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### **Can compliance to the international management standards enhance the competitiveness of firms in South Latin America?**

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#### Abstract

This paper explores the motivations and facilitators underlying ISO 9000 and ISO 14000 certification in South America. In particular, we explore the impact of internationalisation of these economies on the diffusion of certification. Relying on both national aggregated data for a period of 1995-2005 as well as on firmlevel data from the Chilean salmon farming industry, we find that exposure to international markets influences positively the decision of compliance with these international standards. Still, certification relies heavily on the meso and macro institutional capabilities, and consequently on the economic development of these economies.

#### 1. Introduction

International management standards such as ISO 9000 and ISO 14001 have emerged and spread widely around the world, during the 1990s as the consolidation of the globalization process was taking place. Moreover, access to international markets, such as supplychain production networks, deregulated or common markets, increasingly requires from firms certification with these international standards (Withers and Ebrahimpour, 2000; Larsen and Häversjö, 2001; King et al., 2005; Graham and Woods, 2006).

These voluntary management standards are expected to be of especial importance for the

competitiveness of firms in developing countries, where domestic public regulation bodies as well as consumer groups are not likely to exist or to have stringent requirements in this respect (UNIDO, 2005: 8688). In this context, on the one hand, openness to international capital and markets might lead to a selfregulation of social, quality and safety issues in developing countries (Graham and Woods, 2006). On the other hand, the competitiveness of developing countries, especially in food and agricultural products, seems increasingly dependent on the capabilities of their national firms to obtain certification with international standards, as the European and the North America markets introduce stricter standards and regulations (UNIDO, 2005: 115118). However, the study of how conformance to these international standards, which has been increasingly required for accessing international markets, can be fostered in developing countries has still to be done.

Hence, in this paper, we aim at exploring the motivations and facilitators underlying adoption of ISO 9000 and ISO 14001 for firms in South America. In SA countries, during the 1990s, we observe the liberalisation of international trade, investment and capital as well as the increase in nontraditional natural resourcebased products in the exports (ECLAC, 2002). Moreover, from mid1990s, the number of ISO 9000 and ISO 14001 certificates in SA increased at a faster rate than in the rest of the world (ISO, 2005).

Using both revealed advantage ratios and negative binomial regressions to analyse the ISO data on certificates issued, we compare the sectoral pattern of standards diffusion in SA countries with the rest of the world as well as the importance of globalisation of the SA economies on the diffusion of these international quality standards. Additionally, using a firmlevel survey data, we explore in depth the motivations and facilitators of certification for firms in one of the most successful natural resourcebased export industry in the region, the Chilean salmon farming industry.

This paper suggests that exposure to international markets influences the decision of compliance with standards by firms in SA. Still, certification depends greatly on the capabilities of firms as well as on the development of adequate national institutions. Hence, international competitiveness of firms in developing countries depends on the capability building within firms but also on the national level efforts towards institutional and standardisation development.

This paper is organised as follow. Section 2 reviews the literature on the adoption of these management standards. Section 3 describes the data and methodologies used to explore the underlying reasons for adoption of ISO 9000 and ISO 14001 by SA firms. Section 4 presents the macro results of the analysis. Section 5 shows the results from the indepth analysis of Chilean Salmon industry. Section 5 concludes the paper.

## 2. ISO 9000 and ISO 14001 certification

The evidence on the existing literature is reasonably consensual on accepting that ISO 9000 and ISO 14001 adoption by firms depends on some nonexclusive motivations. More

controversial is the evidence on the impact of certification of the performance of firms. In this section, we review the main reasons for ISO 9000 and ISO 14001 certification as well as their main impacts on the performance of firms.

ISO 9000 and ISO 14001 are voluntary standards which soon became the most widespread and popular ISO standards ever (ISO, 2001, 2005). ISO 9000, the standard of quality management, was first published in 1987 and updated in 1994 and 2000. Only from 1994, the standard previews thirdparty certification of the conform implementation by firms. ISO 14001, standard of environmental management, was published in 1996 and updated in 2004 (ISO, 2001, 2005). They are process rather than product standards, which means that instead of focusing on the characteristics of products, they emphasise in making the processes of developing, producing, and marketing more efficient in terms of quality or environmental impact (Tassey, 1996). Thus, these standards can be adopted by firms in almost any sector.

Despite their wide diffusion, these standards are surrounded by controversy and criticism, which is mainly related to the fact that they do not set specific performance goals. They only represent a method and some guidelines, the adopting firm needs to build up its quality and environmental management system, to formulate their policy, objectives and practices with these indications and respecting some controlling rules (Bénézech et al., 2001; Larsen

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and Häversjö, 2001).

