Chapter 6

Analysis of Survey Results on the Willingness to Pay for Renewable Energy in Indonesia and Malaysia

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Chapter 6

Analysis of Survey Results on the Willingness to Pay for Renewable Energy in Indonesia and Malaysia

This chapter analyses the results of the willingness to pay (WTP) survey for renewable energy (RE) in Malaysia and Indonesia, where this year's surveys were conducted.

1. Discrete Choice Model Results

2. Regression Analysis

As shown in the previous chapter, the sample covered 1000 households in Indonesia and 1050 in Malaysia. From this sample, households with outlier values for the monthly electricity bill were excluded from the following regression analysis.

We estimated household WTP using the conditional logit. The utility was assumed to be a linear function of attributes of RE share and price. RE types, including solar, biomass, wind, mini hydro, and geothermal, were represented by dummy variables. Hydropower (Indonesia and Malaysia) was considered the status quo type in the model. Mathematically, for respondent *i*, the utility of choosing an alternative *j* is a function of the characteristics of the alternative *j*, and the utility function (U_{ij}) contains two parts: a deterministic part V_{ij} for observed characteristics and a stochastic error part ε_{ij} for unobserved variables.

$$\boldsymbol{U_{ij} = V_{ij} + \varepsilon_{ij}} \qquad (\mathbf{6-1})$$

where the deterministic part V_{ij} represents the observable portion of the utility that can be measured and is related to both attributes of alternatives and characteristics of the respondent. It is expressed as a linear-in-parameter function:

$$\boldsymbol{V_{ij} = \sum_{k} X_{jk}\beta_k} \qquad (\mathbf{6-2})$$

where X_{jk} is the *k* attribute value of the alternative *j* , and β_k is the coefficient associated with the *k*th attribute.

Table 6.1 presents the results of our utility model. The pseudo R squared for Malaysia is not high.

Table 6.1. Utility Function Estimates

Variables	Countries	
	Indonesia	Malaysia
Price	−0.096***	−0.070***
(% of the monthly bill)	(0.003)	(.003)
RE share (%)	0.017***	0.006*
	(0.002)	(0.003)
Renewable energy types		
Base type	Hydropower	Hydropower
Solar	−0.548***	0.404***
	(0.063)	(0.065)
Wind	−0.839***	-
	(0.065)	
Geothermal	−1.280***	-
	(0.072)	
Mini Hydro	-	0.096
		(0.065)
Biomass	−0.762***	−0.253***
	(0.067)	(0.068)
Obs	24,000	24,096
Number of households	1,000	1,050
Log-likelihood	−6,219	-7,953
Pseudo R^2	0.292	0.099

RE = renewable energy.

Note: Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' calculation.

The results can be summarised as follows:

- Respondents prefer higher RE shares, and the RE share coefficients in all three cities were positive and significant.
- Increased price reduces the utility of households.
- Amongst all the renewable energy types, solar is the most preferred in terms of the effect of the dummy variable.

2.1. WTP Estimations

Estimates of WTP for different RE share levels and different RE types were calculated using the results of the conditional logit. We converted both significant and insignificant parameters into marginal WTP by dividing the marginal utility of attributes by the marginal utility of price. The utility function of the household can be expressed as follows:

$$\boldsymbol{V_j = \beta_1 share_j + \beta_2 Solar_j + \beta_3 Wind_j + \beta_4 Hyd_j + \beta_5 Geo_j + \beta_6 Bio_j + \beta_7 Price_j} \qquad \boldsymbol{(6-3)}$$

where V_j is the utility of choice set *j*; $share_j$ is the RE share amongst total electricity production of choice set *j*; $Solar_j$, $Wind_j$, Hyd_j, Geo_j, and Bio_j are dummy variables representing RE types of choice set *j*; and $Price_j$ represents the percentage of increasing monthly electricity tariffs.

To examine $Price_j$ at different $share$ levels, we specified $share_j$ and determined the changes in WTP_j using the following function:

$$\boldsymbol{WTP_j = \frac{\beta_1(share_j - share_{sq}) + \beta_2 Solar_j + \beta_3 Wind_j + \beta_4 Hyd_j + \beta_5 Geo_j + \beta_6 Bio_j}{-\beta_7}} \qquad \boldsymbol{(6-4)}$$

Table 6.2 shows the estimation of the mean WTP in the percentage of monthly electricity bills in United States dollars (US$) when increasing the RE share. It follows the same pattern as the results of last year.

Table 6.2. Willingness to Pay Estimates for Renewable Energy Types in % of Monthly Electricity Bill

	RE Share	Solar % of monthly electricity bill (US$)	Wind % of monthly electricity bill (US$)	Geothermal % of monthly electricity bill (US$)	Mini Hydro % of monthly electricity bill (US$)	Biomass % of monthly electricity bill (US$)
Indonesia (status quo = 11%)	20%	−4.08% (−1.27)	−7.12% (−2.22)	−11.72% (−3.66)	-	−6.31% (−1.97)
	30%	−2.25% (−0.70)	−5.29% (−1.65)	−9.89% (−3.09)	-	−4.48% (−1.40)
	40%	−0.43% (−0.13)	−3.47% (−1.08)	−8.07% (−2.52)	-	−2.65% (−0.83)
	50%	1.40% (0.44)	−1.64% (−0.51)	−6.24% (−1.95)	-	−0.83% (−0.26)
Malaysia (status quo = 17%)	30%	6.90% (1.60)	-	-	2.48% (0.58)	−2.52% (−0.58)
	40%	7.76% (1.80)	-	-	3.34% (0.77)	−1.67% (−0.39)
	50%	8.61% (2.00)	-	-	4.19% (0.97)	−0.81% (−0.19)

Note 1: The official exchange rate by the World Bank in 2019 was used for the conversions (US$1 = Rp14,147.67 = RM4.1) (World Bank, n.d.-b)

Note 2: The mean monthly electricity bills are as follows: Indonesia, US$31.2/month; Malaysia, US$23.2/month.

Note 3: The status quo of renewable share is different in cities (Indonesia, 11%; Malaysia, 17%).

Source: Authors' calculation.