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Corporate Preferences for Domestic Policy Instruments under a Sectoral Market Mechanism: A Case Study of Shanxi Province in China

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to gain companies' support. Under the policy with mandatory installation-level targets, it suggests that policymakers should focus on status of energy use management and internationalization orientation. Policy instruments familiar to companies that are able to relieve corporate financial pressures might be good options to gain higher acceptance. Moreover, our results show that it is very important to choose an issuance frequency of one to three years under sectoral crediting.

Keywords
Sectoral market mechanism; Domestic policy instruments; Policy preference; Company; China

JEL Classification
D22; O13; P28; Q43; Q48; Q53; Q58.

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Corporate Preferences for Domestic Policy Instruments under a Sectoral Market Mechanism: A Case Study of Shanxi Province in China

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Understanding companies' preferences for various domestic policy instruments is crucial to designing and planning Sectoral Market Mechanism (SMM) in China. Based on a detailed overview of domestic policy instruments under SMM, this paper evaluates corporate preferences for diverse domestic policy instruments and identifies potential influencing factors through econometric analysis. The data were collected from 113 respondents in all 11 prefecture-level cities of Shanxi province, China. Regarding policy instruments under the system of government receiving tradable units, corporate energy saving potential, learning capacity and companies' characteristics have shown significant influences on companies' preferences. Dissemination and the popularization of knowledge are also important to help companies learn how to improve energy efficiency. In terms of policy measures with voluntary installation-level targets, corporate competition level, organizational size and ownership are the main factors influencing companies' preferences. Reducing inequality in the distribution of responsibility is especially important to gain companies' support. Under the policy with mandatory installation-level targets, it suggests that policymakers should focus on status of energy use management and internationalization orientation. Policy instruments familiar to companies that are able to relieve corporate financial pressures might be good options to gain higher acceptance. Moreover, our results show that it is very important to choose an issuance frequency of one to three years under sectoral crediting.

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1. Introduction

At the Durban Climate Change Conference in 2011, parties to United Nations Framework Convention on Climate Change (UNFCCC) agreed to define a new market mechanism (NMM) (UNFCCC, 2011). NMM is proposed not only to stimulate mitigation in broad segments of the economy but also to ensure a net decrease of global greenhouse gas (GHG) emissions, which has been proved to be an important and efficient tool in generating emission reductions and leveraging low carbon investments (NEFCO and Kfw, 2013). Given the increasing global calls to fulfill more ambitious mitigation targets before 2020, NMM is expected to play a significant role in the 2015 agreement (Marcu, 2014) and therefore is closely related to both the pre-2020 and post-2020 climate regimes. Amongst different structures of market mechanisms, sectoral market mechanism (SMM) has always been the focal point within a wide range of discussions about NMM and has often been assumed to be the future of NMM (e.g. Öko-Institut, 2012; Ecorys, 2012; Wuppertal-Institute, 2013).

The basis of implementation of an SMM is an approved sectoral emission (reduction) target. To a large extent, achievement of this target depends upon the mitigation actions of firms in the sector. Therefore, motivating firms to reduce emissions effectively is crucial for the successful implementation of SMM. A variety of domestic policy instruments must be applied in order to stimulate emissions reduction activities of the companies under SMM by the host-country. Learning and understanding the firms' responses to and their preferences for various domestic policy instruments is thus crucial to designing and planning SMM. Some literature has brought forward and analyzed several domestic policy instruments in response to the SMM, but mostly issues of policy design are discussed theoretically (e.g. IETA, 2010; Dransfeld, 2011; Michaelowa, 2012). However, very little is known in terms of companies' responses and preferences related to different domestic policy instruments.

Some parties regard NMM as a step towards cap-and-trade for developing countries (Hession, 2013). As the largest GHG emitter in the world, implementing NMM shows its priority in China. However, policy design in China is usually based on a top-down approach rather than relying on bottom-up information collection (NSD, 2014), which has been proven to promote a more effective achievement of policy targets.

Aiming to close the existing research gap on SMM and provide support for top-down policy

design in China, this paper assesses companies' preferences for different domestic policy instruments under SMM and examines the determinants of corporate preferences through both qualitative and quantitative analyses. Shanxi province was targeted due to its position as a heavy-industry region in China.

The paper is organized as follows. Section 2 introduces SMM and different domestic policy instruments in some detail, followed by an analytical framework and elaboration of methodology in Section 3. Section 4 presents the main findings of this research and Section 5 discusses the conclusions and policy implications.

2. Sectoral Market Mechanism and Domestic Policy Instruments

2.1 Sectoral Market Mechanism

The implementation of the SMM should be based on an approved emission target set for a certain sector in the host country. The target can be either an absolute emission cap or intensity-based (e.g. emissions per tonne of steel generated). The government in the host-country should then take action in order to control the emissions in light of the given targets. There are two types of SMM, sectoral crediting and sectoral trading. Under sectoral crediting, if emissions of the entire sector are reduced below the target level, the host-country government receives credits, but if the target is not achieved, there are no penalties. On the contrary, under sectoral trading, the host-country government receives allowances ex-ante. If the target is achieved, there are a surplus of allowances for the host-country government to sell or hold, whereas if the target is not achieved, the government needs to buy tradable units to cover its shortfall.

2.2 Domestic Policy Instruments

Under the SMM, when the sectoral emission target is achieved, the host-country government either receives credits under sectoral crediting or gets a surplus of allowances under sectoral trading. Those credits/allowances (collectively known as tradable units) can mainly be used in two ways (Ward et al., 2008). One way is that the government can retain the tradable units and sell them in a carbon market to get revenue which can be used to support the policy and measures (PAMs) in the sector to encourage companies to reduce emissions; alternatively, the government

can directly distribute the tradable units to companies in order to produce direct economic stimulus. In other words, there are basically two options: 1) government receives tradable units; 2) installations receive tradable units.

Table 1 presents a summary of the domestic policy instruments. All of them were used in the questionnaire of our survey for this study. In what follows, we briefly discuss each of these instruments.

2.2.1 Government Receives Tradable Units

Normally the host-country government develops a broad range of PAMs to ensure that the target will be achieved. Generally there are two types of PAMs considered; mandatory or voluntary policy (Harrison et al., 2011).

A. Mandatory Policy

The government can choose some general economic PAMs and standards. General economic PAMs include the reduction of fossil fuel subsidies and energy/CO_2 tax, among others. Standards include an energy use threshold for energy-intensive equipment and products, a comprehensive energy use threshold by sectors, and energy saving target setting.

B. Voluntary Policy

Voluntary policies include target economic incentives, such as feed-in tariffs for renewable electricity, certification of energy saving products, and subsidies for energy saving investments and new technologies, and information (such as know-how transfer and education).

2.2.2 Installations Receive Tradable Units

This type of policy instrument is based on an assumption that the sectoral target can be broken down to the installation level. When designing this kind of policy instrument, there are two issues to bear in mind; the nature of the targets and the method under which sectoral credits will be issued. In terms of the target nature, each kind of installation is assigned an installation-level target, either a voluntary or mandatory target. As for the way to issue credits, there are three

options from which the government can choose.

2.2.2.1 Nature of the Targets

A. Voluntary target

Voluntary targets assigned to the installations give rise to sectoral underperformance. Some installations may achieve the targets while others won't. The government receives tradable units according to overall sector performance. Therefore, a problem could arise in which the tradable units received by the government cannot cover the installations that beat their targets. There are two options to solve this problem.

a. A low-level tax on emissions for all installations (Michaelowa, 2012)

The tax revenue could be re-invested for the government to purchase shortfall tradable units to cover emissions increases from the installations exceeding their target. If the revenue is not enough, the government would make up the shortfall. This policy seems unfair for the installations that achieve their targets, because those installations would bear part of the costs for the shortfall tradable units.

b. Hold back a share of tradable units to form a reserve (IETA, 2010)

Before allocating the tradable units to installations, the government retains part of them to form a reserve and cover a potential shortfall. Similarly, if it is not enough, the government would complement the shortfall. This is a simple method of implementation, but could also lead to an unfair situation, as only installations that beat the targets pay for the cost of shortfall tradable units.

