

The Effect of Renewable Energies on Employment

Evidence from EU27 Panel Data (2005-2023)

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RESEARCH QUESTION AND MOTIVATION

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Why Renewable Energy and Employment?

EU target: Climate neutrality by 2052

European **Green Deal** brought an acceleration of renewables : *Does this expansion create new jobs?*

Literature with mixed evidence:

- + 1% Capacity → **+ 0,48%** Employment (*Proença & Fortes, 2020*)
- + 1% Capacity → **+ 0,08%** Employment (*Azretbergenova et al., 2021*)
- Caution (Gross vs Net, regional effects) (*Lambert & Silva, 2012*)

Our Contribution

We decide to extend the analysis to **2005 – 2023 (EU27)**

In order to capture:

- Technological progress
- European Green Deal
- Post COVID shifts
- Energy crisis & Russia-Ukraine war

Goal: test whether the **positive employment effect** of renewables still holds today

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SPECIFICATION AND DATA

Research Question & Baseline Model

RQ: *What is the Effect of Renewable Energies on Employment in the EU?*

$$EMP_{ith} = \alpha + \beta REN_{it} + u_{it}$$

- **EMP_{ith} :** Employment (*thousands of people*) in country i at time t
- **REN :** Renewable energy generation (Mw) in country i at time t
- **α :** The expected level of employment when renewable energy is zero
- **β :** Coefficient measuring the effect of renewable energy on employment
- **u :** Error term capturing unobserved factors that influence employment

OVB Considerations

Hypothesis Testing: $\begin{cases} H_0: \beta = 0 & \rightarrow \text{Renewable energy has no effect on employment} \\ H_1: \beta \neq 0 & \rightarrow \text{Renewable energy does effect employment} \end{cases}$

OVB sources:

- **Energy Consumption per Capita** → Control for economic activity
- **Energy Dependency** → Control for prices

Multiple Regression Model

$$EMPth_{it} = \alpha + \beta_1 REN_{it} + \beta_2 EC_{it} + \beta_3 ED_{it} + u_{it}$$

Dependent variable : $EMPth$

Main independent variable: REN

Controls:

- $EC \rightarrow$ Energy Consumption per capita (Tonne of Oil Equivalent, TOE)
- $ED \rightarrow$ Energy Dependency (%)

Data Sources & Data Cleaning Process

<i>Datasets employed</i>	Eurostat	<i>REN, ED, EC</i>
	AMECO	<i>EMPth</i>
<i>Panel Composition</i>	Range of Years	2005 - 2023
	Countries	EU 27
	Total Observations	$17 \times 19 = 513$

Skewed variables (*REN*, *EMPth*, *EC*) were **log-transformed** to reduce skewness, following the existing literature and inspection of density

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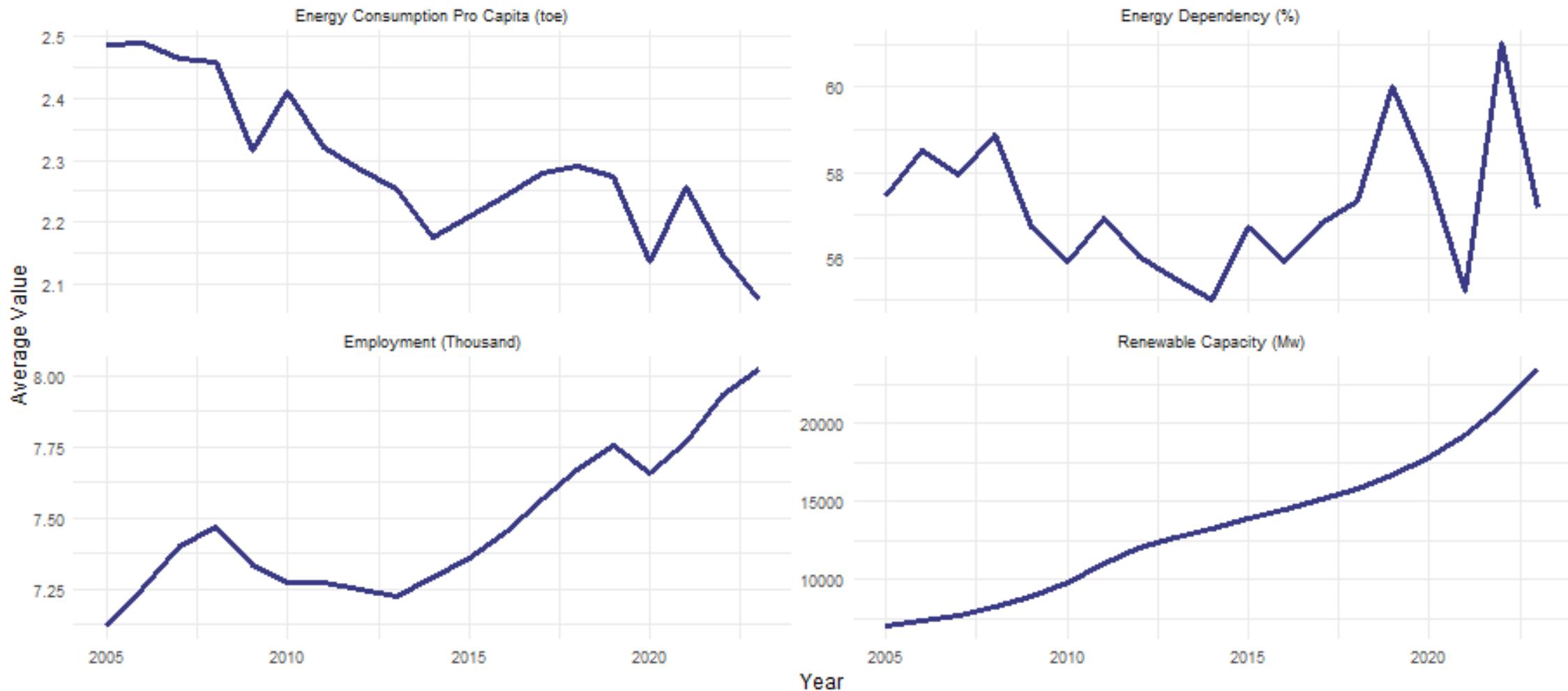
DESCRIPTIVE STATISTICS

