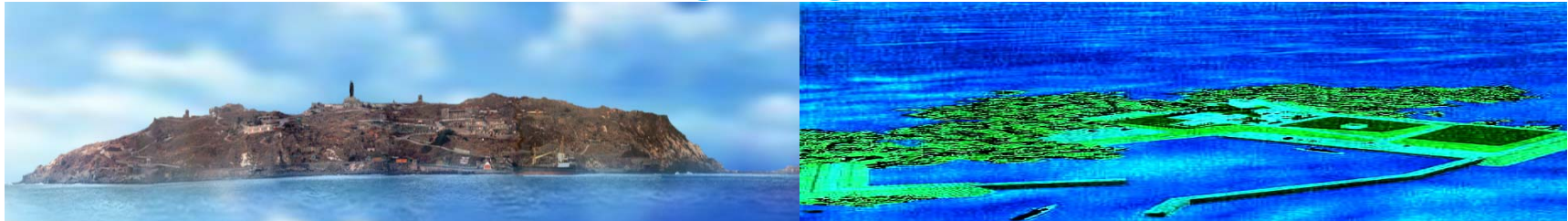




Compensation in Siting Hazardous Facilities

Siting a Radioactive Waste Repository in Taiwan



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2007/12/12



Outline

- Siting history of Radioactive Waste Repository in Taiwan
- Wu-chiu Township
- The Hypothesis of NIMBY Phenomenon
- Empirical Result
- Cases in the US and Switzerland
- Conclusion



Siting history of Radioactive Waste Repository in Taiwan

- In 1995 the Taiwan Power Company (Taipower) adopted a voluntary siting process
- In 1996, there were nine local communities applied for providing site and five were qualified
- In 1997, they all withdrew their application
 - because of the social pressures drew when news media covered this event fervently
- In 1998, Taipower changed its policy from “voluntary siting process” to “experts’ screening and selection process and voluntary siting process simultaneously”
 - It chose Wu-chiu to be the candidate site
- In 2000 we conducted an investigation on all of the residents registered in Wu-chiu Township



Siting history of Radioactive Waste Repository in Taiwan

| Phase | compensation | condition |
|--------------|-------------------|---|
| First phase | NT\$1 million | After signing an agreement with Taipower for further survey and assessment, each local government of voluntary but unqualified sites is entitled to a compensation of NT\$1 million. |
| Second phase | NT\$50 million | After signing an agreement with Taipower for further survey and assessment, each local government of voluntary and qualified candidate sites is entitled to a compensation of NT\$50 million. |
| Third phase | NT\$100 million | Among the candidate sites, Taipower will select some to do geological survey and environmental assessment . For this selected sites, Taipower will offer a compensation of NT\$100 million. |
| Fourth phase | NT\$3,000 million | Among the surveyed sites Taipower will select one site to construct and operate the repository. A compensation of NT\$3,000 million in total will be offered to the local governments surrounding the site. |

