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1 **Biosecurity institutions and the choice of contracts in international fruit supply chains**

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7 Abstract :

8 Biosecurity regulations and standards govern international agricultural inter-firm transactions.
9 Drawing mainly on new institutional economics, our study offers insights into the institutional
10 factors, at both the macro and meso levels, that influence the choice of inter-firm contracts for
11 Chilean apple exports. First and foremost, it examines the influence of the Sanitary and
12 Phytosanitary (SPS) provisions included in trade agreements signed by Chile with its trade
13 counterparts on the choice of alternative contracts displaying different degrees of
14 completeness. It also focuses on the institutions in the importing countries, the legal
15 institutions enforcing contracts, the efficiency of logistics and the effect of hidden informal
16 rules such as corruption, on the choice between free consignment, minimum guaranteed and
17 sale contracts. We also explore the private institutions, primarily linked to direct imports by
18 supermarkets. The results of our econometric analysis show that less complete contracts, i.e.
19 free consignment and minimum guaranteed arrangements, are chosen when exporting to
20 countries with safe business environments and higher number of SPS provision in
21 international trade agreements. On the contrary, when exporting to non-reliable countries,
22 exporters tend to protect themselves through more complete contracts, i.e. sale contracts. We
23 found evidence that direct exports to supermarkets are more prone to occur under sale
24 contracts which suggest the dual function of contracts, both as a safeguard and as a
25 coordination tool to adopt specific customers' requirements.

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26

27 **1. Introduction**

28 Driven by the proliferation of free-trade agreements, trade has grown substantially in
29 recent decades (Swinnen & Maertens, 2007; Swinnen & Vandemoortele, 2011). This
30 development has been made possible through the reduction of tariff barriers on goods and
31 services, together with the development of a more suitable institutional framework for trade
32 (Chen & Mattoo, 2008; Dür, Baccini & Elsig, 2014; Reardon & Timmer, 2012). However, the
33 expansion of commerce increased the biosecurity risks jeopardizing human, animal and plant
34 health, i.e. the introduction of contaminated food, or a plant pest, which might damage a
35 particular crop. Consequently, both public and private actors have adopted severe regulations
36 and standards concerning biosecurity as sanitary and phytosanitary (SPS) institutions to
37 prevent, control and manage these risks (Swinnen & Maertens, 2007; Codron, Giraud-Héraud
38 & Soler, 2005; Reardon & Timmer, 2012; Fulponi, 2006).

39 Problems of market access may arise at distinctive institutional levels. At a macro level,
40 at which rules such as trade policy, international agreements and import conditions are defined
41 (Anderson & Van Wincoop, 2004; Horn, Maggi, & Staiger, 2010), and at a meso level with
42 rules affecting particular sectors, industries or products (Ménard, 2018; Ménard, 2017; Swinnen
43 Maertens, 2007; Engler, Nahuelhual, Cofré & Barrena, 2012; Rigod, 2013). Economic actors
44 carrying out transactions at the micro level are influenced by the general rules of the macro-
45 institutional level and by the specific rules of the meso-institutional level (Ménard, 2017).

46 A large panel of studies has focused on the impact of trade agreements, and more
47 particularly non-tariff measures, on aggregate trade flows (Anderson & Van Wincoop, 2004;
48 Disdier, Fontagné & Mimouni, 2008; Fulponi & Engler, 2013). Studies following in the
49 tradition of transactional economics have studied the new organization of procurement systems
50 through the centralization of retailers' purchases and dedicated wholesalers (Berdegué *et al.*,

51 2005; Gereffi, Humphrey & Sturgeon, 2005; Reardon & Timmer, 2012; Swinnen & Maertens,
52 2007), the effect of institutional changes concerning quality and food safety on supply chain
53 governance (Berdegué *et al.*, 2005; Fulponi, 2006), and on the inter-firm contract formalization
54 and design (Mazé, 2002). The contribution of our paper is twofold. First, to the academic
55 literature because the relationship between SPS institutions, as those negotiated through
56 international trade agreements, and the inter-firm transactions is, to the best of our knowledge,
57 absent from this literature. Second, our approach of SPS institutions is more systematic because
58 we take into consideration both sanitary institutions to protect human health, e.g. food safety,
59 and phytosanitary institutions related to plant health, eg. measures to avoid the spread of plant
60 pests through trade. This is important because it has management implications for growers,
61 exporters and other actors of the supply chains.

62 In light of the topic studied, the main body of references explored here is that of the
63 New Institutional Economics (NEI). In the Northian tradition, institutions affect the adjustment
64 among alternative modes of the governance and formal institutions aim at reducing the
65 uncertainty surrounding the exchange of goods while minimizing transaction costs (North,
66 1990; Williamson, 1996; Ménard, 2017). Williamson's work on contractual governance, which
67 we also explore in this study, demonstrates the interaction between the institutional
68 environment, the governance of transactions, i.e contracts, and the individual level
69 (Williamson, 1996:223). If an institutional environment is deemed to be given, transaction costs
70 theory (Williamson, 1996) is most often called on. However, if the institutional environment
71 changes (over time or in space) and becomes a major source of risks for international
72 transactions, the institutional approaches implemented are more comparative (North, 1990,
73 1991). We also resort to agricultural and food systems literature on the relation between
74 institutions and the governance of economic actors. Recent studies explore the role of food
75 safety, quality, social and environmental standards in shaping the evolution of agri-food

76 systems (Ericksen *et al.*, 2010; Fulponi, 2006). The effect of power domestic and global food
77 chains on decision making and control over production and control decisions of firms' on food
78 quality at the stages of production, processing and trade (Waterlander *et al.*, 2018; Stephens *et*
79 *al.*, 2018; Ericksen *et al.*, 2010).

80 Our study offers insights into the institutional factors, at both the macro and meso levels,
81 that influence the choice of inter-firm contracts for Chilean apple exports. First and foremost,
82 it examines the influence of the SPS provisions included in trade agreements signed by Chile
83 with trade counterparts, and the background institutions in the importing country, the
84 enforceability of contracts (Morrissey & Graves, 2008, Rodrik, 2000, North, 1981), the level
85 of corruption (Cuervo-Cazurra, 2016), the efficiency of the logistics services (Pirrong, 1993;
86 Masten, 2000) and official and private meso institutions (Ménard, 2012, 2017), primarily linked
87 to direct imports by supermarkets, on the choice of alternative contracts displaying different
88 degrees of completeness (Pavez & Codron, 2018). This case study is particularly interesting in
89 that long-distance exports of perishable products are characterized by a high level of price and
90 quality uncertainty and pose acute inter-firm coordination risks; and in that Chile, a major fruit
91 trade player, has developed one of the most dynamic trade agreement negotiating processes in
92 the world (Stallings, 2009; Fulponi & Engler, 2013).

93
94 Calling on non-declaratory micro-data, our paper provides a quantitative analysis
95 testing. This type of quantitative analysis is, to the best of our knowledge, rare in academic
96 literature. It has been made possible by i) access to a customs database providing contract data
97 for all apple transactions conducted by Chilean exporters around the world; and ii) access to
98 another transactions database identifying the name of the exporters' customers and, through in-
99 depth online research, the nature of these customers (supermarkets or conventional importers).

100 Our results show that a higher number of SPS provisions within trade agreements makes
101 the rules clearer and reduces uncertainty in the institutional environment, with firms

102 consequently tending to resort to less complete contracts, i.e consignment contracts, in which
103 prices are not established ex-ante. In contrast, as the level of corruption in the importing country
104 increases, risks with regards to whether and how rules are interpreted and enforced increases
105 (Cuervo-Cazurra, 2016) and compliance with SPS institutions becomes more complex, firms
106 must protect themselves through more complete contracts by fixing the price before exporting,
107 i.e. sale contract. We also observe that firms exporting directly to supermarkets are also more
108 likely to call on more complete contracts, a fact which reveals the coordination function of
109 contracts (Schepker *et al.*, 2014; Williamson, 1996; Mazé, 2002).