Summary Descriptive Statistics

	Mean	S.D.	Min	Max
EMPth	7.476	10.066	0.163	45.801
REN (Mw)	3,485.709057	22,142.726950	0	156,909.00
EC (TOE)	2.29	1.14	0.88	8.700
ED (%)	57.21	25.28	-50.62	104.14

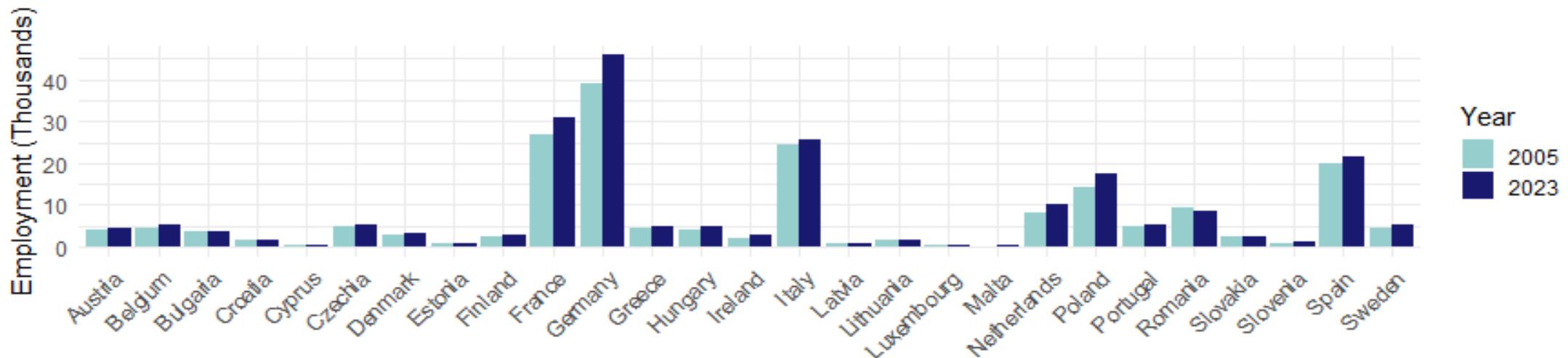
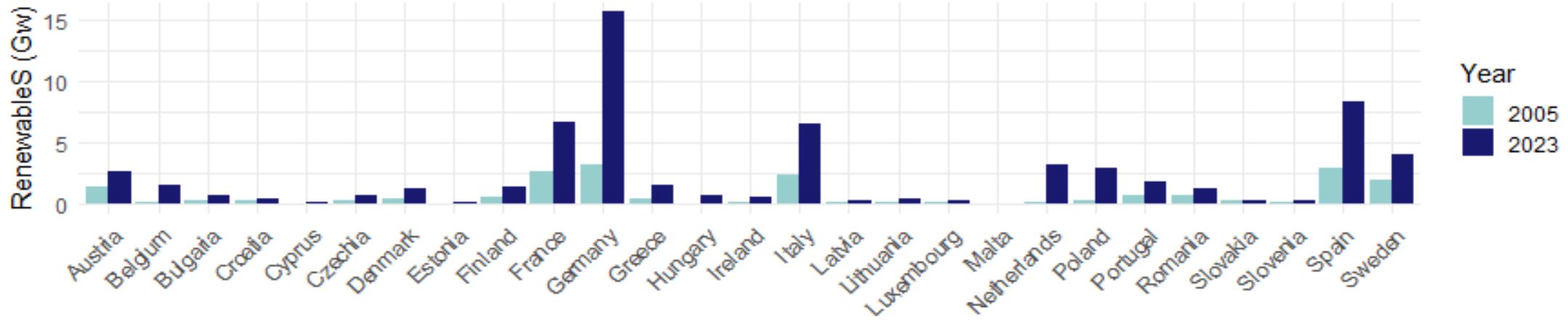
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Average Trends Over Time (2005 – 2023)



