

# **ISO 9000 Norm as a Club Good: Network Effect Evidence From French Employer Survey**

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# *Plan*

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# 1. Introduction

## 1. Introduction

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- ISO (International Standard Organization) is based in Geneva Switzerland.
- The first ISO 9000 certificates attesting that firms were adhering to standards were issued in 1987.
- ISO 9000- quality process production.
- ISO 14000- environmental management system.

# 1. Introduction

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- *The ISO 9000 international standards are a set of written guidelines that make up a non-specific quality management system that can be applied to any organization regardless of the product or service being provided.*
- **ISO certificates are not awarded to the final products or services, but to the quality processes within the organization.**

# 1. Introduction

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- Benefits of ISO certification include:
  - increased customer preference,
  - improved company quality image and competitiveness in the market,
  - compliance with customer requirements,
  - streamlined procedures and documentation,
  - increased awareness of preventive and corrective actions,
  - and provision of foundation for Total Quality Management (TQM).

# 1. Introduction

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- However, the direct cost of certification can be very high, ranging from \$10 000 to \$300 000 per company.

# 1. Introduction

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- Let us recall that goods can be characterized by two properties :
  - Exclusion
  - and Rivalry.

# 1. Introduction

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- Private good :
  - Rivalry and Exclusion
- Common-pool resources :
  - Rivalry and Non-Exclusion
- Pure Public good :
  - Non Rivalry and Non-Exclusion
- Club good :
  - Non Rivalry and Exclusion

# 1. Introduction

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- *ISO certification* can be conceptualized as a Club Good since it respects the exclusion and the non-rivalry properties.
- Club Goods provide two effects :
  - ❖ *Signal effect (brand reputation)*
  - ❖ *Network effect*

# 1. Introduction

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- Signal effect.
- Network effect.
  - According to Bramoullé and Kranton (2007), the production of Public Goods fundamentally induces a network of relationships between the different actors.

# 1. Introduction

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- The purpose of this paper is to provide empirical evidence of the existence of this network effect.

# 1. Introduction

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- Our approach is original because even though there is a number of studies implying ISO norms as a Club Good, there is, no analysis of ISO norms in terms of a network in which firms are certified or not and in which the ties (between the firms) represent an economic relationship.



# 2. Methodology



## 2. Methodology

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- Let us take a set of firms.
- We will construct four categories.

## 2. Methodology

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- The first category of Adopters denotes companies that have ISO certification and their suppliers are also certified.
  - **Direct Complete Adopters (DCA).**
- The category presents the companies that are certified with ISO certification but their suppliers are not.
  - **Direct Non Complete Adopters (DNCA)**

## 2. Methodology

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- The third category is focused on suppliers that have ISO 9000 certification, but the company itself is not certified.
  - **Indirect Adopters (IA)**
- The fourth category presents companies that do not have ISO 9000 certification and also their suppliers do not have ISO 9000 certification.
  - **Non Adopters (NA)**

## 2. Methodology

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- This categorisation allows us to empirically construct the network of relationship between the firms (certified/non certified).
- **Question 1** : What is the relative position of type of firms inside the ISO network ?

