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International Benefit Transfer Related to Coastal Zones: Evidence from Northeast Asia

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Abstract *International benefit transfer from developed countries is often used to evaluate international aid projects due to the lack of primary study in the policy country, particularly when the policy country is a developing one. Three surveys with the same protocol were carried out around the same time in a coastal city in China, Japan, and South Korea to determine which benefits can be most readily transferred and how much uncertainty accompanies transfers from one country to another. The mean transfer errors were in the range of 97 to 243%. The benefits of economic promotion seem to have more transferability than those of environmental improvement and risk reduction. The benefit transfers from the developed country (Japan) to the developing one (China) had fewer transfer errors than vice versa. These results suggest that more attention needs to be paid to the effect of environmental settings on international benefit transfer.*

Key words International benefit transfer, choice experiment, coastal zone, Northeast Asia.

JEL Classification Codes Q5, R5.

Introduction

Benefit transfer applications, despite worries over their validity, have been used more and more frequently in the last decade to estimate the value of environmental goods or the amount of risk reduction (Colombo, Calatrava-Requena, and Hanley 2007). Benefit transfer is used when there are insufficient time and/or financial resources available to carry out original valuation studies in the policy (receiving) country. Benefit transfer assumes that the study and policy sites have similar environmental settings and the same public willingness to pay (WTP) for environmental changes. The number of benefit transfer studies from 1992 to 2004 is 43 (for details, refer to Colombo, Calatrava-Requena, and Hanley 2007). Following the special issues of *Water Resource Research* (Volume

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28, Number 3) in 1992 and *Ecological Economics* (Volume 25, Number 1) in 1998, *Ecological Economics* published a special issue with 15 articles on benefit transfer (Volume 60, Number 2) in 2006, and Navrud and Ready (2007) compiled a related book in 2007 that includes 15 papers. Most of the benefit transfer studies have used the meta-analysis, contingent valuation, or travel cost methods (Colombo, Calatrava-Requena, and Hanley 2007).

Morrison *et al.* (2002) argued that the choice experiment (CE) method has good potential for benefit transfer since, unlike contingent valuation, it allows for differences in improvements in environmental quality as well as differences in socio-demographics when transferring value estimates. Indeed, in the last decade, the CE method has been frequently used for economic evaluation of non-marketed goods, but only a few studies that have used it to estimate the transfer values from a study site to a policy site have been published in peer-reviewed journals (*e.g.*, Morrison *et al.* 2002; Morrison and Bennett 2004; Bueren and Bennett 2004; Jiang, Swallow, and McGonagle 2005; Hanley, Wright, and Alvarez-Farizo 2006; Colombo, Calatrava-Requena, and Hanley 2007). Morrison *et al.* (2002) and Morrison and Bennett (2004) focused on two Australian wetlands and the water quality of five different catchments, respectively. Bueren and Bennett (2004) found that attribute values in a regional context are significantly higher than those in a national context. Jiang, Swallow, and McGonagle (2005) conducted four convergent validity assessments of benefit transfer using the CE method and data from Rhode Island and Massachusetts on coastal land management. Hanley, Wright, and Alvarez-Farizo (2006) did a study of benefits transfer for two neighboring Scottish rivers, both subject to low flow and nutrient enrichment problems. Colombo, Calatrava-Requena, and Hanley (2007) studied the reduction of the off-site impacts of soil erosion in two watersheds in southern Spain. However, all these CE studies looked at economic evaluations from the perspective of transfers within developed countries only.

Several other studies have tested the validity of international benefit transfer with the meta-analysis method, contingent valuation method, or travel cost method (*e.g.*, Alberini *et al.* 1997; Chestnut, Ostro, and Vicit-Vadakan 1997; Shrestha and Loomis 2001; Barton and Mourato 2003; Muthke and Holm-Mueller 2004; Ready *et al.* 2004; About-Ali and Belhaj 2005; Lindhjem and Navrud 2008). Alberini *et al.* (1997) compared the WTP to avoid an episode of ill health in Taiwan to published estimates from two U.S. studies. Chestnut, Ostro, and Vicit-Vadakan (1997) compared estimates of the WTP to avoid ill health episodes in Bangkok, Thailand, to similar estimates from U.S. studies. Shrestha and Loomis (2001) tested the validity of the international benefit transfer of outdoor recreation by comparing the results estimated in 28 studies conducted in 15 countries to values produced from a meta-analysis of U.S. studies. Barton and Mourato (2003) compared the WTP to avoid ill health episodes caused by contaminated seawater estimated in Portugal and Costa Rica. Muthke and Holm-Mueller (2004) found that the estimated WTP values for two lakes in Norway were 6–10 times those estimated for lakes in Germany. Ready *et al.* (2004) measured the benefits of reducing specific health impacts related to air and water quality by using simultaneous contingent valuation surveys conducted in five European countries. About-Ali and Belhaj (2005) found transfer errors of 60–220% when transferring WTP values for air quality improvements between Morocco and Egypt. The empirical evidence is that international benefit transfer is as valid as intra-country transfer (Ready and Navrud 2006). However, a recent study by Lindhjem and Navrud (2008) on the reliability of international meta-analytic transfers found that, even with homogeneous valuation methods, similar cultural and institutional conditions across countries, and a meta-analysis with large explanatory power, there could still be large transfer errors. Furthermore, international meta-analytic transfers do not, on average, perform better than simple value transfers averaged across domestic studies.