In particular, research findings on the impact of certification on the performance of firms

These standards assume that firms control better the quality of their products and the environmental impact of their activities if they have those processes written down; consequently firms need to document their processes (Withers and Ebrahimpour, 1997; Bénézech et al., 2001). The effectiveness of the quality and environmental management system and the concordance between what is written in the firm's quality manual and the actual behaviour is checked by internal and external audits. The certificate is obtained at the end of an external audit, if the certification body determines that the organisational processes in the firm conform to the standard and to the written quality manual. Certificates are awarded for a period of three years, after which an audit is done and the certificates are either extended or withdrawn. Hence, certification only assures that the firm implemented and is complying with a written set of rules (Curkovic and Pagell, 1999; Larsen and Häversjö, 2001; Bénézech et al., 2001; Guller et al., 2002).

diverge greatly. Market or operational financial benefits from certification are difficult to prove empirically (Lima et al., 2000; Delmas, 2002; MartinezLorente and MartinezCosta, 2004; Corbett et al., 2004; Casadesús and Karapetrovic, 2005; Larsen and Häversjö, 2001). Consensus seems instead to exist on the internal organisational improvements related to better management control such as conformity and reliability, widespread quality culture on the shop floor, customer satisfaction awareness and process efficiency from ISO 9000 adoption (Withers et al., 1997; Withers and Ebrahimpour, 2000; Delmas, 2001; Pan, 2003; Casadesús and Karapetrovic, 2005, King et al., 2005). Benefits on conformance and reliability seem dependent on the fact that certification requires a review of production methods and the development of a control management system. Still, some few firms only identify disadvantages from the certification related to time, cost, excessive documentation,

excessive efforts from employees, and crystallisation of knowledge (Curkovic and Pagell, 1999; Withers and Ebrahimpour, 2000; MartinezLorente and MartinezCosta, 2004; Lazaric and Denis, 2005). In particular, benefits from adoption seem dependent on the capabilities of managers and consultants in integrating quality and environmental concerns into the specific context of the firm (Ringe and Nussey, 1994; Larsen and Häversjö, 2001; Bénézech et al., 2001; Withers and Ebrahimpour, 2000, Delmas, 2001).

Major surveys and studies find that firms certify mainly to fulfil the requirements of customers and as way to enter the global market. Indeed, governments and large buyers, especially multinationals, have been requesting suppliers and contractors to conform to ISO 9000 and more recently ISO 14001 (Ringe and Nussey, 1994; Larsen and Häversjö, 2001; Guller et al., 2002; Terziovski et al., 2003; King et al., 2005). Firms have also adopted ISO 9000 and later ISO 14001 to avoid potential export barriers, in particular, to respond to the fact that ISO 9000 was incorporated into the European global assessment procedures of some products (Withers and Ebrahimpour, 2000; Corbett and Kirsch, 2001; Pan, 2003; King et al., 2005). In addition, certification allowed entry in some new deregulated industries and in the provision of some public services that governments were outsourcing (Chu et al., 2001).

In particular multinationals, which operate following certain procedures and standards that suppliers must meet in order to control their performance, have been as well one of the most important channels for the diffusion of certification (Larsen and Häversjö, 2001; Guller et al., 2002; Pan, 2003; Klassen and Vachon, 2003; King et al., 2005). Moreover, as ISO 9000 certification requires the qualification of suppliers, many companies meet this requirement by ordering their suppliers to be certified; therefore in supplychains these standards tend to prevail (Stevenson and Barnes, 2002; Corbett, 2004). Indeed, in groups of enterprises, ISO 9000 seems to assure compatibility of business processes between the different affiliates (Blind and Hipp, 2001; Larsen and Häversjö, 2001; Pan, 2003). Moreover, ISO 14001 certification provides buyers with information on the ongoing suppliers improvement efforts (King et al., 2005)

Additionally, as certification can be viewed as a signalling device used by firms to increase their market share, firms seem to have engaged in certification if many of their competitors have done it (Bénézech et al., 2001; Blind and Hipp, 2001 Terlaak and King, 2001; Pan, 2003). Indeed, the probability of adoption ISO 9000 was found to increase with the fact that the firm supplies a certified firm or with an increase in the extent of certification in its industry (SESSI, 1996; Terlaak and King, 2001). Increasingly companies without certification might face an inability to get work. Therefore, certification seems to serve as an authorisation to enter and to compete in a certain specific market (Curkovic and Pagell, 1999; Withers and Ebrahimpour, 2000; Guller et al., 2002; Pan, 2003; Wiele et al., 2005; King et al., 2005).

Furthermore, most studies identify the expectation of process improvements as the second most important reason for firms certifying, after customer requirements and expected increased in market share (Withers and Ebrahimpour, 2000; Larsen and Häversjö, 2001; Delmas, 2002; Benner and Tushman, 2002). In Japan and Korea, achieving 'quality

improvement' followed by 'corporate image' are even the most important reason for ISO 9000 certification (Pan, 2003). Similarly, in German services, ISO 9000 certification is associated with the objective of internal processes reorganisation to reduce costs and of meeting safety requirements (Blind and Hipp 2001). Improvement of environmental impact is also the main motivation for ISO 14001 certification (King et al., 2005).

Hence, customer pressures, market entry barriers and increased certification of industrial competitors seem to be one of the greatest motivations for firms to certify, followed by the expectation of improving their process efficiency. Their diffusion seems characterised by a bandwagon effect, because in some markets, nonadopters of ISO 9000 are increasingly at a relative disadvantage to their competitors (Larsen and Häversjö, 2001; Guller et al., 2002; Casadesús and Karapetrovic, 2005). Still, firms may wish to certify to signal their quality and to differentiate their products in the market as well as to face market competition due to the wide diffusion of certification in their industry. Time, cost and management involvement are the most mentioned obstacles to adoption. Thus, in a context in which outsourcing of production activities, globalisation of markets, environmental concerns and more demanding customer bases were gaining relevance, ISO 9000 and ISO 14001 diffused greatly.