## 2. Methodology

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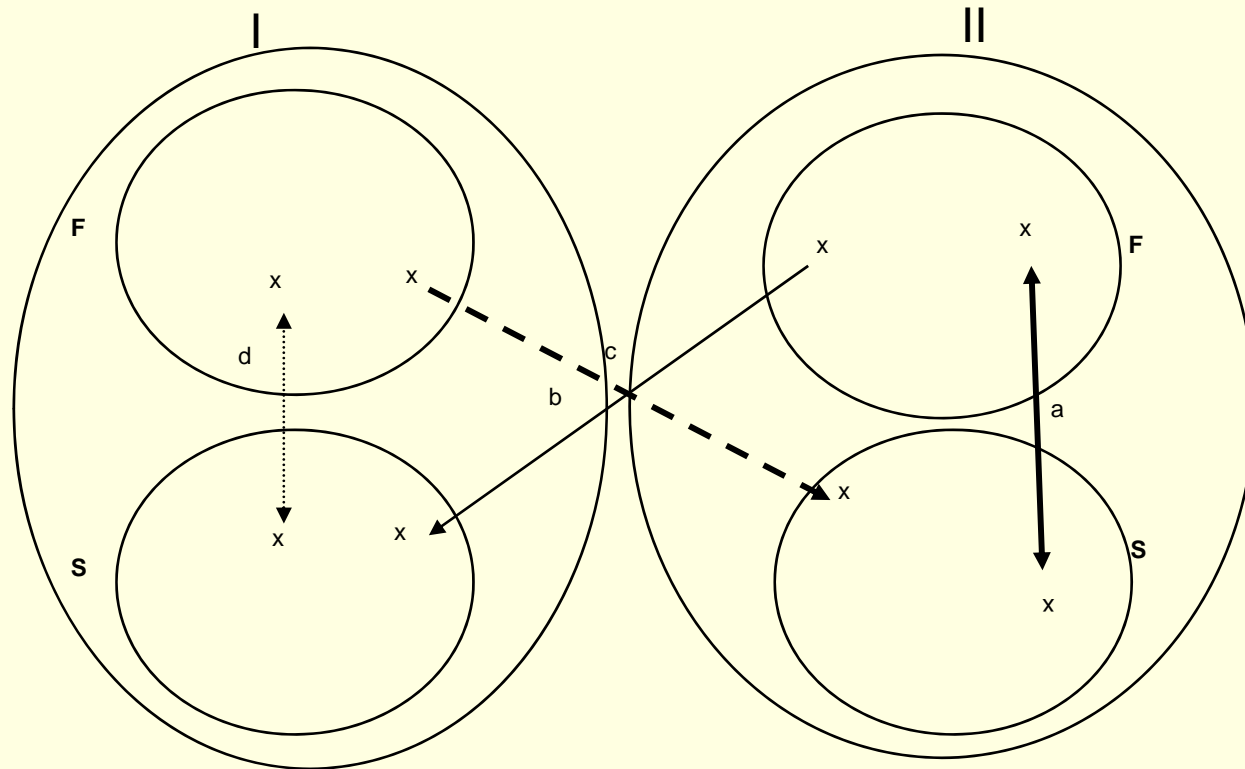
- In order to answer to this question, three remarks:
- Remark 1:
- In the ISO network, being certified is a positive signal concerning quality improvement (Terlaak and King, 2006), and dealing with (i.e. having as a supplier) a certified firm amplifies this positive signal.

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- Remark 2 :
- On the contrary, dealing with (i.e. having as a supplier) a non-certified firm when certified reduces the positive signal concerning quality improvement.
- Remark 3 :
- Dealing with (i.e. having as a supplier) a certified firm while non-certified improves your signal concerning quality improvement.