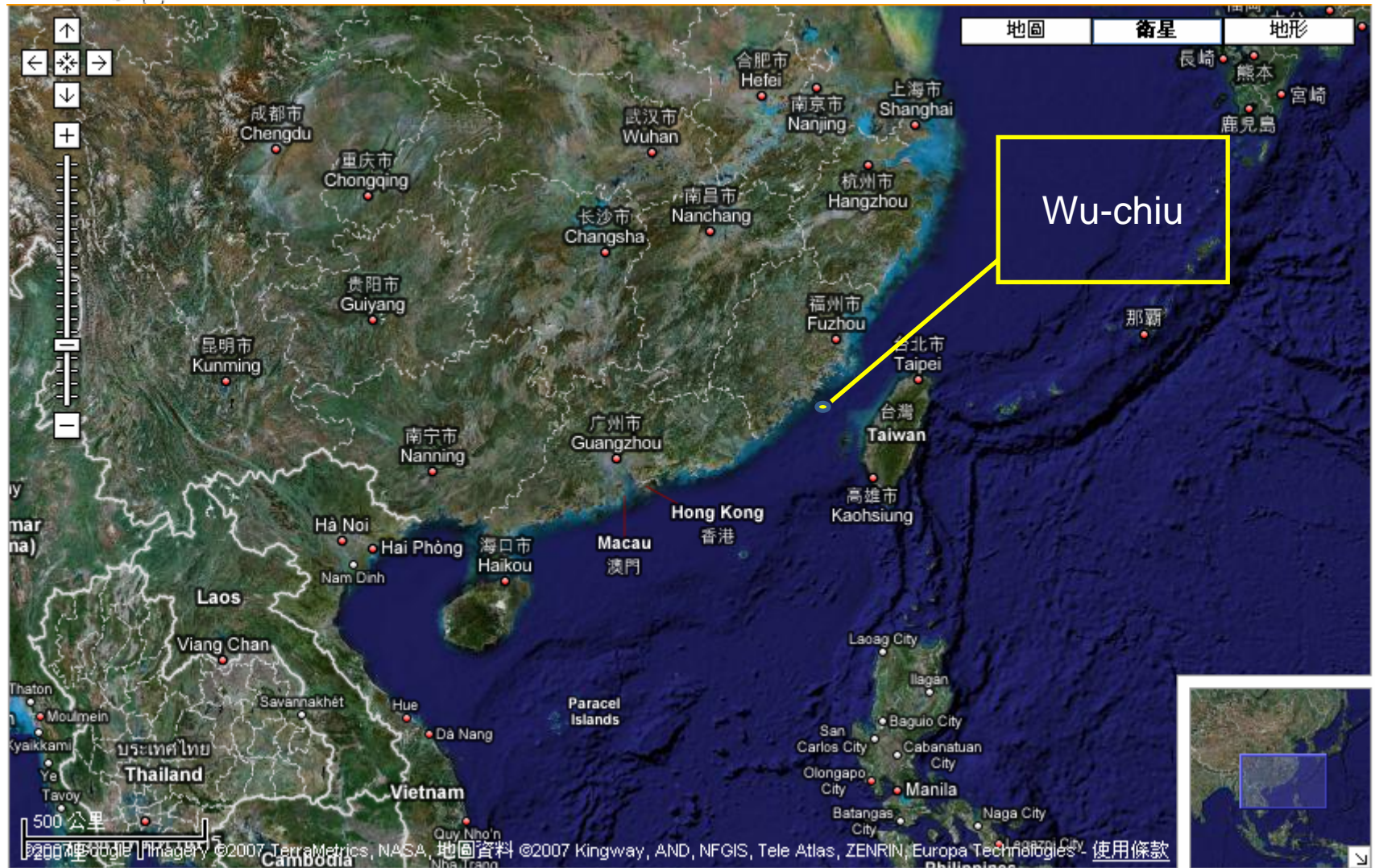


Siting history of Radioactive Waste Repository in Wu-chiu

- Phase I:
 - Taipower proclaimed the siting measure, and granted 1 million dollars for Wu-chiu Township, which provided the letter of consent.
- Phase II:
 - The villagers of Wu-chiu were informed and proclaimed that they wouldn't accept the facility.



Wu-chiu island



<http://maps.google.com.tw>



Siting history of Radioactive Waste Repository in Wu-chiu

- Phase III:
 - Taipower held a villagers' conference, and let the villagers there vote openly. The resolution had three points:
 - a. Against the siting
 - b. Do not against the investigation conducted by Tai-Power
 - c. Do not against the siting of facility if the government keeps its promise
 - Taipower negotiated with the villagers and entered the investigate phase, giving villagers NT\$100 million



Siting history of Radioactive Waste Repository in Wu-chiu

- Phase IV:
 - The investigation shows that the villagers rejected the siting, but said that the facility was essential for the nation, thus thought that it was of no use to against it, only to hope that Taipower could keep its promise to care about the future life of the villagers



Survey

- Visited and investigated residents on the island in person
- Mailed questionnaire and telephoned the residents of Wu-chiu who lived in Taiwan
- Of all the 93 households, we visited 65 households, among them 52 households accepted our visit while another 13 rejected us



Wu-chiu Township



- no transportation toward outside world except the Navy ships

- located at the martial area



Resource: www.taconet.com.tw



Wu-chiu Township



- a deeply-connected society

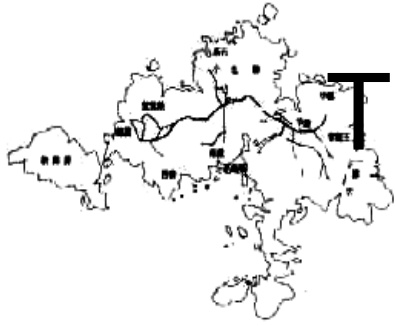
- a small island for fishers to catch fish at fish season temporarily



Resource: www.taconet.com.tw

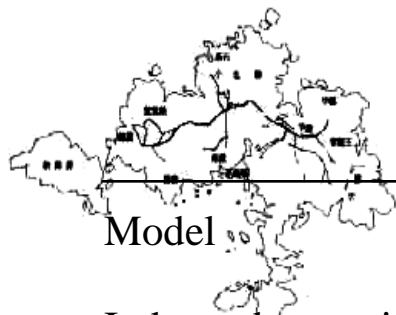
Siting history of Radioactive Waste Repository in Wu-chiu





The Hypothesis of NIMBY Phenomenon

- Hypothesis 1:
 - Compensation raises the public support of building the facility.
- Hypothesis 2:
 - If we do not limit the way of using the compensation, we can raise public support of building the facility.
- Hypothesis3:
 - Residents tend to support the facility if they are the head and the 3 councilors of the village.