In developing countries, the motivations of firms to certify are much identical to those observed in firms in developed countries. According to UNIDO report (2005) in developing countries, firms' certification is also essential to enter in international markets as well as to raise the quality, environmental and safety standards of their production. However, in developing countries, policies to provide necessary infrastructures, such as testing laboratories, equipments, human resources, and domestic regulatory systems, are expected to play a crucial role in supporting national firms to conform and certify with international standards (UNIDO, 2005). This paper aims at exploring how openness to international markets and the national policymaking support firms to comply with these standards.

### 3 Methodology and data

This paper aims at exploring the motivations and facilitators underlying adoption of ISO 9000 and ISO 14001 by firms, in SA. In particular, the objective is to analyse whether and how the internationalisation of SA economies as well as national policymaking influenced the compliance with international standards by SA firms. To address these issues and to illustrate the current situation of standards compliance in SA, we will use both macro and sector aggregated data as well as firmlevel data.

To explore the pattern of diffusion of these international standards, we use data from the ISO surveys on the total number of ISO 9000 and ISO 14001 certificates as well as on the sectoral distribution of these standards in SA countries (i.e. Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela). We use data from the World Development Indicators on Gross Domestic Product (GDP), size of labour force, exports, net inflows of Foreign Direct Investment (FDI), payments of royalties and

licenses, share of high technology exports from total exports, share of services on national GDP. On the strength of this data, we will proceed empirically in two steps. First, we analyse the diffusion pattern of these certificates in SA. Moreover, using revealed advantage ratios

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(Balassa, 1965; Patel and Pavitt, 1994), we compare the sectoral diffusion pattern of these standards in SA with the world average. Second, using negative binomial regressions, we explore the underlying reasons for their diffusion and, in particular, how the internationalisation pattern of a country affected the decision of national firms to conform to these international management standards. The dependent variables are the number of ISO 9000 in each country from 1995 to 2005 and the number of ISO 14001 certificates from 1997 to 2005. To explore the role of internationalisation on the decision of firms to certify, we include as independent variables the following variables: relative intensity of exports, FDI and of payments of royalties and licenses on GDP as well as growth rate of FDI intensity and growth rate of royalties payments, and the share of technologyintensive exports on total exports. FDI may capture delocalisation of production towards SA countries and consequently the degree of integration to global production, while payment of royalties and licenses may capture the intensity of franchising activities and the use of international knowledge in SA. Exports represent the importance of foreign customers as well as the participation in international global production market. The share of technology-intensive exports is used as a proxy for the technology intensity of the national exports.

The diffusion of ISO 9000 and ISO 14001 certificates seems also related to the outsourcing and deregulation of industries and to the private delivery of public services, consequently to developments in services sector (Chu et al., 2001). In addition, their diffusion seems related to demand perception of environmental and quality issues, hence to the level of development of countries (Guller et al., 2002). Therefore, as control variables we include the relative size of services on the GDP, growth rate of service sector, the GDP purchasing power parity (PPP) per capita as well as the logarithm of the national size of labour force.

Using this panel data on time and countries, we compute negative binomial regression on the number of certificates on the twoyear lag values of the independent variables, as the process of implementation and certification was found to take longer than a year. In particular, we will compute three models. One with fixedeffects, which similarly as using country dummies, assumes that omitted variables differ across countries but are constant over time. One with randomeffects in order to allow that omitted variables that may differ across countries may as well vary over time. Additionally, given the importance of national institutional, political and economic conditions on the diffusion of these standards (Delmas, 2002; Franceschini et al., 2004), we will also run a randomeffect model with country dummies, which allows accounting for potential national unmeasured characteristics that could affect the estimates.

At micro level, we look at the process of standards compliance for one of the successful natural resourcebased industry in SA, the Chilean salmon farming industry. In particular, we analyse the motivations and the characteristics of the adopters of these international

standards as well as the national and industrial standardisation efforts to develop infrastructures to support the development of national firms' capabilities and the adoption of those international standards. Besides secondary qualitative sources of information, we will use data collected from a semistructured survey conducted between March and May 2004 to 62 firms that belong to salmon producers—including salmon egg producers, alvine producers (freshwater phase), salmon growers (saltwater phase), fishmeat processors (cutting, smoking, packing) and traders (exporters)—as well as two suppliers, net producers

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and feed producers.

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The revealed advantage ratio gives clear information on whether the intensity of certification in one sector is larger or smaller than the average world intensity. Values higher than one reveal higher than average intensity of certification. Values lower than one reveal lower than average intensity.

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The degree of integration of tasks among the sample is well spread from single tasking to multiple tasks, with over 50% of the firms conducting more than 3 functions (such as egg production, salmon growing and processing). Using this data, we analyse in detail the motivations of standards compliance to firms in the salmon industry. First, we illustrate the national and industrial efforts to support the competitiveness of this industry, in the last 20 years. Second, we explore the characteristics and the reasons recognised by salmon farmers to adopt different standards, using descriptive statistics. Third, we run LOGIT models to identify the factors that contribute most for compliance to international management standards. The dependent variables are the dummy variable certification and categorical variable the level of compliance, which takes the value 1 if the firm finds that the standard is not necessary, 2 if the firm is planning to get a certification, 3 if the firm is in the certification process, 4 if the firm is certified. As independent variables, we include a set of categorical and dummy variables related to characteristics of firms, openness to international markets and capitals, collaborative arrangements for standards compliance and membership with the industrial association. In particular, we use categorical and ordinal variables containing information on the 10 ranges of export intensity of the firm (0%=0 and 100%=10), on the 4 ranges of share of foreign capital (100% national=1, 100% foreign=4), 4 ranges of sales (0-1.5=1, 1.501-5000=2, 5001-50,000=3, 50,001-100,000=4 thousand pesos of annual sales), firm age (count variable). Moreover, we include dummy variables which capture information on whether

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the firm is member of the Association of Chilean Salmon Industry (Assoication) , engaged in collaboration with clients for standards compliance, engaged in collaboration with suppliers for standards compliance as well as if the firm has more or less than 20% of professional and technical staff, and whether it has past experience in participating in local standardisation events.