110 **2. Conceptual background**

111
112 Within the agricultural research community that apply the NEI and Agricultural Systems
113 approaches, it is well acknowledged that the combination of natural, socioeconomic and
114 institutional factors, among others, is source of complexity affecting the governance within the
115 agrifood sector (Ericksen *et al.*, 2010; Fulponi, 2006; Jaffee, 1992; Masten, 2000; Ménard,
116 2018; Stephens *et al.*, 2018; Waterlander *et al.*, 2018). The effectiveness of an economic system
117 strongly depends on how actors conduct their activities and how the process of exchange is
118 governed (Coase,1937).

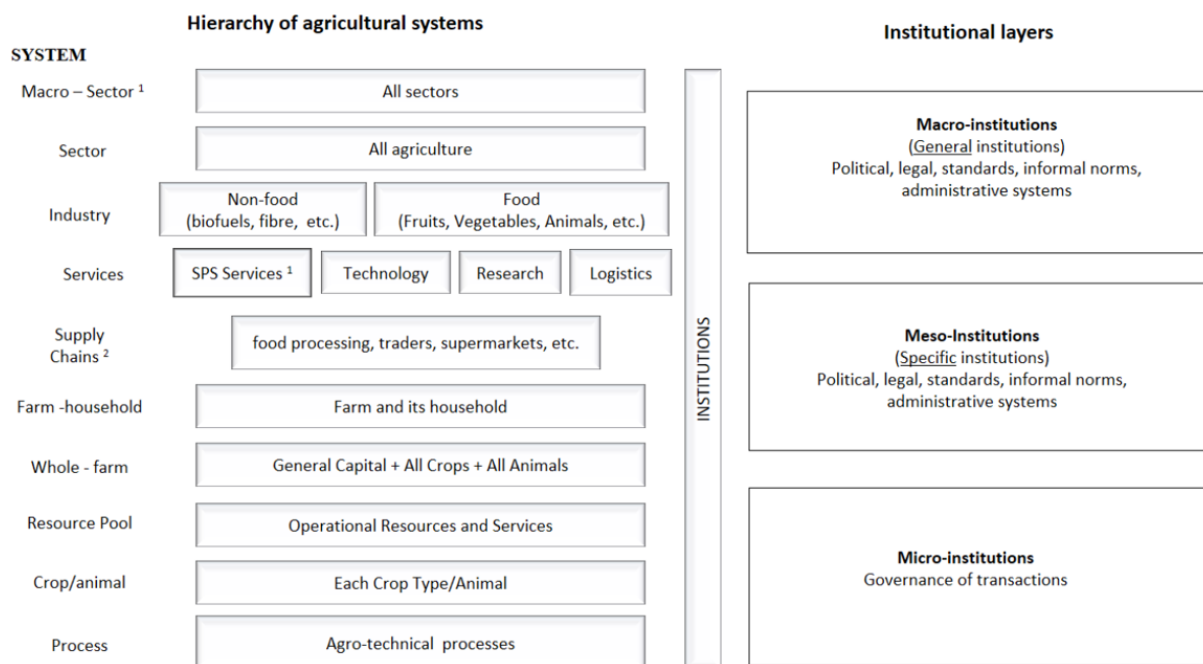
119 The NEI literature addresses the governance choice using mainly two complementary branches
120 of research: North's work on institutional analysis of the background conditions that provide
121 the framework for transactions, and the second branch, led by Williamson, is predominantly
122 concerned with, the governance of contractual relations (North, 1990; Williamson, 1979,1996).
123 Trade interactions are subject to transactions costs, e.g. searching, price discovering,
124 negotiation and enforcement costs, and as Coase (1937) asserts "when it is costly to transact,
125 institutions matter". The term institution is extensive used in several disciplines, as economics,
126 sociology, politics, geography, and there is no unanimity in the definition of the concept
127 (Hodgson, 2006). In this article we adhere to North's definition: "Institutions are the rules of

128 the game in society or, more formally, are the humanly devised constraints that shape human
129 interaction. In consequence they structure incentives in human exchange, whether political,
130 social, or economic” (North, 1990, p. 3). Institutions can be formal, when enforceable by a third
131 legal party, as property rights, polity, judiciary and bureaucracy (North, 1981; North, 1990;
132 Anderson & Van Wincoop, 2004) or informal, such as customs, norms, beliefs, sanctions,
133 taboos, traditions, codes of conduct, traditions and religion (North, 1991; Williamson, 2000).
134 Although, NEI literature operates mostly at the level of governance and at the institutional
135 environment of formal institutions (Williamson, 2000). Williamson agrees with North (1991)
136 in that informal institutions have a persistent influence on economies, e.g. corruption can be
137 severely problematic and undermine the respect of formal rules and limit the effectiveness of
138 law enforcement (Williamson, 2000). As posed by Hodgson, the dividing line between formal
139 and informal institutions is difficult because formal institutions depend on the informal ones in
140 order to operate (Hodgson, 2006).

141 Williamson’s work acknowledges that the governance of contractual relations does not occur
142 in isolation, it varies with the context defined by the institutional environment (Williamson,
143 1996). Williamson proposes an institutional layer scheme that shows the interaction at three
144 levels: (i) the institutional environment (the rules of the game); (ii) the governance (the play of
145 the game), and (iii) the individual level (Williamson, 1996, p. 223). Ménard's work in
146 institutional analysis and governance applied to agricultural and other specific sectors is rich in
147 lessons (Ménard, 2018, 2017, 2012). Building mainly on North (1990, 1991), Williamson
148 (1996, 2000), the author apprehends the functioning of institutions, both formal or informal, as
149 a system constituted by layers. This is much in line with Williamson three-level institutional
150 layer schema (Williamson, 1996), and with Hodgson’s definition of institutions as “integrated
151 systems of rules that structure social interactions” (Hodgson, 2015). Ménard (2017)
152 disentangles institutions in three levels: the macro-level, where general institutions are defined,

153 the meso-level where the general rules are translated into specific guidelines and to mechanisms
154 that shape their implementation; and the micro-level, where the economic actors take decisions
155 on the institutions of governance, e.g. contracts (Fig.1).

156 (Ericksen *et al.*, 2010). Complexity of agricultural systems further increases because of the
157 multilevel interactions with feedback loops between the farm the economic and natural
158 resources, and the enterprises relations within supply chains (Stephens *et al.*, 2018). As
159 Stephens *et al.* (2018) assert, agricultural systems approach often considers the relationships
160 within and between hierarchical levels using as basis the analytical frame proposed by
161 McConnell & Dillon (1997). This analytical frame (Fig. 1) is built using a hierarchical
162 classification within a sectoral system. At the highest level is what the authors call “all
163 agriculture” with subordinate subsystems or subsectors, i.e. services for agriculture,
164 commodity-based industry and individual farm-household subsystems. The lower level systems
165 relate to farms enterprises and to the agro-technical activities at the plot, farm or landscape
166 level. In figure 1, we added a level related to supply chains to take into consideration the new
167 developments of researches on agricultural systems that show the increasing importance of
168 processing enterprises, traders, supermarkets in food systems (Stephens *et al.*, 2018), we also
169 added a macro sector level because agriculture is not isolated from other sectors, financial,
170 health, education, research, among others.