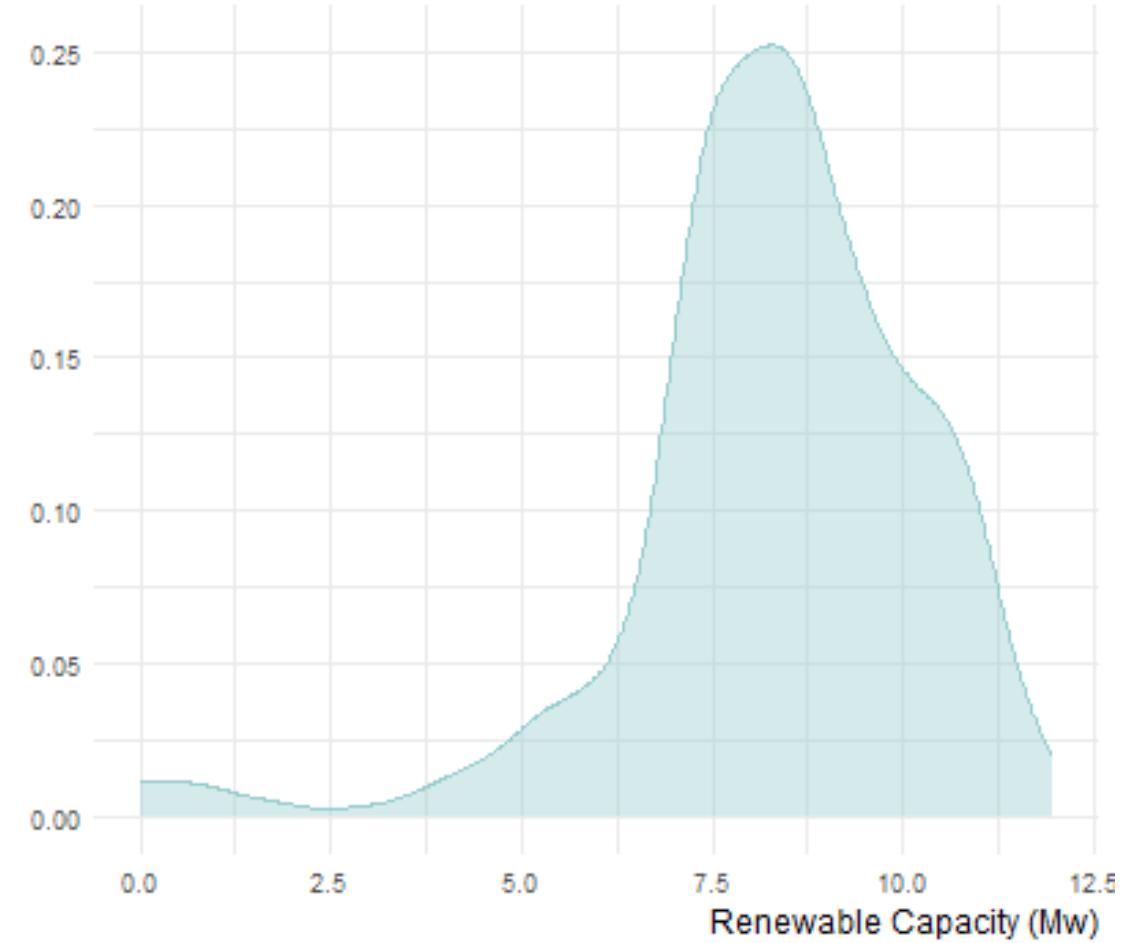
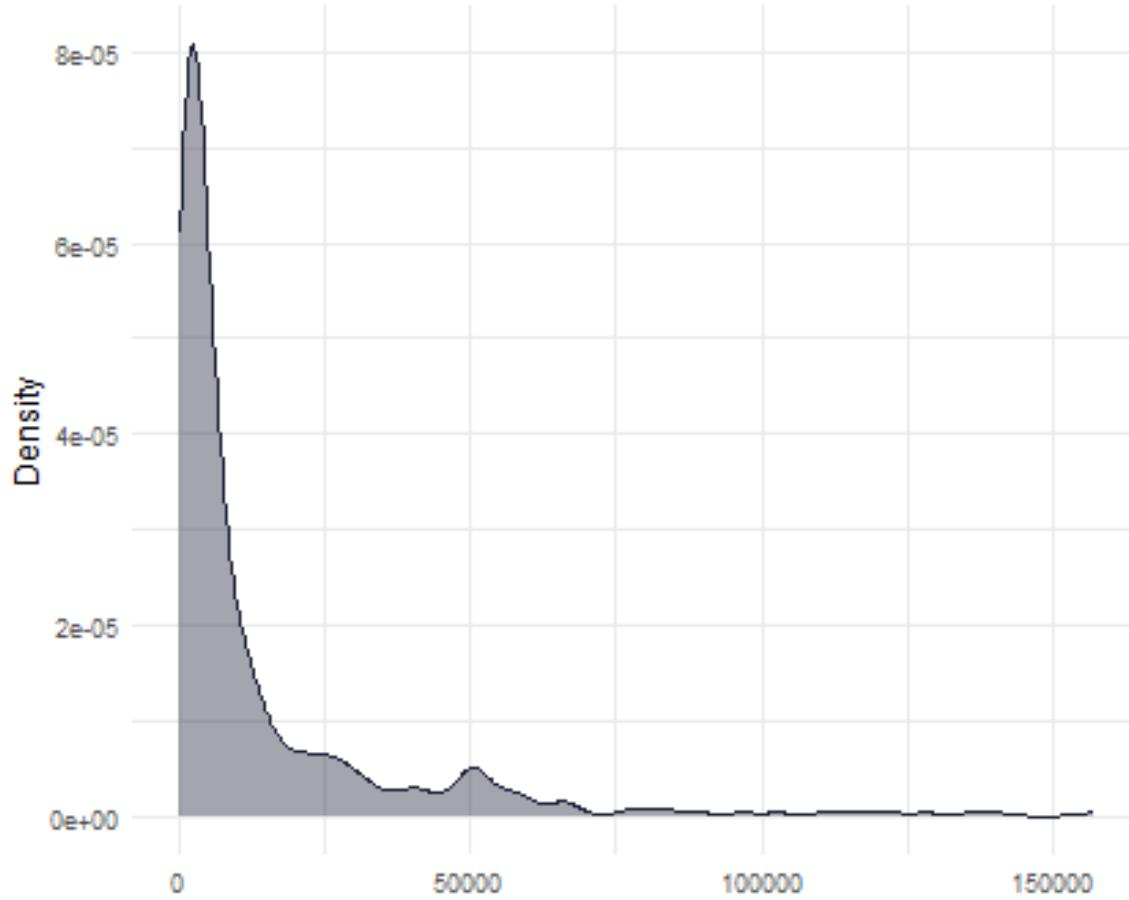
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Renewable Energy and Employment: 2005 vs 2023