The topic of interest here is whether the CE method is as useful for international benefit transfer as it is for intra-country transfer between developed and developing countries, in particular. Not only do developing countries have significantly different levels of economic development than developed countries, but also they generally have different cultures and histories. Furthermore, developing countries have a much greater need for benefit transfer because they often lack the funds to conduct their own evaluation studies. Therefore, the transfer of knowledge among different countries should have an enormous value, both theoretically and practically.

How the differences mentioned above affect the public's WTP is the main interest of this study. We try to answer the following questions. Are the benefits of the CE method transferable from developed to developing countries? What is the transfer error if a benefit is transferred? What differences are there among different evaluated goods like marketed and non-marketed? To answer these questions, three surveys with identical formats were conducted around the same time in Japan, South Korea, and China. These three countries represent different economic development levels: developed, medium-developed, and developing.

The evaluated "commodity" was a coastal zone development program. The economic value of the coastal zone is important for policymakers and analysts concerned with coastal issues in their evaluation of policies that affect coastal development and management. Moreover, human settlement environments along the coasts are confronting increasing risks, such as rising sea levels, coastal environment degradation, coastal erosion, earthquakes (and consequent tsunamis), and high waves. The impact of these risks on coastal zone accessibility can be lessened by instituting certain policies. To determine which policies to implement, policymakers need to know how much the residents would be willing to pay for each alternative. The WTP was estimated using a CE.

China, Japan, and South Korea have very different political, social, and economic characteristics. To reduce the impact of local features, such as being urban or rural on the survey results, similar port cities located in coastal areas were selected as study sites. The cities chosen were Yokohama in Japan, Tianjin in China, and Pusan in South Korea.

Study Context and Design

Choice Experiment

A CE is based on the idea that any good can be described in terms of its attributes, or characteristics, and their levels (Bateman *et al.* 2002). The basic idea behind a CE is to create a hypothetical market situation and elicit individuals' preferences for the attributes by asking them to make choices between certain alternatives. The main theoretical support for the CE technique is random utility theory, which is used as an alternative theory of choice to that used to derive conventional demand curves (Thurstone 1927; McFadden 1973; Manski 1977). According to random utility theory, consumers maximize a utility function (subject to a budget constraint) in which the random term is supposed to have a specific distribution:

$$U_i = V_i + \varepsilon_i, \tag{1}$$

where U_i is the utility of choosing the i^{th} scenario, V_i is the deterministic component, and ε_i is the random term.

If the random term has an extreme value (Gumbel) distribution, the probability of choosing the i^{th} scenario from choice set Y (q is the scenario number for one set) follows a logistic distribution and leads to what is called the conditional logit model (McFadden 1973; Greene 2002):

$$P(i \mid \mathrm{Y}) = \exp(V_i) / \sum_{m=1}^{q} (\exp(V_m)). \quad (2)$$

A linear form of this model is often used to estimate the indirect utility function:

$$V_{in} = A_i + \sum_j \beta_j x_{ij} + \sum_h \alpha_h z_{hn}, \quad (3)$$

where A_i is an alternative-specific constant, β_j is the parameter of the j^{th} attribute of the i^{th} alternative represented by variable x_{ij}, and α_h is the parameter of the h^{th} characteristic of person n represented by z_{hn}.

As a measure of the benefits resulting from changes in an attribute, the marginal WTP, which is widely used for transportation and environmental studies, can be rewritten as:

$$WTP_i = -\frac{\partial V / \partial x_i}{\partial V / \partial price}. \quad (4)$$

The *price* level used here is the mean payment increase proposed in each survey scenario, while V is the marginal indirect utility for attribute i.

