

# The Impact of Green Credit on the Development of Regional Industrial Structure

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# Outline

- 1 Introduction
  - Background
  - Equator Principles
  - Examples
- 2 Literature Review
- 3 Model Setting
- 4 Empirical Study
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# Introduction

## Background

- **Domestic green credit development**
  - **Foreign green credit development**
1. In 1974, the Federal Republic of Germany established the world's first environmentally friendly ecological bank
  2. In 1980, the US Congress passed the Superfund Act
  3. In 2003, 10 banks including ABN Amro and Barclays announced the implementation of the Equator Principles
- **Green Credit Development in Huzhou City**

# Introduction

## Equator Principles

### - The Extent of Application

1. The total cost of project funds exceeds 10 million US dollars;
2. All new project financing and original projects that have significant impact on the environment or society due to renovation and expansion.

### - Financial Institution Implementation Steps

1. The borrower completes environmental and social impacts and risk assessments.
2. The borrower develops an action plan, submits mitigation measures, corrective actions, and monitoring measures for impacts and risks, and determines the order in which actions are implemented.
3. The borrower discloses the relevant impact to the affected parties and consults with the relevant entities.

# Introduction

## Examples

### - Two banks in China



Industrial Bank Co., Ltd



Bank of Jiangsu

# Introduction

## Examples

表1 我国绿色信贷政策文件发布情况一览表

时间	发布机构	文件名称
1995	中国人民银行	《关于贯彻信贷政策与加强环境保护工作有关问题的通知》（银发[1995]24号）
2004	国家发改委、中国人民银行、中国银监会	《关于进一步加强产业政策和信贷政策协调配合控制信贷风险有关问题的通知》（发改产业[2004]746号）
2006	中国人民银行、国家环境保护总局	《关于共享企业环保信息有关问题的通知》（银发[2006]450号）
2007	中国人民银行	《关于改进和加强节能环保领域金融服务工作的指导意见》（银发[2007]215号）
	国家环境保护总局、中国银监会和中国人民银行	《关于落实环保政策法规防范信贷风险的意见》（环发[2007]108号）
	中国银监会	《关于防范和控制高耗能行业贷款风险的通知》（银监办发[2007]161号）
	中国银监会	《节能减排授信工作指导意见》
2008	国家环境保护总局、中国银监会	《信息交流与共享协议》
2009	环境保护部、中国人民银行	《关于全面落实信贷政策进一步改善信息共享工作的通知》（环办[2009]77号）
	环境保护部	《关于贯彻落实抑制部分行业产能过剩和重复建设引导产业健康发展的通知》（环发[2009]127号）
	中国人民银行、中国银监会、中国证监会	《关于进一步做好金融服务支持重点产业调整振兴和抑制部分行业产能过剩的指导意见》（银发[2009]386号）
2010	中国人民银行 中国银监会	《关于进一步做好支持节能减排和淘汰落后产能金融服务工作的意见》（银发[2010]170号）
2011	中国银监会	《关于全面落实节能减排授信工作及做好绿色信贷相关工作的通知》（银监办发[2011]60号）
2012	中国银监会	《绿色信贷指引》（银监发[2012]4号）

- "Guiding Opinions on Improving and Strengthening Financial Services in Energy Conservation and Environmental Protection" (2007)
- Green Credit Guidelines (2012)
- "Key Evaluation Indicators for the Implementation of Green Credit" (2014)
- Energy Efficiency Credit Guidelines (2015)

## Policy Document on Green Credit

# Introduction

## Examples

### Green Finance Development in Huzhou City

Time	Events <sup>a</sup>
2014	The first pilot zone(ecological civilization).
2015	The five-year plan for green financial reform(2016-2020).
2016	Established the country's first green banking rating system.
2017	Approved the establishment of national green finance reform.
2018	Four local standards passed the experts' approval.

Table: Huzhou City

<sup>a</sup> The development of green credit in China.