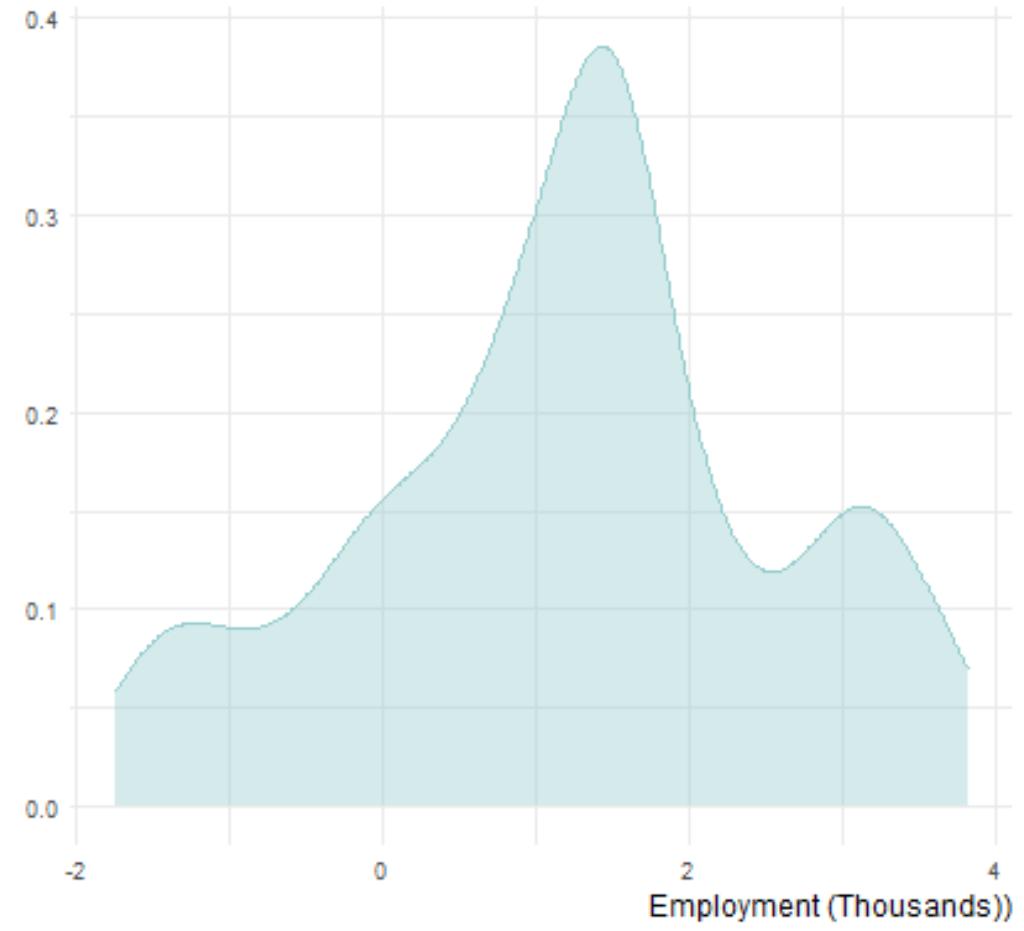
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REN Distribution: Before vs After Logs