171
 172 Note: Hierarchy of agricultural systems by McConnell and Dillon (1997); ¹ Macro sector and SPS services added by this study;
 173 ² Supply chains level added according to Stephens et al. (2018); Institutional layers (Ménard, 2017)
 174
 175

Figure 1. Hierarchy of agricultural systems and institutional layers.

176
 177 Although McConnell & Dillon (1997) do not highlight the role of institutions in shaping
 178 the agricultural systems, it is at the farm level where growers and exporters take decisions about
 179 the production practices to comply with the diversity of SPS requirements by the official
 180 authorities and by the downstream actors in the supply chain. Ménard’s (2017: 6) approach
 181 facilitates an understanding of the complexity of adhering to the SPS institutions that govern
 182 international fresh fruit transactions. A number of characteristics generate this complexity: (a)
 183 the diversity of institutions embedded in SPS management, cover a large spectrum of
 184 technological, economic, environmental, and health issues; (b) the multi-level institutional and
 185 decision-making systems involved (e.g. the Agreement on the Application of Sanitary and
 186 Phytosanitary Measures¹ “SPS Agreement” of the World Trade Organization (WTO), the
 187 bilateral trade agreements signed between countries or economic regions that include SPS

¹ The terms measures in the SPS Agreement they refer to any legislation, decrees or official procedures and international standards. https://www.wto.org/english/tratop_e/sps_e/sps_handbook_cbt_e/c2s2p1_e.htm#txt1

188 provisions or clauses; the country or product specific SPS regulations and private standards;
189 and, (c) the existence of multiple uses or users of the resources with potentially conflicting
190 goals. While sanitary institutions seek to protect human health, e.g. food safety, phytosanitary
191 institutions aim at protecting plant health, e.g. specific treatments to control plant diseases. Par
192 example. the use of plant protection pesticides at the farm level, may have detrimental effects
193 on human health and environment.

194

195 **2.1 Research context**

196

197 **Chile case**

198 Some 94% of Chile's exports are governed by trade agreements (Direcon, 2015). The
199 country opened to international competition in the mid-70s. Structural reforms were
200 implemented such as the reduction of state intervention, e.g. the liberalization of land, labor and
201 transport markets, coupled with the empowerment of the private sector and policies promoting
202 exports (Stallings, 2009). Export logistics services were modernized and the performance of
203 the cargo handling capacity was improved. Furthermore, in addition to agricultural
204 improvements, the country opted to align the public-private capacities on SPS matters with the
205 very highest standards on a wide variety of markets (Engler *et al.*, 2012). Nowadays, Chile is
206 the southern hemisphere's largest exporter of fruit (USD 4,000 million). Apples and grapes are
207 the main products, accounting for over 59 percent of fresh fruit exports from the southern
208 hemisphere. Exports are shipped to more than 100 countries, the main markets being the US
209 (USD 1,472 million), China (USD 415 million), Netherlands (USD 415 million) and the United
210 Kingdom (USD 187 million) (Odepa, 2015). Interestingly, these main markets impose the most
211 stringent SPS measures. For example, the US has 90 restricted pests, 154 restricted diseases
212 and 95 restricted weeds, followed by China with 11 restricted pests. In terms of sanitary
213 protection rules, in particular relating to maximum residue limits, the most severe are the

214 countries of the European Union. In these countries, official requirements and supermarkets'
215 private standards are both more stringent than the levels and numbers of regulated pesticides
216 established by the Codex standard of the World Trade Organization (WTO) (Engler *et al.*,
217 2012).

218 Price volatility and the resulting difficulty to anticipate the market prices, compounded
219 by environmental uncertainty and the difficulty in measuring and maintaining the quality of
220 perishable products throughout long-distance supply chains, play a key role in the design of
221 contracts in the fruit trade. Chilean fruit exports are governed by three main types of export
222 contracts: a) sale with fixed price contract, under which the importer takes possession of the
223 goods at the time of the sale, or at delivery when special conditions are required. The price of
224 the goods is fixed at the time of the sale which is concluded before the goods are shipped abroad;
225 b) guaranteed minimum, whereby the parties agree on a minimum price while maintaining the
226 possibility of improving the price after the sale on the destination market; and c) free
227 consignment, where the price of the good is left open and the exporter discovers the price after
228 the sale. The usual main clauses of these contracts are: product, quality, quantity, date and terms
229 of delivery, terms of payment. It is necessary to mention that the same importer, e.g. wholesaler,
230 product manager or supermarket, can alternatively use the three types of contracts as part of
231 their commercial strategy.

232 In accordance with transaction cost theory (TCT), The alternatives modes of governance
233 can be hierarchical, where transactions occur within the firm boundaries, or hybrids where
234 transactions occur between separate firms, e.g. inter-firm contracts, alliances, joint-ventures,
235 among others, or markets, in which the parties to a contract are independent, and identity does
236 not matter. The choice of governance depends on the transaction characteristics: asset
237 specificity arising when investments cannot be redeployed to alternative uses or users, the
238 frequency in which transactions occurs, and the uncertainty that may arise from the institutional

239 environment or from the transacting parties' behavior (Williamson, 1996). The transaction
240 hazards increase with the assets specificity, whether physical, human, site-specific, dedicated
241 assets, brand, and temporal specificity.

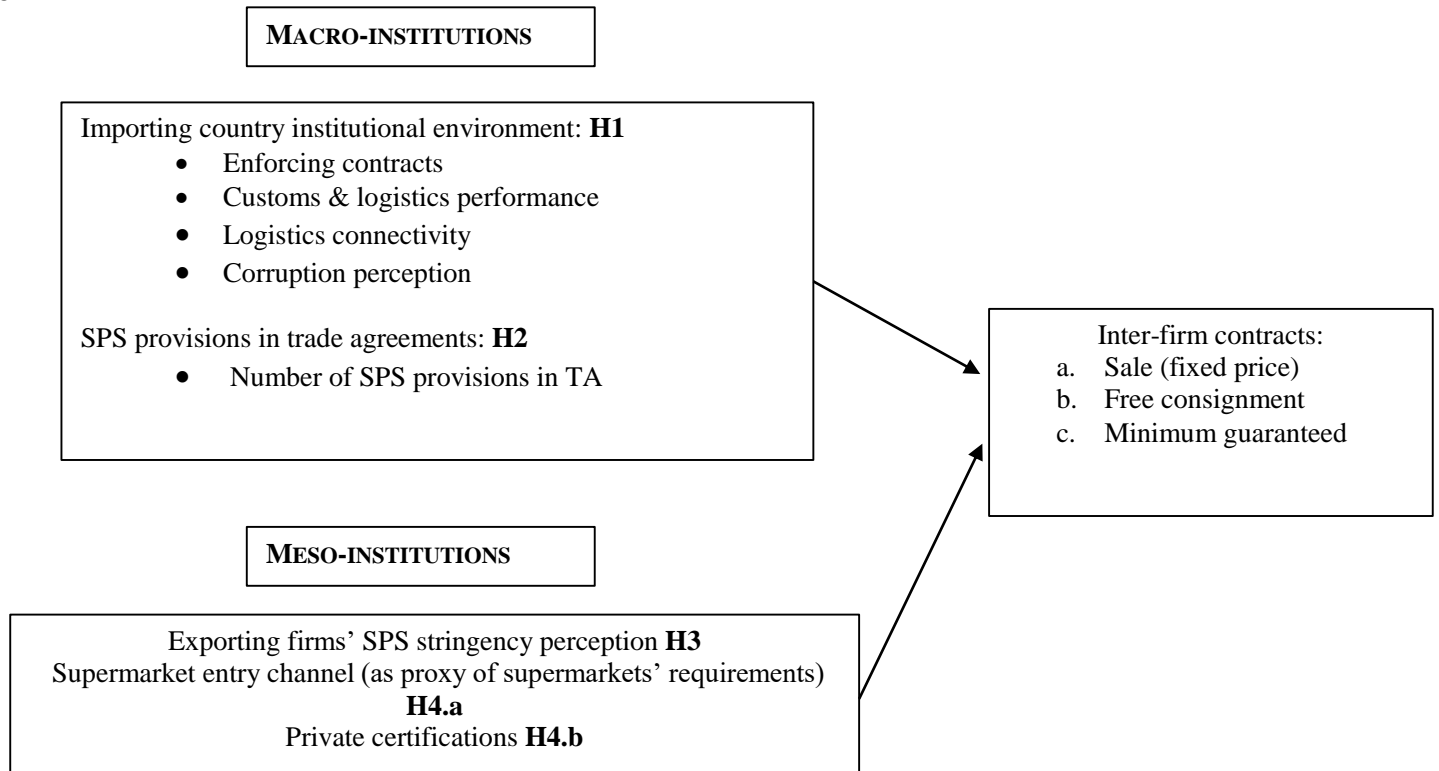
242 In this study, our primary emphasis is to demonstrate the relation between the
243 institutional uncertainty on the inter-firm contract choice, we also show the effect of temporal
244 specificity where timely performance is critical to the transaction (Masten, 2000). Contracts
245 remain incomplete (Williamson, 1996; Rodrik, 2000) although to differing degrees (Crocker &
246 Masten, 1988; Crocker & Reynolds, 1993). A contract is more complete than another if it
247 provides a more detailed definition of the transaction (Saussier, 2000:192). For products highly
248 sensitive to changes in prices, and to technological and quality uncertainty, the parties tend to
249 leave pricing provisions incomplete (Williamson, 1996; Crocker & Reynolds, 1993; Crocker &
250 Masten, 1988). Crocker & Reynolds (1993) classified procurement contracts by their price
251 provision: firm-fixed price contract, where the price is specified ex-ante with no possibility of
252 ex-post adjustments to prices; and the least complete contract, the "fixed-price incentive
253 successive targets" which allows for ex-post negotiation of prices. Following these authors can
254 argue that a sale contract (fixed price) is more complete than a free consignment (open price)
255 or a guaranteed minimum that is situated between the other two agreements (Pavez & Codron,
256 2018).