# Graph 2. Relative position inside the network



**Legend:**

Set "I" is the Non-adopter's network

Set "II" is the ISO adopter's network

Subset "F" is a set of firms which do not supply any other firms

Subset "S" is the set of firms which supplies other firms

**The nodes:**

Node "x" = firm or supplier

## 2. Methodology

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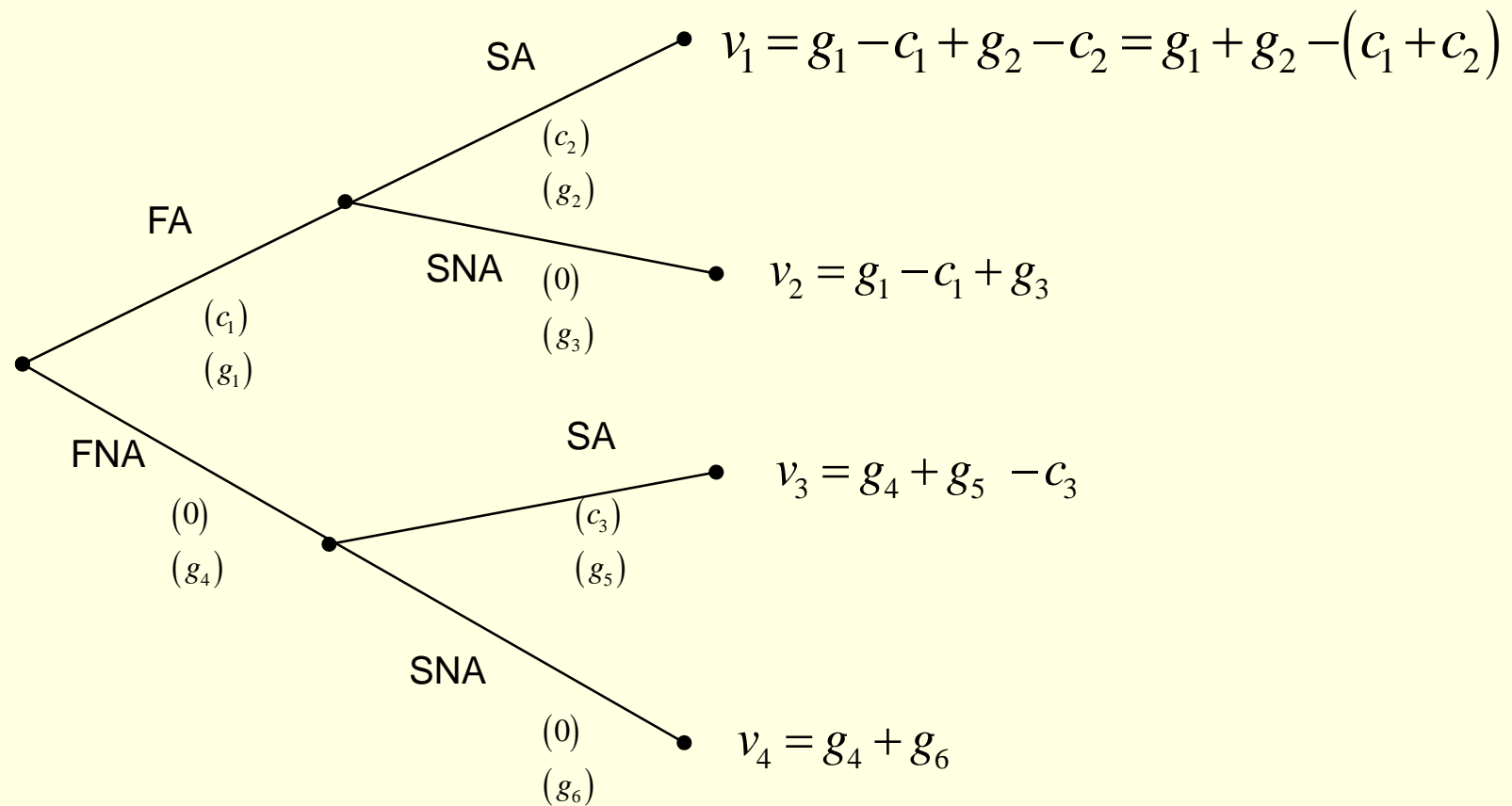
- We can classify our four types of firms:
  - Direct Complete Adopters are on the top of the classification
  - followed by Direct Non Complete Adopters,
  - then Indirect Adopters
  - and finally Non Adopters.

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- **Question 2** : Does the hierarchy inside the ISO network imply a similar hierarchy in terms of monetary gains ?
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- The level of costs and benefits could help us to define the real advantages of each member inside the network.

## Graph 2. Net Monetary Gains for the ISO and the Non-Iso adopters.



### Legend

- FA, FNA, SA and SNA respectively mean "ISO Adopter Firm", "not ISO Adopter Firm", "ISO Adopter Supplier", "not ISO Adopter Supplier".

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- From Graph 2, two remarks :
- Remark 1 :
- A decision of a firm to become a Direct Complete Adopter, Direct Non Complete Adopter, Indirect Adopter or Non Adopter is always optimal.
- Remark 2 :
- As a consequence, the ordering inside the ISO network does not necessarily imply a similar ordering ( $v1 > v2 > v3 > v4$ ) in terms of monetary gains.

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- Main Question is to verify empirically if,  
 $v1 > v2 > v3 > v4$

Is it the case that the value (v1) for the Direct Complete Adopters is higher than the value (v2) for the Direct Non Complete Adopters which is higher than the value (v3) for the Indirect Adopters which is higher than the value (v4) for the Non Adopters ?