B. Mandatory target

Introducing a mandatory target with penalties for installations exceeding their target seems to be most straightforward to solve the problem associated with a voluntary target.

a. Levy an emission tax for excess emissions (Butzengeiger et al., 2012)

If an installation beats its target, it can receive tradable units from the government. If not, the government would tax emissions above the target with the tax rate being the average carbon price in recent years.

b. Oblige installations to buy tradable units for excess emissions (Whitesell, 2009)

After installations buy tradable units for excess emissions, those tradable units are turned over to

the government. The carbon price fluctuates compared to the above tax rate, which means that the installation owners can get the tradable units either at a high level or low level.

c. **Deposit-refund system** (Michaelowa, 2012)

Under a deposit refund system, installation owners would be required to pay a deposit for each ton of emissions ex-ante which would be refunded if they achieve the targets, and would not be refunded if they do not. Any unclaimed deposits can be used to cover the shortfall.

d. **Mandatory emission trading system (ETS)** (Bolscher, et al., 2012)

Under an ETS there would be a strong incentive to reduce emissions since installations with deficit tradable units would be required to purchase them to cover their overshooting. If sectoral crediting is used, the government would need to establish a separate national emission allowance in order to allocate the tradable units to installations ex-ante. If sectoral trading is chosen, there is no need for the domestic carbon currency since the tradable units received by the government ex-ante can be allocated to the installations directly.

e. **Mandatory emission trading System (ETS) with internationally fungible tradable units** (Schneider et al., 2009)

As mentioned above, the government needs to establish a separate national emission allowances under sectoral crediting. Under this option, the government would allow the installation owners to exchange national emissions allowances against future sectoral credits. Thus, this option gives the installation owners the opportunity to make the investment strategy both in the national and international carbon market.

2.2.2.2 Method of Issuing Credits

It bears noting that the method of issuing credits only relates to sectoral crediting since sectoral trading is always along with the ex-ante allocation. There are three options for how and when the government receives the credits from the international regulatory body (Aasrud et al., 2009).

A. Aggregate-no-lose. The net issuance of credits that governments receive depends on overall performance during the whole crediting period, i.e. annual emissions below target in some years against annual emissions above target in other years. The issuance only happens at the end of the crediting period.

B. Year-by-year no-lose. Annual emissions below the sectoral target lead to the issuance of credits, but annual emissions above target are neglected, meaning that the credits are issued once a year.

C. No-lose until crediting starts. This is an intermediate method between the above two options. Under this situation, issuing credit will only start from the year in which annual emissions beat the target, but will be aggregated together with the performance over the following years of the crediting period. It implies that the government can be issued credits once it beats the target, but after that it can only receive the credits at the end of the crediting period.

The aforementioned three methods are the ways that a host-country government gets credits from an international regulatory body. But it is worth noting that the way of installation owners issued in the host country is exactly the same as the way of government issued. Whether the net issuance amount is based on annual performance or overall performance depends on the outcome of the political negotiation, which is beyond the scope of this paper. Instead, the paper analyzes the companies' acceptable frequency of issuance which gives some insights for policymakers.

Table 1

Summary and abbreviations of policy instruments targeted by this study

Category	Policy instruments		Description	Abbreviations
Government receives tradable units		Mandatory policy	Include general economic PAMs and standards	GovMan1
		Voluntary policy	Include target economic incentives and information	GovVol2
Installations receive tradable units	Voluntary target	A low-level tax on emissions for all installations	Not fair for the installations which beat their targets	InsVol3
		Hold back a share of tradable units to form a reserve	Simple for implementation but further lead to unfairness	InsVol4
	Mandatory target	Levy an emission tax for excess emissions	Tax rate is fixed and equals the average carbon price in recent years	InsMan5
		Oblige installations to buy tradable units for excess emissions	Carbon price fluctuates and the installation owners can buy the tradable units either at high level or low level	InsMan6
		Deposit-refund system	Affect cash flows of companies	InsMan7
		Mandatory emission trading	Companies can get the	InsMan8

	system	tradable units ex-ante and make the investment strategy in national carbon market	
	Mandatory emission trading system with internationally fungible tradable units	Companies can get the tradable units ex-ante and make the investment strategy both in the national and international carbon market	InsMan9

3. Methodology

3.1 Analytical Framework

This study aims to understand company's preferences for diverse policy measures. We develop a two-step analytical framework. First, an econometric analysis is carried out to identify the relationship between corporate preferences and their determining factors. Second, we examine the barriers to energy saving investments of companies which help to understand corporate preferences. The analytical framework is presented in Fig.1.

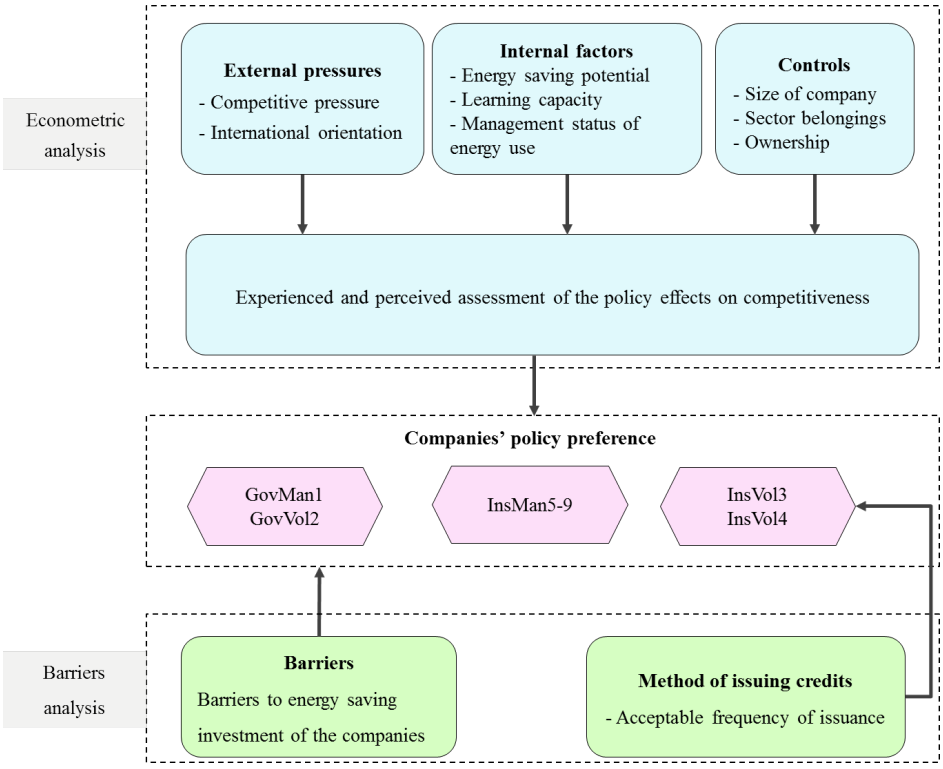

Fig.1. Analytical framework of this study

It is posited by the theory of reasoned action that behavior is determined by behavioral intention, which suggests that people consider the outcomes of their behavior before acting and choose to conduct behaviors with desirable outcomes (Fishbein and Ajezen, 1975). Therefore, it is reasonable to infer that the experienced and perceived assessment of a policy's effect on a company's competitiveness plays a significant role in determining a company's support of a specific policy. Then, there is a need to identify which factors affect the company's evaluation of the policy impacts. The potential influencing factors are examined as follows:

External Pressures: Research has attempted to explain a company's environmental behaviors through institutional theory (e.g. Jennings, et al., 1995; Delmas, et al., 2004). This framework follows the institutional perspective and admits that external pressures play an important role in influencing companies' forecast of policy effects. Institutional theory emphasizes the role of social and cultural pressures imposed on organizations that influence organizational practices and structures (Scott, 1992). Therefore, external pressures, including governmental pressure and expectations from relevant groups such as industrial associations, have an important impact on companies' environmental behaviors. However, small and medium-sized enterprises (SMEs), which make up a large proportion of the samples in the survey, are still not in the sphere of governmental regulations on energy efficiency in China. Moreover, the role of industrial associations at present is still weak in enhancing companies' energy saving activities in China (Liu et al., 2012). Therefore, coercive and normative dimensions have not been incorporated into this analytical framework. It is worth analyzing companies' reaction to the energy management performances of their competitors. There is already some evidence showing that the adoption of environmental strategies is related to market competition (De Groot et al., 2001). Meanwhile, given the higher degree of internationalization that a company faces, the more likely that the company is to implement a proactive environmental strategy (Aguilera-Caracuel et al., 2012). Two external pressures including corporate competitive pressures and internationalization orientation are thus defined in this research.