257 Contracts have both a safeguarding and coordination function (Williamson, 1996;
258 Schepker *et al.*, 2014). In terms of safeguarding, contracts can be used to adapt to uncertain
259 environments through provisions involving to alternative pricing arrangements (Schepker *et al.*,
260 2014; Mazé, 2002; Crocker & Reynolds, 1993). In the case of fruit trade, a sale contract offers
261 the exporter more protection, because prices are established ex-ante without possibility of ex-
262 post negotiation. In the case of a free consignment, the transaction is done without a settled
263 price at time of shipment with a high degree of information asymmetry as the exporter has little

264 means of verifying the true price at which the product is sold at the destination market, this type
265 of contract offers the exporters less protection, because when market conditions are
266 unfavorable, they can find themselves in a situation of liquidation with prices lower than
267 production costs. A guaranteed minimum price balances the risks between both parties. In terms
268 of coordination, when transactions are highly uncertain and complex, inter-firm contracts
269 require higher coordination and control provisions for monitoring whether process or outcomes.
270 SPS institutions structure the organization of production and supply chain management,
271 because when suppliers choose, or are chosen by buyers, to serve a market or a customer with
272 specific SPS requirements, a range of coordination schemes are put into operation:
273 communication, controls, inspections, certifications. The degree of coordination will depend on
274 the specificity of the SPS requirements (Codron, et al., 2018).

275 This raises one question: if sale contracts are more complete and offer more ex-ante
276 protection, why would exporters choose to export by means of free consignments or guaranteed
277 minimums? In the next section, we try to answer to this question, focusing on the institutional
278 factors that influence this contractual choice. The model we propose can be summarized as
279 follows:

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Figure 2. Model of the determinants of export contracts

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3.1 Environmental uncertainty: weakness, incompleteness and enforceability

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From a NEI perspective, the quality of the institutional environment weighs heavily on contract enforceability. All formal and informal institutions contribute to defining the institutional environment, and international transactions are especially sensitive. This is because differences between legal systems make arbitrations and judgments difficult (Morrissey & Graves, 2008), and may affect the recognition of decisions in foreign jurisdictions (Rodrik, 2000; Morrissey and Graves, 2008). According to Williamson (1996), variations in the quality of the institutional environment push economic agents to choose alternative modes of governance, in our case, different inter-firm contracts whereby “two or more partners pool strategic decision rights as well as property rights, while simultaneously keeping distinct ownership over key assets, so that they require specific devices to coordinate their joint activities and arbitrate the allocation of payoffs” (Ménard, 2012:2).

298 The weakness of institutions makes contracts difficult to enforce. Non-verifiability by a
299 third-party authority, either in court or through arbitration, due to a lack of information
300 concerning the detailed terms agreed by the contracting parties, the bounded rationality of the
301 third-party or a lack of technical knowledge with respect to the transaction could generate acute
302 enforcement problems (Williamson, 1979).

303 In the same vein, Anderson & Van Wincoop (2004) state that trade costs heavily depend
304 on the efficiency of trade institutions, for instance the efficiency of customs in clearance
305 procedures, transportation and distribution, operational management and human resources
306 capabilities. Weaknesses in trade services expose supply chains to constraints and uncertainties
307 that impact their efficiency. This is especially critical for transactions relating to fresh produce
308 with high temporal specificity, because logistics failings translate into a loss of quality, loss of
309 product value and loss of customers (Pirrong, 1993; Masten, 2000).

310 Certain informal institutions, such as corruption and even the perception of corruption,
311 negatively affect the functioning of legal systems and, in general, the business context in which
312 transactions occur. Corruption generates substantial costs and creates barriers (Uhlenbruck et
313 al., 2006) or challenges (Cuervo-Cazurra, 2016) to the entry of foreign firms. Consequently,
314 increased environmental uncertainty makes contracts more difficult to enforce (Anderson &
315 Van Wincoop, 2004; Cuervo-Cazurra, 2016), “leaving international transactions hostage to an
316 increased risk of opportunistic behavior” (Rodrik, 2000:1979). On the contrary, when the
317 environment is able to define the sharing of property rights between economic agents precisely
318 and ensure compliance with both this principle of sharing and the conditions for the exchange
319 of these rights, uncertainty and opportunism diminish and trade increases (North, 1981).

320 The relationship between the degree of reliability of institutional environments and the
321 level of inter-firm contract completeness has been studied by a number of authors (Poppo &
322 Zenger, 2002; Zhou, Poppo & Yang, 2008). Anderson & Van Wincoop (2004) analyzed the

323 impact of a number of indicators such as economic policies, impartiality, transparency, the
324 efficiency of legal systems in enforcing commercial contracts and tariff/non-tariff barriers on
325 the import flows. Berkowitz, Moenius & Pistor (2004) extended this analysis by including the
326 exporting countries and found that institutions such as property rights protection bodies, tax
327 collection agencies, courts and contract enforcement agencies provide suitable guarantees to
328 exporters and importers and thus increase mutually favorable trade. In their study of U.S.
329 exporters of food products, Antràs & Foley (2015) compare the use of alternative financing
330 terms in contracts, from cash in advance and letter of credit terms, which are more complete, to
331 open account terms, which are less complete. The authors' results show that transactions are
332 more likely to occur with less complete terms when the importer is located in a country
333 benefiting from strong contractual enforcement.

334 Therefore:

335 Hypothesis 1: the better the quality of the macro institutional environment at the
336 importing country, the lower the probability of resorting to sale contracts.