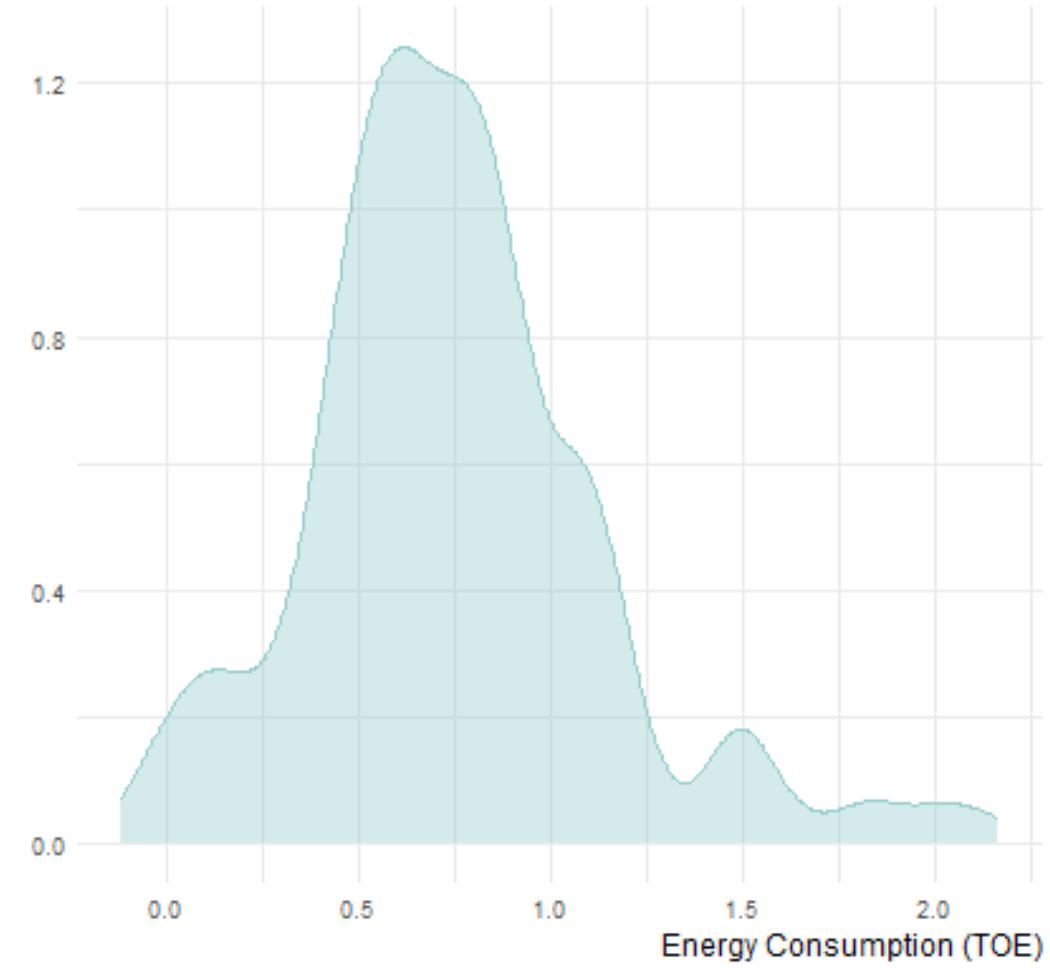
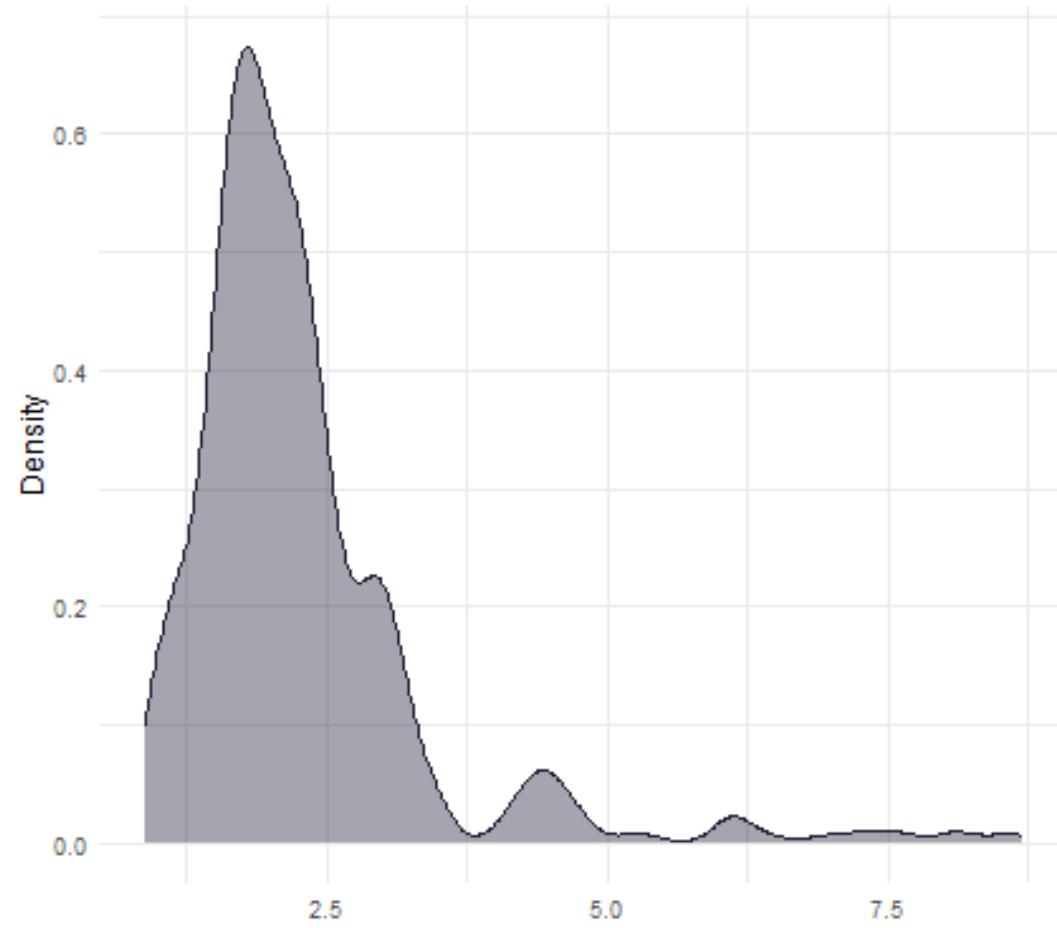
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EMPth Distribution: Before vs After Logs

