Understanding the impact of Environmental Tax on the Competitiveness of Enterprises: A case study from China

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Outline

* Background and Research Question
* Literature
* Methodology and approach
* Case Study
* Empirical Results
* Findings and Insights

Research Background

* **The upcoming reform of environment tax in China**

Pollution Levy System → Environmental Tax System

* Theoretically same
* Different in practice
  * Collected by different agency, less negotiation
  * Higher rate (August 2014)
* Potentially
  * More pollutants covered, CO2
  * welfare impact by different fund using or restructuring tax structure

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Research Background

* **Research Question**
  * What is enterprise-level Competitiveness Impact of the Environment Tax ？

Literature

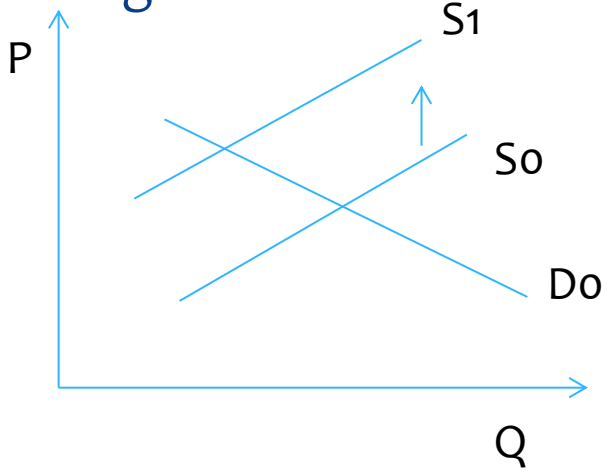
* **Competitive Advantage： an advantage that a firm has over its competitors (M. Porter)**

* **the Impact of Environmental Regulation on firm Competitiveness**
  * Traditional Opinion: negative relation btw Env. Regulation and productivity, by econometric Method
    * Barbara &McConnell(1990): 5 industry
    * Gray & Shadbegian（1995）: paper mill, refinery, iron & steel
    * Jaffe, Peterson, Portney & Stavins（1995）:paper mill

  * Porter Hypothesis: positive relation btw environmental and financial performance
    * Slater & Angel (2000): Case Study
    * Judge & Douglas(1998)
    * Murty & Kumar(2003): output distance function

Methodology and approach

* In principle, the impact of environmental tax depends on
  * How much supply curve will be shifted up?
  * How will the supply curve slope (elasticity) will be changed?
  * How much will demand curve slope will be changed?



Literature

* **What are the factors that cause the impact?**
  * Alanen(1996) :Two major types of Competitive Advantages
    * Comparative Advantage（Cost Advantage）
    * Differential Advantage

  * Jingyan Fu（2002）
    * Cost increase (pollution intensity, technology)
    * Cost- competitiveness relevance (the ability to absorb incremental cost, or shift cost burden)
    * Differentiation impact (consumer preference)
    * Differentiation –competitiveness relevance (product homogeneity)

Methodology and approach

* **Determinants**
  * Cost:
    * Short-term: strict environmental regulation would make the external environmental cost internalized, thus increasing producers' cost
    * Long-term: technology innovation and efficiency improvement would also reduce the cost. It depends on the technology capability of the enterprise.
  * Differentiation ： When products are classified according to their environmental characteristics, positive effect of differentiation would be achieved

Determinants

Index

Pollution Emission Intensity (X1)

Pollution Control Investment (X2)

Enterprise Scale (X3)

Investment Ability (X4)

Production Capacity (X5)

Pollution Control Ability (X6)

Proportion of environmental cost in capital investment (X7)

Profitability (X8)

Value added (X9)

Market share (X10)

Price elasticity (X11)

Cost Dimension

Scale of Environmental Externalities

Technology capability

→ Net Increase of Cost Caused by Environmental Tax (C1)

Ability of Enterprises to Absorb Cost

Ability of Enterprises to Pass on Cost to Consumers

→ Importance of Cost in Competitiveness of Enterprises (C2)

Determinants

* **Differential Impacts on Enterprises**
  * the Importance of Differentiation on Competitiveness (D1)
    * the homogeneity of product, geographical position, time of entry, business coverage in production chain
  * the Importance of Environmental Factors in Differentiation (D2)
    * reflects the relationship between differentiation and environment, and depends on customer's environment preference or sensitivity, the position of product in production stage

