex), 3) there is a reflection effect around the reference point at which the losses seem greater than gains, 4) people's sensitivity to change diminishes as they move further away from the reference point in either direction. At the same time, gains are treated differently from losses; people hate losing more than they like winning (Levy 1992: 175), 5) there is an over evaluation of

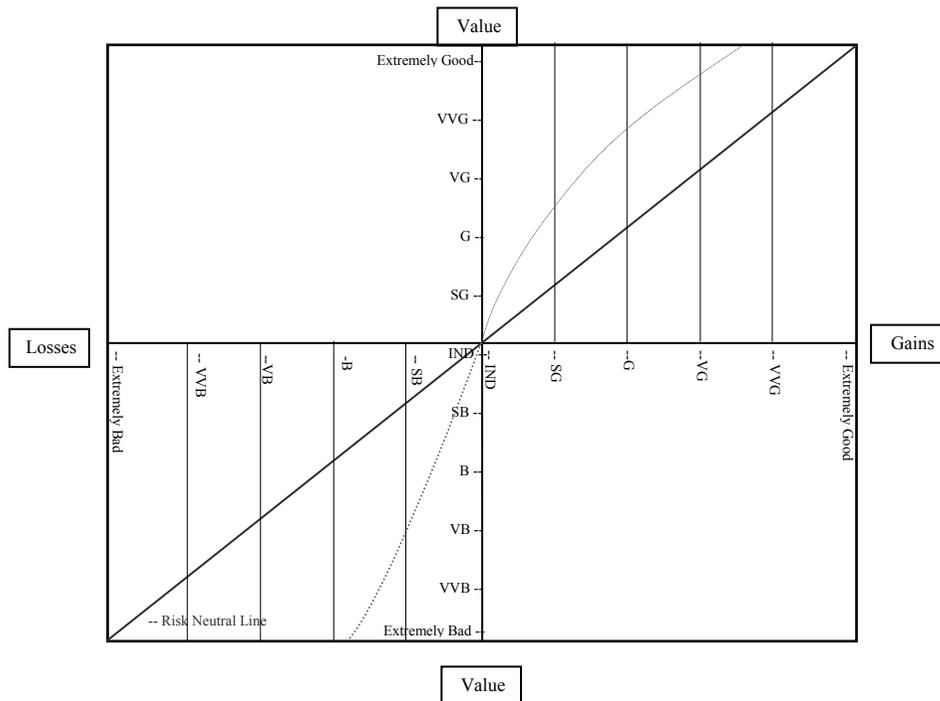


Fig. 3. Value Function Chart.

current possessions, also called the endowment effect. This endowment effect can be strengthened by the symbolic value of political or economic assets (Kahneman and Tversky 1979; Tversky and Kahneman 1986; Kahneman and Tversky 2000: 13; Levy 1992: 175). If Beijing's elite perceive that China is entitled to Taiwan, they may alter their preferences even if the endowment is not real and regardless of Taiwan's actual status under international law. At the same time, if Beijing unofficially recognizes Taiwan's de facto independence, then Beijing's preferences may be more accommodating to the status quo.

Prospect theory evaluation consists of the value function and the weighting function. The decision maker will evaluate the edited prospects and choose the one with the highest value, calculated by the product of a value of an outcome and a decision weight (Kahneman and Tversky 1979; Levy 1992). The value function of the evaluation phase consists of three attributes. First, it is defined in terms of gains and losses relative to the reference point instead of net assets. Second, it is usually concave for gains and convex for losses, thereby illustrating risk aversity and risk seeking (Kahneman and Tversky 1979; Levy 1992: 181-82). Third, the hypothetical S curve is steeper for losses than it is for gains (Fig. 3), illustrating the idea that actors are more sensitive to losses than to gains.

The probability-weighting function of the evaluative phase measures the impact of the probability of an event on the desirability of a prospect. It is not a linear function of probability and the decision weights are not probabilities (Kahneman and Tversky 1979; Levy 1992: 181). Hence, the weight does not compare directly to conventional conceptions of probability. Therefore, when the actor calculates the value of each outcome by its

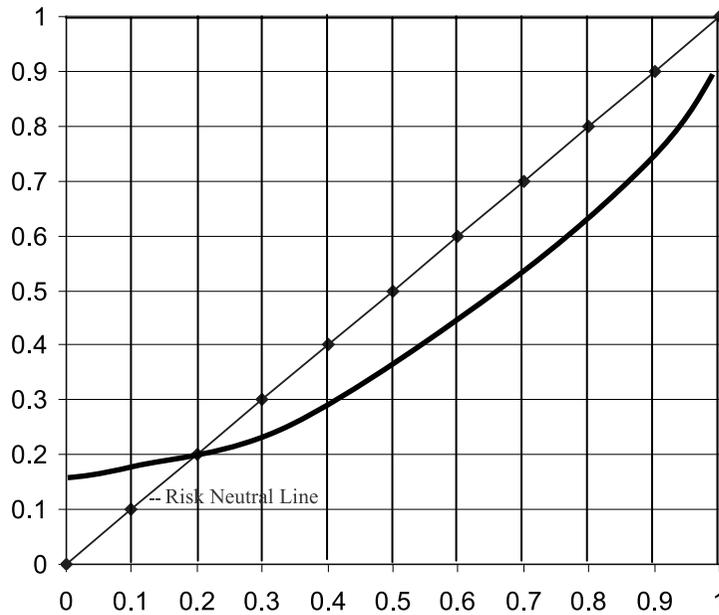


Fig. 4. Weighting Function Chart.

respective decision weight, the end result differs from what one would expect with regular probability calculations (McDermott 1998: 29).