337

338 **3.2 Public SPS: macro- and meso-institutional layers**

339 Taking Ménard (2017) macro- and meso-institutional levels approach into consideration
340 facilitates an understanding of the complexity of the SPS institutions that govern international
341 fresh fruit transactions. International trade agreements, which have an important role in framing
342 cross-border transactions, include provisions related to the general mechanisms that outline the
343 implementation of SPS measures of the WTO. The complexity of SPS matters and the high
344 costs arising from negotiation make it impossible to cover all domestic regulations and to make
345 provision for every contingency. The SPS provisions included in trade agreements are mostly
346 general and apply to the entire agricultural sector (Rigod, 2013; Horn et al., 2010). This echoes

347 Ménard's assertion (2017) that general rules tend to remain abstract and specific guidelines are
348 required at a meso-institutional level to shape their implementation.

349 At the meso-institutional level, specific SPS rules are set by countries outside the trade
350 agreements which are, or might be, product-specific to sanitary matters, e.g. food additives,
351 pesticide residues, contaminants, good practices, among others (Codex, 2013); or phytosanitary
352 matters, e.g. pest management, surveillance, risk analysis, import regulations, among others
353 (IPPC, 2012).

354 The effect of SPS measures on trade has been extensively studied in recent years
355 (Disdier *et al.*, 2008; Jaffee & Henson, 2004; Melo *et al.*, 2014; Swinnen & Vandemoortele,
356 2011, among others). Empirical evidence for the Chilean case (Engler *et al.*, 2012; Fulponi and
357 Engler, 2013) supports the argument of Jaffee and Henson (2004) that stricter SPS measures
358 are not necessarily an obstacle to trade. From the NIE standpoint, standards play a significant
359 role to facilitated exchanges by reducing the transaction and measurement costs (Mazé, 2017,
360 2002). Dür *et al.*, (2014) analyzed some 587 agreements in their exhaustive study on the design
361 of international trade agreements. Their findings showed that the more detailed the agreements
362 (e.g. provisions for technical cooperation, harmonization, information exchange on SPS
363 measures under the WTO SPS agreement, harmonization), the higher the rate of growth of
364 trade.

365 The degree of completeness of SPS provisions in trade agreements signed by Chile
366 varies. Many of them govern the mechanisms of coordination and cooperation between the
367 authorities of both parties to facilitate trade, thereby enhancing the quality of the institutional
368 framework (Fulponi & Engler, 2013). In their study on fruit Chilean exports, Engler *et al.*,
369 (2012) found that the stringency of regulations in SPS importing countries does not necessarily
370 match the stringency perceived by the exporters. For instance, Chilean exporters consider it
371 easier to export to the US rather than to Mexico, even though the US has imposed a higher

372 number of SPS requirements. This fact is explained by the long-term institutional cooperation
373 and coordination between the US and Chilean authorities and private sector, making the export-
374 import procedures more expeditious and transparent (Engler *et al.*, 2012). This statement is at
375 the core of our analysis. We argue that a higher number of SPS provisions in the international
376 trade agreements signed by Chile does not necessary mean barriers to trade but allows for more
377 transparency concerning the rules of the game, which would thus reduce the level of
378 environmental uncertainty and facilitate contractual relationships between exporters and
379 importers, and reduce transaction costs. Therefore:

380 Hypothesis 2: The more exhaustive the macro SPS provisions within trade agreements,
381 the lower the probability of resorting to sale contracts.

382 In contrast, exporters' perceptions of the stringency of requirements imposed by
383 importing countries, which is fed by the associated complexity, reveals the weakness of import
384 procedures and the consequent difficulty in compliance (Engler *et al.*, 2012). We argue that
385 firms tend to protect themselves from this source of environmental uncertainty. Thus,

386 Hypothesis 3: The more stringent the exporter's perception of SPS meso-institutions at
387 the importing country, the greater the probability of resorting to sale contracts.

388

389 **3.3 Private SPS: meso-institutional layers**

390 Empirical studies have also analyzed the relationship between the distribution channels,
391 or entry channels, and the choice of contracting (John & Weitz, 1988; Buckley & Casson,
392 1998). In their study on the influence of uncertainty over the choice between direct or indirect
393 distribution channels, John & Weitz (1988) considered that the emergence of behavioral
394 uncertainty is related to the difficulty in assessing the performance of the parties to a contract.
395 The study confirmed econometrically that behavioral uncertainty due to the time-span from

396 initial contact to order placement increased the probability of relying more on direct channels
397 in order to reduce opportunism.

398 Exporters normally deal with intermediaries in the importing countries while the direct
399 channel to supermarkets is still in development. Supermarkets have increased their participation
400 in global fresh and vegetable supply chains and their requirements are stricter than the official
401 regulations in terms of quality, labor, food safety and environmental standards (Codron *et al.*,
402 2005; Mazé, 2002). In order to meet these private standards, supermarkets have started to
403 develop close interactions with year-round domestic and international suppliers (Codron *et al.*,
404 2005; Berdegué *et al.*, 2005; Gereffi, Humphrey & Sturgeon, 2005; Reardon & Timmer, 2012).
405 Consequently, supermarkets tend to move from spot markets to preferred supplier lists allowing
406 for transaction cost savings in terms of searching (screening and selection of providers),
407 negotiating and coordinating (Reardon *et al.*, 2003; Codron *et al.*, 2005). This major change
408 has resulted in a shift in governance from market to relational governance through the use of
409 renewable annual contracts (Gereffi, Humphrey & Sturgeon, 2005). Therefore,

410
411 Hypothesis 4a: The higher the share of direct exports to supermarkets, the greater the
412 probability of resorting to sale contracts.

413 Hypothesis 4b: Private certifications increase the odds of resorting to sale contracts.

414

415 **4. Methodology**

416 To test our models, we used two databases. The first database, called Eximfruit (a
417 private database), identifies both parties to the transaction; we used this database to construct a
418 variable to capture direct exports to supermarkets. The second database, obtained from Chilean
419 Customs, contains all shipments sent in 2013² by exporting firms and the type of contract used

² We have retained this year because in subsequent years, the number of firms requesting that, for reasons of confidentiality, their identity or that of the customers be replaced by an x or by “To order” has increased.

420 for each shipment, although the identity of the importer is not provided. In both databases, the
421 names of some firms have been erased or covered: transactions with no identification of the
422 importers were excluded (1,187 observations deleted). The discrepancies between the two
423 databases concerning the identifiers of the exporting firms were resolved manually. Our final
424 sample consists of 151 apple exporters (60% of the Customs database) and 54,387 observations.

425 We constructed three original indicators: i) the number of provisions related to SPS
426 matters that are included in trade agreements signed by Chile; ii) the channel type, whether the
427 importer is a supermarket or not; and iii) the number of the Chilean exporting firm's private
428 certifications.

429 4.1.1 **Dependent variable: the choice of contract**

430 In this study the dependent variable is the type of contract chosen by the exporting firm. It takes
431 the value "1" if the alternative chosen by the exporting firm is a sale contract, "2" for free
432 consignment contract and "3" for minimum guaranteed contract.

433 4.1.2 **Independent variables: environmental uncertainty**

434 We measure the quality of the institutional environment using the following indicators:
435 Enforcing contracts, Customs & logistics performance, Logistics connectivity and Corruption
436 perception. Although SPS institutions are also part of the institutional environment, in this
437 study, because of their particular nature, they are tested through separate hypotheses.

438 *Enforcing contracts* is an indicator taken from the World Bank Doing Business
439 Database, measuring the time and cost for resolving a commercial dispute through the courts
440 and the quality of judicial processes (court organization, case management, court automation
441 and alternative dispute resolution). This indicator is scaled from 0 (lowest performance) to 100
442 (highest performance). We used the index corresponding to year 2012.

