Does the “Belt and Road Initiative” affect the energy intensity of countries along the routes?

An analysis of the direct and indirect effects

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Background

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➢ The "Belt and Road Initiative"

The "Belt and Road Initiative (BRI)" was proposed by in September 2013 with the aim of promoting regional cooperation and economic integration.

- **Direct effect**-The Five-Connectivity

  Policy coordination

  Facilities connectivity

  Unimpeded trade

  Financial integration

  People-to-people bonds

- **Indirect effect**-Outward foreign direct investment (OFDI)

  Economic development

  Structural change

  Technological progress

Motivation

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➢ **Whether the Initiative is green?**

①Project - Energy and transportation infrastructure

②Energy structure - Coal-fired power projects

③Purpose - Absorb the excess capacity in China's heavy industry

①The development status and demands of the host countries.

②Paying increasing attentions to the green BRI policies.

③ Growing reserves in clean energy technologies.

What we do

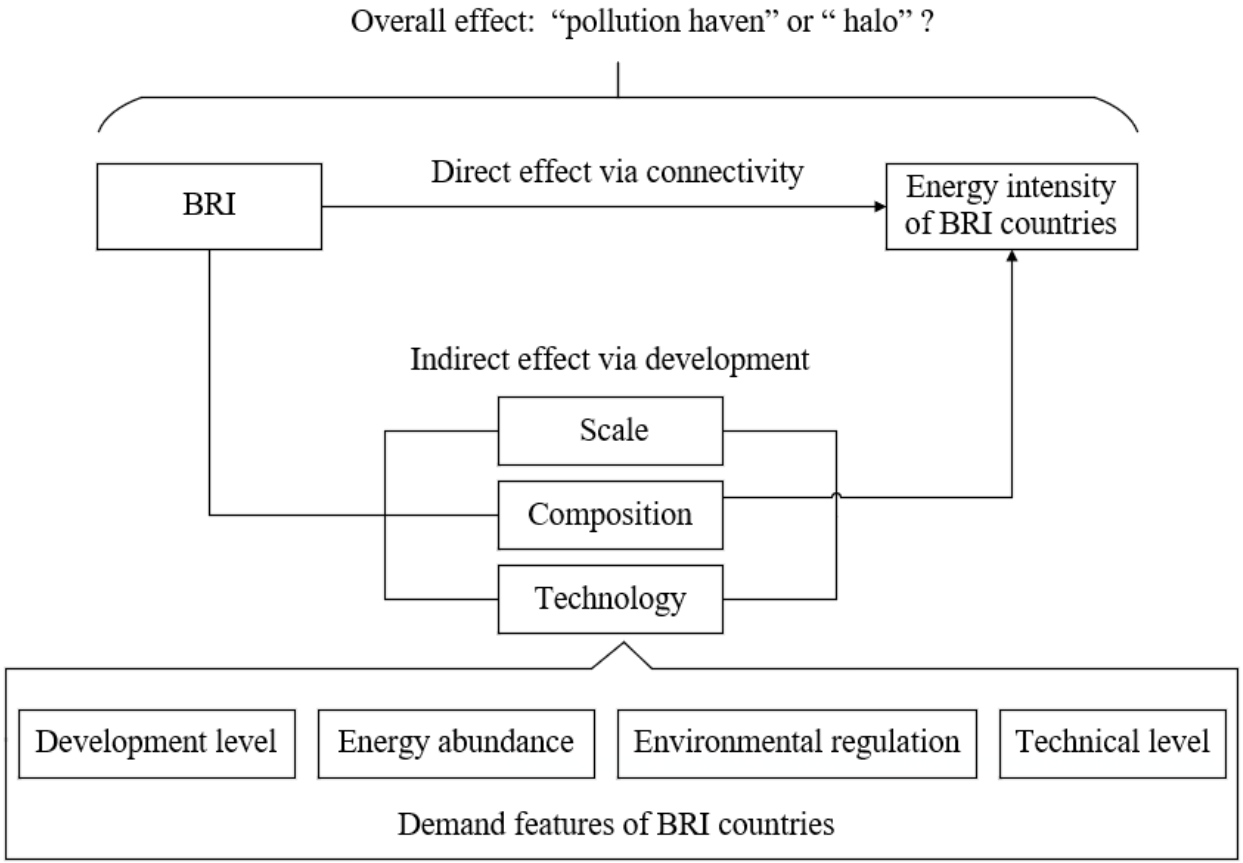

Figure 1 Research design

Potential contributions

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01 A relatively new counterfactual analysis method.

Combines the advantages of DID and synthetic control method.

Better estimate the policy effect when the original data does not satisfy the parallel trend assumption.

02 Direct and indirect effect

The indirect channels further emphasize the development perspective

A more comprehensive assessment.