#### 4. Certification in South Latin America

In this section, we analyse the diffusion pattern of certificates in South American countries, exploring differences with world average as well as the relationship between the internationalisation of South Latin America countries and certification.

#### 4.1 Pattern of diffusion of ISO 9000 and ISO 14001 certificates in Latin America

Since 2000, the growth rate of ISO 9000 and ISO 14001 certificates in South American countries (i.e. Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela) has been higher than the world average growth, especially for the ISO 14001. In 1996, the total number of ISO 9000 certificates in South American countries represented one percent of the total world certificates issued. In 2000, when the ISO 9000:2000 was published, obliging a firm to build a quality system that comprises design, production, and product inspection and testing (ISO, 2000), the certificates in these countries already represented 2.5 percent of the world total. Given the efforts required to conform to the new standard, in 2005, this share did not overcome the 3 percent. The number of ISO 14001 certificates in South American countries represented around 2 percent of the world total, until 2001. This share increases significantly after 2001, reaching the 3 percent of world total in 2004.

Analysing the share of these certificates by country in SA, we find that in 2005, Brazil is the leading country in the number of certificates with 39% of the certificates, followed by Argentina (26%) and Colombia (23%). Chile occupies the fourth place, with more than one thousand certificates (5%). The diffusion of ISO 14001 seems still to be more skewed.

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APSTCAssociacion de Productores de Salmon y Trucha de Chile, later became SalmonChile.

Brazil is still the leader with 63% of the certificates in 2005, followed by Argentina (13%) and Chile and Colombia (8%). It is worth of referring that in 2000, the distribution of ISO 9000 certificates resembled the distribution of ISO 14001 in 2005.

When considering the number of ISO 9000 certificates per number of employees, we find instead that Argentina and Uruguay have a higher rate of certificates per employee in 2005 (3 certificates per 10.000 employees in 2005) followed by Chile and Colombia with 2 certificates per 10.000 employees. Brazil comes next with less than one certificate per 10.000 employees. Concerning ISO 14001 certificates, Chile has the highest number of certificates 0.4 per 10.000 employees, followed by Uruguay (0.3), Argentina, Brazil (0.2) and Colombia (0.1). The ranking of countries maintains, if we consider instead the number of certificates per GDP constant at 2000 prices, in dollars.

Table 1 column 2 and 5 shows the share of ISO 9000 and ISO 14001 certificates by industry across the world in 2005. Results suggest that the highest average number of ISO 9000 and ISO 14001 certificates are concentrated on construction, basic and fabricated material, electrical equipment, machinery and equipment and wholesales, followed by other services, rubber and chemicals, food, and transport, storage and communication. Instead the



least adopting sectors are water, gas supply, publishing, shipbuilding, aerospace, wood products, publishing and nuclear fuels. A similar industrial pattern is found within the SA (Table 1, column 1 and 4). However, the revealed advantage ratios (Table 1, column 3 and 6) suggest that sectors related to the exploration and manufacturing of natural and energetic resources (i.e. food, coke and petroleum, pulp and paper, mining, nonmetallic mineral products, rubber and plastic, agriculture and fishing, concrete, leather,) tend to have a greater relative share of certificates in SA than the world average. Pharmaceuticals, chemicals and services related to the energy supply, transport and distribution, and health and social services have considerable higher share of certificates than the world average. Instead, manufacturing sectors related to machinery and equipment, electrical and optical equipment, other transport equipment and wholesales have a lower concentration of certificates in SA than the world average.

Note of reference is the fact that in Chile, the share of ISO 9000 certificates in food industry is 5.7 times higher than the world average, while the share of ISO 14001 is 14.2 times higher. In section 4.2, we explore the reasons and facilitators for this early involvement of agricultural and food industry, especially of the Chilean salmon industry, in complying with international management standards.

Table 1: Industrial revealed advantages in the number of ISO 9000 and ISO 14001 certificates, in South Latin America compared with world average

	ISO 9000 industrial shares		SA revealed advantages	ISO 14001 industrial shares		SA revealed advantages		
	SA			World			SA	World
Nuclear fuel	0.2%	0.0%	10.09	0.0%	0.3%	0.14		
Publishing companies	0.3%	0.1%	2.77	0.0%	0.1%	0.29		
Gas supply	0.2%	0.1%	1.41	0.1%	0.4%	0.20		
Shipbuilding	0.2%	0.2%	0.97	0.0%	0.1%	0.32		
Aerospace	0.4%	0.2%	2.36	0.1%	0.2%	0.87		
Recycling	0.2%	0.2%	0.64	0.5%	3.0%	0.18		
Water supply	0.5%	0.2%	1.98	0.7%	0.7%	1.05		
Manufacture of coke & petroleum products	0.4%	0.3%	1.26	2.9%	0.9%	3.10		