# Outline

- 1 Introduction
- 2 Literature Review
  - Two Kinds of Literature
- 3 Model Setting
- 4 Empirical Study
- 5 Conclusion
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# Literature Review

## Two Kinds of Literature

### ● 1: Industry Structure

- Heavy pollution or "double high" industry
- Three industrial output values
- Study 33 industrial industries in Huzhou City

### ● 2: Green Credit

- Energy saving and environmental protection industry loan.
- Corporate financial statement data
- Total amount of green project loans issued by banks

# Outline

- 1 Introduction
- 2 Literature Review
- 3 Model Setting**
  - Two Models
  - Gray Analysis Model
  - Regression formula
- 4 Empirical Study
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# Model Setting

## Two Models

- **1:Gray Model(Preliminary analysis of data)**
  - Finding the degree of association of variables, preliminary exploration of the potential correlation between variables, paving the way for the construction of late regression models.
- **2:Regression Analysis(In-depth analysis of data)**
  - Undertake the gray analysis model, taking the green credit ratio as the main explanatory variable, the industry profit as the explanatory variable, and the rest as the control variable for the regression model analysis.

# Model Setting

## Gray Analysis Model

$$[x_1, x_2, \dots, x_m] = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

- Normalized
- $z = [z_1, z_2, \dots, z_m]$
- Calculate the absolute difference between each indicator and the sequence indicator one by one, and calculate:
  - $\min_{i=1}^m \min_{j=1}^m |z_{ij} - z_{0j}|$  and  $\max_{i=1}^m \max_{j=1}^m |z_{ij} - z_{0j}|$
  - And we can get:  $\xi_{ij} = \frac{\min_{i=1}^m \min_{j=1}^m |z_{ij} - z_{0j}| + \eta \max_{i=1}^m \max_{j=1}^m |z_{ij} - z_{0j}|}{|z_{ij} - z_{0j}| + \eta \max_{i=1}^m \max_{j=1}^m |z_{ij} - z_{0j}|}$
  - Here  $\eta$  take the value of 0.5

# Model Setting

## Regression formula

- Regression formula

- $InPRO_{it} = \beta_0 + \beta_1 PGD_{it} + \gamma Control_{it} + \alpha_i + \epsilon_{it}$

- $Control : InNB_{it} + DA_{it} + AS_{it} + RE_{it}$

### Tabular for Variables

	Variables	Symbol
Y <sup>a</sup>	Industry profit	<i>InPRO</i>
X <sup>b</sup>	Green credit ratio	<i>PGD</i>
C <sup>c</sup>	Market structure	<i>InNB</i>
	Assets and liabilities	<i>DA</i>
	Capital labor ratio	<i>AS</i>
	Environmental regulation	<i>RE</i>

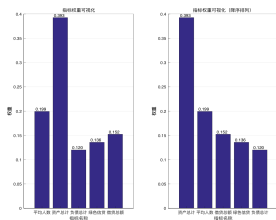
<sup>a</sup> Explained variable. <sup>b</sup> Explanatory variables. <sup>c</sup> Control variables.

# Outline

- ① Introduction
- ② Literature Review
- ③ Model Setting
- ④ **Empirical Study**
  - Grey Model
  - Panel Data Regression Model
  - Regression Model Results
  - Robustness Test
- ⑤ Conclusion

# Empirical Study

## Grey Model



### 1. Main model formula

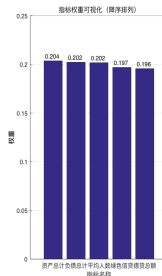
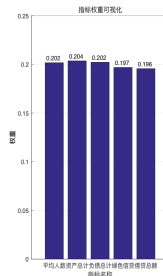
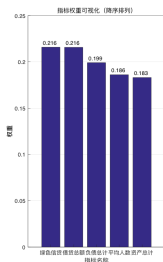
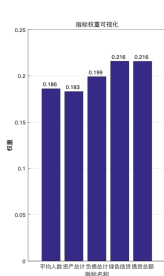
$$\xi_{ij} = \frac{\min_{i=1}^m \min_{j=1}^m |z_{ij} - z_{0j}| + \eta \max_{i=1}^m \max_{j=1}^m |z_{ij} - z_{0j}|}{|z_{ij} - z_{0j}| + \eta \max_{i=1}^m \max_{j=1}^m |z_{ij} - z_{0j}|}$$

### 2. MATLAB modeling solution

- Secondary industry
- Divided into polluting industries and non-polluting industries