# 3. Empirical Analysis



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## The database

- The research is based on two micro data surveys, the Annual Survey of Industry 1997 (EAE) and the Organizational Changes and Computerization of 1997 (COI).
- Our research is based on questions to the manufacturing industry and we worked with a sample of 4577 companies with more than 20 employees.

## Table 1. Descriptive Statistics

	Direct Complete Adopters	Direct Non Complete Adopters	Indirect Adopters	Non Adopters
<b>Year of ISO Certification</b>				
1994	38%	47%	0%	0%
<b>Company's Size</b>				
20 to 49 employees	39% (a)	54%	62%	69%
50 to 199 employees	38%	34%	30%	27%
200 employees and more	23%	12%	8%	4%
<b>Quality department in 1997</b>				
Full time quality manager	74%	56%	43%	21%
<b>Quality outsourcing in 1997</b>				
Outsource quality manager	18%	22%	14%	6%
<b>Previous certification</b>				
Other certification or total quality management	15%	12%	25%	8%
<b>Mean export by firm's turnover</b>				
Mean of export	0.22	0.19	0.17	0.16
<b>Total</b>	32%	4%	22%	42%

Source: Survey COI, sample 4577 companies, weighted by the number of employees.

Field: manufacturing industries of more than 20 employees.

Lecture: (a) 39% of "direct complete adopters" are companies that have from 20 to 49 employees (category-small company).

# 3. Empirical Analysis

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- The position inside the ISO certification network may not be random and may depend on the firms' individual characteristics.
- Hence, the switching regression model controls for the endogenous effect by estimating simultaneously the selection equation and the performance economic equations, for the two regimes (superior or inferior position inside ISO network).

# 3. Empirical Analysis

- The economic performance variable was denoted  $y$  which is the logarithm of the productivity per employee.
- In order to estimate the logarithm productivity per employee we follow a Cobb Douglas production function:

$$\ln\left(\frac{Y}{L}\right) = \eta + \alpha \ln\left(\frac{K}{L}\right) + \beta \ln L + \gamma ISO + \delta X + \varepsilon$$

- where  $\ln Y/L$  is the logarithm of value added per employee,  $\ln KL$  is the logarithm of capital per employee,  $\ln L$  is logarithm of number of employees,  $ISO$  denotes ISO 9000 categories and  $X$  represents the vector of explanatory variables.

# 3. Empirical Analysis

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We will consider five models:

- *In Model 1 (dummy 1)* = Direct Complete Adopters=1 and Indirect Adopters=0.
- *In Model 2 (dummy 2)* = Direct Complete Adopters=1 and Non Adopters=0.
- *In Model 3 (dummy 3)*, Indirect Adopters=1 and Non Adopters=0.
- *In Model 4 (dummy 4)*, Direct Complete Adopters and Direct Non Complete Adopter=1 and Indirect Adopters=0.
- *In Model 5 (dummy 5)*, Direct Complete Adopters and Direct Non Complete Adopter =1 and Non Adopters=0.

# 3. Empirical Analysis

- The switching model structure is defined by two states: state 1 and state 0, corresponding respectively to certain type of ISO adopters. As we define and represent productivity, so corresponding productivity equations can then be written as follows:



$$\ln(y_{1i}) = \alpha_1 + \beta_1 X_i + \varepsilon_{1i},$$

$$\ln(y_{0i}) = \alpha_0 + \beta_0 X_i + \varepsilon_{0i},$$

- Where  $X_i$  is a vector of explanatory variables (features of the company's strategy, external market's constraints, logarithm of the capital per employee and logarithm of the labour),  $\beta_1$  and  $\beta_0$  are slope coefficients to be estimated.  $\alpha_1, \alpha_0$   $\varepsilon_1$   $\varepsilon_0$  are intercepts and the disturbance terms for the two equations, respectively.

# 3. Empirical Analysis

- Choosing one ISO category is not exogenous, it depends on differences between monetary gains associated with different ISO categories. Let us note  $ISO_i^*$ , the monetary gain of belonging to one of ISO categories. A firm  $i$  will choose one of the categories if:

$$ISO_i^* = \alpha_i + \gamma X_i + \zeta M_i \varepsilon_i > 0,$$

- where  $X_i$  is a vector of explanatory factors of ISO categories (features of the company's strategy, external market's constraints, logarithm of the capital per employee and logarithm of the labor),  $M_i$  are instrumental variables (quality department and outsourcing),  $\gamma$  and  $\zeta$  are slope coefficients to be estimated and  $\alpha_i$  and  $\varepsilon_i$  are intercepts and disturbance, respectively.