The way in which the probability-weighting function weights the probability is shown in Fig. 4. The straight line represents the risk neutral line that is typically found in utility theory models. The dashed line is the weighted line (π), which represents the weighted probability. From this illustration, it is clear to see how the weighted probabilities are overweighted at low levels of probability and underweighted at moderate and high levels of probability.

The political implications of loss aversion are that the event of losses activates further efforts that can be risky and can lead to even more losses, regardless of the net value of assets. Loss aversion in political life may not be entirely cognitive. In domestic politics, an actor may try to increase his chances of winning a reelection campaign, by introducing or continuing an inevitably failing policy abroad, that on the other hand would raise his popularity at home. This is logical, since an actor's losses abroad may not be on the same scale of significance as the actor's loss of image or reputation at home (Levy 1992: 285). Therefore, prospect theory can explain an actor's perception of his domestic gains and losses, as a causal explanation of his foreign policy.

3. CASE STUDY

The 1996 Taiwan Strait crisis illustrates the region's precarious security situation, especially during Taiwan's democratic election process in the 1990's. The lack of systematic conflict forecasting, not only in the Taiwan Strait but also on a global level, presents a challenge and an opportunity for researchers to model past events in order to gain insight

toward potential future scenarios and to better understand the probabilities of war. This research does not focus on a specific decision by China. Instead, it will look at China's broad evaluation of its potential options for dealing with Taiwan. At the same time, it does not focus on a specific decision maker and assumes the Beijing elite to be a single unitary actor.

Three main factors are identified as being responsible for a lack of stability in the region during that time (Lin 1998: 127). First is China's resolve in preventing Taiwan from *de jure* independence. China considers Taiwan to be a renegade province and seeks Taiwan's eventual unification with the mainland. There have been major shifts in the tone of China's policy towards Taiwan, from the use of force under Mao Zedong, to peaceful unification under Deng Xiaoping, and greater flexibility under Jiang Zemin and Hu Jintao. Although a conciliatory tone was present in Jiang Zemin's *Eight Points* plan, which was more flexible than the unification plan under Deng Xiaoping and shifted China's policy on Taiwan from confrontation to peaceful reunification (Swaine 2001: 310), China still considers Taiwan to be part of the One China principle and under China's sovereignty. With regards to this paper, the status quo is set at the idea that there is one China and two systems (Mingqing 2001), but Taiwan has not yet officially reunited with mainland China, nor does China have physical control over the Taiwan territory.

A second factor contributing to a lack of stability in the region is Taipei's pursuit of pragmatic diplomacy, through which Taiwan hopes to gain international recognition (Garver 1997: 27). At the same time, Taiwan has made conciliatory gestures towards China by renouncing its claim as the rightful government of the mainland. China was pleased with that gesture, but troubled by Taiwan's statement of one China divided by two political entities. Under President Lee Teng-hui, the idea of One China no longer referred to one state, but to a sharing of common traits such as language and culture. Taiwan's new vision of the One China principle was not acceptable to China's leadership for several reasons, but most importantly because it opened the possibility of multiple state organizations within a "One China" system (Garver 1997: 28). Under Chen Shui-bian, tensions mounted further as his rhetoric gestured closer towards Taiwanese independence. However, Taiwan's current leadership under Ma Ying-jeou projects a diplomatic and non-confrontational approach towards eventual reunification.

A third source of instability is that China has been deterred from attempting forced reunification with Taiwan because of America's stated strategic interest in protecting a democratic Taiwan, as well as an interest in promoting stability in the region (Lin 1998: 127). Initially, this third point would appear to promote regional stability rather than instability. However, the US has maintained a policy of strategic ambiguity with respect to whether or not it will protect Taiwan in case of attack from China¹ (Benson and Niou 2001; Clough, 1999: 113-15). Surprisingly, this policy of ambiguity has surprisingly played a large role in maintaining an uneasy, but relatively stable situation in the region.² US policy consists of walking a fine line between three communiqués with China and the Taiwan Relations Act of 1979 (Hu 1998: 159-60). At the same time, Taiwan is restrained from declaring *de jure* independence, as that action would allow China to take action without fear of military reprisals from the US. However, America's strategic ambiguity leaves China unable to fully predict the extent of US reprisals, unless the moment of truth should arrive.

¹ The author assumes that President Bush's remarks last year about defending Taiwan, although significant, do not represent an official US policy shift (Gertz 2002).

² Ambiguity is important for modeling purposes since it implies both risk and imperfect information.

America's potential willingness to defend Taiwan from unprovoked attack by China was made clear during Taiwan's first democratic elections in 1996. At that time China conducted a series of war games in the Taiwan Straits that included the firing of missiles that landed ten miles off Taiwan's coast. Scholars continue to disagree on the purpose of the exercises. Whether they were conducted in an effort to influence Taiwan's elections, or to show that China will use the PLA as a form of coercion, or because of China's shifting domestic politics, is up for debate (Hu 1998: 152-54).