Internal Factors: It has been noted that institutional perspectives are not always effective, as organizations may pursue different strategic targets even if they are subject to the same level of institutional pressures (Gunningham et al., 2003). Delmas and Michael (2004) argued that companies adopt heterogeneous environmental practices because they interpret objective pressures

differently due to companies' characteristics. Therefore, three internal factors are added to moderate the influence of external pressures. Improving environmental performance is a dynamic process which has a high correlation with the company employee's ability (Hart, 1995). We use the learning capacity of a company as a proxy for its ability to collect information on domestic policies. Energy saving potential is defined as the second internal factor. It is generally recognized that a company with a higher energy saving potential has more flexibility to relieve the climate policy costs (Suk, et al., 2014). The last internal factor is the corporate status of energy use management. Normally if a company knows more about its energy use and emission status, they are more likely to accept the policy instrument that sets an installation based target.

Controls: There are also three control variables introduced into the analytical framework. Previous studies found that large-scale companies are more likely to be supervised by governments (Hettige et al., 1996). In China, large companies from energy-consuming sectors are also the focus of the central government for improving energy efficiency (Price et al., 2008; Zhang, 2010 and 2014b). On the contrary, it has been proven that small companies are often at a disadvantage in collecting strategic information (Gruber et al., 1991). Sectoral attributes are also important. For example, companies from energy-intensive industries have more experiences in reducing emissions (Prindle, 2010). Thus, company size, sector belongings and corporate ownership are selected as controls.

Additionally, within the analytical framework we also consider the barriers to energy saving investment as a complement to understanding corporate preferences. Companies may increase investments in energy saving and energy efficient technologies in response to the pressures from various domestic policy instruments. Interpreting the factors that are perceived to prevent companies from investment would help to better understand their policy preferences and provide insights for policymakers in designing domestic policy instruments. As mentioned in Section 2.2.2, the method of issuing credits also has a great impact on companies' preferences through the frequency of issuance. We use the acceptable investment payback time as a proxy in this study. Most companies' acceptable investment payback time of energy savings is short (Thollander et al., 2010), which is usually regarded as one of the barriers to investment in energy saving. Thus, we also include the method of issuing credits into our barriers analysis.

3.2 Case Study Area

The survey was conducted in Shanxi province which is located in the inland area of China as shown in Fig. 2. The province oversees 11 prefecture-level cities with a permanent residential population of 36.1 million (as of 2013). The per capita GDP was CNY 34,813 in 2013, or 16.2% lower than the national average. Shanxi province to a large extent represents the situation of inland regions with economic development at the middle level in China. As a province of rich coal resources, the coal industry is a pillar industry and its economic structure is dominated by heavy industries. Traditional energy intensive industries, such as coal, coke, electricity and coal chemicals, as well as emerging industries, such as equipment manufacturing and food, contribute to its economic development. While companies in those sectors have shown the characteristics of small size and decentralization, with small and medium-sized companies accounting for 69.7% and 22.8% respectively, and large companies sharing only 7.5% (SSB, 2013).

Shanxi has made great effort in energy saving and emissions reduction in recent years. An emission trading system that includes four kinds of pollutants had been established since 2011. Moreover, the development of clean development mechanism (CDM) in Shanxi happened quite early. The total number of CDM projects is above the average of China and 186 CDM projects in this province has been approved by the National Development and Reform Commission (NDRC) by 2014. Meanwhile, a variety of economic incentives have been issued to reward companies with excellent energy saving performance. Since 2007, the total amount of 2.43 billion Yuan government subsidies have been provided for the replacement of outdated energy-intensive equipment. In the area of energy management, Shanxi has also made great progress. The 'Top 1000 Enterprises Energy Conservation Action Program', which aims to establish a comprehensive energy management system, was created in Shanxi in 2012.

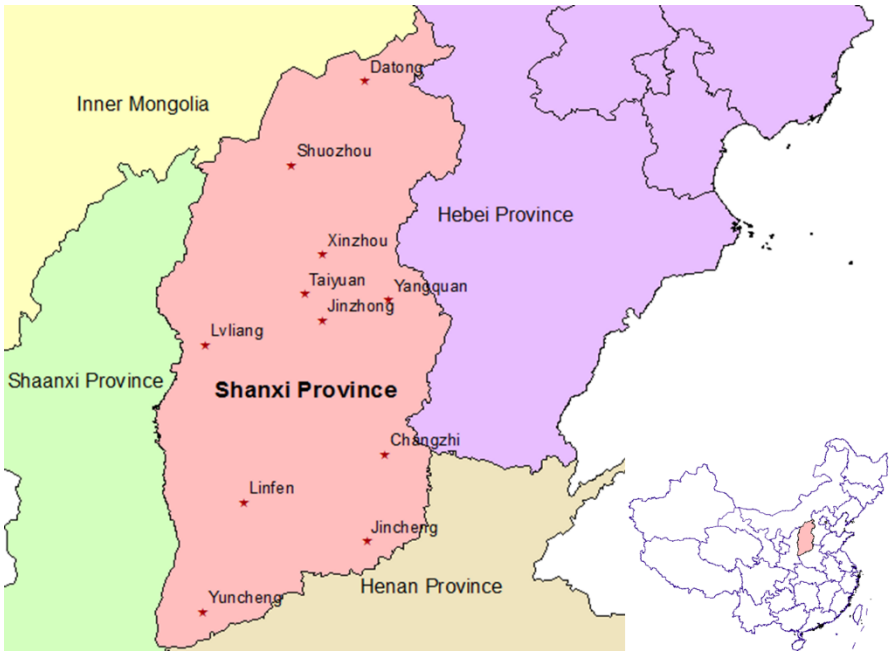

Fig.2. The location of the case study area

3.3 Questionnaire Development and Data Collection

A questionnaire survey aimed at measuring the corporate preferences for various policy instruments was conducted in all eleven prefecture-level cities of Shanxi province from February to March, 2013. The design of the questionnaire was based on the analytical framework shown in Fig. 1. The questionnaire includes four sections: basic information about companies; barriers to energy saving investment; the preference of companies for various policy instruments, and potential determining factors. The study targeted middle or senior level managers who take charge of corporate environmental and energy management. Specifically, data was collected in two phases, a pilot test and a field survey.

Pilot Test: We initially interviewed relevant experts for their opinions and tested whether the items are comprehensible. Then five companies were chosen to conduct a pilot test to examine whether the questionnaire items were appropriate and understandable. Based on the suggestions from experts and companies, we modified the structure and wording of the questionnaire.

Field Survey: A team consisting of five professionals was chosen to conduct this survey. We contacted the local environmental protection agencies (EPA) of 11 cities and each EPA provided a list of companies beforehand. The survey took the form of a forum in each city. Before filling out

the questionnaire the respondents were given an introduction for about 30 minutes, which gave a detailed description of SMM. The related information about the nine policy instruments was summarized in the questionnaire in a simple one-page table that could be easily understood. During the survey our team members spoke the respondents to ensure that they really understood every item in questionnaire. A total of 141 companies participated in the survey and there were 113 valid responses, with an effective rate of 80.1%. The distribution of usable samples by cities is listed in Table 2.