Mining and quarrying	0.5%	0.4%	1.36	6.1%	1.0%	5.89
Leather and leather products	0.6%	0.4%	1.71	0.3%	0.3%	0.90
Electricity supply	0.7%	0.4%	2.05	4.1%	1.7%	2.45
Pharmaceuticals	1.5%	0.5%	3.33	0.9%	0.8%	1.08
Hotels and restaurants	0.5%	0.6%	0.88	0.7%	0.9%	0.84
Public administration	0.8%	0.7%	1.19	0.2%	1.3%	0.13
Manufacture of wood and wood products	0.4%	0.8%	0.50	0.5%	0.8%	0.62

Agriculture, Fishing and Forestry	0.6%	1.0%	0.68	3.3%	1.7%	1.98
Pulp, paper and paper products	1.2%	1.0%	1.27	1.2%	1.7%	0.71
Printing companies	1.0%	1.0%	1.03	0.3%	1.4%	0.26
Other social services	1.6%	1.1%	1.39	1.9%	4.8%	0.40
Manufacturing not elsewhere classified	0.8%	1.2%	0.65	0.9%	1.0%	0.85
Nonmetallic mineral products	1.8%	1.5%	1.22	0.7%	1.3%	0.56
Concrete, cement, lime, plaster etc.	1.5%	1.5%	1.01	1.6%	1.0%	1.51
Financial intermediation, real estate, renting	1.8%	1.7%	1.04	0.2%	0.9%	0.24
Textiles and textile products	1.6%	1.8%	0.86	1.7%	1.4%	1.26
Other transport equipment	1.4%	2.1%	0.68	4.8%	3.3%	1.47
Information technology	2.9%	2.1%	1.38	0.9%	0.9%	1.01
Education	1.3%	2.1%	0.60	0.4%	0.4%	0.92
Health and social work	3.7%	2.2%	1.70	0.9%	0.5%	1.81
Engineering services	3.2%	3.5%	0.91	2.0%	2.6%	0.76
Chemicals, chemical products & fibres	5.7%	3.9%	1.46	9.1%	6.0%	1.51
Transport, storage and communication	7.1%	3.9%	1.84	8.9%	4.0%	2.23
Food products, beverage and tobacco	4.6%	4.2%	1.09	12.4%	4.7%	2.62
Rubber and plastic products	4.9%	4.4%	1.11	3.8%	5.8%	0.66
Other Services	10.1%	5.7%	1.77	3.6%	3.7%	0.98
Wholesale & retail trade; repairs	4.1%	7.2%	0.57	2.7%	6.7%	0.41
Machinery and equipment	1.8%	7.4%	0.24	2.8%	5.9%	0.48
Electrical and optical equipment	7.0%	9.4%	0.74	7.2%	11.0%	0.65
Basic metal & fabricated metal products	11.8%	11.4%	1.04	7.7%	9.6%	0.81
Construction	10.9%	13.6%	0.80	3.6%	7.1%	0.50

Source: ISO Survey 2005, elaboration of the authors

## 4.2 Impact of national internationalisation pattern and diffusion of certification

Table 2 shows the negative binomial estimates for the number of ISO 9000 and ISO 14001 certificates in South American countries (i.e. Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela). Results suggest that the randomeffect model without country variables produce the best fit; consequently, we will only analyse those estimators.

The number of ISO 9000 issues in South American countries depends positively on time, level of national income per capita, growth rate of payments of royalties and licences abroad, growth rate of intensity FDI and share of services on GDP, and to a less extent export intensity. These results suggest that ISO 9000 diffusion is positively associated with national levels of development in terms of income and size of service sector as well as to the degree of internationalisation of national firms, in particular increasingly use of foreign knowledge and property rights, increasing openness to international capitals, and to

a less extent to international markets.

Table 2: Estimates of Negative binomial regression for the number of ISO 9000 and ISO 14001 certificates (lagged 2 years) in South Latin America

	ISO 9000			ISO 14001		
	Fixed effects	Random effects	Random effects	Fixed effects	Random effects	Random effects
Constant	507.9*** 53.69	471.42*** 52.63	227.6** 100.77	905.8*** 85.60	799*** 67.45	709.8*** 144.23
Year	0.25*** 0.03	0.23*** 0.03	0.05 0.07	0.45*** 0.04	0.39*** 0.03	0.35*** 0.10
Ln (size of national labour population)	0.14 0.27	0.21 0.32	6.54*** 2.00	0.37 0.24	0.71*** 0.18	0.53 3.09
GDP PPP	0.0003*** 0.00	0.0003*** 0.00	0.0004*** 0.00	0.00 0.00	0.0003*** 0.00	0.0005*** 0.00
Share export on the GDP	0.02 0.02	0.04* 0.02	0.1*** 0.01	0.04** 0.02	0.03* 0.02	0.02 0.02
Share royalties on the GDP	1.18 0.95	0.46 1.05	1.62* 0.86	1.48 1.42	1.22 1.30	3.15** 1.26
Share FDI on the GDP	0.04 0.03	0.03 0.03	0.04 0.02	0.08* 0.04	0.05 0.04	0.1*** 0.04
Share services on the GDP	0.04* 0.02	0.05** 0.02	0.11*** 0.01	0.02 0.01	0.02 0.01	0.03*** 0.01
Growth rate services	0.00 0.01	0.00 0.01	0.01 0.01	0.01 0.01	0.01 0.01	0.02 0.01
Growth rate royalties	0.01** 0.01	0.01** 0.01	0.01** 0.01	0.01 0.01	0.01 0.01	0.01 0.01
Share gross fixed capital	0.04* 0.02	0.03 0.03	0.00 0.02	0.01 0.03	0.01 0.02	0.00 0.02
Share high technology export	0.01 0.01	0.01 0.02	0.08*** 0.01	0.01 0.01	0.02** 0.01	0.02** 0.01
Growth rate of FDI	0.14** 0.06	0.12** 0.06	0.01 0.04	0.18** 0.08	0.15** 0.07	0.19** 0.07
country dummies			Significant			Non Significant
/ln_r		0.15 0.47	16.39 93.77		1.36 0.60	18.47 219.76
/ln_s		3.45 0.67	19.94 93.77		2.65 0.74	19.83 219.76
Observations	104	104	104	86	86	86
Wald chi2	582.21***	572.33***	3763.85***	648.66***	924.09***	4212.52***
df	12	12	21	12	12	21