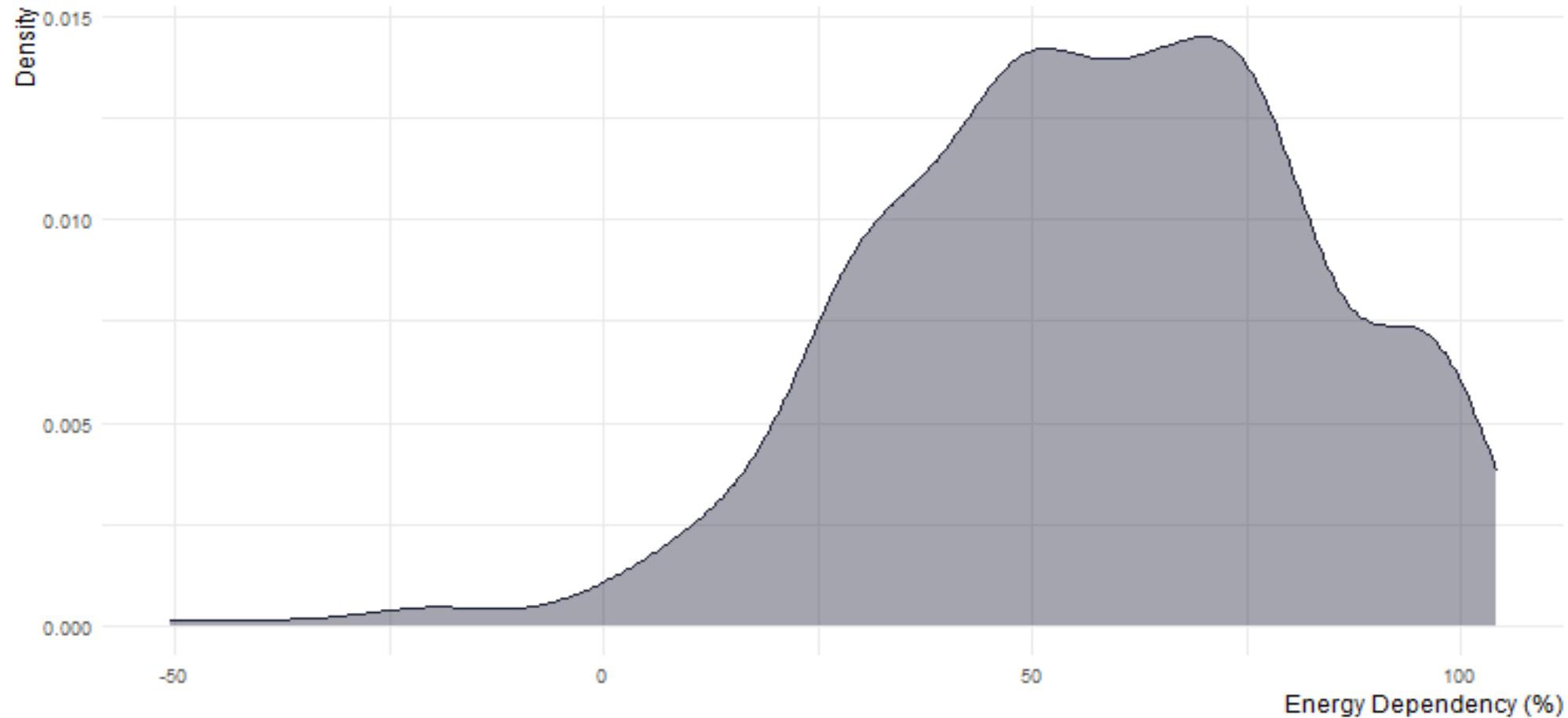


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EC Distribution: Before vs After Logs