Table 2

Distribution of usable respondents by cities

Cities	Number of samples	Percentage	Number of valid samples	Percentage
Yangquan	9	6.4	8	7.1
Datong	14	9.9	13	11.5
Xinzhou	10	7.1	8	7.1
Taiyuan	15	10.6	11	9.7
Linfen	12	8.6	10	8.8
Changzhi	17	12.1	14	12.4
Jinzhong	9	6.4	8	7.1
Yuncheng	13	9.2	10	8.8
Lvliang	13	9.2	9	8.0
Shuozhou	15	10.6	9	8.0
Jincheng	14	9.9	13	11.5
Total	141	100.0	113	100.0

3.4 Econometric Analysis

3.4.1 Valuation of the Variables

A company's preferences for nine policy instruments are the dependent variables in econometric models. Respondents were asked to rate their policy preferences on a 5-level Likert

scale as follows: '1'= completely nonsupport; '2'= hardly support; '3'= moderate support; '4'= relatively support; '5'= fully support.

The two external pressures and three internal factors jointly constitute independent variables. To evaluate competition pressure we apply a 5-level Likert scale, with higher scores indicating stronger competition. Internationalization orientation is valued using the export ratio of the products as a proxy with '1'= an export ratio of less than 10%; '2' = a 10%-20% ratio; '3' = a 20%-30% ratio; '4'= a 30%-50% ratio; '5' = more than 50%. In terms of the three internal factors, the average education level of employees is used to represent the learning capacity of a company since it is the basis of a company's learning capacity (Yang et al., 2005). A 5-point scale is applied to evaluate the average education level of employees, with '1'meaning less than 10% of employees with educations of college and above; '2' meaning a 10%-20% ratio; '3' meaning a 20%-30% ratio; '4' meaning a 30%-50% ratio; '5' meaning over 50%. Assessing energy saving potential uses a 4-point scale: '1'= hardly for further saving; '2'= limited potential; '3'=relatively large potential; and, '4'=very high potential. A 4-point scale is applied to evaluate the management status of energy use: the higher score means a company knows more about its energy use and emission status.

For the control variables, selected sectors are classified into six categories, namely, coal, equipment manufacturing, coke, electricity, chemical and others. The company's size is divided into three categories: small, medium and large. The ownership of companies covers three different types including stated-owned, domestically private and others. Table 3 presents a detailed description of all the variables.

Table 3

Description of the variables included in the analysis

Category	Abbreviation	Description	Valuation
Dependent	PolicyPre	Company's preference for the 9 policy instruments	A 5-Likert point
External pressures	Compete	Competition level a company faces in the similar products sales market	A 5-point scale
	Export	Export rate of the product	
Internal	Potential	The level of energy saving potential of	A 4-point scale

factors		the company	
	Edu	Average education level of employees	Categorized into 5 levels
	Enman	Management status of energy use	A 4-point scale
Control variables	Size	Size of a company	Categorized into 3 scales
	Sector	Industrial sector to which the company belongs	Categorized into 6 sectors
	Owner	Ownership status	Categorized into 3 types

3.4.2 Econometric Model

An econometric model is constructed to capture the relationship between the company's policy preferences and the pre-identified determinants. The dependent variable in this research is rated on an ordinal five-level Likert scale. Some literature indicates that ordinal data of five or more classes can be treated as continuous (Borgatta et al., 1980). However, some argue that it would lead to the wrong results and it is better to choose the ordinal model (Winship et al, 1984). Because the former method has a strong assumption that the rating scale intervals are equal, this paper chooses the ordinal model with no such strong assumption. As suggested it is better to choose the logistics model if the response decision is made based on the maximization of utility (Supan, 1990). Considering that the preference depends mainly on the expected utility, the ordinal logistics model was selected, as shown in the following:

$$y_i^* = \beta x_i + \varepsilon_i$$

Where y_i^* is the latent and continuous measure of preferences for the domestic policy instruments; x_i is the vector of observations for the two external pressures, three internal factors and controls; β is the vector of parameters to be estimated; ε_i is the random error term. The observed preference rating y_i is determined from the model as follows:

$$y_i = 1 \quad \text{if } -\infty < y_i^* \leq \mu_1$$

$$y_i = 2 \quad \text{if } \mu_1 < y_i^* \leq \mu_2$$

$$y_i = 3 \quad \text{if } \mu_2 < y_i^* \leq \mu_3$$

$$y_i = 4 \quad \text{if } \mu_3 < y_i^* \leq \mu_4$$

$$y_i = 5 \quad \text{if } \mu_4 < y_i^* \leq +\infty$$

Where μ_i is the thresholds to be estimated along with the parameter vector β.

The probabilities of y_i in different coded value are defined as follows:

$$\Pr(y_i = 1) = \mathrm{F}(\mu_1 - \beta x_i)$$

$$\Pr(y_i = 2) = \mathrm{F}(\mu_2 - \beta x_i) - \mathrm{F}(\mu_1 - \beta x_i)$$

$$\Pr(y_i = 3) = \mathrm{F}(\mu_3 - \beta x_i) - \mathrm{F}(\mu_2 - \beta x_i)$$

$$\Pr(y_i = 4) = \mathrm{F}(\mu_4 - \beta x_i) - \mathrm{F}(\mu_3 - \beta x_i)$$

$$\Pr(y_i = 3) = 1 - \mathrm{F}(\mu_4 - \beta x_i)$$

Where $\Pr(y_i = k)$ represents the probability that a respondent i responds the preference at the level of k; $\mathrm{F}(\cdot)$ is the probability-distribution function of ε_i.

4. Results

4.1 External and Internal Factors

Both external pressures and internal characteristics of companies are examined for their potential influences on corporate preferences. Table 4 presents the descriptive statistics of these independent variables. The degree of competition of the companies shows a high score (average at 4.02), which means that the surveyed companies face strong pressure from competition between other companies in a similar sales market. In terms of exports, the samples are generally characterized by a lower degree of internationalization, with an average export rate of 1.38. Nearly 80% of the samples have an export rate of less than 10%. The variable *Potential* has a mean of 2.61 indicating that the production technology of the samples is at the domestic average level and has relatively high potential for further improvement. The variable *Edu* has a mean of 2.71 revealing a medium educational level; the share of employees with educations of college and above is, on average, 20-30%.

Table 4

Descriptive statistics of determinant factors in the ordinal model

Variable		Mean	Std. dev.	Min	Max
External pressures	Compete	4.02	0.91	1	5
	Export	1.38	0.99	1	5
Internal factors	Potential	2.61	0.57	1	4
	Edu	2.72	1.22	1	5
	En-man	2.94	1.16	1	4

The control variables represent the company's characteristics. SMEs make up a large portion of the samples. Small-sized companies account for 49.6% and medium-sized companies account for 37.1%, with the remaining 13.3% being large-sized companies. State-owned companies account for half of the samples (50.9%). Private, domestic companies account for 42.6% and the remaining 6.5% consists of collectively-owned and joint venture companies. By sector, coal, equipment manufacturing, coke, electricity and chemical companies account for 16.8%, 9.5%, 11.6%, 16.8% and 20% respectively. The distribution of the surveyed companies is a good representative of the study area.

4.2 Companies' Energy Dependences

Different sectors often show different preferences for a specific policy instrument because their various energy uses are related to the heavy industries. Therefore, the study surveyed the energy use status of different sectors in order to understand their preferences. Fig.3 shows the structure of energy use by sector. The results show that coal is the most important energy in Shanxi province with a mean of 51% in total energy use, which is consistent with the characteristics of Shanxi as the national coal base. The second important energy is electricity which shares an average of 34%. Different sectors have different energy structures. Coal accounts for around 87% in electricity and coke companies. The companies from the equipment manufacturing and coal industries use electricity as their major energy, with an average of 50%. In the chemical industry, electricity and coal are the two main energy sources and have approximately the same share, 40% and 45%.

