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Internationalization of Firms' Activities and Company Union Wage Strategies

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Abstract

Using a two-country duopoly model with homogeneous goods, firms' decisions with respect to international activities (trade vs. foreign direct investment - FDI) in the presence of company-wide unions are analyzed. If firms export, they pay trade costs per unit of the goods exported. If firms invest and set up plants abroad, they incur sunk costs. The full set of production structures that arise as sub-game perfect Nash equilibriums are derived when internationalization is feasible. The interdependence of exogenous integration costs, endogenous union wage strategies, and firms' strategic interactions affect the equilibrium outcome: either symmetric (intra-industry trade *or* reciprocal FDI) or multiple symmetric (intra-industry trade *and* reciprocal FDI) equilibriums exist.

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Two results emerge as the most evident consequences of the process of economic integration occurring in the European context. First, the completion of the Single Market Program in 1992, established the free movement of goods, capital, services, and people among the member states of the European Union (EU). Second, the creation of the European Monetary Union (EMU) concluded with the introduction of the Euro in 2002. Increases in the degree of liberalization of capital markets and continuous removal of internal tariff and non-tariff barriers, with a consequent reduction in trade costs in product markets, exemplify this course of action. Further developments and improvements in the Financial Service Action Plan (FSAP) and financial market integration within the EU itself have driven significant growth in the figures related to intra-industry trade (IIT) (see European Commission, 2008a) and intra-EU foreign direct investments (FDI) (Jovanović, 2006; European Commission, 2008b).

The EU economic background offers ideal "humus" for the internationalization of firms' activities. At the same time, as product and capital markets become more integrated, major actors in European labor markets, as trade unions, start considering a broader perspective in their activities. Some of the European Commission's legislative initiatives, such as the approval of the 1994 European Working Councils (EWC) directive[1] and the 2001 European Company (Societas Europaea - SE) directive, which advanced the practice of informing and consulting the workforce in transnational contexts, are shifting toward the company level, the key level of collective bargaining, in many industrial sectors. However, depending on the degree of market integration and the presence of productive activities organized internationally, remarkable distinctions between industries exist. Company-level negotiations are prominent in those sectors characterized by a high incidence of multinational enterprise (MNE) operations.

The international dimension of MNEs, rulings by the European Court of Justice, the institutions of the European Works Council, the practice of opting out from national/sector collective bargaining in favor of company-wide agreements (European Foundation for the Improvement of Living and Working Conditions - Eurofound, 2009) have had a deep impact on labor market outcomes. This framework caught the attention of some labor unions because it offered both the prospect of moving their wage bargaining strategies to the European level (the "horizontal Europeanization" of labor relations; see Pernicka & Glassner, 2012; Müller, Platzer, & Rüb, 2013) and arranging transnational agreements at company level. Indeed, the figures related to the cross-border company agreements steadily increased in recent years, from a few dozens in 2000 to 244 in 2011 (Müller, Platzer, & Rüb, 2013).[2]

As Horn and Wolinsky (1988) suggested, firms would like to take strategic advantage of an MNE organizational structure to avoid the creation of an encompassing union. On the other hand, unions may coordinate bargaining across countries but at present, transnational coordination activities are still in an embryonic state. However, instead of explaining current transnational agreements, this work aims at going one step further and asking the following questions. First, if unions in the future are able to coordinate their bargaining activities effectively across countries within the same company, making progress in the process of "horizontal Europeanization" of labor relations, might the prospect of a unique workers' representative body affect the firms' internationalization strategies? Second, to what extent may unions improve their positions in negotiations with respect to firms involved in international business? Focusing precisely on these issues, the intention is to develop a symmetric two-country duopoly model where organized, company-wide workforce representatives seek to gain part of the rents generated in the product market.

In recent years, unions started exploiting the potential of the EWC more intensively during company-wide bargaining processes. For example, in the banking sector, Danish trade unions received the mandate to negotiate on behalf of all employees working in the Danske Bank Work Council (European Industrial Relation Observatory Online - EIROnline, 2009). The European Metalworking's Federation (EMF), the UNI Europa Graphical (UEG) and the European Public Service Union (EPSU), three cross-border industry level federations, devised a procedure to receive the mandate in representing the overall workers' side throughout company-wide transnational agreements. Since the formulation of this internal procedure, the EMF has implemented it with at least five MNEs, including Areva, Schneider, Daimler-Chrysler, John Deere, and ArcelorMittal (Eurofound, 2009; Gennard, 2009a), while the EPSU used it with Suez-Lyonnais des Eaux (Papadakis, 2010). The creation of cross-border unions is another response to company-wide negotiations. In 2009, for instance, a trans-boundary seafarers' union, Nautilus International, was launched, based in the UK and the Netherlands. It represents a wide range of personnel working in the shipping sector, at sea, on inland waterways, and ashore. The cross-border union is the result of a merger process following several years of closer cooperation between Nautilus NL and Nautilus UK, including joint industrial negotiations with companies employing British and Dutch workers (Gennard, 2009b). Finally, transnational campaigns to support wage bargaining, either in selected sectors or in MNEs, are further vehicles labor unions take advantage of to move closer to issues at the core of traditional collective bargaining at an international level (Keune & Schmidt, 2009).