Methodology and approach

* Environment Competitiveness Matrix (ECM)
  * 1） construct a cost impact matrix to summarize the cost impact
  * principal component analysis

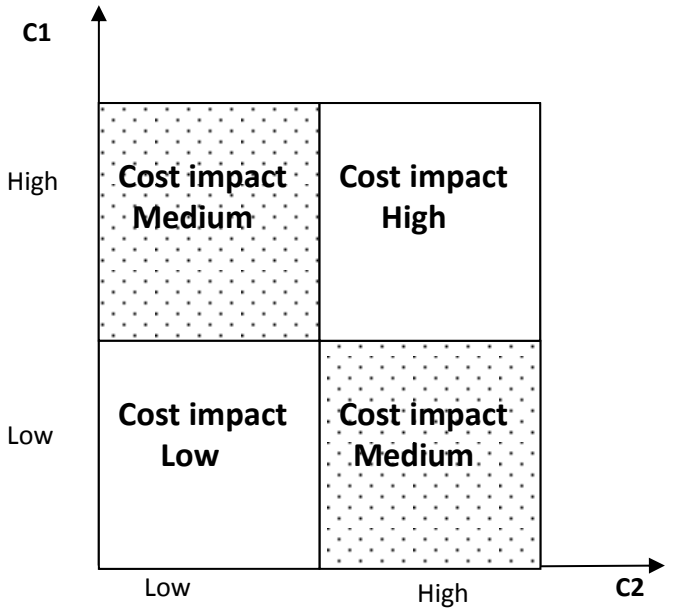


Fig.1 Cost impact matrix

Methodology and approach

* Environment Competitiveness Matrix (ECM)
  * 2） construct a differentiation matrix to summarize the potential differentiation impact

* Subjective assessment by interviewing industrial experts

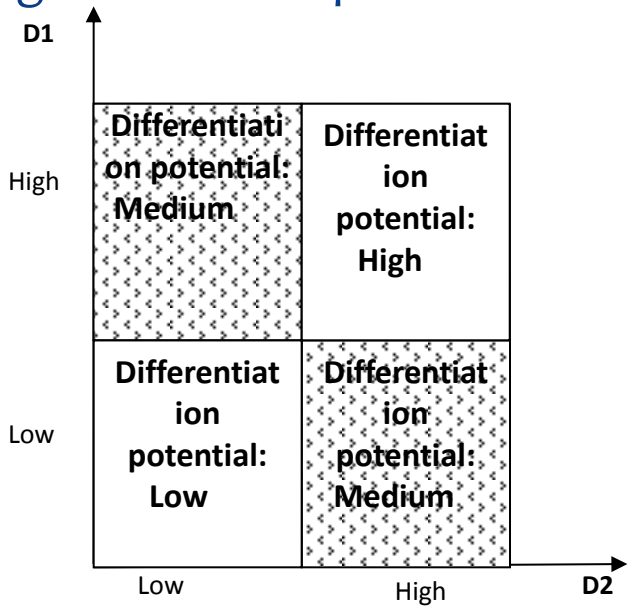


Fig. 2 Differentiation Potential matrix

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Methodology and approach

* Environment Competitiveness Matrix (ECM)
  * 3） all of the result about cost impact and potential differentiation impact will be plug into an ECM

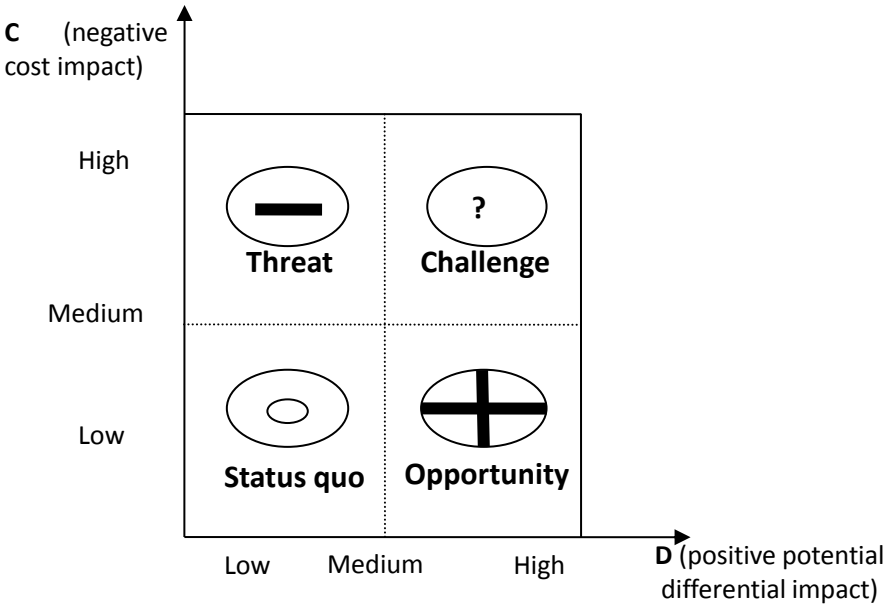


Fig. 3 Environment Competitiveness Matrix

Case Study (S city in China)