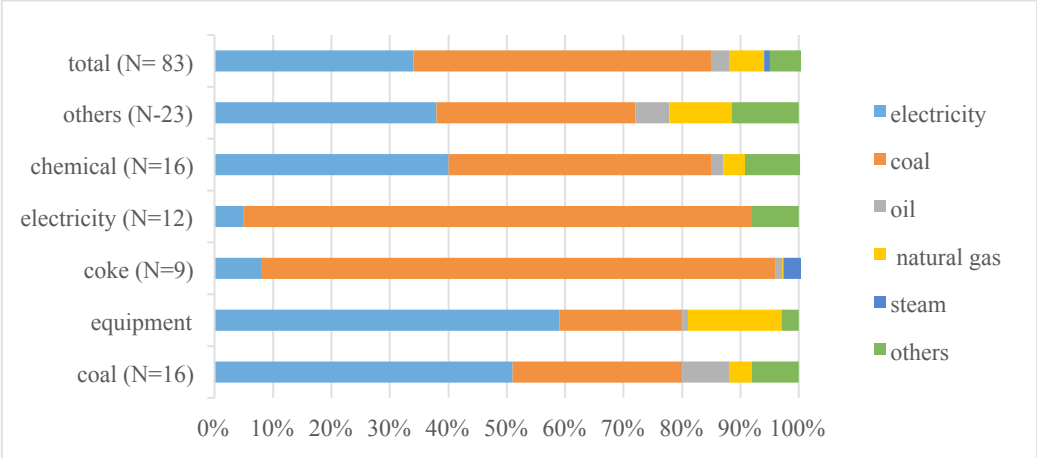

Fig. 3. The structure of energy use by sector

Fig.4 shows the distribution of each sector's energy cost share in total sales. The electricity industry shows the highest energy intensity. The number of companies with an energy cost ratio above 50% accounts for 86%. The second sector with high-energy intensity is coke; 64% of coke companies have an energy cost ratio above 50%. The coal industry shows the least energy intensity. Around 45% of coal companies have an energy cost ratio below 5%, and about 70% of the companies have an energy cost ratio below 10%. The equipment manufacturing industry also has a low energy intensity with 56% of companies having a ratio below 10%. The chemical industry shows a phenomenon of polarization. About 30% of the companies have a low ratio of 10%-20%, while 27% have a ratio above 50%.

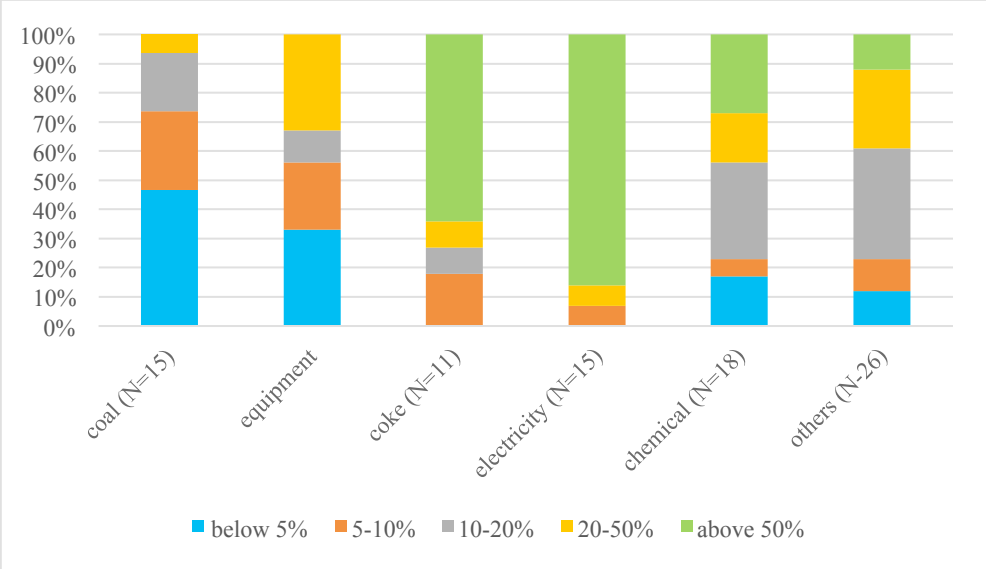

Fig. 4. Distribution of energy cost shares in total sales by sector

4.3 Corporate Preferences for Domestic Policy Instruments and their Determinants

4.3.1 Corporate Preferences for Domestic Policy Instruments

The survey requested companies to rate their preference for all nine policy instruments. Fig.5 shows the average scores. There are some great differences among policy tools, which can be categorized into three areas.

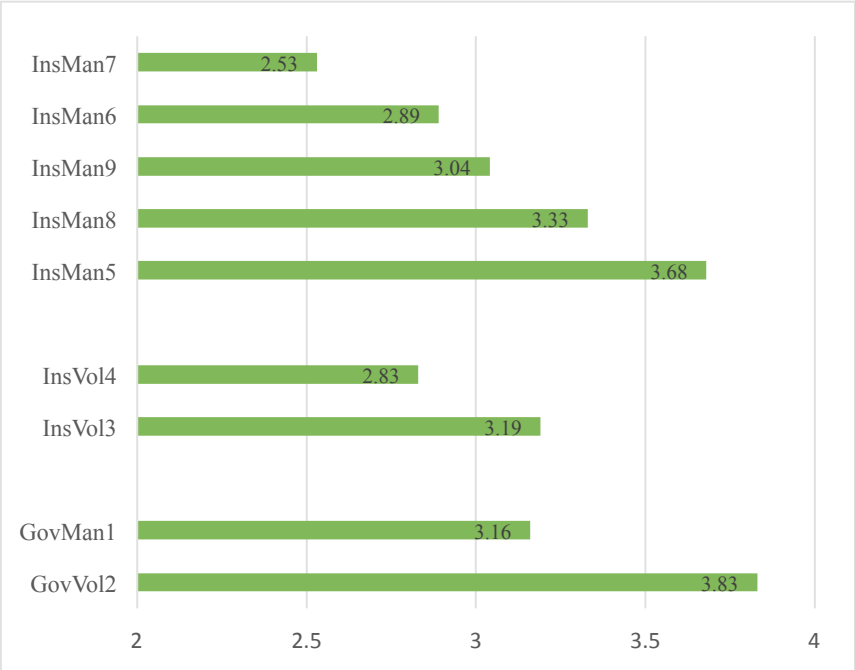

Fig. 5. Company's preference degree of domestic policy instruments

First, under a policy in which the government receives tradable units, the voluntary approach is preferred to the mandatory regulations which is consistent with the previous study of Dutch companies (De Groot et al., 2001). In fact, voluntary policies (GovVol2) get the highest average score of 3.83 in all nine policy tools. The samples support the mandatory policies moderately with a mean of 3.16. According to the discussion during the survey, many thought that if the government implements a mandatory policy, it would be better to distribute the tradable units to companies and allow the companies to make the investment decision themselves.

Second, even though a voluntary installation-level target gives a lot of freedom to companies, this policy was not very attractive in our sample. The reason is that an unfair situation emerges due to the fact that companies that achieve their target are required to take the risk of other companies that do not achieve their targets. The samples show moderate acceptance of the InsVol3 (a low-level tax on emissions for all installations) with a mean of 3.19, and a low acceptance for the InsVol4 (which holds back a share of tradable units to form a reserve) with a mean of 2.83. This implies that the unfair situation can be more or less ignored since all the companies pay the cost of the shortfall of tradable units, and the tax is low compared with the tradable units from beating the targets under InsVol3. However, the sample did not accept the fact

that only the companies that achieve targets carry the burden of the cost, even though the share is small under InsVol4. Although the InsVol4 is very simple for governments to implement, the low acceptance may prevent actual progress. In summary, inequity in responsibility distribution is an important factor that should be taken into account by policymakers when applying this type of policy instrument.