During these exercises, the US had the resource capabilities and the willingness to become involved, if only symbolically, and send two carrier battle groups, USS Independence and USS Nimitz, to the area (Hu 1998: 158). At present time, the US military resource capabilities are not at the same level of readiness as they were in 1996 (Ashton and Perry 1999: 96). Were a similar situation to occur today, current US military engagements would prevent it from responding with a strong show of force. However, while China's military capabilities have risen along with its economic output, the PLA continues to lack the ability to project significant military force at a constant rate ("Annual Report to Congress: Military Power of the People's Republic of China" 2008).

These factors also explain what this paper views as the status quo in the region; an important point since the status quo represents the reference point for the models used in this paper. The basic outline of the status quo is that China has declared sovereign control over Taiwan but does not have physical control over Taiwan. At the same time, Taiwan has grown politically and militarily, but has stopped short of declaring independence.

4. MODELS

The chosen method for this study, formal models, was almost necessitated by the subject matter. First, it would have been difficult to illustrate the subjective utility decision process and how it is evaluated by prospect theory without the use of basic formal modeling. Second, the use of formal models was a natural choice for the purpose of abstracting real world situations in order to analyze the decision making process. Furthermore, in the event that the models reproduce deductions that were already known, they are still helpful in identifying the causal mechanism behind the question that the researcher is trying to answer (Kanner, 2001). It is important to stipulate that the models represent a generalized abstraction of what occurred at the height of the Taiwan Straits Crisis in March of 1996. The second model represents hypothetical and abstract scenarios of the present day situation that China faces with respect to the Taiwan issue.

For this case study there are four applied models that show two separate situations. Models 1A and 1B represent the Taiwan Straits Crisis in March of 1996, as a subjective expected utility model and a prospect theory model, respectively. Models 2A and 2B show hypothetical present day scenarios, before and after prospect theory evaluation. Each model is broken down into the following sections: Alternatives (A), outcomes (o), Utilities (u), Probability of Outcome [Pr (o)], Expected Utility of Outcome [EU (o)], and Expected Utility of Alternative [EU (A)]. All sections that have not been evaluated with prospect theory are in bold and those that have been evaluated are in italics.

Additional charts in this study are the Value Function Chart (Fig. 3), the Weighting Function Chart (Fig. 4), the Semantic Value Chart (Fig. 5), and the Semantic Equivalent Chart (Fig. 6). The Semantic Equivalent Chart was borrowed from *Politics and Uncertainty*

- Extremely Good
- Very Very Good
- Very Good
- Good
- Slightly Good
- Indifferent
- Slightly Bad
- Bad
- Very Bad
- Very Very Bad
- Extremely Bad

Fig. 5.

Verbal Equivalent	Probability of Occurrence Scale
•“Certainly, for sure, always”	1.00
•“Very high chance, most likely, almost certainly”	0.95
•“High chance, close to certain, or very good chance”	0.80
•“Likely, reasonable to assume, one should assume, reasonable chance, it seems to me, can expect, it seems, better than even, we believe, or probable”	0.60
•“even-odds, fifty-fifty”	0.50
•“could be”	0.40
•“Perhaps, may happen, or chance not great”	0.20
•“Small chance, doubtful, improbable, or unlikely”	0.05
•“Impossible, never”	0.00

Fig. 6.

(Cioffi 1998: Table 7.2).

In the Value Function Chart, we can see the Kahneman and Tversky hypothetical S curve, that represents nonlinear risk propensity in value (Fig. 4). The following equation represents the weighted value of a prospect in the Value Function Chart (Fig. 3), with V representing the value.

$$V = \pi(p_1) * v(x_1)$$

p_i probability; $\pi()$ probability weighting function; $v()$ value function; x_i is outcome. (Kahneman and Tversky 1979)

In the Weighting Function Chart, the decision weights or probabilities, are overweighted at the lowest levels and underweighted for moderate and high probabilities. Therefore, people may be risk seeking when facing unlikely gains, gains that have a low probability of occurring. Meanwhile, people may be risk averse when facing unlikely losses (Kahneman and Tversky 1984).

The Semantic Value Chart illustrates the way in which the ordinal utility values were labeled, in order to show how the actor perceived their value (Fig. 5). Moreover, this chart helps in seeing the distance between values after prospect theory evaluation. The Semantic Equivalent Chart is used in situations where “exact quantitative estimates of causal probability are impossible or impractical, but verbal or lexical values are available or can be estimated” (Cioffi 1998: 244). In that sense, this chart is used to illustrate an estimated likelihood of an alternative’s outcome. The range of likelihood for the two models can be seen as mostly representing extremes in probability of occurrence- the reason being that the outcomes are mainly one-sided in likelihood.

The outcomes that were given a “very high chance” of occurrence, probability of 0.95, were either based on assessments of China’s military resource capabilities or were representative of what had actually occurred or is currently occurring. Conversely, since China did not invade Taiwan during the Taiwan Straits Crisis in 1996 and force Taiwan to unify, that outcome was given a “highly unlikely” probability of 0.05.³

5. DATA

The data for this research was obtained from literature that analyzed the events that took place in the Taiwan Straits in March 1996, as well as literature that analyzed China’s current options for the Taiwan issue. Empirical data that illustrated China’s current military capabilities was also used to aid in the construction of the model’s alternatives.