Survey Design

Careful survey design is critical for obtaining useful information. Coastal development refers to the overall process and approach by which the socio-economic, environmental, and natural resources of a coastal area are fully, efficiently, and equally used to maximize the benefit to coastal residents. Coastal development takes into consideration three factors: environmental conservation, natural disaster countermeasures, and coastal area usage promotion. We used 14 criteria (attributes) to represent public preferences for various possible components of the development program (table 1). Seven levels were assigned to all the attributes except annual additional expense per capita, which was assigned five.

Brief interpretations and definitions were provided in the survey questionnaires to help the respondents understand each attribute. These interpretations and definitions also clarified that the attributes were independent and specific.

"Coastal environment" refers to the natural environment and living environment. Natural environment includes aquatic plants and animals in both the sea and coastal ecosystem. "Living environment" refers to the relationship between the sea and people, including water quality (mainly biochemical oxygen demand (BOD) and chemical oxygen demand (COD)), landscape, and coastal space. "Natural disaster countermeasures" and "coastal area usage promotion" refer to the degrees of disaster occurrence probability and usage activity, respectively. Water-related disasters are divided into high waves and tsunamis (ocean) and floods (rivers). A typhoon is strictly defined as a wind-related disaster. Each aspect of environmental quality and promoting coastal usage is also strictly specified in order to avoid respondent misunderstanding. The levels for the attributes of

Table 1
Attributes and Levels in Choice Experiment

			Attribute Levels					
	Attribute	Status Quo	1	2	3	4	5	6
Improve coastal environemnt	1. Water quality	0	–50%	–20%	–10%	10%	20%	50%
	2. Garbage and oil on sea surface and sand beaches	0	–50%	–20%	–10%	10%	20%	50%
	3. Trees and grass at seaside	0	–50%	–20%	–10%	10%	20%	50%
	4. Coastal landscapes including revetments and blocks	0	–50%	–20%	–10%	10%	20%	50%
Reduce natural disaster frequency	1. Earthquakes	0	–50%	–20%	–10%	10%	20%	50%
	2. High waves and tsunamis	0	–50%	–20%	–10%	10%	20%	50%
	3. Floods	0	–50%	–20%	–10%	10%	20%	50%
	4. Typhoons	0	–50%	–20%	–10%	10%	20%	50%
Promote coastal usage	1. Fishery	0	–50%	–20%	–10%	10%	20%	50%
	2. Industry	0	–50%	–20%	–10%	10%	20%	50%
	3. Ports	0	–50%	–20%	–10%	10%	20%	50%
	4. Service sector (*e.g.*, restaurants)	0	–50%	–20%	–10%	10%	20%	50%
	5. Recreation facilities (*e.g.*, parks and sports facilities)	0	–50%	–20%	–10%	10%	20%	50%
Annual additional expense per capita (Yen/Won/RMB)		0/ 0/0	1,000/ 3,000/10	2,000/ 7,000/20	5,000/ 15,000/50	10,000/ 30,000/100	NA	NA

Note: NA indicates not applicable.

environmental conservation, natural disaster countermeasures, and coastal area usage promotion were defined with improvement/degradation rates of 10%/−10%, 20%/−20%, 50%/−50%, and 0% for the status quo. The +/− signs were only used in the survey design and data analysis. In the survey questionnaire, they were replaced with the words "improved" and "reduced" to make the questions more understandable. This is because the minus sign can be confusing since it actually represents improvement for undesirable items, like floods and pollution. While the frequency of natural disasters cannot be reduced, the damage they cause can be reduced by strengthening prevention measures, which requires additional investment. The last attribute was the additional amount the respondent would have to pay for the selected improvements and levels.

Similar to previous application studies using a CE, possible choice options based on the attributes and their levels were created by using an orthogonal design approach with the conjoint option of Statistical Package for the Social Sciences (SPSS) version 10.0J. A full factorial design would produce 484,445,052,035 choice sets ($7^{13}\times5^{1}$). Since the respondents would have great difficulty making a rational decision with such a complex tradeoffs between 14 attributes, a partial combination form was applied like the example of a CE in Louviere, Hensher, and Swait (2000, p. 14). At first, one attribute is randomly drawn from each category, such as: "Coastal environmental protection," "Coastal disaster change," and "Coastal usage promotion" and then one level for each selected attribute and "Annual additional expense per capita" are randomly chosen to combine a choice card. The total number of choice sets was reduced to 137,200 [$(7\times4) \times (7\times4) \times (7\times5) \times (5^{1})$]. Following the stated choice methods of Louviere, Hensher, and Swait (2000, pp. 120–1), the total number can be simply represented as $5^{7.3}$. The smallest design is 36. The number of choice sets excluding the status quo was marginally 36, so the design used is reasonable.