# Empirical Study

## Grey Model



Non-metallic Mining Industry

Agricultural Food Processing Industry



# Empirical Study

## Grey Model

第二产业明细行业	平均人数	资产总计	负债总计	绿色信贷	贷款总额
农副食品加工业	0.20168	0.20363	0.20221	0.19683	0.19565
木材加工及草制品业	0.2132	0.20492	0.19688	0.19355	0.19145
家具制造业	0.20425	0.20496	0.20056	0.19671	0.19353
印刷业和记录媒介的复制	0.20171	0.20216	0.20026	0.21054	0.18534
非金属矿物制品业	0.20154	0.19597	0.19465	0.20448	0.20337
黑色金属冶炼及加工业	0.19445	0.19555	0.19831	0.20457	0.20712
金属制品业	0.21219	0.20753	0.19272	0.19441	0.19315
通用设备制造业	0.20216	0.19829	0.19405	0.19843	0.20707
专用设备制造业	0.18457	0.19731	0.19672	0.20993	0.21148
汽车制造业	0.21218	0.2031	0.19675	0.19264	0.19533
铁路、船舶	0.19056	0.20246	0.20218	0.19235	0.21245
电气机械及器材制造业	0.20113	0.20237	0.20095	0.19713	0.19842
通信设备制造业	0.21163	0.20469	0.19722	0.19499	0.19147
仪器仪表及机械制造	0.19808	0.19895	0.19771	0.19847	0.20679
其他制造业	0.21476	0.22866	0.18057	0.19406	0.18195
废弃资源综合利用	0.30071	0.22032	0.11911	0.18199	0.17787

Polluting industry

第二产业明细行业	平均人数	资产总计	负债总计	绿色信贷	贷款总额
非金属矿采选业	0.18616	0.18312	0.19915	0.21583	0.21573
食品制造业	0.20128	0.18652	0.19761	0.20829	0.2063
酒、饮料等制造业	0.20296	0.19023	0.20715	0.19742	0.20224
纺织业	0.20786	0.20199	0.19915	0.19625	0.19474
纺织服装、鞋、帽制造业	0.20287	0.20122	0.20006	0.19712	0.19873
皮革、毛皮及其制品业	0.20105	0.20146	0.20631	0.19875	0.19243
造纸及纸制品业	0.19741	0.20557	0.20943	0.19286	0.19473
文教用品制造业	0.19802	0.18572	0.19907	0.2109	0.20628
石油加工炼焦业	0.19455	0.2022	0.18517	0.19374	0.22433
化学原料制造业	0.19863	0.19819	0.19858	0.20368	0.20091
医药制造业	0.20016	0.19985	0.19836	0.19997	0.20165
化学纤维制造业	0.20636	0.20757	0.203	0.19801	0.18505
橡胶和塑料制品业	0.21021	0.20356	0.19954	0.19275	0.19393
有色金属冶炼加工业	0.19644	0.19403	0.19701	0.20004	0.21249
电力等的生产和供应业	0.21046	0.20159	0.20895	0.19387	0.18512
燃气生产和供应业	0.19723	0.19468	0.19356	0.20816	0.20637
水的生产和供应业	0.21056	0.21111	0.21127	0.18215	0.18492

Cleaning industry

# Empirical Study

## Panel Data Regression Model

	Correlation matrix between variables						
	lnPRO	lnNB	PGD	AS	DA	RE	
lnPRO	1.0000						
lnNB	0.7393*	1.0000					
		0.0000					
PGD	-0.5183*	-0.3550*	1.0000				
	0.0000	0.0000					
AS	-0.0728	-0.4028*	0.1402	1.0000			
	0.3529	0.0000	0.0725				
DA	0.0931	0.1106	-0.3340*	0.1980*	1.0000		
	0.2343	0.1572	0.0000	0.0108			
RE	0.0188	-0.1521	-0.1124	0.3303*	0.1420	1.0000	
	0.8105	0.0511	0.1504	0.0000	0.0689		

# Empirical Study

## Regression Model Results

- Clustering and mixed regression, fixed effects, and random effects regression results.