Similar research studies that have focused on US foreign policy decision making, have enjoyed the privilege of relying on access to decision maker’s accounts of what took place; a clear advantage of researching US foreign policy. In this instance, it was not possible to obtain similar accounts of how China’s decision makers behaved in time of crisis.

The alternatives were decided upon by looking at the range of possibilities that the decision maker could have at his disposal. Since many potential decisions of this nature have the choice of inaction, a non-action alternative was provided in both models. At the other end of the spectrum is the alternative of using force in order to exercise state policy. In the middle is the option of utilizing political pressure. These alternatives do not represent all possible courses of action that China has at its disposal. Instead they are meant to be a representation of the fundamental choices that China may exercise in a similar situation.

The choices of doing nothing, exerting political pressure, or using force, can be recognized as a familiar basis for actions in international relations. The likelihood of occurrence for each of the outcomes is an approximation, based on logical deductions of empirical data and not on actual probabilities. The outcomes within the model were based on an analysis of China’s military capabilities, where applicable. For the hypothetical alternatives that could not be fully substantiated with empirical data, either due to a lack of resources or availability of such analysis, the values and likelihood of the outcomes were

³ Please refer to the Semantic Equivalent Chart in Fig. 6 (Cioffi 1998: Table 7.2).

estimated by a comparison with the more substantiated alternatives of the models. This gap in research needs to be amended with further empirical research, but it is helpful to note that prospect theory looks at relative gain within a set of prospects as opposed to net gain.

6. PROCEDURE

The procedures for the models are based on subjective utility theory. Alternatives are representative of the range of possible alternatives that the actor could possibly choose. Outcomes represent the results of the respective alternative. Utilities are a representation of what the actor could gain or lose as a result of the outcome. The labels represent the Utility as being in the domain of “good” or “bad,” on an ordinal scale. The Probability of Outcome is the likelihood that the particular Outcome will occur. The Pr (o) does not represent an actual probability, but a semantic equivalent of likelihood that is based on empirical research (Cioffi 1998: Table 7.2). The purpose of this verbal to quantitative transformation is to gain a better understanding of the subjective probability of the level of risk that is associated with a decision.

The utility portion of the models, represents a generalized utility that the actor could expect if the respective outcome were to occur. Again, the utility itself is not an in-depth representation of the consequences of each outcome, it merely represents a logical abstraction of what China would experience as a result of the outcome. The value label of the utility of outcome or U(o) was estimated first, by comparing the outcome to the reference point of the models, then it was estimated whether that particular outcome was equivalent to the reference point, an improvement from the reference point, or a decline from the reference point. Therefore, if an outcome was at or similar to the reference point, its utility value would be “indifferent.” Additionally, the utility value is compared to the best case scenario, Taiwan unifying without pressure from China, and the worst case scenario, if China attempted to unify by force and failed.

From there, the labels, as shown in Figure 5, were adjusted to represent how far from the reference point the outcome would be. For example, if China chose to take Taiwan by force and failed to achieve its goal, then it is logical that China would experience a loss of both domestic and international status. This outcome could also be considered to be the worst case scenario if China chose to use force against Taiwan, thereby earning the label “extremely bad.” At the same time, if China chose to do nothing and as an outcome Taiwan chose to unify, then this could be considered to be the best possible outcome and would therefore gain the greatest amount of utility for China, even more than if Taiwan chose to unify under duress from China. Hence, the utility for this outcome earned the label “extremely good.”

The Expected Utility of Outcome is calculated as a result of multiplying Utility with Probability of Outcome [$U \bullet Pr(o)$]. The Utility of an Outcome can never be increased, but if the Probability of Outcome is extremely low then the utility value can be reduced. For example, in Figure 1A, alternative A1, the Utility of Outcome was estimated at “very very good” because China would successfully unify with Taiwan and the US would not be involved, hence China would sustain less military costs than if the US was involved. However, since the probability of such an outcome was estimated to be “highly unlikely” the Utility of the Outcome was reduced to “good.” If for the same alternative and outcome, the probability was estimated around 50%, then the Utility of Outcome would have only dropped to “very good.” Moderate to high probabilities allow the Utility of Outcome value to remain

the same after calculation.

The Expected Utility of an Alternative is calculated by averaging the two EU (o) of each alternative. The goal is to measure the actor's subjective view of each alternative, whether the alternative is in the domain of "good" or "bad," and the actor's order preference. These same method for calculating the Utility of Outcome U(o), Probability of Outcome Pr (o), Expected Utility of Outcome EU(o), and Expected Utility of Alternative EU(A) was used on the prospect theory models after prospect theory evaluation, in order to establish the actor's preference order in the prospect theory models.

6.1. Figure 1A, Alternative A1

In the Taiwan Straits model (Fig. 1A), alternative A1, consists of a direct attack against Taiwan, and is based on China's execution of multiple waves of war games prior to and during Taiwan's first democratic elections (Garver 1997: 96-101; Godwin 1993: 15-27). China has maintained a policy on Taiwan that does not exclude the use of force, and that particular set of war games was the closest that China had ever come to showing a real war scenario, using its most advanced weaponry (Hu 1998: 153).