443 *The customs & logistics performance index* is constructed by the World Bank. It
444 measures the perception of a country's logistics based on six components: i) the efficiency of

445 customs and border clearance; ii) the quality of the trade and transport infrastructure; iii) the
446 ease of arranging competitively priced shipments; iv) the competence and quality of logistics
447 services; v) the ability to track and trace consignments; and vi) the frequency with which
448 shipments reach consignees within the scheduled or expected delivery times. These components
449 are aggregated to form a single score scaled from 1 (worst performance) to 5 (best
450 performance). We used the index corresponding to year 2012.

451 *Logistic connectivity* is an index constructed by the United Nations Conference on Trade
452 and Development (UNCTAD). Originally referred to as “liner shipping bilateral connectivity”,
453 the index measures the efficiency of services, the level of competition on transportation
454 services, and connectivity between a dyad of countries A and B (in our case the connectivity
455 between Chile and 154 countries). The index is scaled from 0 (minimum connectivity) to 1
456 (maximum connectivity). We used the index corresponding to year 2012.

457 *Corruption perception* is an index constructed by Transparency International. It
458 measures the perception of corruption in the public sector in 176 countries. The score is scaled
459 from 0 to 100, 0 being a country perceived as highly corrupt and 100 a country perceived as
460 very clean. According to the criteria of Transparency International, a score below 50 indicates
461 a serious corruption problem. To facilitate the interpretation of results in our model, we reversed
462 the score so that 100 reflects a high level of corruption and 0 a very clean country and
463 dichotomized this variable to highlight whether the destination country presents a high level of
464 corruption (≥ 50) or a lower level of corruption (≤ 50). We used the index corresponding to
465 year 2012.

466 *Number of SPS provisions in trade agreements.* In our study, we fully reviewed each of
467 the 25 agreements signed by Chile until 2013. We counted the number of provisions concerning
468 SPS matters. Because the majority of the agreements signed by Chile establish a global
469 framework, we counted all SPS provisions, except where it was possible to exclude those that

470 strictly refer to animal health, such as the EU-Chile Association Agreement which includes
471 detailed and clearly separated measures on animal and plant health. Since agreements are each
472 structured differently, we consider that a provision can be a clause, an article or a paragraph.

473 *Exporting firms' SPS stringency perception* is an index constructed by Engler *et al.*,
474 (2012) and Melo *et al.*, (2014). It measures Chilean exporters' perceptions of the difficulty
475 encountered in fulfilling SPS specific measures with regard to apples, grapes cherries and kiwi
476 fruit in sixteen main importing countries³. Exporters from a random sample of firms were asked
477 to assess through a Likert scale the complexity, i.e. monetary and human efforts for complying
478 with the following SPS measures: 1) pest, diseases and weeds regulated, quarantine treatment
479 requirements; 2) tolerance limits for pesticide residues and contaminants; 3) microbiological
480 requirements; 4) labeling, marking and packaging; 5) good agricultural practice requirements,
481 quality standards; and 6) registration procedures (e.g. registration of production sites, export
482 firms). Stringency is scaled from 0 to 7 (7 being the highest level of stringency).

483 *Supermarket entry channel* measures direct exports to supermarkets. This is a proxy
484 variable because we cannot observe in our databases the private standards required by the
485 supermarkets for each transaction. We extracted the importers' names and identified the type
486 of importers using as reference specialized directories and checked the firms websites. In total,
487 857 unique importers were identified. Finally, we constructed a binary variable: 1 if the
488 importer was a supermarket and 0 if not. We then calculated the share of exports for each
489 exporter to a supermarket during 2013.

490 *Firms' SPS private certifications*. We counted the number of certifications that the firms
491 in our sample indicate either on their own website or on other websites. We created a database
492 with each certification by exporting firm then aggregated those related to SPS matters, e.g.
493 those related to food safety and phytosanitary management. GlobalGap and BRC were double-

³ USA, Canada, Mexico, Colombia, Brazil, United Kingdom, Netherlands, Spain, Russia, Taiwan, Hong Kong, Japan, China, India, United Arab Emirates and Saudi Arabia.

494 checked as information on certified firms is available online. Certifications that did not fall
495 within the scope of this study were excluded, e.g. Kosher or social certifications. Official
496 phytosanitary certifications are not included as these are compulsory for export.

497 **4.2. Estimation procedure**

498 In this study of contract choice where the outcome is nominal, i.e. the categories are assumed
499 to be unordered, we apply the multinomial logit model (MNL) which is the most frequently
500 used (Long & Freese, 2014). In our multinomial logit regression, the dependent variable is the
501 type of contract chosen by the exporting firm whether sale, free consignment and minimum
502 guaranteed contract. In our sample, apples were exported under sale contracts (57.52%), free
503 consignment agreements (28.16%) and minimum guaranteed agreements (14.32%). The model
504 computes the probability of each alternative (free consignment and minimum guaranteed)
505 compared to the reference outcome b (in our model a sale contract), which can be written as:

$$506 \quad \Pr(y = m|x) = \frac{\exp(x\beta_{m|b})}{\sum_{j=1}^J \exp(x\beta_{j|b})}$$

507 where β is the vector of independent variables.

508 Tables 1 and 2 present descriptive statistics and a correlation matrix for the variables comprising
509 our models. We excluded the customs & logistic performance variable from the models because
510 it is strongly correlated with the perception of corruption variable insofar as those countries
511 suffering from corruption are less efficient. The Collin Stata test for multi-collinearity showed
512 that dropping the customs & logistic performance variable allows for satisfactory variance
513 inflation factor. Model 3 introduces the indicator developed by Engler et al. (2012) measuring
514 Chilean exporting firms' perceptions of SPS stringency in a sub-sample of 17 destination
515 countries. We dropped variables logistic connectivity and corruption perception to keep a
516 satisfactory VIF.

517 **4.3 Independence of irrelevant alternatives and multinomial probit**

518 Multinomial logit models rely on the assumption of independence of irrelevant
 519 alternatives (IIA), which states that the odds of one outcome versus another is not influenced
 520 by other available options. We tested this assumption with the Hausman-McFadden test and the
 521 Small-Hsiao test. The results revealed that the IIA assumption in our multinomial logit models
 522 is violated. Although for much of applied settings the IIA property is not particularly relevant
 523 (Dow & Endersby, 2004), we re-estimate the MNL models in the previous section with a
 524 multinomial probit (MNP) procedure. Probit offers an advantage over MNL in that the MNP
 525 relax the IIA assumption. Results in Table 4 show our MNP estimations produce nearly
 526 identical results as MNL, with the same signs and the same number of statistically significant
 527 coefficients which confirms our results.