Log likelihood	521.17752	616.65304	593.10164	246.98808	315.07845	297.84213
Likelihoodratio test vs. pooled: chibar2(01) =	0.00	44.76***	0.1		51.8***	0.1
Prob>=chibar2						

The number of ISO 14001 certificates is positively affected by time, level of national income per capita, share of high technology exports and growth rate of FDI intensity. Results suggest that ISO 14001 diffusion in SA is associated with the level of national development revealing that a more demanding customer base affects positively diffusion of environmental standards. Moreover, it depends also the level of openness to international capital, as well as on the hightechnology intensity of national exports.

All in all, these results suggest that internationalisation as well as the economic development of South American economies seems to be the main factors affecting the diffusion of the quality and environmental standards. Furthermore, in South America, ISO 14001 certification seems still to be a market signal for firms' quality and high technology, the same does not seem to be still found for the ISO 9000 certification, as the signs and significance of the share of high technology exports suggest.

## 5. Chilean Salmon Industry

According to UNIDO (2005), food industry is considered as an outlier that has lower compliance level with international standards despite high proportion of exports. In Chile, however, food industry is the sector with highest revealed advantages, compared with the rest of the world, in using ISO 9000 and 14001. Chilean salmon industry, in particular, exports more than 90% of their production mainly to USA, Japan and Europe. The conformity to international standards, hence, is crucial for the competitiveness of the industry. In this section, we analyse the diffusion of conformance and certification with international standards in the Chilean salmon industry and explore the factors that facilitate this process.

Since the mid 1980s, several initiatives to control quality of the product to enhance international competitiveness were undertaken. The first attempt to develop a quality

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standard for Chilean salmon was undertaken by the private sector. In 1987, the Association with the technical cooperation of the FundacionChile, the private run institution with public purpose to promote technological transfer, created the private standards called 'quality seal' (sello de calidad) and 'code of best practice' (codigo de practica). The quality seal, a private voluntary standard, outlined the sanitary procedures for the fish processing plant, for exports. The Association monitored and controlled this certification, enforcing that all exporting members to comply with this certification. In this way, the Association aimed at controlling and differentiating the quality of the products of member firms. This effort of Association had contributed to the success in enhancing competitiveness as Chile

became the number two exporter of farmed salmon in 1992.

The public sector followed this private initiative. In particular, in 1985, The National Fishery Service (Servicio Nacional de Pesca: SERNAP, later SERNAPESCA) started developing the guideline, POS (Procedimiento Operacion de Saneamiento, Sanitary operation procedure), based on the international standard HACCP Hazard Analysis and Critical Control Point. From the mid 1990s, SERNAPESCA started to monitor and regulate this standard (PAC Programa asegureamiento de Calidad, hereafter mention as HACCPPP) for the fishery products that are exported (interview SERNAPESCA, 2004). Hence, all the fish processing plants producing for exporting need to comply with this standards, and SERNAPESCA became official responsible agent in enforce that requirement. The same procedure is later followed with HACCPCC, HACCP for cultivation centre, which was introduced in the early 2000s. The introduction of HACCPPP by SERNAP in the mid 1990s replaced the privately initiated “quality seal” (Alvial, 2005).

The involvement of public sector in the standardization of quality standards control and in the certification ensured transparency in the certification system and consequently the wider diffusion of standards. These efforts permitted firms to reduce transaction costs in searching

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The Association of Salmon and Trout Producers of Chile (APST) was established in 1986 by salmon producers . In 2001, the membership was extended to suppliers and its name changed to Association of Salmon Industry in Chile (SalmonChile).

for the information, technical assistance as well as to ensure firms of its international credibility, over and above, supporting technically in decodifying the standards to the specificity of sector and local context and recodifying to facilitate further the compliance.

In the 2000s, international environmental concerns increased and some Chilean salmon producers started obtaining ISO 14001 certification. Aiming at responding to the market

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demand, in 2002, the Association and the public sector developed the protocol Acuerdo de Produccion Limpia (APL), Cleaner Production Agreement, to ensure that Association members would meet the target agreed on environmental issues. From 2004, firms, which participated and complied with the target set by the APL, were given the APL certificate. Despite being a voluntary scheme at industry level, this collaboration between industry and the public sector towards the setting of national environmental standards ensured the transparency in monitoring and regulation (Interview with SalmonChile, 2004).