Empirical Result

Model

Independent variable

Willingness to accept facility

(1) (2) (3)

Estimate (standard deviation)

| | | | |
|--|----------------|----------------|----------------|
| Constant | -8.99 (1.64)** | -3.73 (1.23)** | -3.66 (0.94)** |
| Offer compensation (1=yes, 0=no) | 0.95 (0.35)** | — | — |
| Offer compensation but limited the way of using (1=yes, 0=no) | — | -2.12 (0.36)** | — |
| Being Councilors of Wu-chiu (1=yes, 0=no) | — | — | -0.15 (0.47) |
| Equity (“1=very low” to “5=very high”) | 0.88 (0.23)** | 0.33 (0.21)** | 0.24 (0.16)** |
| the trust in the developers (“1=very low” to “5=very high”) | 0.86 (0.26)** | -0.12 (0.23) | 0.31 (0.18)** |
| the need for the facility (“1=very low” to “5=very high”) | 0.08 (0.20) | -0.07 (0.16) | 0.04 (0.14) |
| social pressure (how many % of inhabitant will accept facility) | 0.004(0.0086) | 0.0003(0.006) | -0.001(0.005) |
| risk perception (“1=very low” to “5=very high”) | 0.07 (0.17) | 0.27 (0.16)** | 0.02 (0.12) |
| Income (NT\$10 thousand/year) | -0.003(0.002)* | 0.0001(0.002) | -0.001(0.001) |
| level of education | -0.02 (0.11) | 0.02 (0.08) | -0.01 (0.06) |
| Leaving Wu-chiu (1=yes, 0=no) | 0.43 (0.41) | 0.44 (0.29)** | 0.12 (0.24) |
| Probability to built LLRW facility (“1=very low” to “5=very high”) | 0.14 (0.17) | 0.22 (0.16)* | 0.05 (0.12) |
| N | 78 | 81 | 160 |
| Log likelihood | -77.75 | -86.77 | -218.01 |

Note: **=significant at 95% level, * =significant at 90% level



Empirical Results

- Hypothesis 1:
 - Compensation raises the public support of building the facility.
 - Yes
- Hypothesis 2:
 - If we do not limit the way of using the compensation, we can raise public support of building the facility.
 - Yes
- Hypothesis3:
 - Residents tend to support the facility if they are the head and the 3 councilors of the village.
 - Not important



Empirical Results

– Compensation

- Residents of Wu-chiu thought that the compensation was essential, because
 - the disposal of the low radioactive waste disposal facility was not their responsibility
 - their health was at risk.

– Risk perception

- The Wu-chiu case was special because the residents there did not have to shoulder the risk of the facility, since they would all move to Taiwan.



Empirical Results

– Social Pressure

- The social pressures faced by the residents of Wu-chiu come from clan because villagers there have kin relationship and this characteristic can be seen in their town representative election.

– Civic duty

- Most villagers thought that the government had ignored the infrastructure of Wu-chiu and only to think of it when there was no place to deposit radioactive waste.
- Wu-chiu did not have the responsibility to provide place to deposit those waste.