The outcomes for alternative A1 were based on whether or not the US would have become involved in that scenario. Since the US had the resources to intervene, at least symbolically, and sent two carrier battle groups, the USS Independence and the USS Nimitz, to the area there was a very good chance that US military forces would have been involved had China carried out an actual attack against Taiwan (Hu 1998: 158; Ashton and Perry 1999: 96). Based on US estimates of Chinese military capabilities, it is highly unlikely that China would have succeeded in a full attack on Taiwan while trying to fend off US military forces. Even presently, it is a point of contention amongst US analysts whether China would be able to carry out a successful attack against Taiwan, even without US intervention (Buisenga 1998; 112-15; Sheng 2001: 123; O'Hanlon 2000; Russell 2001; Warner 1999).

Furthermore, during the military exercises, China had given assurances to the US that the military exercises were not intended to be an actual attack. It is fair to assume that China preferred to avoid a military confrontation with the US, especially one that they would not be able to win (Sheng 2001: 123). If China were able to win such a confrontation and if Taiwan were to unify under those circumstances, then China's domestic and world prestige would have greatly elevated (Buisenga 1998: 115).

Therefore, although labeled "highly unlikely" for the probability section, outcome (o) 1 would have been highly valued by China, and is therefore labeled "very very good." Because of its inherent costs, notice that the utility is not as high as it could be if Taiwan unified freely without coercion from China. Of course, if China lost such an attack, it is logical to conclude that there would be little utility gained. Hence, the utility label for outcome (o) 2 in alternative A1 is "extremely bad," a worst case outcome.

6.2. Alternative A2

Another possible military option for China during that Taiwan Straits Crisis was to establish a blockade and economically cripple Taiwan, as represented by alternative A2 (Klintworth 1998: 115; Sheng 2001: 123). This alternative, as with alternative A1, would also likely invite military intervention by the US and possibly its allies, making this an unattractive option (Garver 1997: 134-45). Although the utility of outcome (o) 1 would be

significantly high, “very very good,” because the goal of unification would be achieved, the strong presence of US military forces in the area and the strong possibility of US intervention on behalf of Taiwan, makes it “highly unlikely” that Taiwan would concede to China’s demands and unify, giving outcome (o) 1 an extremely low probability.

At the same, with the large US military presence in the area and high likelihood of US military help, there is a “very high chance” that China’s attempts of coercion through an embargo would fail. There is also the possibility that Taiwan may not back down and may have an opportunity to declare independence. Therefore, with the negative outlook for the situation, the utility of outcome (o) 2 of alternative A2 was given the worst value label, “extremely bad.” If China could not succeed in coercing Taiwan to unify and achieved the opposite effect, an opportunity for Taiwan to declare independence while expending significant military and political costs, this would be a worst possible outcome for China with regards to the Taiwan issue.

6.3. Alternative A3

The third option, alternative A3, represents the course of action that China had taken during 1995-1996. China opted for a show of force that did not involve direct confrontation with Taiwan or the US. China’s military exercises showed that future military coercion was a possibility if peaceful coercion was not effective (Hu 1998: 154-55). Although the long-term effects may have been counterproductive to China, the short-term effect of the military exercises pushed Taiwan to tone down their rhetoric regarding independence. However, this alternative and outcome (o) 2 represent an abstract version of what actually occurred at the time, not the long-term effects.

The probability of outcome (o) 2 for alternative 3 shows a “very high chance” of occurrence, mainly because this is what occurred at the time. The probability label of “certain,” representing a certain probability of 1.0, was not used for two reasons. First, this model represents an abstract view of events during March 1996, at which time there was no certainty that the exercises were not going to escalate into a direct action against Taiwan. Also, China could not have known for certain how the US were going to react to its military exercises, and in fact, was surprised by the strong US reaction during that time (Garver 1997: 96-97, 111). Therefore, even though alternative A3 represents the choice that China had made, that fact only helps to establish a “very high chance” of occurrence for the model.

Since the utility of outcome (o) 2 represents the reference point for the model, the label “indifferent” was used to show the value of the utility. It can be argued that China may see outcome (o) 2 as negative because of its negative long-term effects. However, since this outcome represents the reference point of the models and the purpose of the models is to see the alternatives with respect to the reference point, outcome (o) 2 was labeled as “indifferent.” The utility for outcome (o) 1, as with all outcomes that end with unification without the use of force, was estimated to be “extremely good.” The reasoning for this is that this would be a best case scenario for the actor in both models; unification without resorting to direct military action, something that China reserves the right to use.

6.4. Alternative A4

The fourth Alternative, A4, represents the hypothetical option of inaction by China. For this to occur it would have been necessary for China to go beyond fully accepting the status

quo and also accept the idea that Taiwan will continue to pursue practical diplomacy and international recognition, unhindered by China. This inaction would have furthered China's perception of a worsening security dilemma in the region (Dickson 2001: 84). Had China chosen inaction, it would have been "highly unlikely" for Taiwan to voluntarily unify with China and Taiwan would have "most likely" continued in its pursuit towards international recognition. The utility value of outcome (o) 1, although highly unlikely, is "extremely good," because it would show the best possible outcome for China, unification without any costs. The value of the utility of outcome (o) 2 is "very bad," because there would be little utility for China to gain if Taiwan continued its path of practical diplomacy without any interference from China. In the past and in the present, China would not have chosen and is not likely to choose inaction because of its belief that the Taiwan situation requires a strong political reaction in order to manage the issue (Sheng 2001: 125).