# 3. Empirical Analysis

- Here  $ISO_i^*$  is a latent variable that determines the ISO categories in which firm  $i$  belong to and has following form:

$$ISO_i = 1 \quad \text{if} \quad ISO_i^* > 0$$

$$ISO_i = 0 \quad \text{otherwise.}$$

Finally, we observe  $\log(y_{1i})$  if  $ISO_i=1$  and  $\log(y_{0i})$  if  $ISO_i=0$

The Variance-Covariance Matrix:

$$\Sigma = \begin{pmatrix} \sigma_1^2 & \rho_{10} & \rho_{1\mu} \\ \rho_{10} & \sigma_0^2 & \rho_{0\mu} \\ \rho_{1\mu} & \rho_{0\mu} & 1 \end{pmatrix}$$

# 3. Empirical Analysis

- The expected productivity, conditionally on ISO adoption, can be calculated as follows:

$$E[\log(y_{1i}) | ISO_i = 1] = \beta_1 X_i + \sigma_1 \rho_{1\mu} \frac{-\phi(\gamma M_i)}{1 - \Phi(\gamma M_i)}.$$

- In the same way, the expected productivity, conditionally on the, is given by

$$E[\log(y_{0i}) | ISO_i = 0] = \beta_0 X_i + \sigma_0 \rho_{0\mu} \frac{-\phi(\gamma M_i)}{1 - \Phi(\gamma M_i)}.$$

**Table 2. Switching regression (part 1)**  
**Equation 1: Determinants of choosing one of the ISO categories**

	Direct Complete Adopters vs Indirect Adopters (ref)	Direct Complete Adopters vs Non Adopters (ref)	Indirect Adopters vs Non Adopters (ref)
Constant	-2.35***	-4.40***	-2.34***
	<b>Features of the company's strategy</b> <i>Ref = Less Important and Not Important</i>		
Quality improvement	-0.00	0.22***	0.17**
Cost reduction	0.05	0.09	0.08
New process	0.13**	0.15***	0.02
	<b>External market's constraints</b>		
Competitive pressure-yes	0.00	0.05	0.14**
Uncertainty on the market-yes	-0.08	-0.05	0.04
Clients conditioned- yes	0.08	0.28***	0.16***
Suppliers conditioned-yes	-0.03	0.11*	0.12*
Stockholders conditioned-yes	0.02	0.18**	0.06
	-0.39***	-0.02	0.54***
	<b>Quality department and outsourcing in 1994</b>		
Full time quality manager-yes	0.31***	0.62***	0.23***
Outsource quality manager-yes	0.30***	0.38***	0.06
	<b>Capital and Labor</b>		
Logarithm of the capital per employee	0.22***	0.20***	0.03
Logarithm of the labor	0.28***	0.51***	0.21***

**Table 3. Switching regression (part 2)**  
**Equation 2: Determinants of logarithm of added value per employee**  
**(superior position inside ISO network)**

	Direct Complete Adopters vs Indirect Adopters (ref)	Direct Complete Adopters vs Non Adopters (ref)	Indirect Adopters vs Non Adopters (ref)
Constant	2.63***	2.99***	3.03***
	<b>Features of the company's strategy</b> <i>Ref = Less Important and Not Important</i>		
Quality improvement	0.03	0.03	-0.00
Cost reduction	-0.07**	-0.08**	0.00
New process	0.02	0.01	-0.02
	<b>External market's constraints</b>		
Competitive pressure-yes	-0.05*	-0.05**	-0.09**
Uncertainty on the market-yes	-0.05**	-0.05**	-0.02
Clients conditioned- yes	-0.00	-0.01	-0.04
Suppliers conditioned-yes	-0.02	-0.01	-0.04
Stockholders conditioned-yes	0.02	0.02	0.01
	-0.06***	-0.02	0.03
	<b>Quality department and outsourcing in 1994</b>		
Full time quality manager-yes	-	-	-
Outsource quality manager-yes	-	-	-
	<b>Capital and Labor</b>		
Logarithm of the capital per employee	0.18***	0.16***	0.15***
Logarithm of the labor	0.05***	0.02***	0.01