After discarding the unreal options, we created 16 choice cards (evaluation cards), each one including a status quo option from the 32 options that were left. For each card, the respondents were asked to indicate their preference from among two alternatives for coastal improvement at different additional expense levels (options A and B) and the status quo at no additional expense (option C) (figure 1). The valuation section of each questionnaire consisted of four choice cards, and there were four different versions of the questionnaire, each with four unique cards. The respondents were told in the questionnaire that the policy they choose was to be implemented for approximately 20 years. In the later multinomial logit models, a dummy variable, "Choice," was added, and it took the value 1 if an option was chosen and the value of 0 if an option was not chosen.

Survey Implementation

Survey Protocol

As mentioned, the surveys were conducted in Japan, South Korea, and China, and the same questionnaire was used in each country to ensure comparability. The survey instrument was initially prepared in Japanese and conducted in Japan. After it was validated, it was translated into Chinese by Chinese survey cooperators who are fluent in Japanese and into Korean by Korean native translators living in Japan. After it was translated, the Chinese version was checked and confirmed by one of the authors (a native Chinese) and the Korean version by Korean survey cooperators who are fluent in Japanese.

The three surveys were all administered in the same year (2006) to avoid any timing bias effects (table 2). The surveys followed the total survey design method, which attempts to achieve an optimum balance across all areas of effort, including the use of attractively designed survey booklets, a glossary, easy-to-follow instructions, and breaks between survey sections. This method was developed by Mangione (1995) and has proved successful in securing high response rates for both general and specialized samples. The procedure for the survey used here has also been tested and proven to be effective in Japan (Zhai and Ikeda 2006; Zhai *et al.* 2006; Zhai, Fukuzono, and Ikeda 2007). The number of validly distributed samples was 835, 1,000, and 1,090 in Japan, China, and South Korea, respectively. The response rates were 53.9% for Japan, 96.5% for China, and 79.4% for South Korea.

Please read each question below and choose ONE AND ONLY ONE option.

	Option A	Option B	Option C
Coastal environmental protection	Status quo	Increase trees and grass by 10%	Status quo
Coastal disaster change	Reduce flood frequency by 50%	Reduce high waves and tsunamis frequency by 20%	Status quo
Coastal usage promotion	Improve recreation facilities by 50%	Improve industrial production by 10%	Status quo
Annual additional expense per capita	¥5,000	¥1,000	¥0
	↓	↓	↓
I would select	A.	B.	C.

Figure 1. Example Valuation Choice Card (Japanese version)

Table 2
Survey Process in Japan, China, and Korea

	Japan	China	Korea
Survey period	April 14 to May 14, 2006	mid-November to mid-December, 2006	November 1 to December 11, 2006
Focused participants	Coastal residents	Coastal residents	Coastal residents
Sampling method	Random sampling from telephone directory	Random sampling from school list	On-site delivery
Distributed samples	1,000	1,000	1,090
Validly distributed samples	835	1,000	1,090
Collected samples	450	965	865
Survey process	Delivered survey booklets and reply postcards to sampled participants.	Delivered survey booklets to sampled schools.	Delivered survey booklets to surveyors.
	Sent reminder postcards to those who had not returned the reply postcards.	Schools distributed booklets to students.	Surveyors distributed booklets to participants.
	Collected booklets.	Students took booklets home and asked parents to answer them.	Collected booklets.
		Collected booklets.	

General Characteristics of Data Collected from Respondents

The three surveys had different respondent characteristics (table 3). In Japan and South Korea, there were more male respondents, while in China there were more female respondents. The respondents in China and South Korea were somewhat younger than those in Japan. A wide range of ages was covered in all three countries. Respondents in Japan ranged in age from 20 to 70; those in South Korea and China ranged in age from teenagers to age 70. The Chinese and Japanese respondents had lived in their communities longer than those in South Korea, and a smaller percentage of the Chinese had moved into the area from other areas. This last characteristic reflects the socio-economic setting: China has strict regulations on migration, and this reduced the percentage of respondents who had moved into the area from other areas. Coastal zones have greater development potential and tend to develop along with national economic growth, so they tend to draw people from other areas. The percentage should increase along with the loosening or abolishing of migration regulations in China.