6.5. Figure 2A, Alternative A1

The alternatives illustrated in Figure 2A, present day scenarios, represent hypothetical scenarios that China may currently opt to use in dealing with the Taiwan issue. The first possible option, alternative A1, consists of a surprise attack against Taiwan by China. In this scenario, the surprise attack would mean that China would not resort to any public statements or diplomatic signals that hostilities may be pending. China would publicly pursue the opposite approach, a conciliatory tone towards Taiwan while planning hostile operations against Taiwan (Russell 2001).

The reasoning behind this option can be explained in two ways. First, US assessments state that China's military does not have the resources to execute a successful attack if Taiwan has any prior warning and opportunity to reinforce its defenses against an amphibious attack by China (Report to Congress 1999: 02261; Russell 2001). Second, China does not have the resources to sustain a prolonged attack against Taiwan, especially if the US were to become involved, yet China sees a swift surprise attack as a way of overcoming their military's technological disadvantage (Russell 2001). In effect, this type of surprise attack will help avert an immediate US military response. At present, US military forces are stretched thin and would require significant time to coordinate an appropriate military response such as the one during the Taiwan Straits Crisis in 1996 (Ashton and Perry 1999: 96). By the time the US would be able to react militarily, China may have hit major command and control areas inside Taiwan and incapacitated Taiwan's ability to successfully deter its attackers enough so that China could continue its attack inland.

After this type of swift attack, it may be too costly for the US and its allies to become involved in any military action outside of a naval blockade of the area (Russell 2001). It would be fair to assume that if China succeeded with such an attack, it would not value this type of a successful outcome as highly as one that was obtained through political pressure or at the very least as a result of an attack by China that was provoked by Taiwan's declaration of independence. If this alternative ended with China being thwarted by Taiwan's forces, then China's view of such an outcome would almost certainly be viewed as the worst possible outcome, both domestically and internationally.

Clearly, this scenario is a hypothetical one and is not outright supported by China's public statements. It is illustrated here to provide a military option for the model. However, with such strong disagreements in the policy literature about the feasibility and outcome of such an attack, it is difficult to provide even a ballpark estimation of the likelihood of these

two outcomes, (o) 1 and (o) 2 (Godwin 1993: 18-20; Halloran 2000; Klintworth 2000: 13-19; Sheng 2001: 123; O'Hanlon 2000; Report to Congress 1997; Scobell and Wortzel 2001: 2-4; Tenet 2000). Therefore in order to represent the contention in the literature regarding China's ability to take Taiwan without US interference, and for modeling purposes, the likelihood of this alternative's outcomes were assumed to be "fifty-fifty," giving both outcomes an even chance of occurrence.⁴ The purpose of this alternative is to present a potential, devil's advocate use of force scenario that could be considered by China (Russell, 2001). Since nearly all of the literature on the subject deems China's military as being unable to launch a successful attack against Taiwan, the "surprise attack" aspect of this scenario made it particularly interesting as a possible alternative.

The utility value of outcome (o) 1 was estimated at "slightly good" because of the potential for high military and political costs that would be sustained by China, including a possible blockade by US led forces (Russell 2001). Even if Taiwan unified as a result of this alternative, the inherent costs would offset the utility gained. If Taiwan was able to defend against China's attack, the utility value of outcome (o) 2 would be "extremely bad," an estimation of a worst case scenario. Not only would China have suffered a military defeat, it would have to deal with significant worldwide political consequences, exceedingly greater than the ones that were sounded by US allies during the Taiwan Straits Crisis in 1996 (Garver 1997: 135-45).

6.6. Alternative A2

The second option in Figure 2A, alternative A2, tries to represent a generalization of the current status quo: China's resorting to political pressure against Taiwan in an effort to manage Taiwan's political and military growth. As was shown in the 1996 model (Fig. 1A), the alternative consisting of political pressure seems to be the option that China is currently utilizing. Therefore, the likelihood of outcome (o) 2, that Taiwan does not choose to unify but is slowed down in its pursuit of political and military growth, is considered to be "most likely."

The Beijing elite may believe that their inability to pressure Taiwan into reunification is not a highly valued outcome, since it allows the Taiwan question to linger. Yet, when compared to the possibility of failure while using alternative A1, alternative A2 represents less risky, more likely and preferable outcomes. The value of utility for outcome (o) 1 represents an outcome that, although "extremely unlikely," would be highly valued because it satisfies China's unification goals without significant risks or costs. Therefore, the utility value of outcome (o) 1 is labeled "extremely good."

Outcome (o) 2 shows a generalization of what is currently occurring and is considered to be the status quo and reference point for the model, therefore it has the utility value of "indifferent." Again, this does not mean that China is indifferent to outcome (o) 2; the utility value is simply aligned with the reference point of the model.

⁴ Even if the probability of China's success was shown to be much lower than 50% in the expected utility model, the high variance between outcomes for this alternative creates a very high amount of risk. After prospect evaluation, even with a low probability, this alternative would still be significantly unattractive when compared to the other alternatives in this model.

6.7. Alternative A3

The last option, alternative A3, does not differ from the similar alternative, A4, in the 1996 model. The choice of inaction has little risk associated with it but it would also have no restraining effect on Taiwan's military and political growth. It is estimated that the most valuable outcome from this alternative, outcome (o) 1, would be Taiwan's decision to unify with China, especially if China had no costs, political or military, associated with the outcome. Therefore, the utility value for outcome (o) 1 is "extremely good," a best case scenario. However, given the fact that outcome (o) 1 has not occurred and does not seem likely to occur, outcome (o) 1 was given a "very small chance" likelihood. Outcome (o) 2, the more likely outcome, has a "very bad" utility estimate because it counters China's goal of unification with Taiwan as well as China's intention of playing a strong politically active role on the Taiwan issue (Sheng 2001: 125).