* **Data Collecting and Processing**
  * 4 Heavy Pollution Industries
    * Power, the Iron and Steel, Cement and Pharmaceutical industry
  * 38 Enterprises among these 4 Industries
    * 7 from power industry, 5 from iron and steel industry, 17 from cement industry, 9 from pharmaceutical industry

* Policy Scenarios

Scenario	Air Emission （RMB/PE）			Water Discharge （RMB/PE）	
	SO_2	NO_X	Industrial Dust/soot	COD	NH4-N
Low Rate	1.2			1.4	
Medium Rate	2.9			3.0	
High Rate	4.6			4.7	

Empirical Results : Cost Impact （C1）

Index	Tax rate	Power industry		Iron and steel industry		Cement industry		Pharmaceutical industry	
		Principal component 1	Principal component 2	Principal component 1	Principal component 2	Principal component 1	Principal component 2	Principal component 1	Principal component 2
Pollution emission intensity X1	Low	0.059	0.8	-0.352	0.224	0.116	0.824	-0.281	0.304
	Medium	0.058	0.797	-0.352	0.238	0.114	0.833	-0.265	0.449
	High	0.057	0.791	-0.352	0.255	0.112	0.848	-0.256	0.604
Pollution control investment X2	Low	0.498	-0.115	0.463	0.005	0.382	0.407	0.49	0.423
	Medium	0.497	-0.122	0.463	0.031	0.389	0.388	0.517	0.349
	High	0.496	-0.131	0.464	0.066	0.398	0.36	0.528	0.295
Fixed assets X3	Low	0.448	-0.027	0.295	-0.73	0.458	-0.206	0.437	-0.28
	Medium	0.449	-0.023	0.291	-0.732	0.456	-0.2	0.426	-0.201
	High	0.45	-0.017	0.286	-0.736	0.455	-0.19	0.421	-0.06
The number of employee X4	Low	0.317	0.501	0.467	-0.158	0.419	-0.224	0.379	-0.263
	Medium	0.317	0.505	0.466	-0.167	0.418	-0.229	0.37	-0.325
	High	0.315	0.512	0.464	-0.18	0.416	-0.235	0.366	-0.4
Enterprise revenue X5	Low	0.445	-0.308	0.437	0.369	0.47	-0.232	0.46	-0.331
	Medium	0.446	-0.307	0.439	0.36	0.469	-0.228	0.465	-0.222
	High	0.448	-0.305	0.441	0.349	0.467	-0.222	0.474	-0.089
Pollution control ability X6	Low	0.489	0	0.405	0.505	0.484	0.095	0.367	0.688
	Medium	0.499	-0.003	0.407	0.497	0.483	0.098	0.357	0.694
	High	0.5	0.005	0.41	0.484	0.481	0.102	0.347	0.614

Empirical Results：Cost Impact（C1）

- **Power Enterprises**
  - pollution control ability and pollution control investment contribute the most to cost increase caused by environmental tax
- **Iron and Steel Enterprises**
  - the number of employment contributes the most to cost increase caused by environmental tax
- **Cement Industry**
  - pollution control ability contributes the most to cost increase caused by environmental tax
- **Pharmaceutical Industry**
  - pollution control investment contributes the most to cost increase caused by environmental tax

Empirical Results：Cost Impact（C1）

Enterprises' ranking order of cost increase impacts caused by environmental tax under low tax rate scenario

Industry	Enterprises' ranking order（from high to low）
Power	HD5、HD1、HD8、HD3、HD4、HD7、HD9
Iron and steel	GT1、GT9、GT2、GT4、GT3
Cement	SN22、SN1、SN4、SN9、SN20、SN2、SN3、SN25、SN17、SN18、SN19、SN10、SN14、SN11、SN16、SN13、SN12
Pharmaceutical	YY10、YY11、YY13、YY15、YY4、YY16、YY32、YY29、YY30