Third, the preference for the mandatory installation-level target depends upon the policy tools, which implies that a mandatory installation-level target may be accepted if the appropriate instruments are used. InsMan5 (levy an emission tax for emissions above the target) gets the second highest average score of 3.68 in all nine policy tools. According to the discussion during the survey, the reason for this is that the emission tax under InsMan5 is similar to the pollutant charge implemented in Shanxi, so companies have relevant experience and are confident in dealing with it well. InsMan8 (mandatory emission trading system) and InsMan9 (mandatory emission trading system with internationally fungible tradable units) achieve a mean of 3.33 and 3.04, indicating good acceptability of the samples toward ETS. This kind of policy tool gives companies more freedom to make their own investment decisions and allows companies to obtain an upfront fund, which greatly relieves their financial burden. InsMan9 gets a slightly lower score than InsMan8 because the samples have little experience in making investment decisions in the international carbon market. This also explains why InsMan6 (Oblige installations themselves to buy tradable units for excess emissions) gets an average score of 2.89. It is worth noting that InsMan7 (deposit-refund system) receives the lowest mean of 2.53. This indicates that the companies object to policy instruments that collect money ex-ante which would greatly affect their capital flow.

4.3.2 Factors Influencing Corporate Preferences

An ordinal logistics regression is used in order to identify potential determinants of corporate preferences. The regression results are presented in Table 5.

Table 5

Ordinal logistics regression results

Independent variables	Dependent variables: PolicyPre

		GovMan1	GovVol2	InsVol3	InsVol4	InsMan5	InsMan6	InsMan7	InsMan8	InsMan9
External pressures	Compete	-0.029	0.358	0.142	**-0.468***	-0.330	-0.107	-0.096	-0.238	0.045
	Export	-0.015	-1.193	0.082	0.131	-0.179	-0.155	0.294	**0.631*****	**0.721*****
Internal factors	Potential	**0.759***	-0.214	0.195	-0.202	-0.829^{b}	-0.930^{b}	-0.169	-0.316	-0.601
	Edu	**-0.372***	**0.359***	-0.171	-0.291	-0.029	-0.137	**-0.520****	0.015	-0.319
	Enman	0.190	1.113	-0.064	0.079	0.038	-0.120	**0.704*****	**0.368***	**0.452****
Control variables	Small	0.679	**1.457****	0.343		0.662	1.287^{c}		0.097	-0.069
	Medium	0.145	**1.795*****	-0.021	**-1.320*****	0.636	0.650	-0.337	0.100	-0.896
	Large				0.098			0.951		
	State							-1.159	-0.433	-0.861
	Domestic	**1.284****	-0.560	-0.334	**1.082****	-0.172	-0.068		0.317	0.028
	Others	-0.111	-1.122	-0.770	-0.840	-1.515^{c}	0.966	0.350		
	Coal		**-2.256****						1.436	0.465
	Equipment	0.196	-0.927	-0.172	-0.840	0.332	1.630	0.211	-0.050	-0.376
	Coke	**-2.108****		-0.523	0.249	0.418	1.020	-1.403		
	Electricity	**-2.131****	-0.238	-1.460	0.536	-0.604	0.759	-0.461	**2.470*****	**2.194****
	Chemical	-1.689	-0.995	-0.339	-0.180	-0.371	-0.420	-1.031	0.064	-0.529
	Others	-1.045	-0.873	-0.249	-0.076	-0.459	0.431	-0.507	0.618	0.158
Obs.		84	84	84	84	84	84	84	84	84
LR chi		**31.68*****	**21.15***	10.06	**23.11***	11.23	15.38	**24.27****	**24.98****	**30.39*****
Pseudo		0.129	0.098	0.042	0.094	0.051	0.063	0.096	0.101	0.127

Notes: *** Significant at the 1% significance level; ** Significant at the 5% significance level; * Significant at the 10% significance level.

The regression models for simulating six domestic policy instruments are statistically significant, (GovMan1, GovVol2, InsVol4, InsMan7, InsMan8 and Ins Man9). The variable *Compete* is found to be significantly but negatively related to the preference of InsVol4. This implies that a company with a higher competition level is less willing to take the risk of paying the cost for other companies. A significant and positive relationship between *Export* and the preference for InsMan8 and InsMan9 is found. One important implication is that a company with a higher level of internationalization will have more experience and information on the current ETS, and thus has a higher level of competence.

The variable *Potential* is significantly and positively associated with the preference of GovMan1. Companies with a higher energy savings potential are more adaptable under mandatory regulation because their marginal cost of mitigation is relatively lower. *Edu*, the educational level of the employees, has a significant and negative effect on the preference for GovMan1 and

InsMan7. It implies that companies with lower educational levels of employees are more likely to accept mandatory regulations passively. By contrast, it is significantly and positively related to the preference for GovVol2. Since GovVol2 often provides economic incentives for energy saving products and technologies, a company with higher educational levels is more capable of looking for appropriate energy saving projects and engaging in environmental innovation, and therefore, is more likely to gain those economic incentives. Significant and positive relationships are found between the *Enman* and the preferences for InsMan7, InsMan8 and InsMan9. The results reveal that a company would prefer to receive an installation-level target if it knows much about its own energy use status and has relevant emission data.

A company's size is significantly associated with its preference for GovVol2 and InsVol4. The results show that the SMEs are more accepting of GovVol2, since voluntary policies do not put pressure on them, and some policies (such as know-how transfer and education policies) are attractive for those companies. However, the larger companies are reluctant to support InsVol4, because they are more likely to beat their targets, and thus do not want voluntary targets with additional costs from other companies. Ownership also has a significant effect. Compared with the state-owned companies, domestically private companies are more likely to support the GovMan1 and InsVol4 compared with state-owned companies. According to the discussion during the survey, when there are voluntary policies in the sector the private companies have little opportunity to get the economic incentives and tradable units revenue because of the lower competence. Therefore, they would rather accept mandatory regulations for all companies in the sector. Some difference are observed between different sectors. Companies in coke and electricity industries are reluctant to support GovMan1. This may be attributed to their energy intensity and energy use structure. According to Fig. 3 and Fig. 4, the energy source of the electricity and coke sectors is dominated by coal, and over half of the companies from the two sectors have the higher energy cost ratio above 50%. Therefore, the mandatory PAMs will place a lot of pressure and costs on those companies. Coal companies are reluctant to support GovVol2 compared with the companies in other sectors. The explanation may be twofold. On the one hand, the coal industry has the lowest energy intensity according to Fig.4, and, due to their lower energy saving potential, it is thus hard for them to increase their energy saving in order to gain economic incentive. On the other hand, there are many small companies in the coal industry which are less capable of looking

for energy saving projects to increase their emission reductions. The companies from the electricity industry show much more interest in the ETS. On the one hand, some companies in this sector have already developed the CDM projects and they thus know how to trade in the carbon market. On the other hand, electricity is the focus sector in the current national ETS pilots in China. Therefore, power companies have more information and expertise about ETS.

4.4 Barriers to Companies' Energy Saving Investments

Based on the analytical framework in Fig.1, barriers analysis to energy saving investments is conducted in order to further understand corporate preferences. Twelve barriers identified are categorized into three types: uncertainties in new technology and policy; financial constraints and general barriers associated with investment decision-making. A 5-level Likert scale was used to assess the barriers: '1'= completely unimportant barrier; '2'= low importance; '3'= moderate importance; '4'= important; '5'= very important. Fig. 6 depicts the average score of the twelve barriers.