Table 3
Respondent Characteristics

	Japan	China	Korea	Total
Percentage of females	21	57	30	40
Age (Teenagers =1, …, more than 70 =7)	5.7	2.9	2.8	3.4
No. people in household	3.0	3.9	3.8	3.7
Percentage of respondents who relocated	84	24	91	62
Residing period (years)	33.7	33.7	9.2	24.2
Sample	450	965	865	2,280
Response rate (%)	(53.9)	(96.5)	(79.35)	(77.9)

Results

WTP for Each Attribute

Table 4 shows the results for three multinomial logit models containing both the attributes and various socioeconomic factors for China, South Korea, and Japan. The data were all processed using LIMDEP Version 8.0 (Greene 2002). The status quo is defined as zero. All three models had satisfactory explanatory power with an adjusted value for rho-squared of 19.2–22.1%. The chi-squared statistics indicate that each model was significant overall.

Six attributes (**GARBAGE_OIL**, **ECOSYSTEM**, **WAVES**, **EARTHQUAKES**, **FLOODS**, and **PAYMENT**) were statistically significant at the 0.1 level with all the models, and their coefficient signs were the same across the three models. The remaining eight attributes (**WATER**, **LANDSCAPES**, **TYPHOONS**, **FISHERY**, **INDUSTRY**, **PORTS**, **SERVICES** and **RECREATION**) were not statistically significant with any of the models. Socio-demographic factors like sex and age had mixed effects on public preferences for coastal policies.

Table 5 presents the implicit prices and the 95% confidence intervals obtained from equation (4). These are the amounts of money individuals are willing to pay for the changes listed in table 4. The plots show that the three countries have similar value distributions for each attribute except for **SERVICES**. If the statistical significance is ignored, the biggest differences in the WTPs are for **LANDSCAPES**, **EARTHQUAKES**, **WAVES**, **FLOODS**, and **SERVICES**.

Table 4

Results for Three Multinomial Logit Models with Choice as a Dependent Variable

Independent Variables	China	Korea	Japan	Expected Sign in the Model
Improve coastal enviornment				
1. **WATER** (Water quality)	0.012***	0.0052*	0.001	+
2. **GARBAGE_OIL** (Garbage & oil on sea surface & sand beaches)	–0.030***	–0.0252***	–0.038***	–
3. **ECOSYSTEM** (Trees and grass at coast)	0.026***	0.0117***	0.019***	+
4. **LANDSCAPES** (Coastal landscapes including revetments & blocks)	–0.008	0.0159*	–0.029	+
Reduce natural disaster frequency				
1. **EARTHQUAKES**	–0.021***	–0.0131***	–0.038***	–
2. **WAVES** (High waves & tsunamis)	–0.050***	–0.0269***	–0.044***	–
3. **FLOODS**	–0.034***	–0.0218***	–0.052***	–
4. **TYPHOONS**	–0.001	–0.0069*	0.006	–
Promote coastal usage				
1. **FISHERY**	0.006**	0.0018	0.001	+
2. **INDUSTRY**	0.005	–0.0008	–0.002	+
3. **PORTS**	0.018**	0.0036	0.019***	+
4. **SERVICES** (Service sector; *e.g.*, restaurants)	–0.037**	0.0171	–0.064***	+
5. **RECREATION** (Recreation facilities; *e.g.*, parks & sports facilities)	–0.007	–0.0142***	–0.022***	+
PAYMENT (RMB, Won, and Yen)	–0.019***	–0.0001***	–0.00037***	–
Interaction terms of respondent characteristics with constants				
ASCA	1.254***	0.7770*	0.367	
ASCA x **SEX** (female=0, male=1)	0.037	–0.0971	–0.403*	
ASCA x **AGE** (year)	–0.093*	0.1111*	0.108	
ASCA x **INCOME** (< ¥2 M=1, ¥2–4 M=2,…, > ¥14 M=8)	0.002	–0.0228	0.082*	
ASCA x **EDUCATION** (over high school=1, else=0)	0.043	0.2550*	–0.119	
ASCA x **IMMIGRATION** (yes=1, no=0)	–0.077	–0.2066	–0.601*	
ASCB	1.226***	0.8405*	–0.690	
ASCB x **SEX** (female=0, male=1)	0.008	–0.1774	–0.456**	
ASCB x **AGE** (year)	–0.107*	0.0823	0.250***	
ASCB x **INCOME** (< ¥2 M=1, ¥2–4 M=2,…, > ¥14 M=8)	–0.022	–0.0029	0.040	
ASCB x **EDUCATION** (high school graduate=1, else=0)	0.135	0.0357	–0.302*	
ASCB x **IMMIGRATION** (yes=1, no=0)	–0.098	–0.0753	–0.221	
Number of observations	2,852	2,992	1,086	
Log likelihood function	–2,430	–2,923	–952.56	
R-sqrd	0.224	0.11	0.202	
R-sq Adj	0.221	0.10	0.192	
Chi-squared [24]	730.34	399.28	435.96	
Prob [chi squared > value]	<0.00001	<0.00001	<0.00001	

Note: *, **, and *** refer to the statistical significance probabilities of 0.1, 0.05, and 0.01, respectively.