	(1)	(2)	(3)	(4)
	lnPRO	lnPRO	lnPRO	lnPRO
lnNB	2.286*** (15.19)	2.286*** (18.03)	0.0456 (0.05)	2.243*** (12.77)
PGD	-0.0207*** (-7.00)	-0.0207** (-2.75)	-0.0257*** (-4.77)	-0.0223*** (-7.00)
AS	0.00729*** (6.10)	0.00729*** (5.35)	0.00711* (2.20)	0.00747*** (5.49)
DA	-0.0343*** (-3.60)	-0.0343 (-1.94)	-0.0520* (-2.60)	-0.0369*** (-3.44)
RE	0.0673 (0.38)	0.0673 (0.35)	0 (.)	0.0442 (0.21)
_cons	3.071*** (4.00)	3.071* (2.63)	12.46*** (3.40)	3.377*** (3.83)
N	165	165	165	165

# Empirical Study

## Regression Model Results

- Relative pollution and relative clean industry fixed effect and random effect regression results table.

	(5) lnPRO	(6) lnPRO	(7) lnPRO	(8) lnPRO
lnNB	-0.850 (-0.52)	2.574*** (8.57)	1.174** (3.18)	1.997*** (10.32)
PGD	-0.0390*** (-3.61)	-0.0246*** (-5.18)	0.0124* (2.58)	0.00144* (0.33)
AS	-0.00463 (-0.46)	0.00846* (2.28)	0.00535*** (5.79)	0.00540*** (6.14)
DA	-0.0868* (-2.31)	-0.0665*** (-3.74)	-0.0238*** (-3.52)	-0.0202** (-2.92)
_cons	19.08** (2.90)	3.647** (2.64)	6.648*** (4.69)	3.525*** (4.13)
N	85	85	80	80

# Empirical Study

## Robustness Test

### 1. Hausmann test

- Prob>chi2                      0.0550
- Prob>chi2(RE=0) 0.0258
- Prob>chi2(RE=1) 0.0083

### 2. Robustness test

	33个行业整体 lnPRO	相对清洁行业 lnPRO	相对污染行业 lnPRO
lnNB	0.0456 (0.05)	-0.850 (-0.52)	1.174** (3.18)
PGD	-0.0257*** (-4.77)	-0.0390*** (-3.61)	0.0124* (2.58)
AS	0.00711* (2.20)	-0.00463 (-0.46)	0.00535*** (5.79)
DA	-0.0520* (-2.60)	-0.0868* (-2.31)	-0.0238*** (-3.52)
_cons	12.46*** (3.40)	19.08** (2.90)	6.648*** (4.69)
F	11.64	7.43	17.82
sigma_u	1.5396377	2.083823	1.0215261
sigma_e	0.99176106	1.3260028	0.22938758
Rho	0.70674768	0.71178523	0.95199616
R-sq (Within)	0.2667	0.3171	0.5430
R-sq (Between)	0.1397	0.0081	0.4802
R-sq (Overall)	0.1747	0.0711	0.4821
N	165	85	80

# Outline

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- 5 Conclusion**
  - Main Conclusions
  - Main Policy Recommendations
- 6 Reference

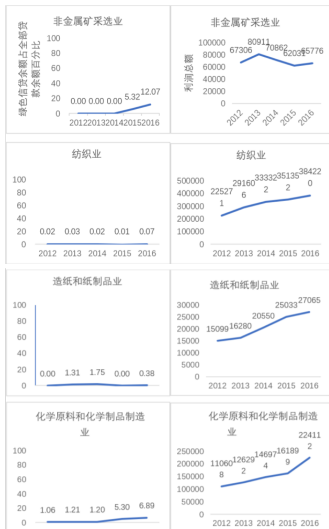
# Conclusion

## Main Conclusions

1. Grey correlation analysis
  - Huzhou green credit ratio is related to industry profit.
2. Short-panel regression analysis
  - Green credit ratio has a positive impact on the profitability of polluting industries, and has no significant impact on clean industries.

# Relatively polluting industry

## Main Conclusions





# Relatively cleaning industry

## Main Conclusions



- Relatively polluting industry
- v.s.
- Relatively cleaning industry

# Conclusion

## Main Policy Recommendations

1. The banking industry continues to increase investment in green credit for polluting industries and promote the transformation of polluting industries.
2. Green credit issuance takes into account the heterogeneity of clean and polluting industries.
3. Establish a long-term effective green credit policy system and a detailed corporate environmental rating system.

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# Reference

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- Thank you!
- Yi Cui, Ya Gao, Zhiqing Li