Green Bonds: The Impact of Vegetation on Loneliness, Social Cohesion, and Electoral Turnout

Table A1. Data information (Survey)

1	2021-2022 Koreans' Happiness Survey	Happiness levels, inequality, and their determinants in Korea, providing insights into subjective well-being, attitudes, beliefs, and social values	National Assembly Futures Institute (https://kossda.snu.ac.kr/handle/20.500.12236/25423/simple-search)

Table A2. Variables (Survey data)

<table>
<tr><th></th><th>Variable</th><th colspan="2">Description</th><th>Note</th></tr>
<tr><td>1</td><td>Loneliness</td><td colspan="2">"How frequently did you feel loneliness yesterday?" Respondents use a scale ranging from 0 (not at all) to 10 (all day)</td><td></td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Income</td><td colspan="2">Individual Income from various sources, including earned, business, property, and transfer income.</td><td rowspan="2">Unit: 10000KRW
As of July 10, 2024, the exchange rate between the United States Dollar (USD) and the South Korean Won (KRW) stands at 1USD to 1,288.60KRW</td></tr>
<tr><td>None = 1
Less than 100 = 2
100 ~ 200 = 3
200 ~ 300 = 4
300 ~ 400 = 5
400 ~ 500 = 6</td><td>500 ~ 600 = 7
600 ~ 700 = 8
700 ~ 800 = 9
800 ~ 900 = 10
900 ~ 1000 = 11
Over 1000 = 12</td></tr>
<tr><td>3</td><td>Education</td><td colspan="2">None = 0
Primary = 1
Middle school = 2</td><td></td></tr>
</table>

		High school = 3 College (less than 4 years) = 4 College (for years) or over = 5	
4	Homeownership	Homeownership = 1 Otherwise = 0	
5	Age	10s and 20s = 1 30s = 2 40s = 3 50s = 4 60s = 5 70s or over = 6	
6	Sex	Woman = 1 Otherwise = 0	
7	Marital status	Living with spouse or partner = 1 Otherwise = 0	
8	Religion	Having a religion = 1 Otherwise = 0	

Table A3. Data information (District level)

	Data	Description	Source
1	Vegetation Density Indices (EVI, NDVI	For NDVI and EVI, which are designed to minimize canopy background variations and maintain sensitivity in densely vegetated areas, we utilized the MODIS/Terra vegetation indices product (MOD13Q1.061). This product offers a spatial resolution of 250 meters and a temporal resolution of 16 days. The greenness data derived from these satellite-based indices were aggregated to yield mean annual values for each administrative district. (a) Enhanced Vegetation Index (EVI): EVI is designed to optimize the vegetation signal by correcting for canopy background signals and reducing atmospheric influences, including those from aerosols. EVI is particularly useful in areas with dense vegetation, where it improves sensitivity to variations in vegetation. The formula for EVI is: $$\mathrm{EVI} = \mathrm{G} \times \frac{(\mathrm{NIR} - \mathrm{RED})}{\mathrm{NIR} + \mathrm{C_1} \times \mathrm{RED} - \mathrm{C_2} \times \mathrm{BLUE} + \mathrm{L}}$$ Where NIR is the near-infrared reflectance, RED is the red reflectance, BLUE is the blue reflectance, L is the canopy background adjustment, and G, C_1, and C_2 are coefficients. (b) Normalized Difference Vegetation Index (NVDI): NDVI is a widely used index that	For EVI and NDVI, EVMODIS/Terra vegetation indices product (MOD13Q1.061) /

		measures the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). NDVI values range from -1 to +1, with higher values indicating healthier and denser vegetation. The formula for NDVI is: $\text{NVDI} = \frac{(\text{NIR} - \text{RED})}{(\text{NIR} + \text{RED})}$	
2	Electoral turnout	$\frac{\text{Votes}}{\text{Elligibal people to vote}}$ 2016 and 2020 Congressional elections 2017 and 2022 Presidential elections	National Election Commission
3	Economic Inequality	Palma ratio, $p^d = \frac{\sum_{\text{h} \in \text{d}(R_{10})} I_{R10}}{\sum_{\text{h} \in \text{d}(P_{40})} I_{P40}}$	National Health Insurance Service
4	Income	Average Income (unit: 10000 KRW)	Democratic Party (https://idp.theminjoo.kr/board/view/press/2128)
5	Homeownership	$\frac{\text{Households with their own houses}}{\text{Households without their own houses}}$	Korean Statistical Information Service
6	Education	$\frac{\text{Population of high education}}{\text{Population of low education}}$ - High education: Population with Tertiary education or higher based on national census data	Korea Employment Information Service
7	Age	Average age of population	Ministry of the Interior and Safety of South Korea

8	Sex	$\frac{\text{Male population}}{\text{Female population}}$	Korean Statistical Information Service
9	Urbanization	$\frac{\text{Population living in urban area}}{\text{Population}}$	Ministry of Land, Infrastructure and Transport of South Korea