In 2003, the Association created SIGEs (Sistema Integrada de GEstions: Integrated Management System) as a voluntary scheme that incorporate several standards. Designed to facilitate the compliance with all the important standards in the salmon industry, SIGes

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aimed to become the umbrella standards for the salmon sector. Consequently, SIGes is expected to demonstrate a signal of the firms’ engagement on compliance with international

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standards, such as ISO 9000, ISO 14001 and OHSAS 18000.

Parallel to above, the Undersecretary of Fishery established sectoral regulation on environment (RAMA in 2001) and sanitation (RESA in 2002), involving a committee of representatives of various private aquaculture associations. This participatory regulatory process allowed policymakers to get information on the latest development on the market and technology as well as on the local specific conditions in which firms were operating. “The time is over, when it was possible to ‘copy and paste’ regulations of international organization or of developed countries” if the aim is to develop a regulatory system that achieves a specific solution for the national industry, which competitive and operative environment is changing at incredible rapid pace (interview ArmadaChile, 2004).

Overall, conscious efforts were made by both private and public sector in guiding firms to better performance by means of standards. We will now proceed to the analysis of the level of compliance with the different national and international standards among the salmon producers and some suppliers (feed and net) firms. Table 3 shows for each standard, which has been recognised as important for the salmon industry, the number of firms in each level of compliance. Results suggest that the national HACCPPP is the most widespread standard among salmon producers, followed by ISO 9000 and HACCPCC. A group of industrial, national and international standards follow these ones, such as SIGes, ISO 14001 and OHSAS 18000.

The high positive and significant Spearman's correlation coefficients between the levels of compliance of different standards suggests that conformance with national standards is not a substitute for conformance with international standards. Consequently, the industrial and national efforts towards standardisation and codification of quality, safety and environmental bestpractices seem to support national firms to upgrade their capabilities to conform with international standards. The conformance with national quality and safety

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The agreement was made between a national and industrial group of regulatory bodies for environmental issues on fishery and a group of firms.

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The SIGes includes the elements of: APL, RAMA, RESA, Code of good practice for environment, ISO 14000, ISO 9000, Ohsas 18000, Safe quality food (SQ|F), HACPPPP, HACCPCC RCA (Environmental qualification Resolution). SIGes conforms to Safe Quality Food standards of the Association of Salmon Farming in Canada and the USA. It is also currently used by WalMart in its procurement of salmon.

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OHSAS18001 is the Occupational Health and Safety Zone management specification, created by a group of the world's leading national standards bodies, certification bodies, and specialist consultancies.

standards may allow firms to develop the capabilities to certify with international standards.

Table 3: The level of compliance with international and national standards by Chilean firms in Salmon Industry

Share of

	No answer	Not necessary	Planning	In process	Certified	Total answers	certified firms
ISO 9000	16	6	19	11	10	46	21.7
ISO 14001	18	12	19	9	4	44	9.1
OHSAS 18000	27	14	13	5	3	35	8.6
HACCPPP	25	8		3	26	37	70.3
HACCPCC	29	10	7	9	7	33	21.2
SIGes	28	13	7	11	3	34	8.8
APL	15	6	39		2	47	4.3

Source: survey data, 2004

Table 4: Reasons for compliance with standards. Average rating

Reasons	All firms (N=38)		Freshwater (N=20)		Cultivation (N=24)		Processing Plant (N=21)		Trading (N=22)		Feed (N=6)		Net (N=16)	
	M.	S.D	M.	S.D	M.	S.D	M	S.D	M	S.D	M.	S.D	M	S.D
Required by the association	2.41	2.07	2.35	1.98	2.54	2.13	3.09	1.90	2.78	2.09	3.00	2.10	4.91	1.18
Competitors have them	2.65	1.63	2.75	1.48	2.75	1.51	3.09	1.56	2.71	1.71	3.00	1.79	4.91	0.93
Required by the consumer	2.98	2.02	3.30	1.75	3.29	1.83	3.22	2.02	2.96	2.10	4.17	2.04	4.78	0.86
Improve the image of firm	4.38	1.07	4.55	0.51	4.38	0.92	4.64	0.49	4.39	1.08	5.00	0.00	4.10	1.04
Required by the Market	4.08	1.35	3.85	1.31	4.08	1.28	4.48	0.59	4.33	0.92	4.00	2.00	4.64	0.73
Required by the clients	4.18	1.24	4.20	1.01	4.25	1.03	4.30	1.18	4.17	1.31	5.00	0.00	4.78	0.69
To comply national regulation	3.75	1.69	3.75	1.48	3.71	1.71	3.87	1.69	3.92	1.68	2.83	2.04	4.55	1.07
Increase value added	3.63	1.71	3.80	1.28	3.96	1.23	3.74	1.63	3.83	1.52	3.67	1.86	4.83	0.95

Note 1: Source: survey data

Note 2: Some firms have operation in more than one function.

M average (1= not important , 5=very important, 0=don't know not applicable); SDstandard deviation

Firms were asked to rate from 1 to 5 (1not important to 5very important), the importance of a list of reasons for deciding to engage on conforming to standards. Table 4 shows the average importance of different reasons for standards compliance. Most firms say that they

engage in certification mainly due to the demand of customers and market pressure, but also for the improvement of their image. Other reasons such as competition, increased value-added, meeting national regulations, demand from the industry association, or consumer demand scored low. Therefore, conformance with standards seems mainly to be a reactive decision of firms to their customers' requests, in which the national standards might have had a role of guiding these firms into the certain direction.