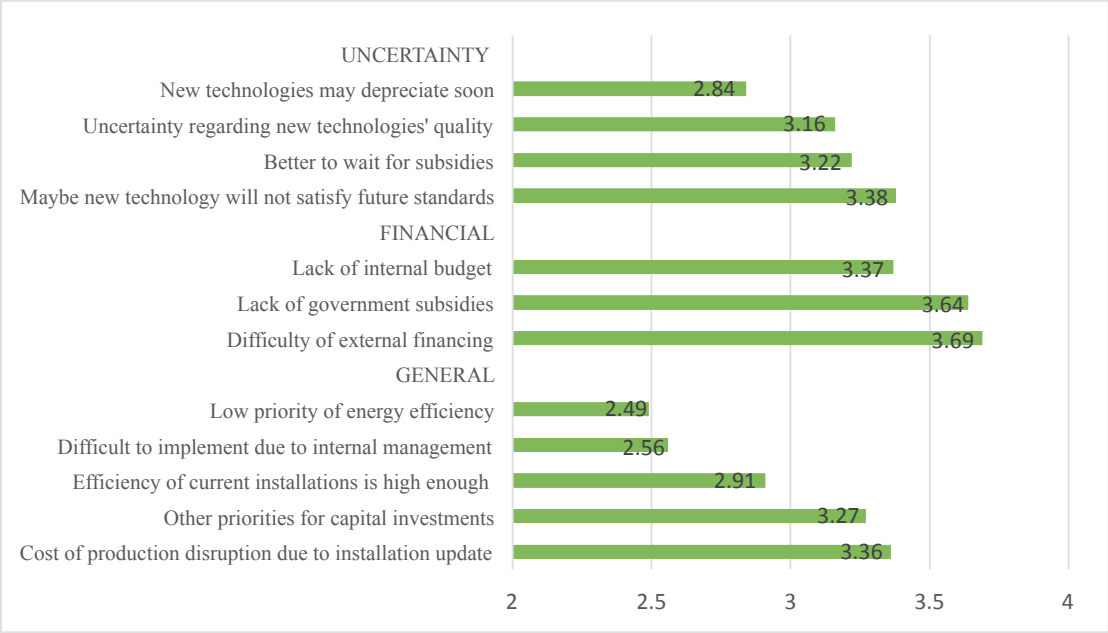

Fig. 6. Barriers to energy saving investment of the companies

The results show that the most important barriers are the difficulty of external financing and a lack of government subsidies, with a score of 3.69 and 3.64 respectively. The lack of an internal

budget is another important obstacle with a score of 3.37, implying that financial constraint is the major barrier for industrial companies. This finding explains why policy instruments with ex-ante issuance (InsMan8 and InsMan9) and voluntary "carrots" with government subsidies (GovVol2) get the higher score. It also reconfirms that the companies greatly object to the policy instrument with collecting money ex-ante (InsMan7). Meanwhile, uncertainty whether or not new technology will satisfy future standards is also a significant barrier (averaged at 3.38), which may be resulted of the unstable industrial energy efficiency policies in China. Since SMM is a brand new policy, it is more important for policymakers to provide stable domestic policy signals for companies to make investment decision. The production disruption due to installation update has a relatively great effect on investment decisions (averaged at 3.36). This kind of obstacle can be dealt with the voluntary policies (GovVol2) providing know-how transfer, education policies, specialized consultancy, demonstration and training etc. To sum up, policy packages consisting of ex-ante issuance (InsMan8 and InsMan9) as well as voluntary policies (GovVol2) with stable policy signals can get more acceptance form the companies.

Additionally, the companies were asked to show their acceptable investment payback time (as shown in Fig. 7) in order to give some insights for policymakers to choose an appropriate method of issuance under sectoral crediting. Nearly 80% of the samples can only accept the energy saving projects with payback time less than three years. About 18% of the companies even expect to get their investment back with one year. Only 10% of the companies can accept a payback time of three to five years. Therefore, it is very important for policymakers to choose an issuance frequency of one to three years in order to establish an effective incentive for companies with voluntary targets to reduce emissions.

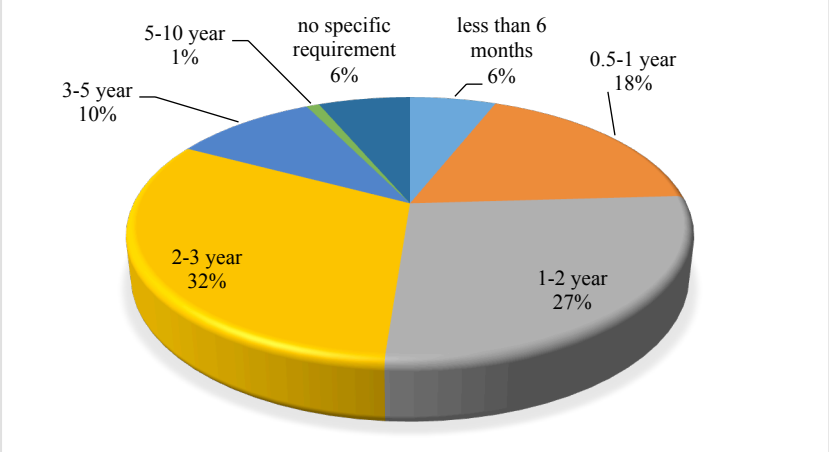

Fig. 7. Acceptable payback time distribution of the samples

5. Conclusions and Policy Implications

Based on a detailed overview of nine types of domestic policy instruments under SMM, this paper evaluates companies' preferences for policy instruments, and examines potential determinants of their preferences through an econometric analysis.

An analysis of company's preferences provides three important policy implications. First, voluntary approaches are more accepted in contrast to mandatory regulations under that a system where the government receives tradable units. When applying a mandatory policy instrument, it is better to distribute the tradable units to companies directly and leave companies to make investment decisions by themselves. Second, even though voluntary installation-level targets impose less pressure on companies, this policy is not as attractive as expected since it brings along the issues of unfairness. When adopting policies with voluntary installation-level targets, reducing inequity in the distribution of responsibility would be conducive to win companies' support. Third, a mandatory installation-level target would be well accepted if the appropriate instruments are applied. Policy instruments that are familiar to companies and is able to relieve financial pressures would a good choice to get companies involved.

Results from ordered logistics model simulation are partially in line with the expectations on the influences of those pre-classified determinants. First, when considering design of policy instruments, especially government receiving tradable units, policymakers should pay attention to the energy saving potential, learning capacity and companies' characteristics. Companies with a higher energy saving potential are more adaptable to mandatory regulation due to their lower marginal cost of mitigation. SMEs are more accepting of voluntary policies, since those policies give them less pressure and provide some educational policies (such as know-how transfer). Domestic private companies and companies with a lower learning capacity are more likely to accept the mandatory regulations passively due to their rare knowledge about the acquisition of economic incentives from the government. Companies within sectors that have higher energy cost ratio and rely on coal as their primary energy source, would be more susceptible to mandatory regulations. Hence, dissemination and popularization of knowledge on how to improve energy

efficiency, and a commitment to ensuring that companies have equal opportunities for getting economic rewards are the key points to implementing this kind of policies. Second, competition level, organizational size and corporate ownership are major factors to consider when designing voluntary installation-level targets. Large companies and companies with higher market competitive pressure will pay close attention to the equity issue in the distribution of responsibility. Compared with state-owned companies, domestic private companies prefer voluntary targets, where only companies that beat the targets pay for the cost of the shortfall of tradable units. Thus, they may be inclined to do nothing because of less competence. Third, the status of energy use management, internationalization orientation and sector belongings are the key factors when adopting policies with installations receiving mandatory targets. Mandatory targets (even ETS) are more likely to be accepted by companies with good data basis and higher level internationalization due to their rich information about their own energy use and emissions situation and current ETS. Meanwhile, the electricity industry may be a good candidate to take apart in the ETS because of their high-level knowledge base of carbon trading from the CDM and pilot national ETS in China. In summary, the design of domestic policy instruments should be diverse and try to satisfy different expectations from different companies with various characteristics.

Corporate understanding of barriers is also relevant for policy design. On the one hand, financial constraint, uncertainty about instable policies, and lack of knowledge about new technology are three major barriers for companies' energy saving investments. Thus, policy packages consisting of ex-ante issuance as well as voluntary policies with stable policy signals will win more acceptance form the companies. Additionally, it is very important for policymakers to choose an issuance frequency of one to three years in order to incentivize companies to reduce emissions under sectoral crediting since most companies can only accept a payback time of less than three years. This creates a new impetus for energy pricing reforms in China. Indeed, since 1984, China has been making great efforts towards reforming energy prices, and has accomplished great achievements. However, such reforms are far from complete (Zhang, 2014a). Removing energy subsidies and getting energy prices rights will increase the value of the amount of energy saved, and thus help to shorten payback time.