7. FINDINGS

In Fig. 1A, we see that alternative A3 is the preferred alternative based on the average of the two outcomes' Expected Utility of the Outcome. Alternative A4 is a close second, leaving the use of force alternatives, A1 and A2, as the last choices. In Fig. 1B, after prospect theory evaluation, we see that A3 became a significantly more attractive alternative. This follows prospect theory since the Expected Utility of Alternative, of alternative A3 in Fig. 1B is in the domain of gain, meaning that the actor is risk adverse. At the same time, the Expected Utility of Alternative for the use of force alternatives, A1 and A2 in Fig. 1B, became significantly less attractive because they land far below the actor's reference point. For the use of force to become a more preferable alternative the actor would have to drastically change his reference point. In the 1996 scenario, China would have to have demanded an immediate and forceful unification for such alternatives to be considered.

The same phenomenon occurred after prospect theory evaluation for the Present Day Model in Fig. 2B. The Expected Utility of Alternative, went beyond the far ends of the scale. It became more "good" in the domain of gain and more "bad" in the domain of loss.⁵ Again, the preferred alternative A2 became more attractive, since it was in the domain of gain and the actor was more risk adverse. The alternative that required the use of force, alternative A1, become far less attractive since it was in the domain of loss and the actor would have to become more risk acceptant for that alternative to be acceptable.

Additional sets of findings from this research also relate to the value of the utilities after they were placed in the Value Function Chart in Fig. 4, and the probabilities after they were weighted in the Weighting Function Chart in Fig. 3. The utility values had changed as expected according to prospect theory's value function. Utility values that were in the "bad" range were perceived as being much worse and in some cases they went beyond the chart, thereby earning the label "infinitely bad." Utility values that were in the "good" range were perceived as being even better, and similarly, when they went off the chart they were labeled as being "infinitely good."

The Probability of the Outcomes, $Pr(o)$, also changed as expected, following the

⁵ See Fig. 3 for the value domains.

Weighting Function Chart. Low probabilities, those less than approximately 23%, that were “improbable” or “unlikely” according to the Semantic Equivalents Chart in Fig. 6, were overweighted and perceived as being higher. Probabilities above 23%, those that had a small chance of occurring but were unlikely, were underweighted and perceived as being even less likely to occur. Although the Weighting Function results showed an increase in the likelihood of very low probabilities, this overweighting of unlikely probabilities had little impact on increasing the preference for the respective alternatives. In fact, after prospect theory evaluation, the hypothetical S curve had such a significant impact on the utility values, that even if they suffered from moderate inaccuracy, the utility values will still reach the far ends of the Value Function Chart. Therefore, after prospect theory evaluation, this study shows that risk attitudes will shift significantly further into their respective domains of gain or loss.

8. DISCUSSION OF FINDINGS

Possibly the most significant results deal with the differences among the expected utility of each alternative $EU(A)$. The differences among the outcomes in the expected utility model are fairly insignificant, since they range from “good” to “bad.” So there is not as strong of an argument as to which one is selected over the other. When looking at the calculation using the prospect value, the weighted functions, the argument for China maintaining their policy under all options becomes stronger, since the $EU(A)$ ranges from “infinitely good” to “infinitely bad” (Fig. 7). Therefore, the results show that when prospect theory was applied the subjective values experienced a significant change, illustrating how perception under risk could affect how the actor perceives the expected utility of each alternative.

The range of change between the $EU(A)$ is interesting because the less attractive alternatives had become extremely more unattractive and therefore, less likely to be chosen. Meanwhile, the preferred alternatives became significantly more acceptable, without a shift

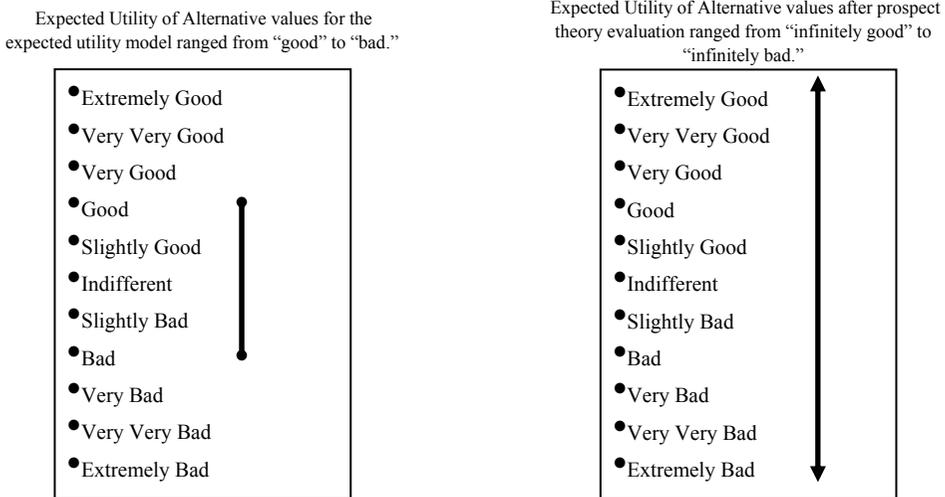


Fig. 7.

in frame of reference. Moreover, the point is that the magnitude of the differences between each expected utility of alternative EU(A) became so great that one alternative becomes significantly more likely, if the state of nature does not change. These findings provide added value to an analysis of the situation in the sense that China is even less likely to use force against Taiwan than previously illustrated in the subjective utility model.