Empirical Results : Cost Impact（C2）

Index	Tax rate	Power		Iron and steel	Cement		Pharmaceutical
		Principal component 1	Principal component 2	Principal component 1	Principal component 1	Principal component 2	Principal component 1
Environmental cost structure X7	Low	-0.36	0.775	-0.376	-0.398	0.649	-0.328
	Medium	-0.415		-0.393	-0.402	0.645	-0.324
	High	-0.454		-0.417	-0.405	0.638	-0.314
Profitability X8	Low	0.531	-0.27	0.496	0.481	-0.449	0.484
	Medium	0.536		0.492	0.479	-0.452	0.489
	High	0.54		0.486	0.478	-0.452	0.492
value added of product X9	Low	0.533	0.488	0.536	0.536	0.48	0.567
	Medium	0.508		0.531	0.536	0.481	0.572
	High	0.488		0.524	0.537	0.477	0.574
Market share X10	Low	0.552	0.294	0.571	0.567	0.383	0.568
	Medium	0.531		0.567	0.566	0.385	0.573
	High	0.512		0.562	0.568	0.383	0.574

Empirical Results：Cost Impact（C2）

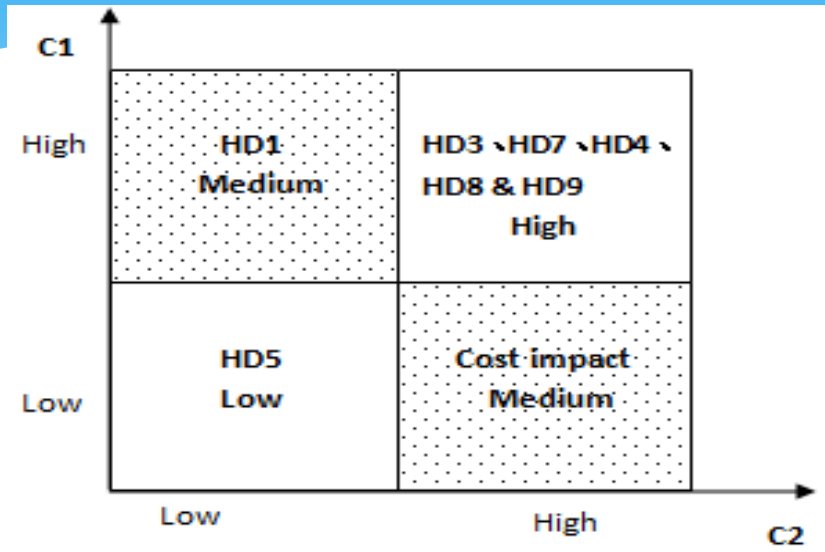
Tax rate	Power	Iron and steel	Cement	Pharmaceutical
Low	market share	market share	market share	market share
Medium	profitability	market share	market share	market share
High	profitability	market share	market share	market share value added of product