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References

Aasrud, A., Baron, R., Buchner, B., McCall, K 2009. Sectoral Market Mechanisms – Issues for Negotiation and Domestic Implementation. IEA/OECD, Paris. http://www.oecd.org/env/cc/44001884.pdf

Aguilera-Caracuel, J., Hurtado-Torres, N. E., Aragón-Correa, J. A., 2012. Does international experience help firms to be green? A knowledge-based view of how international experience and organizational learning influence proactive environmental strategies. International Business Review 21 (5), 847-861.

Borgatta, E.F., Bohrnstedt, G.W., 1980. Level of measurement: once over again. Sociological Methods and Research 9, 147–160.

Butzengeiger, S., Dransfeld, B.,Cames, M., Michaelowa, A., Healy, S., 2012. New market mechanisms for mitigation: Getting the incentives right. Carbon markets or climate finance: 146-167.

Castro, P., Hayashi, D., Harthan, R., Cames, M., Michaelowa, A., 2012. Setting baselines for the new market mechanism: Examples from the power, cement and buildings sectors. Öko-Institut/IPZ, Berlin/Zürich. http://www.oeko.de/oekodoc/1613/2012-465-en.pdf

De Groot, H.L.F., Verhoef, E.T., Nijkamp, P., 2001. Energy saving byfirms: decisionmaking barriers and policies. Energy Econ 23, 717-740.

Delmas, M., Toffel, M. W., 2004. Stakeholders and environmental management practices: an institutional framework. Business strategy and the Environment, 13(4): 209-222.

Dransfeld, B., Michaelowa, A., Cames, M., Healy, S., 2011. Design of the post-2012 climate regime: Sectoral approaches for greenhouse gas mitigation. Discussion paper: Incentives for mitigation investments. http://www.uba.de/uba-info-medien-e/4145.html

Ecorys, 2012. Design options for sectoral carbon market mechanisms and their implications for the EU ETS. Ecorys, Rotterdam. http://ec.europa.eu/clima/policies/ets/linking/docs/study_20120831_en.pdf

Fishbein, M., Ajzen, I.,1975. Belief, attitude, intention, and behavior: an introduction to theory and research. Boston: Addison Wesley.

Gruber, E., Brand, M., 1991. Promoting energy conservation in small and medium sized companies. Energy Policy 19, 279-287.

Gunningham, N., Kagan, R. A., Thornton, D., 2003. Shades of Green: Business, Regulation and Environment. Stanford University Press, Stanford.

Harrison, D., et al., 2011. Evaluation of Incentives in International Sectoral Crediting Mechanisms. NERA Economic Consulting, Boston. http://www.nera.com/nera-files/PUB_Enel_Report_102411.pdf

Hart, S.L., 1995. A natural-resource-based view of thefirm. The Academy of Management Review 20 (4), 986-1014.

Hession, M., 2013. New Market Mechanism, How to get there - the role of the EU ETS and pilot projects to prepare for what's to come. Presentation at Workshop on Market Based Mechanisms & Results Based Finance. http://www.nefco.org/sites/nefco.viestinta.org/files/Hession_NewMarketMeckanism_EU.pdf

Hettige, H., Huo, M., Pargal, S., Wheeler, D., 1996. Determinants of pollution abatement in developing countries: evidence from South and Southeast Asia.World Development 24, 1891-1904.

IETA, 2010. Thinking Through the Design Possibilities For a Sectoral Crediting Mechanism. IETA, Geneva.

http://www.ieta.org/index.php?option=com_content&view=article&id=126:thinking-through-the-design-possibilities-for-a-sectoral-crediting-mechanism&catid=26:reports&Itemid=93

Jennings PD, Zandbergen PA. 1995. Ecologically sustainable organizations: an institutional approach. Academy of Management Review 20: 1015–1052.

Liu, X.B., Wang, C., Zhang, W.S., Suk, S.H., Sudo, K., 2012. Company's affordability of increased energy costs due to climate policies: A survey by sector in China. Energy Econ 36, 419-430.

Marcu, A., 2014. The Role of Market Mechanisms in a Post-2020 Climate Change Agreement. CEPS, Brussels. http://www.ceps.eu/book/role-market-mechanisms-post-2020-climate-change-agreement

Michaelowa, A., 2012. Can New Market Mechanisms Mobilize Emissions Reductions from the Private Sector? Harvard Project on Climate Agreements. Cambridge, MA: Harvard University Discussion Paper ES: 12-1. http://belfercenter.ksg.harvard.edu/files/michaelowa_nmm8.pdf

NEFCO (Nordic Environment Finance Corporation) and Kfw Development Bank, 2013. Workshop on Market Based Mechanisms & Results Based Finance. http://www.norden.org/en/publications/publikationer/2013-925

NSD (National School of Development), 2014. Brief report: The new stage of China economic reform (in Chinese). http://www.nsd.edu.cn/cn/article.asp?articleid=18110

Price, L., Wang, X.J., Yun, J., 2008. China's Top-1000 Energy-Consuming Enterprises Program: Reducing Energy Consumption of the 1000 Largest Industrial Enterprises in China. LBNL-519E. http://ies.lbl.gov/iespubs/LBNL-519E.pdf

Prindle, W.R., 2010. From Shop Floor to Top Floor: Best Business Practices in Energy Efficiency. http://www.pewclimate.org/energy-efficiency/corporate-energy-efficiency-report.

Schneider, L., Cames, M., 2009. A framework for a sectoral crediting mechanism in a post-2012 climate regime. Report for the Global Wind Energy Council. Öko-Instiitue, Berlin. http://www.oeko.de/oekodoc/904/2009-022-en.pdf

Scott, W. R., 1992. Organizations: Rational, Natural, and Open Systems. Prentice-Hall: Englewood Cliffs, NJ.

SSB (Shanxi Statistics Bureau), 2013. Shanxi Statistical Yearbook.

Suk, S., Liu, X., Lee, S. Y., Go, S., & Sudo, K., 2014. Affordability of energy cost increases for Korean companies due to market-based climate policies: a survey study by sector. Journal of Cleaner Production 67, 208-219.

Supan, B., 1990. On the compatibility of nested logit models with utility maximization. J Econ, 43(3):373–88.

UNFCCC, 2011. Report of the Conference of the Parties on its seventeenth session, held in Durban from 28 November to 11 December 2011, Addendum, Part Two: Decision 2/CP.17. FCCC/CP/2011/9/Add.1. Available at: http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf#page=4

Thollander, P., Ottosson, M., 2010. Energy management practices in Swedish energy-intensive industries. Journal of Cleaner Production 18, 1125-1133.

Ward, M., Streck, C., Winkler, H., Jung, M., Hagemann, M., Höhne, N., & O'Sullivan, R., 2008. The Role of Sector No-Lose Targets in Scaling Up Finance for Climate Change Mitigation Activities in Developing Countries. Report prepared for the International Climate Division, Department for Environment, Food and Rural Affairs (DEFRA), United Kingdom.

Wehnert, T., Harms, N., Sterk, W., 2013. Ambitious New Market Mechanisms: Exploring Frameworks for Pilots. Wuppertal Institute, Wuppertal. http://www.jiko-bmub.de/english/background_information/publications/doc/1299.php

Whitesell, W., 2009. Tradable Intensity Standard for Sector Crediting. CCAP, Washington. http://ccap.org/assets/Tradable_Intensity_Standard-for-Sector-Crediting_CCAP-Nov-2009.pdf

Winship, C., Mare, R. D., 1984. Regression models with ordinal variables. American Sociological Review, 512-525.

Yang, D.N., Zhou, C.X., 2005. Driving forces for enterprises voluntarily adopting standardized environmental management system: a theoretical framework and empirical analysis. Management World (in Chinese) 2, 85-95.

Zhang, Z.X., 2010. China in the transition to a low-carbon economy. Energy Policy 38, 6638-6653.

Zhang, Z.X., 2014a. Energy prices, subsidies and resource tax reform in China. Asia and the Pacific Policy Studies 1(3).

Zhang, Z.X., 2014b. Programs, prices and policies towards energy conservation and environmental quality in China. In: Shunsuke Managi (ed), Handbook of Environmental Economics in Asia, Routledge, London.