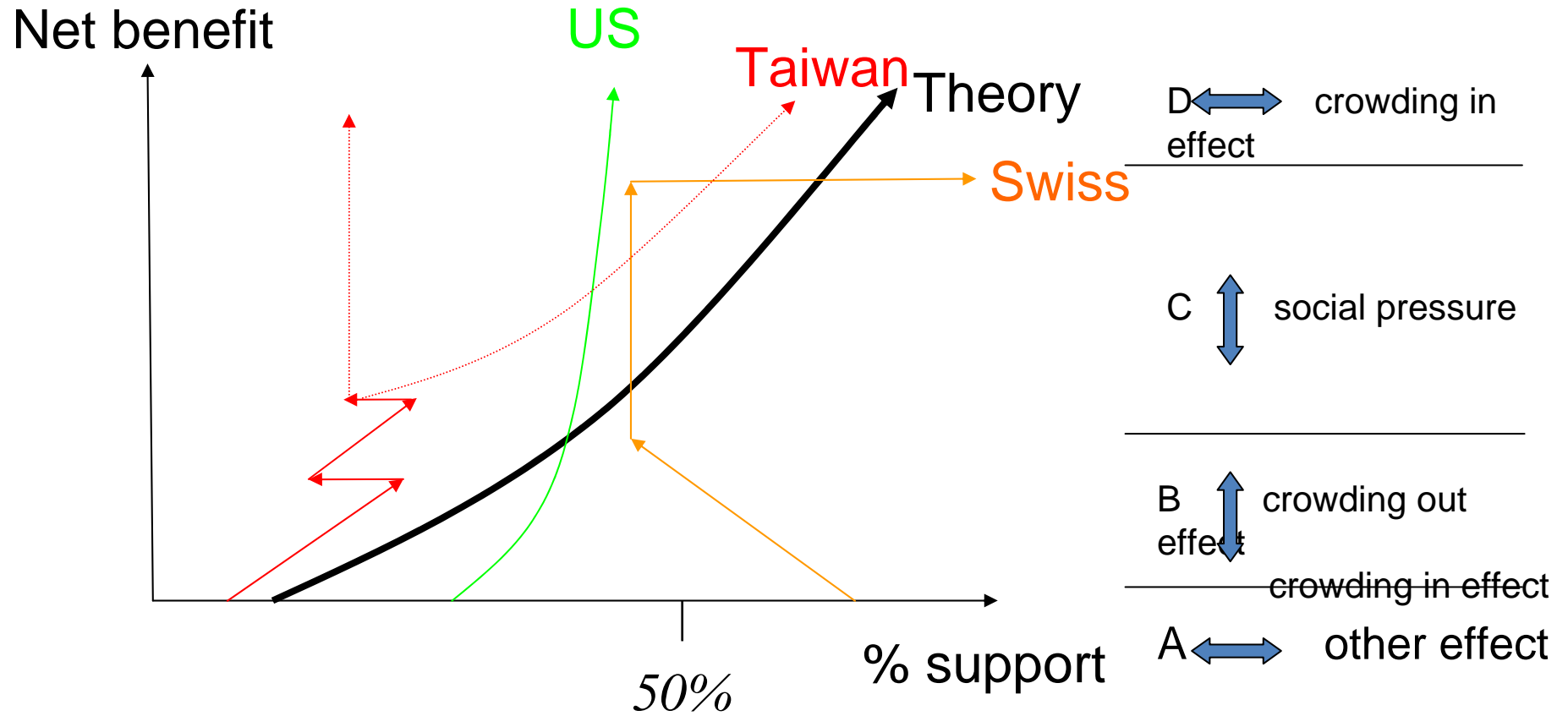


Cases in Taiwan, the US and Switzerland

- Three cases of Radioactive Waste Repository are compared
 - Switzerland (Frey and Oberholzer-Gee, 1996)
 - Pennsylvania (Oberholzer-Gee and Kunreuther, 2005)
 - Wu-chiu



Cases in Taiwan, the US and Switzerland





Cases in Taiwan, the US and Switzerland

A. **Without** compensation Phase

– At this phase the acceptance is influenced by

- the risk of the facility
- the decision-making procedures
- the authenticity of those who site
- Fairness
- the demand for the facility
- social pressures
- civic duty



Cases in Taiwan, the US and Switzerland

B. **With** compensation Phase

- Compensation producing improvement effects and crowded-out effect simultaneously.
 - In Switzerland the compensation would lower the civic duty and thus produce crowd-out effect.
 - In US the degree of the support of the resident rise slightly as the level of compensation rise.
 - In Wu-chiu the acceptance of the residents rises as the level of compensation rises
- Residents in different countries have different feelings toward social pressure and compensation.



Cases in Taiwan, the US and Switzerland

C. Alternatives-to-be-Negotiated Phase

– The site-developer continued to raise its level of compensation, while residents, who were under social pressures, negotiated it but being tortured with ambivalence.

- The residents of Wolfenschiessen, struggled between social pressures and the effect of receiving bribery, was a case in point.
- The residents of Wu-chiu, however, were different because the exposure of their situation on news provoked their intense opposition.



Cases in Taiwan, the US and Switzerland

D. Receive compensation Phase

- After they balance internal and external factors, residents make their final decision.
 - The acceptance of Pennsylvania's residents failed to reach 50%, thus the hazardous facility could not be established, while that of Switzerland was successful.
 - The case of Wu-chiu has not developed further because our government, under the intense pressure from mainland China, gave up this project.



Conclusion

- Unlike the case in Pennsylvania and that in Switzerland, the siting process in Wu-chiu was brought to a halt because of other infeasible factors.
- Although we fail to observe how the case in Wu-chiu develops, we understand more about the NIMBY phenomenon in Taiwan, that is, although the acceptance for building the facility sways, it rises as the level of compensation rises.
- Meanwhile, our empirical result shows that compensation is significant to the acceptance, thus we predict that the case in Wu-chiu would continue to thrive to the fourth case.



Thank you for your attention