Indeed, according to the MannWhitney test, exporters firms (export more than 50% of their production) and nonexporters (firms that export less than 50% of their production) differ significantly in their level of compliance with all these analysed standards, required to export. This seems to coincide with the view that firms will upgrade their capabilities and comply with global standards as they get access to foreign markets. Additionally, it reflects the importance of local institutions, which introduced and monitored adoption of nationally adapted international standards to pave a way towards the better compliance with global standards for exporting firms.

This empirical evidence demonstrates that the level of compliance with international standards might not only be a consequence of the interaction with global buyers, but also of the national efforts to improve the national quality, safety and environmental standards of salmon production. To understand the role of the international market pressure as well as of the national policy efforts towards standardisation and certification on the decision of Chilean salmon producers to obtain a certification with international standards, Ordinal and Binary Logit models are computed for the variable categorical level of compliance and for the dummy variable certification with international standards.

From the three Binary Logit models computed, only the one on the ISO 9000 certification is significant better than the intercept only model, as there were only 3 and 4 firms with OHSAS 18000 and ISO 14001 certification, respectively. Results suggest that ISO 9000 certification is more likely for firms that are members of the Association. Looking instead at the level of compliance, we find that the level of compliance ISO 9000 is expected to be higher for firms with larger sales, in other words to larger firms. The level of compliance with ISO 14001 is also expected to be higher for firms that are members of the Association as well as for firms that collaborate with suppliers in obtaining certification.

Therefore, besides size, being member of Association of Chilean Salmon Industry and cooperating with local suppliers are of major importance for compliance with international standards. As the earlier brief historical description suggests, being member of the APSTC reflects as well the willing of firms to improve their competencies and to maintain and reinforce their competitiveness in international markets. Additionally, it should be note that in the late 1990s and early 2000s, due to the market competition pressure, firms concentrated on their core activities and increased outsourcing of many activities that firms withheld (Montero, 2002). This process coincides with the emphasis on traceability of the food related products at international market. Therefore, as firms' dependence on suppliers of auxiliary activities increased significantly, conformance to international management standards increasingly requires collaboration with suppliers.



All in all, as put forward by the macro analysis and the analysis of the Chilean Salmon industry confirms, access to external market created in firms the need to comply with international standards. However, the analysis of the Chilean Salmon industry showed that external exposure alone would not enable firms to fulfil the standards required by multinationals or by the institutional and regulatory framework of developed countries. The national standardisation efforts together with producersupplier collaboration played a crucial role in supporting salmon farming firms to develop capabilities to conform to international standards and to obtain a certification.

The Kruskal Wallis test on the categorical variable for exporters shows as well significant differences in the compliance level with all standards across each range of exporters, except for ISO 9000.

## 6. Conclusions

This paper has aimed at exploring the motivations and facilitators underlying adoption of international quality and environmental standards, such as ISO 9000 and ISO 14001 by firms in SA. It has done that by analysing both aggregated data on the national and sectoral number of certificates in SA as well as firmlevel data on the process of compliance to international management standards in the Chilean salmon industry.

This paper has shown that SA firms have less than 3% of the total number of ISO 9000 and ISO 14001 certificates issued in the world. Moreover, in SA, the diffusion of these international management standards is wider than in the world average in industries related to the exploration and manufacturing of natural and energetic resources as well as in food, pharmaceuticals, chemicals, transport and distribution and health and social services, when compared with the rest of the world. Some of these sectors have the lowest shares of world certificates. However, these sectors are of particular importance in SA economies. Consequently, with the openness of SA economies to international markets and capitals, certification in these sectors increased faster than in the rest of the world.

Indeed, this paper has shown that the diffusion of these international standards in SA is positively associated with the national levels of development, including the development of service sector, as well as of internationalisation of markets and capital of SA firms. Thus, their diffusion seems to reveal the development and interaction with a more demanding customer base. Moreover, the diffusion of ISO 9000 certificates seems to reflect the increased use of foreign knowledge and copyrights, while the diffusion of ISO 14001 certificates reflects the level of technological intensive of exports.

Focusing on the Chilean salmon industry, we find that firms feel indeed the need to comply with international standards when aiming to access international markets, mainly due to request from customers in developed countries. However, the analysis of the Chilean Salmon industry showed that external exposure alone would not enable firms to fulfil the standards required by multinationals or by the institutional and regulatory framework of developed countries. Instead, firms' size, membership to the Association and collaboration with suppliers seem to be particularly important to explain the level of compliance of firms

with international standards. Consequently, international competitiveness of salmon farmers depends on firmlevel capability as well as ability to collectively mobilize resources towards technological and institutional improvement.

Hence, contrary to the conventional understanding, the international competitiveness of firms of catching up country may depend on the presence and development of institutional and technological infrastructures, which are essential to the upgrade of firms' capabilities and consequently their possibility to comply with international standards. In particular, our evidence suggests that the privatepublic collaboration in the designing of infrastructures and the producersupplier collaboration towards creating innovative responses to their market are crucial on the development of firms' capabilities, and consequently on for their international competitiveness. From this evidence, two policy implications come out.

First, internationalization of capitals and trade per se is not sufficient condition for the upgrade of national firms' capabilities. Selected and timely policy supports for the development of institutional and technological infrastructures are essential. Second, quicker and customised responses in changing environments increasingly require policies to facilitate different types of collaboration and alignment of interests. In the case of the food industry, fostering publicprivate collaboration takes even a greater dimension (Yoruk and von Tunzelmann, 2000).

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