land

Identifying the Necessities of Regional-Based Analysis to Study Germany's Biogas Production Development under Energy Transition

Supplementary Material

Table S1. Variance inflation factor of independent variables.

Control Variables	Variance Inflation Factor	Region Dummy Variables	Variance Inflation Factor
BTP	45.35	*Schleswig-Holstein*	8.76
ln(LP)	15.67	*Lower Saxony*	6.01
ln(DIC)	8.14	*North Rhine-Westphalia*	3.59
		Rhineland-Palatinate	2.26
		Baden-Württemberg	2.45
		Bavaria	4.31
		Brandenburg	2.84
		Mecklenburg-Vorpommern	3.24
		Saxony	2.96
		Saxony-Anhalt	6.55
		Thuringia	3.33

Note: Here we set the threshold of variance inflation factor of 10. The variance inflation factors of the control variables are above the threshold, however, we do not interpret the coefficients on these variables. Therefore, their high variance inflation factors can be safely ignored.

Table S2. The results of the Shapiro-Wilk and Kolmogorov-Smirnov tests for the regression residuals.

Test	Statistic	p-Value
Shapiro-Wilk	0.99	0.64
Kolmogorov-Smirnov	0.04	0.96

Note: Both Shapiro-Wilk and Kolmogorov-Smirnov are hypothesis test with the null hypothesis that the underlying data comes from a normally distributed population.

Table S3. The land use/cover area change metrics from 2000-2018 in Saxony-Anhalt (unit: km^2).

From	To								Loss
	UA	AL	PA	OA	FO	NG	OV	WW	
UA	-	145.25	85.25	10.25	55.50	8.50	32.50	22.25	359.50
AL	265.25	-	724.25	66.00	239.75	14.50	43.50	16.00	1360.25
PA	21.00	167.25	-	6.75	36.50	15.75	5.50	12.25	265.00
OA	38.00	185.25	180.25	-	77.75	10.50	15.75	4.75	512.25
FO	26.00	115.00	72.00	6.00	-	4.00	62.50	5.25	290.75
NG	3.00	4.00	10.75	0.75	19.75	-	60.50	2.00	100.75
OV	6.00	3.00	4.50	0.00	99.75	9.50	-	25.25	148.00
WW	2.75	5.75	16.25	1.25	3.75	4.75	1.00	-	35.50
Gain	353.00	625.50	1093.25	91.00	532.75	67.50	221.25	87.75	
Balance	-6.50	-734.75	828.25	-421.25	242.00	-33.25	73.25	52.25	

Note: The total balance is difference between contribution from others and contribution to others. Positive value indicates that this land type increase its area in the examined period, while negative value means loss.

Table S4. The land use/cover area change metrics from 2000-2018 in Bavaria (unit: km²).

From	To								Loss
	UA	AL	PA	OA	FO	NG	OV	WW	
UA	-	178.50	185.50	15.00	98.00	2.00	3.00	19.25	501.25
AL	642.00	-	1623.75	122.25	575.50	3.00	8.50	20.75	2995.75
PA	273.00	1054.50	-	37.50	420.25	50.00	8.25	15.00	1585.50
OA	357.75	4216.50	3982.25	-	779.75	25.75	11.50	20.00	9393.50
FO	120.00	440.25	664.75	34.00	-	115.75	363.75	38.00	1776.50
NG	11.75	4.50	37.75	0.50	80.75	-	28.25	0.50	164.00
OV	3.25	6.00	15.50	0.00	470.25	150.00	-	2.25	647.25
WW	12.00	17.50	84.25	4.75	81.75	11.25	4.50	-	216.00
Gain	1419.75	5917.75	6593.75	214.00	2506.25	357.75	427.75	115.75	
Balance	918.50	2922.00	4735.25	-9179.5	729.75	193.75	-219.50	-100.25	

Note: The total balance is difference between contribution from others and contribution to others. Positive value indicates that this land type increase its area in the examined period, while negative value means loss.

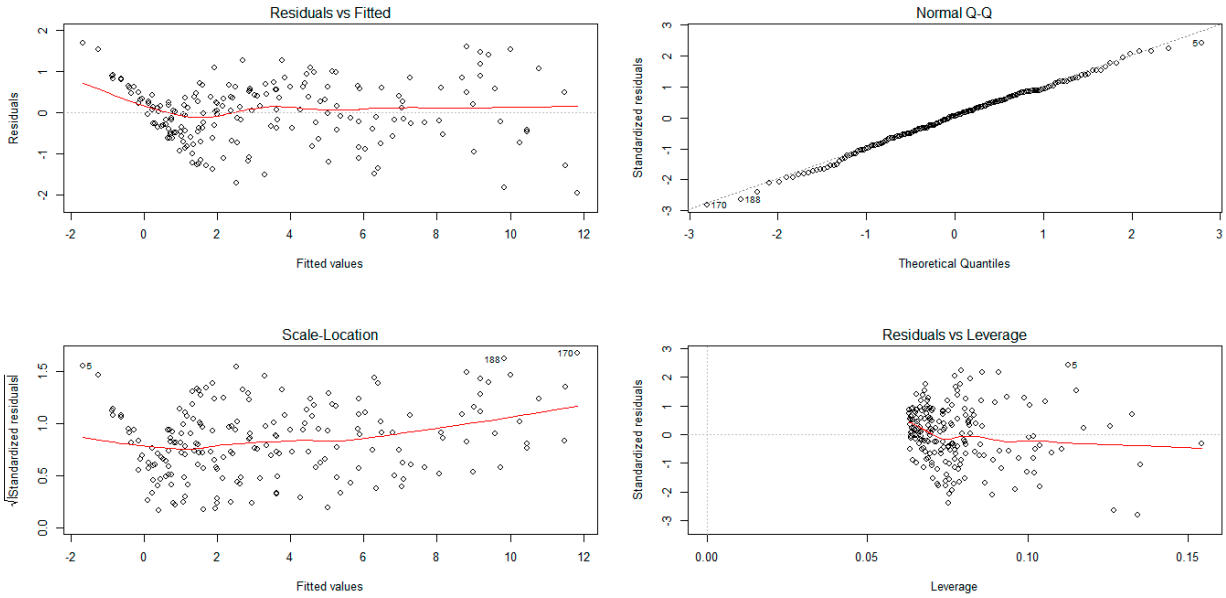

Figure S1. Diagnostics plots of regression residuals.