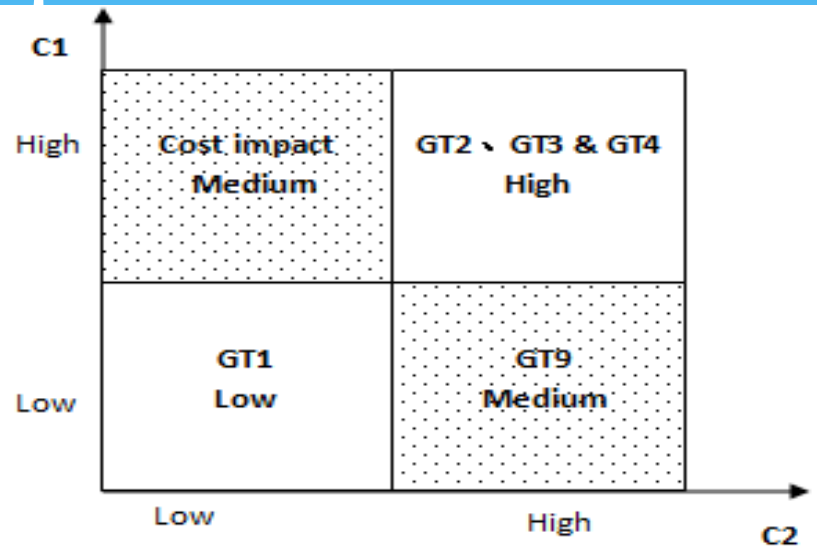
Empirical Results：Cost Impact（C2）

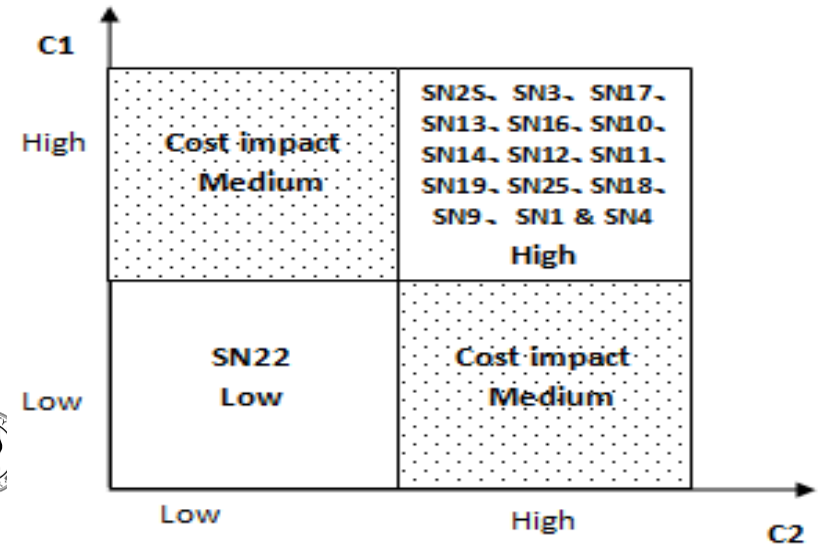
Enterprise ranking order in the dimension of the importance of cost in the competitiveness of enterprises (C2) under low tax rate scenario

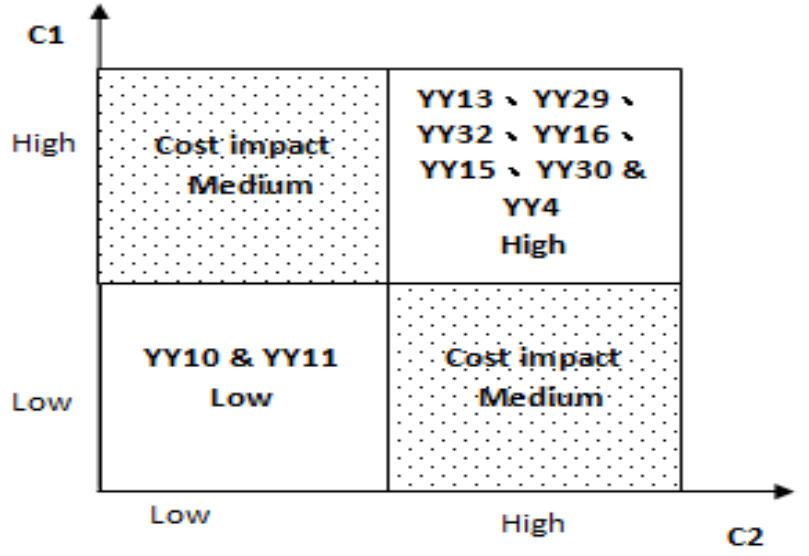
Industry	Enterprises' ranking order（from high to low）
Power	HD5、HD1、HD3、HD9、HD4、HD8、HD7
Iron and steel	GT1、GT9、GT4、GT2、GT3
Cement	SN22、SN1、SN9、SN25、SN17、SN10、SN13、SN18、SN12、SN11、SN20、SN16、SN19、SN2、SN14、SN4、SN3
Medicine	YY11、YY10、YY15、YY30、YY29、YY16、YY13、YY4、YY32