**Table 4. Switching regression (part 3)**  
**Equation 3: Determinants of logarithm of added value per employee**  
**(inferior position inside ISO network)**

	Direct Complete Adopters vs Indirect Adopters (ref)		Direct Complete Adopters vs Non Adopters (ref)		Indirect Adopters vs Non Adopters (ref)	
Constant	3.13***		3.13***		3.03***	
	<b>Features of the company's strategy</b> <i>Ref = Less Important and Not Important</i>					
Quality improvement	-0.01		0.09***		0.08**	
Cost reduction	0.00		-0.07**		-0.08**	
New process	-0.04		-0.04*		-0.03	
	<b>External market's constraints</b>					
Competitive pressure-yes	-0.08*		-0.05*		-0.07**	
Uncertainty on the market-yes	0.00		-0.07**		-0.07***	
Clients conditioned- yes	-0.05		-0.07***		-0.07**	
Suppliers conditioned-yes	-0.02		-0.02		-0.03	
Stockholders conditioned-yes	-0.01		-0.00		-0.01	
	0.11***		-0.05		-0.16***	
	<b>Quality department and outsourcing in 1994</b>					
Full time quality manager	-		-		-	
Outsource quality manager	-		-		-	
	<b>Capital and Labor</b>					
Logarithm of the capital per employee	0.12***		0.17***		0.18***	
Logarithm of the labor	-0.05***		-0.05***		-0.04**	
$\sigma_j^2 (j = 0,1)$	0.51	0.44	0.45	0.43	0.49	0.45
$\rho_{j\mu}^2 (j = 0,1)$	-0.62 ***	0.45***	-0.39**	0.02	-0.63** *	-0.06

**Table 5. Observed and predicted productivity**

Model 1	Direct Complete Adopters		Indirect Adopters	
	<i>Observed Productivity</i>	<i>Predicted Productivity*</i>	<i>Observed Productivity</i>	<i>Predicted Productivity</i>
<b>Means</b>	3.82	3.84	3.66	3.41
<b>SD</b>	0.49	0.24	0.56	0.24

Model 2	Direct Complete Adopters		Non Adopters	
	<i>Observed Productivity</i>	<i>Predicted Productivity</i>	<i>Observed Productivity</i>	<i>Predicted Productivity</i>
<b>Means</b>	3.82	3.84	3.56	3.64
<b>SD</b>	0.49	0.25	0.54	0.26

Model 3	Indirect Adopters		Non Adopters	
	<i>Observed Productivity</i>	<i>Predicted Productivity</i>	<i>Observed Productivity</i>	<i>Predicted Productivity</i>
<b>Means</b>	3.66	3.69	3.56	3.64
<b>SD</b>	0.56	0.32	0.54	0.30

Source: Survey COI merges to the EAE, sample of 2909, 3434 and 2445 companies, respectively.

\*Predicted productivity comes from the switching model

**Table 6. Switching regression (part 1)**  
**Equation 1: Determinants of choosing one of the ISO categories**

	Direct Complete and Direct Non Complete Adopters vs Indirect Adopters (ref)	Direct Complete and Direct Non Complete Adopters vs Non Adopters (ref)
Constant	-1.98***	-4.02***
	<b>Features of the company's strategy</b> <i>Ref = Less Important and Not Important</i>	
Quality improvement	-0.04	0.18**
Cost reduction	0.03	0.07
New process	0.12**	0.12**
	<b>External market's constraints</b>	
Competitive pressure-yes	0.02	0.08
Uncertainty on the market-yes	-0.10*	-0.07
Clients conditioned- yes	0.03	0.23***
Suppliers conditioned-yes	-0.06	0.07
Stockholders conditioned-yes	0.04	0.19***
	-0.38***	0.01
	<b>Quality department and outsourcing in 1994</b>	
Full time quality manager	0.28***	0.58***
Outsource quality manager	0.27***	0.40***
	<b>Capital and Labor</b>	
Logarithm of the capital per employee	0.20***	0.19***
Logarithm of the labor	0.28***	0.48***