The analysis also revealed that the preference order did not change, as represented by a comparison of models A to models B. Therefore, in this case, the axioms of the subjective expected utility models, not related to framing, have not been violated. In that respect, the evaluative phase of prospect theory did not provide a better explanation of the case study than the one provided by the subjective expected utility model.

The expectation was that the preference order would change when the utility and probability of outcome sections were adjusted according to the Kahneman and Tversky hypothetical value function and S curve (1979). Specifically, the axiom of transitivity, which states that a preferred alternative will not change under other conditions, was expected to be violated (McDermott 2001: 17).

The preferred alternative for model 1B, alternative A3, coincided with what China chose to do in March 1996; it chose to harass Taiwan through military exercises. If the conditional assumptions of the models and the alternatives and probabilities of outcome are correct, we may be able to infer that the present day model 2B could have some predictive properties. As long as China maintains a reference point of peaceful reunification with Taiwan and Taiwan does not pursue *de jure* independence, then China would fairly likely continue to avoid aggressive courses of action that include the use of force. Although China will likely remain risk adverse on Taiwan, this does not imply that China's rhetoric on the Taiwan issue will also not fluctuate.

Problems with the findings are related to problems that were encountered when trying to fit real-world situations into an abstract model. This can result in scenarios that may seem too abstract to be compared to the actual scenarios that the model is trying to depict. The models in this study were not immune to this issue. The alternatives did not always correctly depict all of the options that the actor had at his disposal nor did they contain complete information; an issue that was explained in the data section. In addition, the values and probabilities may not have been an accurate depiction of the situations, both historical and hypothetical. Therefore, an enormous effort was made to show how the calculations were performed and on what basis the estimations were derived. When considering the magnitude of the Expected Utility of the Alternatives, EU(A), and the enormity with which the utility values, U(o), had changed after prospect theory evaluation, we can see that in these prospect theory models, the utility values and probabilities enjoy a moderate margin of error, without significantly affecting the results, when compared to the expected utility models.

Looking at the research models' results, some questions arise that may be applied to the China and Taiwan issue. The conditional conclusions of the models indicate that China may have implicitly accepted Taiwan's *de facto* independence. This observation is based on the results in model 2B that show China's preferred alternative as being "infinitely good" and therefore far above the established reference point. If we are to take China's official stance on Taiwan at face value, then alternative A2 in model 2B should be much closer to the reference point. It could also be supposed that although China has no intention of accepting Taiwan's *de facto* independence and reserves the right to use force against Taiwan, China continues to evaluate the Taiwan issue as being more risky than it actually is and is not likely to use force.

On account of the results that the range between the alternatives, $EU(A)$, increased significantly, we are provided with a more in-depth yet conditional analysis of the modeled situations than was offered by the subjective expected utility model alone. We now see that the alternatives that included the use of force, both for the 1996, and the present day models, are more distant from the preferred alternative. This could have implications for broader research because now we can see that, at least theoretically, that unless the decision maker's reference point changes drastically, other less preferred alternatives are even less likely to become attractive enough for the decision maker to consider.

9. IMPLICATIONS FOR POLICY

The results, although not definitive because of the abstract nature of the models, could have some policy implications. Looking at the subjective expected utility models alone, the magnitude of the $EU(A)$ is not as large as after prospect theory evaluation. The prospect theory evaluation shows the greater magnitude by how far the most preferred alternative is from the least preferred alternative. Again, this result could mean that in order for China to change its policy on Taiwan, China would have to experience an extremely significant policy shift that would include a more aggressive stance on the issue. This reference point shift could occur if China feels that it has fallen into the domain of loss far enough to become significantly more risk seeking. The reasons for this shift could originate from potential domestic loss aversion by the Beijing elite, even if Taiwan was not going to declare *de jure* independence.

Possible future findings from the prospect theory model could be more useful than the subjective expected utility model if they illustrate under what circumstances would transitivity among the preferred alternatives potentially change, with respect to shifts in the actor's reference point (McDermott 2001: 17). However, if the conditional reasoning of this research is correct and if China does not experience significant domestic or international loss, it is unlikely that China's official policy on reunification will become more aggressive in the near future.

This research study has shown that the application of prospect theory could yield better explanatory and predictive results with respect to the magnitude of the alternatives, than could be offered by the rational choice based subjective expected utility model alone. The reason for this is because rational choice theory does not account for cognitive distortions in the face of risk.

The main question that remains is how the Beijing's elite actually perceive themselves on the Taiwan issue. Questions as to how China may perceive itself moving either into the domain of loss or gain, is an interesting area for future research that would focus on framing effects within the Beijing elite. Looking into the framing phase of prospect theory will allow the researcher to assess whether any of the axioms of subjective expected utility theory are violated through the way alternatives are presented to the decision maker and how they are coded by the decision maker. Thorough research about how the Beijing elite perceive themselves could provide further insights as to whether or not prospect theory can be utilized as a real world application.

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