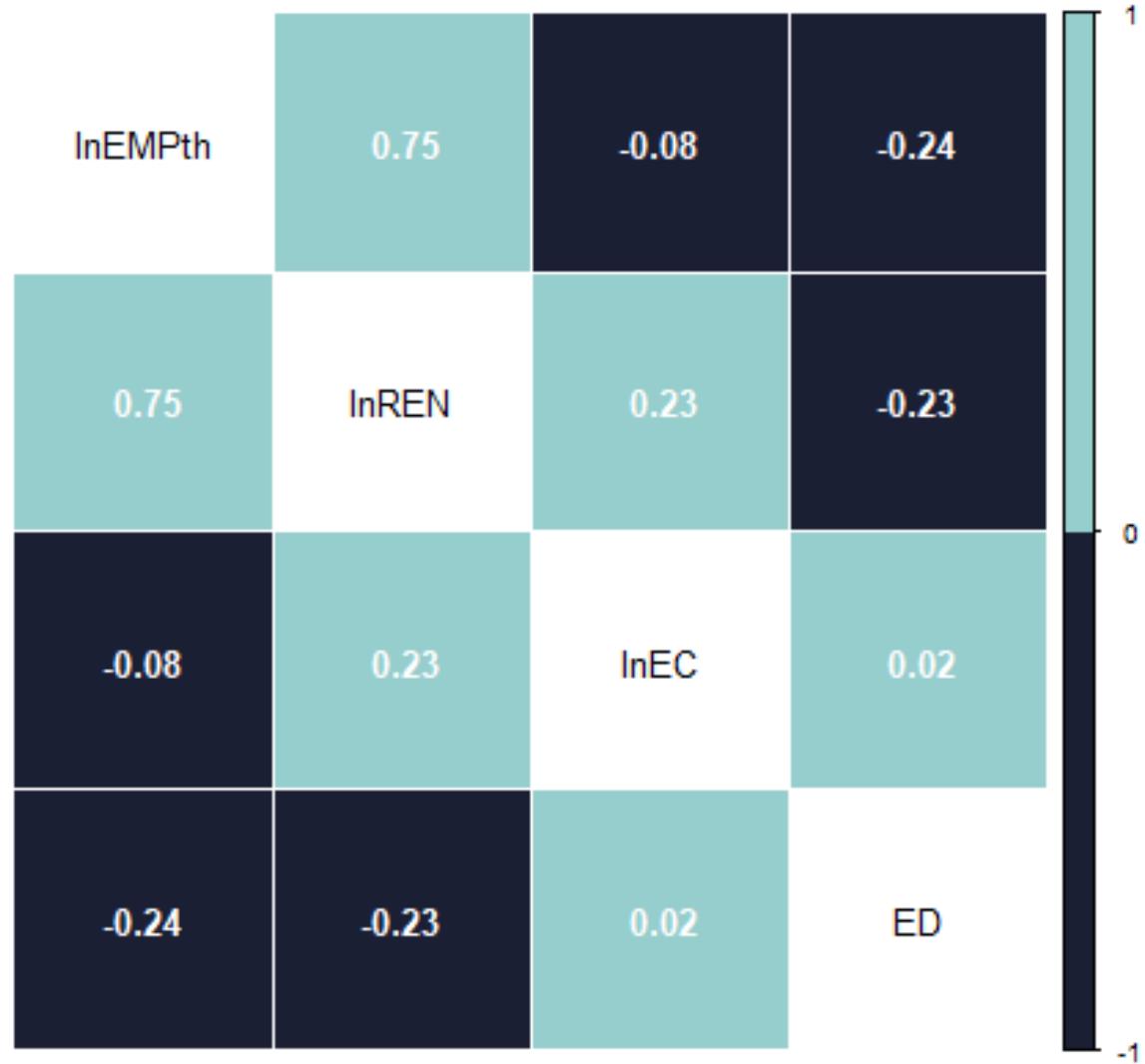


ED Distribution



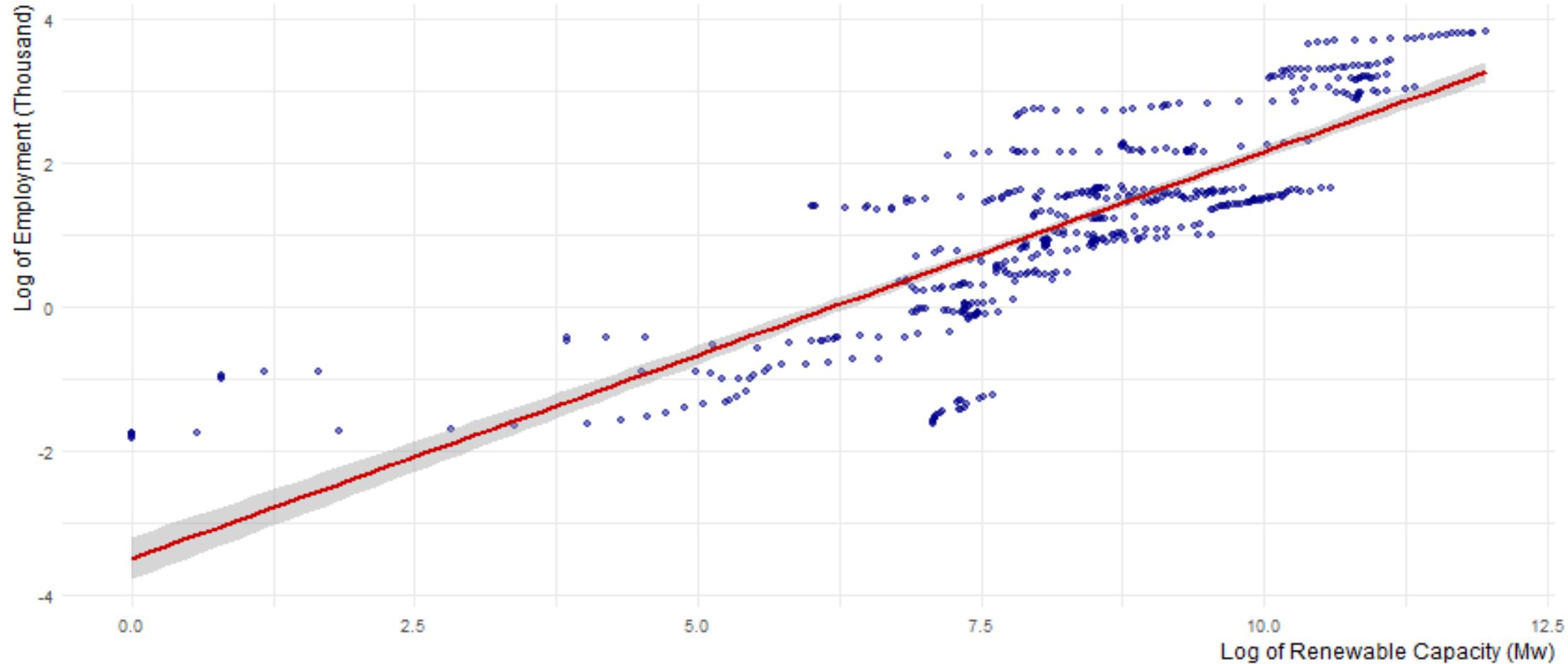
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Correlation Matrix of Key Variables



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Scatterplot of Employment vs Renewables



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RESULTS

Final Empirical Model

- **Baseline model:**

$$\ln EMPth_{It} = \alpha + \beta \ln REN_{it} + u_{it}$$

- **Multiple Regression Model:**

$$\ln EMPth_{it} = \alpha + \beta_1 \ln REN_{it} + \beta_2 \ln EC_{it} + \beta_3 ED_{it} + u_{it}$$

- **NB:** *Log-log specification* allows elasticity interpretation of the coefficients
($\Delta\%$ in $REN \rightarrow \Delta\%$ in $EMPth$)

The Baseline & Multiple Model

Coefficients	Baseline	Baseline Robust	Multiple Regression
Intercept	-2.359*** (0.144)	-2.359*** (0.385)	-1.735*** (0.379)
lmREN	0.433*** (0.017)	0.433*** (0.045)	0.460*** (0.042)
lmEC	-	-	-0.911*** (0.096)
ED	-	-	-0.003** (0.001)
R2	0.564	0.564	0.634
Adj. R2	0.563	0.563	0.632

Beta is statistically significant

Signif. codes: * p < 0.1, ** p < 0.05, *** p < 0.01

Fixed Effects & Clustering

Coefficients	OLS	Year FE	Country FE	FE	Clustering
Intercept	-1.735*** (0.379)	-	-	-	-
lnREN	0.460*** (0.042)	0.500*** (0.042)	0.033*** (0.003)	0.029*** (0.003)	0.029*** (0.004)
lnEC	-0.911*** (0.096)	-1.031*** (0.093)	-0.104** (0.047)	-0.134*** (0.043)	-0.134 (0.117)
ED	-0.003** (0.001)	-0.002* (0.001)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Adj. R2	0.632	-	-	-	-
R2 Within	-	0.68046	0.34329	0.30165	0.30165

Beta is statistically significant

Signif. codes: * p < 0.1, ** p < 0.05, *** p < 0.01

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CONCLUSIONS

Key Findings

- **Renewable Energy (REN)** : *Positive effect* on Employment persists, smaller under FE and Clustering (**0.43% - 0.03%**)
- **Energy Consumption (EC)**: Negative effect in most specifications
- **Energy Dependency (ED)**: *Its effect disappears* when controlling for FE

To conclude, we can say that expanding renewables seem to contribute to job creation, but **the effect is smaller when accounting for structural differences**, in particular across countries

Study Limitations: Internal & External Validity

Other possible Omitted Variables: *GDP Per Capita, Policies & Incentives, Population Size, etc*

Model Misspecification: Loss of temporal trends with cross-sectional analysis

Measurement Error: Use of aggregated estimates leads to loss of detailed information

Reverse Causality: Employment may influence renewables investments

Limited generalization to low-income or resource-rich countries (*different dynamics and fossil-fuel dependence*)

Historical shocks and policies **specific to EU context**

Country heterogeneity within the EU, despite common environmental policies.

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