03 Host countries' status and needs of economic development.

Methodology-The synthetic control method based on interactive fixed effects

- **The synthetic control method based on interactive fixed effects-Gobillon and Magnac (2016)**

  - It controls for the time-varying confounders that may affect pretreatment trends.
  - It constructs a counterfactual scenario based on both the control and treatment samples in the pretreatment periods.
  - It is more suitable for our data.

$$y_{it} = \alpha_1 BRI_{it} + \sigma Z_{it} + x_{it}\beta + f_t'\lambda_i + \mu_i + \eta_t + \varepsilon_{it} \qquad (1)$$

the effect of BRI on energy intensity in B&R countries

control variables

disturbance term

Methodology-Direct effect and indirect effect decomposition

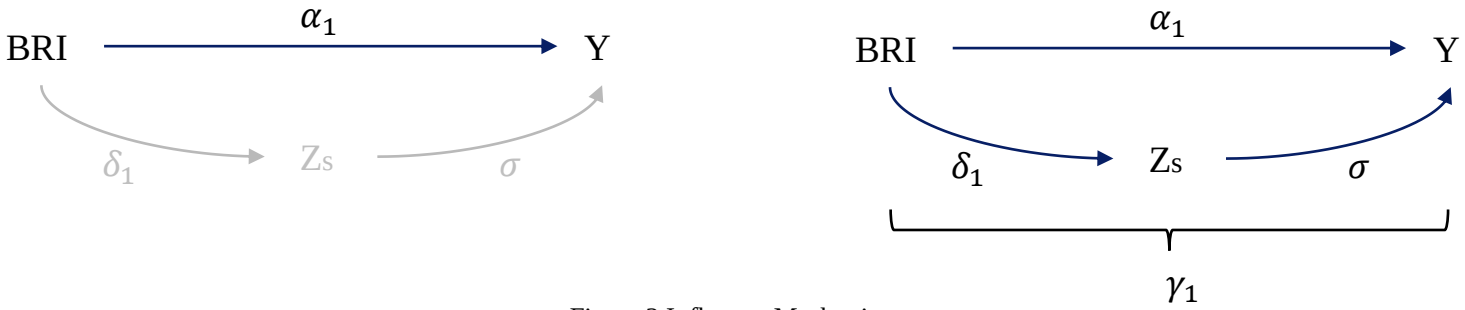

Figure 2 Influence Mechanism

$$y_{it} = \alpha_1 BRI_{it} + \sigma Z_{it} + x_{it}\beta + f_t'\lambda_i + \mu_i + \eta_t + \varepsilon_{it} \quad (1)$$

$$Z_{it} = \delta_0 + \delta_1 BRI_{it} + x_{it}\beta + f_t'\lambda_i + \mu_i + \eta_t + \varepsilon_{it} \quad (2)$$

$$\widetilde{Z_{it}} = Z_{it} - \widehat{\delta_1} BRI_{it} \quad (3)$$

$$y_{it} = \gamma_1 BRI_{it} + \sigma \widetilde{Z_{it}} + x_{it}\beta + f_t'\lambda_i + \mu_i + \eta_t + \varepsilon_{it} \quad (4)$$

α_1 is the direct effect of the BRI on energy intensity.

γ_1 is the overall effect of the BRI on energy intensity.

$\delta_1\sigma$ is the impact of scale, structure and technology on energy intensity.

Data

- 2003-2017 125 countries
- Dependent variable: *y* (energy intensity)
- Independent variable: BRI_{it}
- Indirect effect variables: *pgdp service fossil technology*
- Control variables: *pop trade inelectricity energy price*

Empirical results- Overall and direct effect

Table 1 The effect of the BRI on the energy intensity of countries along the route

Model	(1) Without control variables	(2) Direct effect	(3) Overall effect
BRI	-0.0054** (0.0024)	-0.0125*** （0.0030）	-0.0152*** （0.0030）
95% Confidence Interval	(-0.0101, -0.0006)	（-0.0183，-0.0067）	（-0.0210，-0.0093）
Control variables		Yes	Yes
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Unobserved factors	2	2	2
Observations	1875	1875	1875

Notes: Standard errors are shown in parentheses; *, **, and *** denote $p < 0.1$, $p < 0.05$, and $p < 0.01$, respectively.