Table 5
PPI-adjusted WTP and 90% Confidence Interval

	China	Korea	Japan
WATER	0.347 (0.144 ~ 0.568)	0.120 (–0.006 ~ 0.250)	0.028 (–0.175 ~ 0.229)
GARBAGE_OIL	–0.841 (–1.173 ~ –0.618)	–0.578 (–0.769 ~ –0.426)	–0.767 (–1.069 ~ –0.514)
ECOSYSTEM	0.736 (0.562 ~ 1.017)	0.268 (0.163 ~ 0.402)	0.391 (0.228 ~ 0.586)
LANDSCAPES	–0.222 (–0.307 ~ –0.164)	0.363 (0.029 ~ 0.749)	–0.580 (–2.196 ~ 1.137)
EARTHQUAKES	–0.605 (–0.884 ~ –0.405)	–0.300 (–0.462 ~ –0.172)	–0.764 (–1.086 ~ –0.533)
HIGH WAVES	–1.420 (–1.902 ~ –1.100)	–0.617 (–0.834 ~ –0.466)	–0.900 (–1.252 ~ –0.642)
FLOODS	–0.951 (–1.311 ~ –0.675)	–0.500 (–0.724 ~ –0.338)	–1.051 (–1.424 ~ –0.749)
TYPHOONS	–0.022 (–0.269 ~ 0.221)	–0.159 (–0.306 ~ –0.024)	0.130 (–0.166 ~ 0.401)
FISHERY	0.160 (0.031 ~ 0.300)	0.041 (–0.050 ~ 0.123)	0.028 (–0.116 ~ 0.173)
INDUSTRY	0.150 (–0.047 ~ 0.361)	–0.017 (–0.136 ~ 0.089)	–0.045 (–0.268 ~ 0.185)
PORTS	0.502 (0.151 ~ 0.896)	0.082 (–0.162 ~ 0.335)	0.393 (0.178 ~ 0.641)
SERVICES	–1.048 (–1.879 ~ –0.320)	0.393 (–0.114 ~ 0.894)	–1.296 (–2.235 ~ –0.524)
RECREATION	–0.188 (–0.460 ~ 0.042)	–0.325 (–0.542 ~ –0.152)	–0.449 (–0.765 ~ –0.150)

Equivalent Preference Test

Benefit transferability was evaluated using two tests: one on the equivalence of the models and one on the equivalence of implicit prices (Morrison *et al.* 2002; Colombo, Calatrava-Requena, and Hanley 2007).

Test 1: Equivalence of Models

The test statistics were distributed chi-squared values with degrees of freedom equal to the number of estimated parameters (equation 5). The chi-squared value with 24 degrees of freedom at a significance level of 0.05 was 36.4. Chi-squared values for the combinations of China vs. South Korea, China vs. Japan, and South Korea vs. Japan were 204, 941, and 905, respectively. These results are highly significant because they reject the hypothesis that the same model is applicable to all three countries.

$$Chi\text{-}squared = 2(-lnL(pooled) + (lnL(model\_1) + lnL(model\_2)) \quad (5)$$

$$> Chi\text{-}squared\ (degrees\ of\ freedom)$$

Test 2: Equivalence of Implicit Prices

To test whether the WTP for each coastal development program was statistically different from zero and whether the WTP was different between geographic regions or programs, two statistical techniques were used. The most direct test is to estimate confidence intervals around the mean WTP by using a variance-covariance matrix (Park, Loomis, and Michael 1991). If the confidence interval for the program does not include zero, then the mean WTP is statistically greater than zero. When comparing two programs, if their confidence intervals do not overlap, we can conclude that they are statistically different (Poe, Severance-Lossin, and Welsh 1994). If they do overlap, a more rigorous test of whether the two distributions of the WTP are significantly different can be performed using the method of convolutions (Poe, Severance-Lossin, and Welsh 1994).