528

529

Table 1. Summary Statistics

Variable	Obs	Mean	Std. dev.	Min	Max	Interpretation
Enforcing contracts	79948	61.65	13.43	34.29	83.61	1 to 100 (best quality)
Customs & logistics performance	68873	3.34	0.53	2.03	4.13	1 to 5 (best performance)
Logistics connectivity	78232	0.40	0.06	0.11	0.48	0 to 1 (maximum connectivity)
Corruption perception	79965	54.47	18.92	13	90	>=50 high; <=50 low corruption
SPS provisions in trade agreements	58749	14.69	7.28	1	24	Higher number-> more complete
Firms' SPS stringency perception	49383	4.52	0.45	3.5	5.8	0 to 7 (highest stringency)
Supermarket entry channel	78588	10.12	12.90	0	84.68	Mean per exporter (%)
Firms' SPS private certifications	80470			0	1	Private certifications (yes/no)

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Table 2. Chilean apple exports within trade agreements by destination

Signatory country	Enforcing contracts	Customs & logistics performance	Logistic connectivity	Corruption perception	SPS provisions in TA	SPS stringency perception	Apple exports (000 T)	Share of total apple exports (%)
European Union					23		172.2	20.7
- Netherlands	59.9	4.0	0.4	Low		3.4	77.2	9.3
- UK	68.7	3.9	0.4	Low		4.0	26.4	3.2
- Spain	70.0	3.7	0.4	Low		3.6	19.1	2.3
USA	72.6	3.93	0.44	Low	20	3.8	133.5	16.0
Colombia	34.3	2.87	0.42	High	13	4.2	86.1	10.3
Mercosur					6		39.4	4.8
- Brazil	66.0	3.1	0.34	High			35.4	4.7
Peru	60.7	2.94	0.46	High	24		36.4	4.4
Canada	54.4	3.85	0.37	Low	1	3.5	26.0	3.1
China	78.2	3.52	0.48	High	7	4.7	17.1	2.1
India	40.8	3.08	0.35	High	6	2.9	16.5	2.0
Mexico	67.0	3.1	0.5	High	14	5.2	4.4	0.5
Hong Kong	69.1	4.12	0.48	Low	11	3.4	2.9	0.4
Other apple exports within trade agreements							13.4	2.7
Apple exports without trade agreements							116.9	14.1
Total apple exports							823	100

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Table 3. Determinants of apple export contracts. Estimates using multinomial logit model

Sale (base outcome)	Model 1		Model 2		Model 3	
	Free consignment	Min. guaranteed	Free consignment	Min. guaranteed	Free consignment	Min. guaranteed
Enforcing contracts	0.020 (0.001)**	0.020 (0.001)**	0.030 (0.001)**	0.058 (0.001)**	0.046 (0.001)**	0.070 (0.002)**
Logistics connectivity	2.830 (0.189)**	2.830 (0.189)**	4.555 (0.274)**	7.360 (0.344)**		
Corruption perception (low)	1.052 (0.024)**	1.052 (0.024)**	1.146 (0.034)**	0.407 (0.041)**		
Number of SPS provisions in TA			0.055 (0.002)**	0.027 (0.002)**	0.114 (0.002)**	0.041 (0.002)**
Exporting firms' SPS stringency perception					-0.502 (0.041)**	-0.679 (0.050)**
Supermarket entry channel			-0.041 (0.001)**	-0.007 (0.001)**	-0.045 (0.001)**	-0.005 (0.001)**
Exporting firms' private certifications			-0.685 (0.030)**	-0.401 (0.038)**	-0.487 (0.035)**	-0.152 (0.044)**
Number of observations		78,196		55191		40609
Model chi-square		14447.00		15118.52		11196.02
Prob > chi2		0.000		0.000		0.000
Pseudo R-squared		0.101		0.154		0.147
Nagelkerke		0.201		0.289		0.285
VIF		1.43		1.43		1.15

Standard errors in parentheses, * $p < 0.05$; ** $p < 0.01$

544 **Table 4.** Determinants of apple export contracts. Estimates using multinomial probit model

545

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Sale (base outcome)	Model 1		Model 2		Model 3	
	Free consignment	Min. guaranteed	Free consignment	Min. guaranteed	Free consignment	Min. guaranteed
Enforcing contracts	0.017 (0.001)**	0.044 (0.001)**	0.025 (0.001)**	0.0405 (0.001)**	0.0381 (0.001)**	0.0516 (0.001)**
Logistics connectivity	2.276 (0.143)**	5.615 (0.143)**	3.573 (0.206)**	4.773 (0.001)**		
Corruption perception (low)	0.817 (0.184)**	0.463 (0.194)**	0.884 (0.027)**	0.352 (0.028)**		
Number of SPS provisions in trade agreements			0.041 (0.002)**	0.0236 (0.002)**	0.086 (0.002)**	0.036 (0.002)**
Exporting firms' SPS stringency perception					-0.4704 (0.319)**	-0.569 (0.035)**
Supermarket entry channel			-0.03 (0.001)**	-0.005 (0.007)**	-0.033 (0.001)**	-0.004 (0.002)**
Exporting firms' private certifications			-0.568 (0.023)**	-0.295 (0.023)**	-0.402 (0.027)**	-0.114 (0.004)**
Number of observations		78,196		55,191		40,609
Wald chi-square		12350.3		12765.7		9146.61
Prob > chi2		0.000		0.000		0.000

Standard errors in parentheses, * $p < 0.05$; ** $p < 0.01$

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548

549 **5. Results**

550 Table 1 shows that the standard deviations and ranges of the enforcing contract index,
551 the corruption perception, the SPS stringency perception imply the large variability across the
552 importing countries in terms of institutional quality. Direct exports to supermarkets had a mean
553 of 10.12 and standard deviation of 12.90 ranged from 0 to 85 which also indicates a large
554 variation. Concerning the SPS private certifications, 79% of the shipments in our sample were
555 sent by certified firms.

556 Furthermore, there are two salient aspects to highlight. First, the number of SPS
557 provisions included in trade agreements signed by Chile range from 1 to 24 (table 1 and 2).
558 Agreements with Peru, the European Union and US include higher numbers of SPS provisions,
559 while agreements with Bolivia, Venezuela and Canada⁴ include only one provision. Trade
560 agreements with higher number of provisions, e.g. Peru, USA and EU, establish more detailed
561 procedural provisions to improve transparency and efficiency, e.g. enquiry and notification
562 points for information exchange, export-import checks and inspections processes, statutory
563 certifications attesting to the agreed standards and requirements, among others. Also,
564 coordination mechanisms, like bilateral committees on SPS matters to enhance mutual
565 understanding on measures and regulatory processes. These committees coordinate technical
566 cooperation programs and establish ad hoc working groups to deal with specific issues. They
567 are comprised by official representatives from regulatory agencies or ministries with
568 responsibility for the development, implementation and enforcement of SPS measures. The
569 parties agree on the dispute settlement mechanisms within the frame of the WTO's system, and
570 bilateral procedures to resolve through friendly consultations and negotiations on the basis of
571 technical evidence, any controversy arising under the agreement. As of the date of this study,

⁴ The agreement with Canada has been renegotiated. In 2015, an amendment included a chapter on sanitary and phytosanitary measures, as well as technical measures. These modifications, scheduled for implementation during 2016, had not been made public by the time of this study and do not fall within the time period of analysis.

572 Chile is not involved, neither as respondent nor as complainant, in any dispute concerning SPS
573 issues at the WTO. SPS problems has been solved bilaterally, for example, in 2015 Vietnam
574 suspended imports of Chilean table grapes, apples, cherries and kiwifruit due to fruit fly
575 outbreaks. The resolution of this crisis was achieved through technical and diplomatic actions
576 by the national authorities of both parties, i.e. on-site visits to evaluate the Chilean plant
577 protection system. Second, the corruption perceptions index (in its continuous form) and
578 logistics performance index are highly correlated, (Table 3). This is because countries with high
579 score of corruption tend to be the same with limited coordination on border procedures and
580 customs controls, and other logistics services.