**Table 7. Switching regression (part 2)**  
**Equation 2: Determinants of logarithm of added value per employee**  
**(superior position inside ISO network)**

	Direct Complete and Direct Non Complete Adopters vs Indirect Adopters (ref)	Direct Complete and Direct Non Complete Adopters vs Non Adopters (ref)
Constant	2.64***	2.95***
	<b>Features of the company's strategy</b> <i>Ref = Less Important and Not Important</i>	
Quality improvement	0.01	0.02
Cost reduction	-0.08**	-0.09**
New process	0.02	0.01
	<b>External market's constraints</b>	
Competitive pressure-yes	-0.05*	-0.06**
Uncertainty on the market-yes	-0.06**	-0.06***
Clients conditioned- yes	0.01	0.00
Suppliers conditioned-yes	-0.01	0.00
Stockholders conditioned-yes	0.02	0.02
	-0.06**	-0.02
	<b>Quality department and outsourcing in 1994</b>	
Full time quality manager	-	-
Outsource quality manager	-	-
	<b>Capital and Labor</b>	
Logarithm of the capital per employee	0.18***	0.17***
Logarithm of the labor	0.05***	0.03***

**Table 8. Switching regression (part 3)**

**Equation 3: Determinants of logarithm of added value per employee  
(inferior position inside ISO network)**

	Direct Complete and Direct Non Complete Adopters vs Indirect Adopters (ref)		Direct Complete and Direct Non Complete Adopters vs Non Adopters (ref)	
Constant	3.07***		3.17***	
	<b>Features of the company's strategy</b> <i>Ref = Less Important and Not Important</i>			
Quality improvement	-0.00		0.09***	
Cost reduction	0.00		-0.07**	
New process	-0.04		-0.04*	
	<b>External market's constraints</b>			
Competitive pressure-yes	-0.08**		-0.06*	
Uncertainty on the market-yes	0.01		-0.06**	
Clients conditioned- yes	-0.04		-0.07***	
Suppliers conditioned-yes	-0.02		-0.02	
Stockholders conditioned-yes	-0.02		-0.01	
	0.12***		-0.06	
	<b>Quality department and outsourcing in 1994</b>			
Full time quality manager	-		-	
Outsource quality manager	-		-	
	<b>Capital and Labor</b>			
Logarithm of the capital per employee	0.12***		0.16***	
Logarithm of the labor	-0.05***		-0.06***	
$\sigma_j^2 (j = 0,1)$	0.45	0.52	0.46	0.43
$\rho_{j\mu}^2 (j = 0,1)$	-0.64 ***	0.46***	-0.46***	0.01

## Table 9. Observed and predicted productivity

Model 4	Direct Complete +Direct Non Complete Adopters		Indirect Adopters	
	<i>Observed Productivity</i>	<i>Predicted Productivity*</i>	<i>Observed Productivity</i>	<i>Predicted Productivity</i>
<b>Means</b>	3.82	3.84	3.66	3.41
<b>SD</b>	0.50	0.25	0.56	0.24

Model 5	Direct Complete +Direct Non Complete Adopters		Non Adopters	
	<i>Observed Productivity</i>	<i>Predicted Productivity</i>	<i>Observed Productivity</i>	<i>Predicted Productivity</i>
<b>Means</b>	3.82	3.84	3.56	3.66
<b>SD</b>	0.50	0.25	0.54	0.25

Source: Survey COI merges to the EAE, sample of 3092 and 3617 companies, respectively.

\*Predicted productivity comes from the switching model



# 4. Conclusion



4. Conclusion

# 4. Conclusion

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- We have attempted to demonstrate that ISO as a Club Good gives members the possibility of reflecting their positive status inside the ISO Club on a member out of the ISO Club if they have a link. Implementation of switching endogenous regression helps us to support our considerations.
- Firms which are not certified gain more when they deal with certified companies.
- The principal contribution of this article relates to the analysis of the fact that companies could profit from ISO certification choosing one of three categories, but not excludable direct adopters.

Thanks for your attention!

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