(1) Confidence interval overlap criteria

Table 6 summarizes the PPI-adjusted benefit transferability calculated using the 90% confidence interval overlap criteria. The numbers of transferable attributes for Japan vs. South Korea, South Korea vs. China, and China vs. Japan were 10, 10, and 13, respectively. The attributes with non-transferable benefits were **EARTHQUAKES**, **FLOODS**, and **SERVICES** for Japan vs. South Korea; and **ECOSYSTEM**, **LANDSCAPES**, and **WAVES** for South Korea vs. China. Only seven attributes were transferable among all three countries. If the statistical probability significance of the attributes in the models is ignored, the benefits of economic promotion seem to have more transferability than those of environmental improvement and risk reduction.

(2) Convolutions approach

The one-side significance probabilities were obtained using a convolutions approach and the procedures proposed by Poe, Severance-Lossin, and Welsh (1994) (table 7). The numbers of transferable attributes for Japan vs. South Korea, South Korea vs. China, and China vs. Japan were 10, 7, and 10, respectively. The attributes with non-transferable benefits were **EARTHQUAKES**, **FLOODS**, and **SERVICES** for Japan vs. South Korea; **ECOSYSTEM**, **LANDSCAPES**, **WAVES**, **FLOODS**, and **SERVICES** for South Korea vs. China; and **WATER, ECOSYSTEM**, and **WAVES** for China vs. Japan. The number of attributes transferable among all three countries decreased to six. If the statistical probability significance of the attributes in the models is ignored, the benefits of economic promotion again seem to have more transferability than those of environmental improvement and disaster risk reduction.

Table 6
PPI-adjusted Benefit Transferability by 90% Confidence Interval Overlap Criteria

Independent Variables (attribute)	Japan:Korea	Korea:China	China:Japan	All Sites
Improve coastal environment				
1. WATER	O	O	O	O
2. GARBAGE_OIL	O	O	O	O
3. ECOSYSTEM	O	X	O	X
4. LANDSCAPES	O	X	O	X
Reduce natural disaster frequency				
1. EARTHQUAKES	X	O	O	X
2. WAVES	O	X	O	X
3. FLOODS	X	O	O	X
4. TYPHOONS	O	O	O	O
Promote coastal usage				
1. FISHERY	O	O	O	O
2. INDUSTRY	O	O	O	O
3. PORTS	O	O	O	O
4. SERVICES	X	O	O	X
5. RECREATION	O	O	O	O
Number of transferable attributes	10	10	13	7

Note: O indicates the confidence interval overlap criteria are met; X indicates 0.05 significance levels are not met.

Table 7
One-side Significance Probability Using Convolution Approach (%)

Attribute	Japan:Korea	Korea:China	China:Japan	All Sites
Improve coastal environment				
1. WATER	25.3	6.5	3.9	X
2. GARBAGE_OIL	16.3	7.1	37.5	O
3. ECOSYSTEM	17.9	0.03	1.8	X
4. LANDSCAPES	17.7	0.55	34.3	X
Reduce natural disaster frequency				
1. EARTHQUAKES	0.25	2.31	27.8	X
2. WAVES	8.3	0.01	3.4	X
3. FLOODS	0.67	1.62	34.5	X
4. TYPHOONS	6.9	21.9	23.9	O
Promote coastal usage				
1. FISHERY	44.9	104	13.1	O
2. INDUSTRY	42.1	10.5	13.5	O
3. PORTS	5.7	5.4	34.3	O
4. SERVICES	0.08	0.40	34.5	X
5. RECREATION	30.8	23.5	15.1	O
Number of transferable attributes	10	7	10	6

Note: O indicates confidence interval overlap criteria met; X indicates 0.05 significance levels not met.

Transfer Error

The transfer errors (TEs) of implicit prices among the three countries are listed in table 8. The errors ranged from 9 to 1,136%. The mean TEs for the transfer directions are in the range of 97–243%, larger than those found by Ready and Navrud (2006). The transfers from China had a higher deviation than those from Japan or South Korea. The distribution of the benefit transfer errors (table 9) shows that the TEs of less than 50% from Japan to China and South Korea had the most attributes (five and seven, respectively). This implies that transfers from Japan are better than those from South Korea. Therefore, transfers from Japan can be regarded as the best from the viewpoint of transfer error.

Limitations

This paper raises many interesting issues and leaves several questions unanswered that are important for the stated preference studies. The first is the sample bias; *i.e.*, the representation of the total population resulting from the different sampling methods used. It is best to use an identical sampling method in comparative surveys to avoid sample bias. Using an identical sampling method should improve the result accuracy; however, this was impracticable due to limited resources (budget, staff, and time).