Empirical Results : Cost Impact

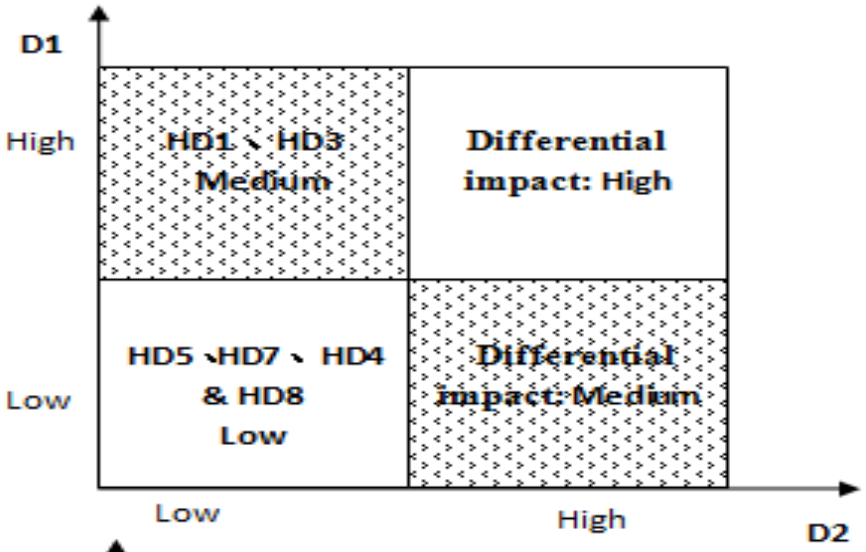


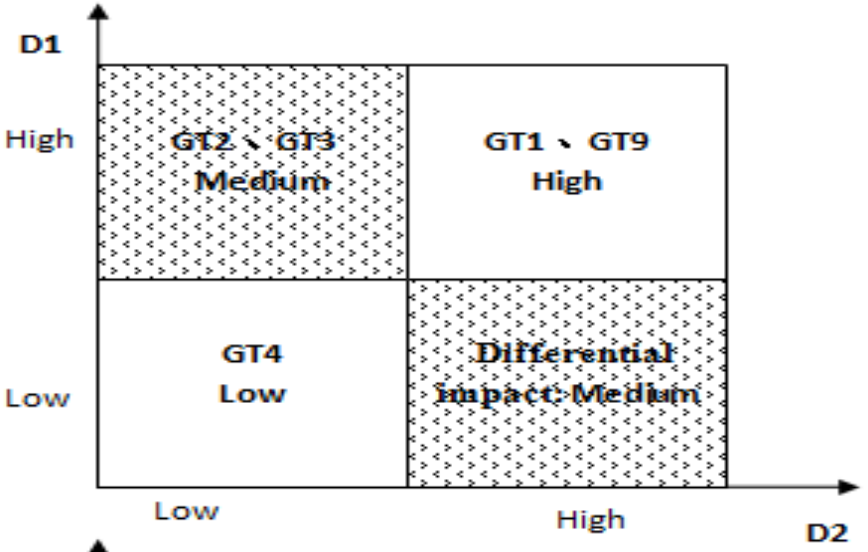


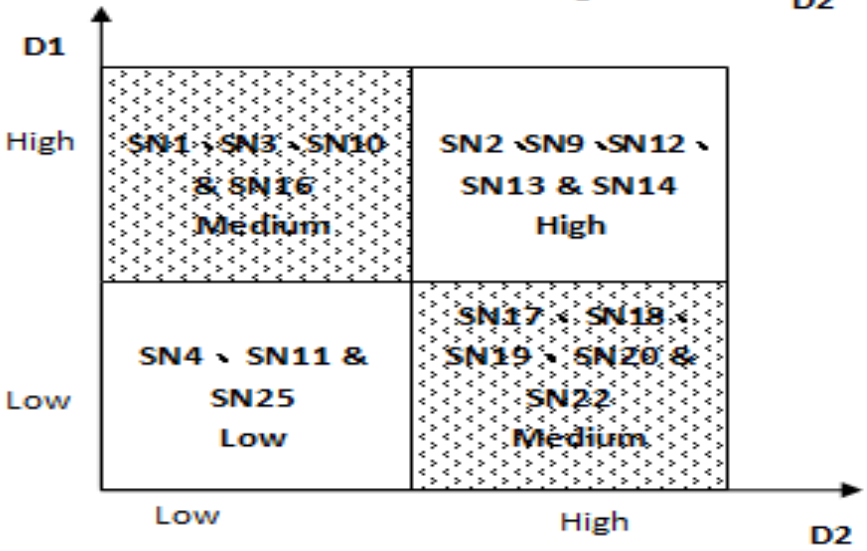


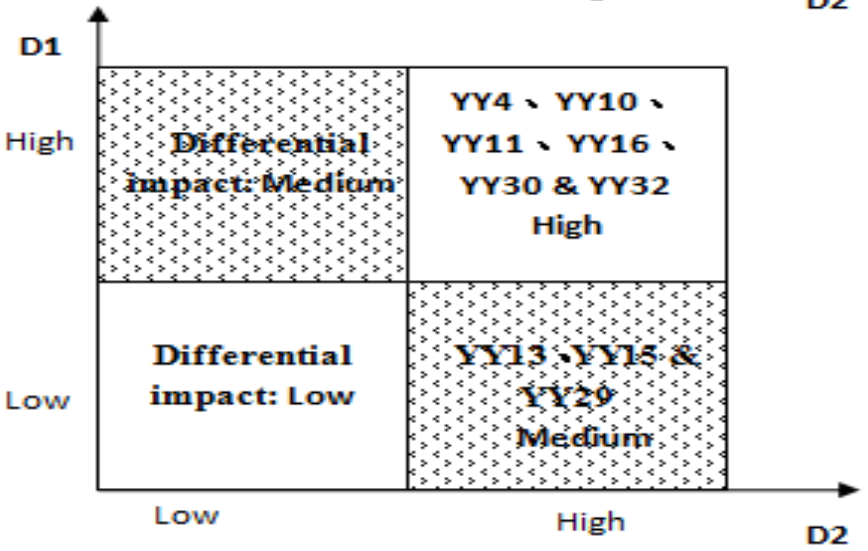


Empirical Results : Differentiation Potential

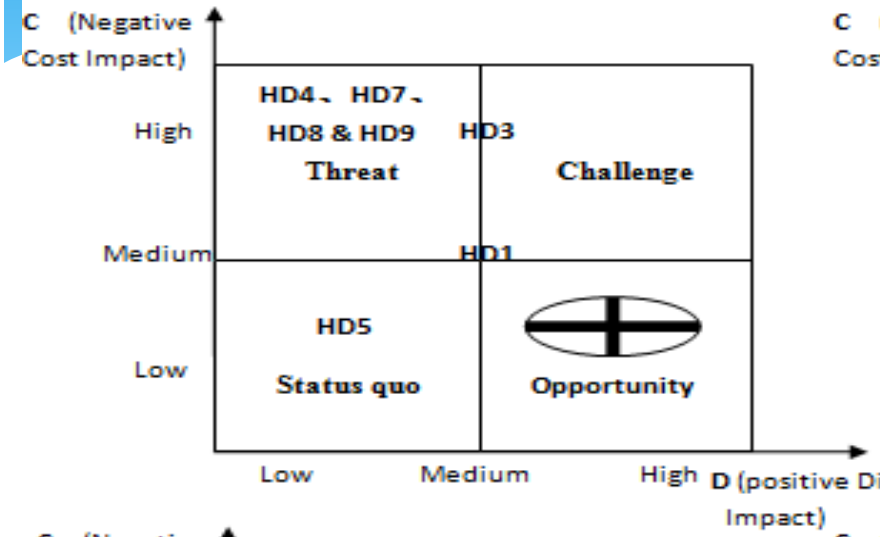


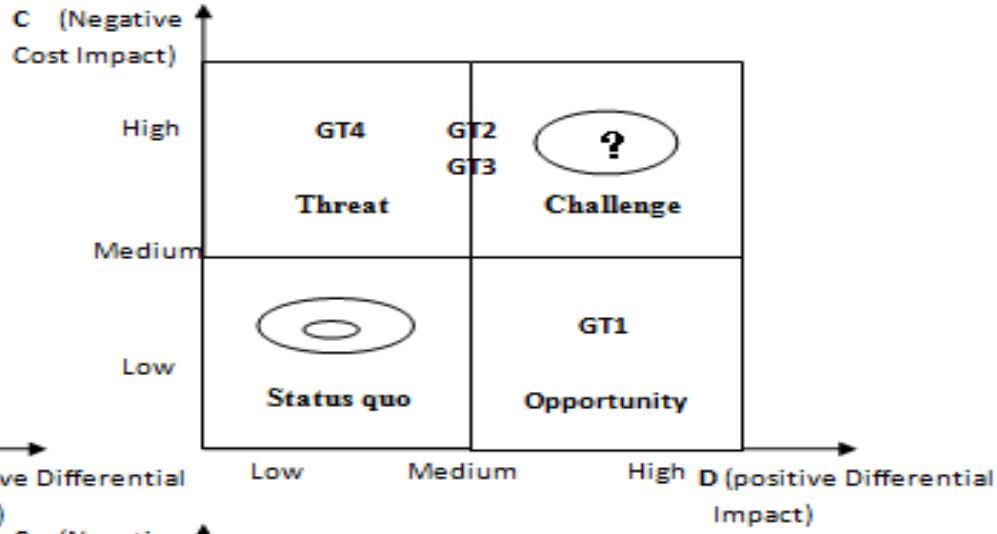


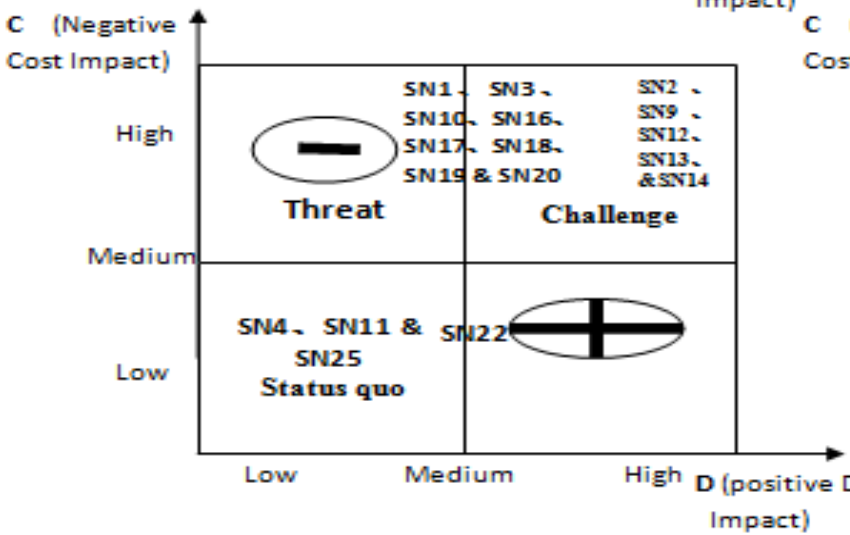


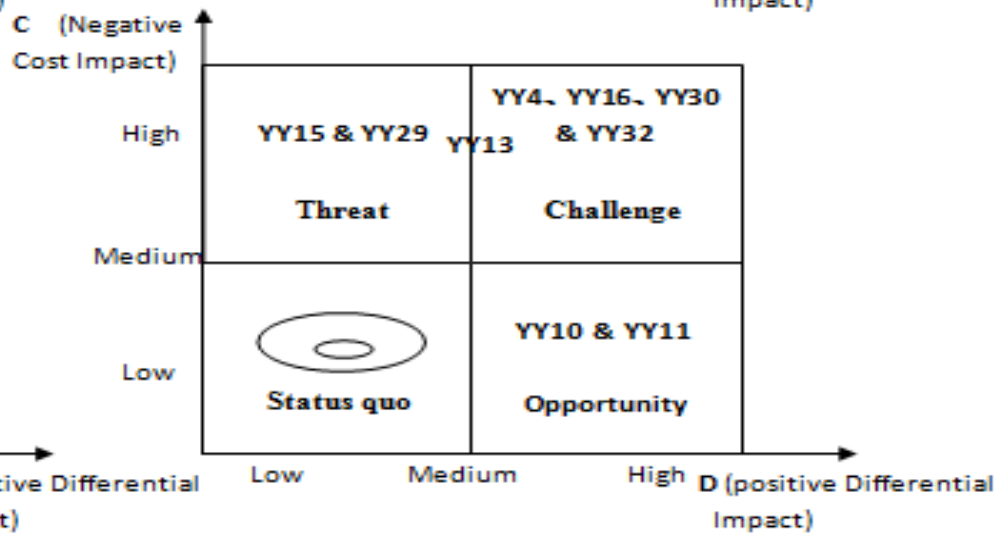


Empirical Results : Overall Impact









Empirical Results : Overall Impact

* **power industry and cement industry are more vulnerable to the threat of environmental tax, and Iron & steel industry and pharmaceutical industry are less threatened by environmental taxes.**
* **Enterprises who are more vulnerable to the threat generally have two characteristics.**
  * Small Scale
  * Very Low Pollution Control Investments

Insights

* 1） Small-scale enterprises are most vulnerable to the threat of environmental tax, which should be paid specific attention to when the levy of environmental tax begins, especially for cement industry.
* 2） The enterprises with inadequate pollution control input are also more vulnerable to the threat of environmental tax.
* 3） For power industries, their products are of high homogeneity, positive differentiation effects are seldom occur in clean corporations, thus undermine the persistence of corporations' emission reduction behaviors.

Thank you!

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