Empirical results-Indirect effect

Table 2 The indirect effect of the BRI on the energy intensity of countries along the route

Model	The impact of BRI on scale, technology, and structural variables				Decomposition of the indirect effects of BRI on energy intensity			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Pgdp	Service	Fossil	Technology	Y	Y	Y	Y
BRI	0.0554*** (0.0039)	1.1410*** (0.1399)	0.5173*** (0.1003)	0.0188 (0.0454)	-0.0158*** (0.0029)	-0.0118*** (0.0030)	-0.0126*** (0.0029)	-0.0125*** (0.0030)
95% Confidence Interval	(0.0478, 0.0629)	(0.8668, 1.4152)	(0.3208, 0.7139)	(-0.0702, 0.1078)	(-0.0214, -0.0102)	(-0.0177, -0.0059)	(-0.0182, -0.0070)	(-0.0183, -0.0067)
Adjusted scale, structure, and technical representative indicators $\widetilde{Z_{it}}$ $\widetilde{pgdp}$					-0.0594***			
$\widetilde{service}$						0.0006***		
$\widetilde{fossil}$							-0.0002	
$\widetilde{technology}$								-0.0003
Indirect effect: $BRI \times \widetilde{Z_{it}}$					-0.0554×0.0594= -0.0033	1.141×0.0006 =0.0007	0	0
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unobserved factors	2	4	4	1	2	2	2	2
Observations	1875	1875	1875	1875	1875	1875	1875	1875

Empirical results-Robustness test

Table 3 The effect of the BRI on the energy intensity of countries along the route

Model	DID		PSM-DID	
	(1) Direct effect	(2) Overall effect	(3) Direct effect	(4) Overall effect
BRI	-0.0193*** (0.0053)	-0.0208*** （0.0053）	-0.0175*** (0. 0052)	-0.0184*** （0.0052）
95% Confidence Interval	（-0.0298，-0.0088）	（-0.0311，-0.0104）	（-0.0277，-0.0073）	（-0.0285，-0.0083）
Control variables	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
R2	0.3351	0.3351	0.3568	0.3568
Observations	1682	1682	1228	1228

Notes: Standard errors are shown in parentheses; *, **, and *** denote $p < 0.1$, $p< 0.05$, and $p < 0.01$, respectively.

Empirical results- Heterogeneity analysis

- Countries along the route with lower level of development, higher energy abundance, lower level of environmental regulation, and higher level of energy technology experience more reduction in energy intensity after the BRI.

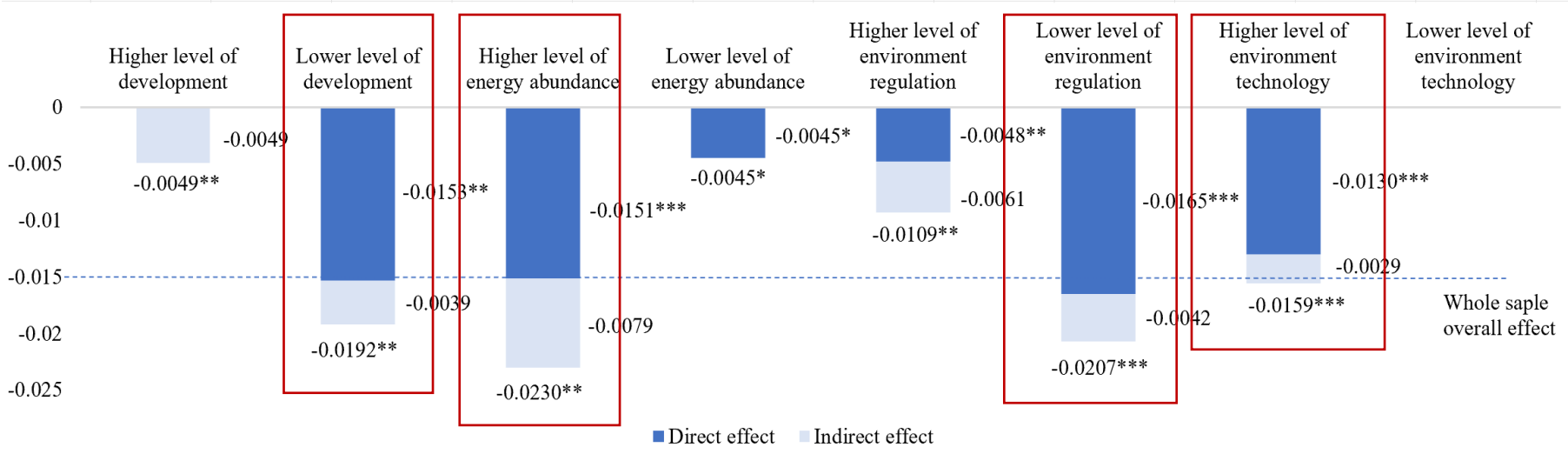

Figure 3 Heterogeneity analysis

Conclusions

➢ **The main conclusions drawn from the research are as follows:**

- The overall effect of the BRI reduces the energy intensity of countries along the route by 0.0152 toe per thousand dollars on average, of which the direct effect is 0.0125 toe per thousand dollars.
- The indirect effect of the BRI on energy intensity is mainly through the economic development and the industrial structure change, while the channel via energy mix and technological progress is not significant.
- Countries along the route with lower level of development, higher energy abundance, lower level of environmental regulation, and higher level of energy technology experience more reduction in energy intensity after the BRI.

Thank you!