The second issue is to what degree culture and economic development affect the WTP. Cultural heritage, shared values, and shared experiences can affect values for public goods (Ready and Navrud 2006). Previous studies, like those by Kawabe and Oka (1996) and Ahmed *et al.* (2006), found that several characteristics of the respondents had statistically significant effects on the WTP. However, the impact of culture on the WTP was not addressed here, and the impact of respondents' socio-demographic characteristics was found to be mixed.

The third issue is to what degree the specified "commodity" was correctly understood by the respondents and how misunderstandings may have affected the WTP, although every effort was made to reduce the gaps in the understanding of the "commodity" between Japanese, Chinese, and Korean.

The fourth and the last issue is the complexity of choice set design as indicated in the text. Although this study strictly and completely followed the experimental design in reference of Louviere, Hensher, and Swait (2000) to deal with the complexity to assure the statistical information, it is unavoidable to lose some information because full factorial designs were not used here due to the limitations of research resource and the respondent's judgment.

Conclusions

International benefit transfer related to coastal zones from developed countries is often used to evaluate international aid projects due to the lack of primary data in the policy country. Benefits are more often transferred from developed countries to developing countries. There are often great differences in nature, economy, culture, and history between the study country and the policy country; therefore, it may be meaningless to require an international benefit transfer as a no-choice tool to pass statistical tests, as shown in this paper. It may be more important to know which benefits are and are not transferable and how much uncertainty accompanies transfers from one country to another. The mean transfer errors in this study were 97 to 243%, larger than those of previous studies. The benefits of economic promotion seem to have more transferability than those of environmental improvement and risk reduction if the statistical probability significance of attributes in the models is ignored. The benefit transfer from a developed country to a de-

Table 8
PPI-adjusted Benefit Transfer Error (%)

	From Japan to		From Korea to		From China to	
	China	Korea	China	Japan	Korea	Japan
Improve coastal environment						
1. WATER	92	77	65	327	190	1,136
2. GARBAGE_OIL	9	33	31	25	45	10
3. ECOSYSTEM	47	46	64	31	175	88
4. LANDSCAPES	162	260	264	163	161	62
Reduce natural disaster frequency						
1. EARTHQUAKES	26	155	50	61	102	21
2. WAVES	37	46	57	31	130	58
3. FLOODS	11	110	47	52	90	10
4. TYPHOONS	694	182	623	222	86	117
Promote coastal usage						
1. FISHERY	83	32	74	48	288	474
2. INDUSTRY	130	159	111	61	972	437
3. PORTS	22	377	84	79	509	28
4. SERVICES	24	430	137	130	367	19
5. RECREATION	139	38	73	28	42	58
Average transfer error (%)	113	150	129	97	243	194

Note: Transfer error =

$$\frac{|WTP_{transfer} - WTP_{policy}|}{WTP_{policy}} * 100\%.$$

Table 9
Distribution of Benefit Transfer Error

Cut-off Point of Transfer Error (%)	<50	50–100	100–150	150–200	>200	Total
From Japan to						
Korea	5	1	1	3	3	13
China	7	2	2	1	1	13
From Korea to						
China	3	6	2	0	2	13
Japan	5	4	1	1	2	13
From China to						
Korea	2	2	2	3	4	13
Japan	5	4	1	0	3	13
Total	27	19	9	8	15	78

veloping one has less transfer error than vice versa. These results suggest that more attention needs be paid to internationally transferred subjects when the environmental settings are dissimilar.

The results yield interesting and important implications regarding future coastal management policy for each country besides just the application of international benefit transfers. First, local governments in each country should reallocate social resources in order to solve the problems that the public thinks are the most important in meeting the requirements for coastal zone management. For example, in the case of Tianjin city, the total annual per capita WTP ranges from 90.9 to 277.5 RMB (Chinese dollars, the exchange rate was about 7.85 RMB/US dollars during Chinese survey) depending on the coastal management programs and estimation models (Zhai and Suzuki 2008). The total WTP for the study population over 20 years may reach 26–59.6 billion RMB for the program focusing on environmental protection, 19.6–55 billion RMB for the program focusing on natural disaster reduction, and 22–40 billion RMB for the program focusing on economic development. The marginal willingness-to-pay of each country for each attribute can be used as an important quantity indicator when allocating social resources for coastal management. Second, a coastal management program can be implemented with less cost for the same utility because of the tradeoff between the attributes and goals of coastal zone management. When economic resources are limited, a more efficient coastal management program must be preferred over less efficient ones. Finally, the participants must be carefully chosen when public involvement in coastal zone management is implemented because their preferences can be significantly affected by their age, gender, education, and annual income.

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