581 Our estimates are reported in Table 4 and results among models are consistent. Model
582 1 displays the results for the entire sample (exports to 64 destination countries), introducing the
583 macro-level variables that create a good institutional environment in the importing country.
584 (Table 4). Model 2 is the most complete, testing the macro-environmental variables and the
585 meso-variables concerning SPS matters, both official and private. All independent variables are
586 significant at ($p < .0001$). The enforcing contracts variable is positive, meaning that when the
587 quality of the legal institutions in the importing country is better exporters are more likely to
588 choose a consignment or minimum guaranteed agreement rather than a sale contract. The
589 variable measuring logistic connectivity is positive and significant for free consignments
590 relative to sale contracts and for minimum guaranteed agreements relative to exporting by
591 means of sale contracts, this means that a better logistic connectivity reduces the risks linked to
592 the temporal specificity of perishable products. A low perception of corruption in the public
593 sector of the importing country is positive, meaning that exporters are more likely to choose
594 free consignments or minimum guaranteed agreements than sale contracts when exporting to
595 countries not affected by corruption, these results support the hypothesis 1, that the higher the
596 quality of the macro institutional environment, the lower the probability of resorting to more

597 complete contracts. With regard to SPS institutions, the variable measuring the number of SPS
598 provisions within trade agreements signed by Chile is positive. This means that as the number
599 of provisions increases, apple shipments are more likely to be exported by means of free
600 consignment or minimum guaranteed agreements than by means of a sale contract, which
601 provides support for hypothesis 2, the more exhaustive the macro SPS provisions within trade
602 agreements, the lower the probability of resorting to more complete contracts.

603 Model 3 shows that the higher the exporters' perceptions of stringency by Engler et al.
604 (2012) with regard to SPS requirements at the importing country, the less likely they are to
605 resort to free consignment or minimum guaranteed arrangements than sale contracts. This
606 supports hypothesis 3, the more stringent the exporter's perception of SPS meso-institutions,
607 the greater the probability of resorting to more complete contracts.

608 Finally, models 2 and 3 consistently show that firms exporting directly to supermarkets
609 and firms with private certifications (mainly GlobalGap, HACCP, British Retail Consortium
610 (BRC), ISO, International Featured Standards (IFS), and supermarket certifications (Tesco,
611 Walmart, among others) are more likely to call on sale contracts, a fact which supports
612 hypotheses 4a and 4b stating that the higher the share of direct exports to supermarkets, the
613 greater the probability of resorting to more complete contracts. And in the same direction,
614 private certifications increase the odds of resorting to more complete contracts. Although not
615 reported in this paper, we also estimated a model including only exports to low-corruption
616 importing countries. The estimates corroborated our results, i.e. even in good environments,
617 exporting directly to supermarkets increases the probability of calling on more complete
618 contracts.

619 **6. Discussion**

620 The effect of SPS institutions on trade has been extensively studied in recent years
621 (Disdier *et al.*, 2008; Jaffee & Henson, 2004; Melo *et al.*, 2014; Swinnen & Vandemoortele,
622

623 2011, among others). Empirical studies have led to alternative interpretations: non-tariff
624 measures are seen alternately as barriers to trade or trade catalysts. The main reasoning for
625 interpreting them as disguised barriers is that they would act as a new form of protectionism in
626 favor of domestic production over external competition (Swinnen & Vandemoortele, 2011).
627 The limit of this perspective is that a broad spectrum of non-tariff measures, especially
628 environmental and sanitary standards, seeks to protect consumers regardless of whether the
629 production is domestic or foreign. Consequently, these measures may hit domestic firms and
630 increase imports (Swinnen & Vandemoortele, 2011). On the other hand, standards can be
631 viewed as trade catalysts when develop capacities to comply with strict standards and achieved
632 the linkage with high-value global supply chains (Jaffee & Henson, 2004; Maertens, &
633 Swinnen, 2009).

634 This paper outlines the effect of SPS institutions on export-import contracts of Chilean
635 apples. Chilean exporters consider easier to comply with countries with stricter SPS
636 requirements, such as the US, than other countries, e.g. Mexico (Engler *et al.*, 2012). Our
637 explanation is that the business environment is better in the US because of a lower perception
638 of corruption of the public services, better logistics performance and better enforceability of
639 contracts. Poor institutional environments in the importing countries weaken the enforceability
640 of inter-firm contracts and the efficacy of trade and SPS services. As supply chains for
641 perishable products are time-specific with an acute risk of the emergence of opportunistic
642 behavior, exporters protect themselves using more complete contracts that involve less risk for
643 them, echoing the findings of Anderson & Van Wincoop (2001), Antras & Foley (2015), Pavez
644 & Codron (2018). In these circumstances, the function of the contract is more that of a safeguard
645 device (Williamson, 1996). However, this raises another question: why are firms exporting
646 directly to supermarkets more likely to use more complete contracts? Our explanation is that
647 contracts also serve a coordinating function (Schepker *et al.*, 2014). Although exporters in the

648 Chilean case study deal mainly with traditional importers, such as wholesalers and brokers,
649 supermarkets have increased direct procurement and impose more complete contracts with
650 stricter and more detailed quality and sanitary requirements (Reardon, & Timmer, 2012; Pavez
651 & Codron, 2018). This can explain the higher probability of exporters dealing with
652 supermarkets calling on sale contracts, which is consistent with results by Mazé (2002), and
653 Fulponi (2006) on the changes in retailers' contract design including certifications and control
654 provisions over the quality specifications in response to sanitary crisis.

655 These findings have key implications: SPS issues are of high importance for developing
656 countries. Policy makers can improve institutions to facilitate trade and create a favorable
657 business environment. Institutions are embedded in multiple layers. On the one hand there is
658 the macro-level where rules and standards create a general environment surrounding all
659 transactions, i.e. the SPS chapters in international trade agreements in which the signatories
660 decide the institutional mechanisms for coordinating, monitoring and arbitrating in the
661 eventuality of phytosanitary and sanitary problems. On the other hand, there is also a meso-
662 level where more specific rules governing specific transactions of products, services or
663 resources are set (Ménard, 2017). In our case, these are specific SPS requirements that lead to
664 decisions being taken to adapt production and coordination within the supply chain (Stephens
665 et al., 2018). We agree with Jaffe and Henson (2005), Maertens & Swinnen (2009), Engler *et*
666 *al.*, (2012), and Berkowitz *et al.*, (2004) that SPS measures do not necessarily have a negative
667 impact on trade if exporting countries can develop their capacities to meet these requirements.
668 Finally, our findings show the dual function of inter-firm contracts both as a safeguard
669 mechanism to protect transactions against opportunism hazards coming out of opportunism in
670 uncertain institutional environments and as a means of coordination to foster adaptation (North,
671 1981; Williamson, 1979; Ménard, 2012; Schepker et al., 2014) to changing market demands
672 and the buyers' specific quality and sanitary requirements (Codron, et al., 2005; Berdegué et

673 al., 2005; Gereffi, Humphrey & Sturgeon, 2005; Reardon & Timmer, 2012; Pavez & Codron,
674 2018).

675 **7. Conclusion**

676 Drawing on institutional economics, this paper tests the effect of biosecurity institutions,
677 i.e. SPS macro- and meso-institutions and their link with the inter-firm contractual choice. We
678 test our models using the Chilean case of fresh apple exports. The results of our econometric
679 analysis show that exporters resort to less complete and more flexible contracts, when exporting
680 to countries that have favorable and safe business environments. We found that the same
681 scenarios apply when the SPS provisions established in international trade agreements are more
682 exhaustive: this could mean that clear rules make an environment less uncertain. On the
683 contrary, when firms have a perception of corruption in the importing countries and a perception
684 of stringent SPS requirements because trade procedures are not clear and reliable, exporters
685 tend to protect themselves through more complete contracts. We consider that this demonstrates
686 that more complete SPS provisions in trade agreements should not necessarily be interpreted as
687 major obstacles to trade because they may signal stronger institutional frameworks that reduce
688 environmental uncertainty in the importing countries. In contrast, corruption constitute a more
689 important trade barrier than non-tariff measures. We also found evidence confirming the dual
690 function of contracts both as a safeguard and as a coordination tool to export to customers with
691 demanding sanitary and phytosanitary requirements as supermarkets.

692

693

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