In the present work, firms' decisions about international activities (trade vs. FDI) in the presence of company-wide unions are analyzed. The model is a two-country, three-stage game duopoly model where firms produce a homogeneous product. Product markets are segmented and both countries are characterized by unionized labor markets. In the first stage of the game, firms choose autonomously whether to invest. Each firm has two strategies: Not to invest, thus maintaining all productive activities in the domestic country; or to invest abroad, thus setting up a new plant. If firms serve the other country through exports, they pay constant, exogenous trade costs per unit of the commodity exported. Otherwise, firms engage in FDI and establish a production plant in the foreign country, incurring an exogenous, positive sunk cost. In the second stage, monopoly unions set their optimal wage strategies, competing with each other in the labor market. Finally, in the third stage, firms compete à la Cournot, choosing profit-maximizing quantities separately for each market.

The main results of the paper are as follows. A rich set of the productive structure regimes will take place in equilibrium for the international oligopoly. While the presence of unique symmetric regimes (IIT or reciprocal FDI - RFDI) is a natural consequence, a novel result is that, for some combinations of integration costs, multiple symmetric equilibriums are possible: IIT and RFDI regimes may occur simultaneously. The rationale for this result resides in the fact that different combinations of integration costs have different effects on prices (due to product market competition) and wages (because of unions' strategic behavior). These, in turn, affect the level of firms' profits and, therefore, their strategic choice concerning the start of international activities. Furthermore, the RFDI regime is one equilibrium of the game also applicable for relatively low

values of trade costs when IIT is feasible, provided the scale of the sunk costs is low enough. The reason is that a decline in trade barriers has a positive effect on the profit level of foreign subsidiaries and this, in turn, makes the investment option more attractive. Nevertheless, if the scale of the sunk costs is large enough, IIT is the unique equilibrium of the game. This is because the company-wide unions set higher wage rates when firms invest than in the case of exports: High wages and sunk costs are not sufficient to counterbalance the trade cost savings.

The focus of this paper is related to a body of literature analyzing, within different contexts, the implications of international economic integration on labor market outcomes in the presence of unions. Few authors have investigated how this process affects the unions' strategic behavior and how the unions' behavior may, in turn, affect firms' strategic choices related to international activities. The first group of authors who have examined how international integration affects the wage formation in the presence of unionized countries is Huizinga (1993), Sørensen (1993), Naylor (1998, 1999), Borghijs and Du Caju (1999), Straume (2002), Lommerud, Meland, and Sørgard (2003), Glass and Saggi (2005), Strozzi (2007, 2008), and Ishida and Matsushima (2009).

Authors such as Huizinga (1993), making use of a monopoly union model, and Sørensen (1993), using a more general right-to-manage model, concluded that product market integration leads to an enlargement of the market size. Consequently, the number of firms operating in the market increases, intensifying the degree of competition. This, in turn, implies a decrease in the level of prices and wages. Moreover, under the assumption of linear demand and production functions, Huizinga (1993) claimed that the decrease in wage levels is more than offset by the increase in employment so that net union utility increases. These two models, however, do not take into account any interaction between the two economies before integration occurs.

Closely related to this work are the contributions of Naylor (1998, 1999). In these articles, two identical firms initially produce a homogeneous product for their home markets and, under the assumption of perfect symmetry in both product and labor markets, engage in reciprocal dumping when trade cost levels fall below a threshold value. This implies a fall in the wage demands of labor unions: IIT, putting unions in competition internationally in the labor market, erodes their monopoly power. As the degree of economic integration increases (further reduction in trade costs), unions set higher wages due to higher profits for both firms, capturing part of the firms' rent. These works studies the effects of economic integration on wages and unions' outcomes and the interaction between the two economies, exemplified by the unions' strategic behavior in labor markets.

Of interest to the analysis are the works of Lommerud, Meland, and Sørgard (2003), Glass and Saggi (2005), and Ishida and Matsushima (2009). Lommerud, Meland, and Sørgard (2003) made use of a two-country reciprocal dumping model of oligopoly with only one country unionized, focusing the analysis on how trade liberalization and wage setting affected the firms' location choice, and therefore, the way firms chose to serve their relevant markets. Ishida and Matsushima (2009) likewise analyzed the same issue in a similar framework when domestic competition occurs between firms located in a unionized country. Taking a different approach from Lommerud, Meland, and Sørgard (2003), Glass and Saggi (2005) determined endogenously the equilibrium FDI regime without considering the effects of trade liberalization. In their international duopoly model, trade costs are sufficiently low such that firms could always export their products. The crucial assumption is that both firms require one intermediate product that a local upstream monopolist supplier provides exclusively. The authors show that under these circumstances, outward FDI can act as a cost-raising strategy. However, in these works, the strategic interaction in the labor markets is absent; consequently, there is not the opportunity to study trade union cooperation.

A second strand of the literature has analyzed the interaction between unionized labor markets and firm activities related to the internationalization of production through FDI. The general approach is to investigate the effect of FDI, examining the union-firm interaction using either a "right-to-manage" (Bughin & Vannini, 1995; Naylor & Santoni, 2003; Eckel & Egger, 2009) or an efficient bargaining model (Mezzetti & Dinopoulos, 1991; Zhao, 1995, 1998) to explore the effects on wages and employment, either in a partial or in a general equilibrium framework. Like Naylor and Santoni (2003), Zhao (1995), and Eckel and Egger (2009), in the present paper, intra-industry RFDI and the presence of unions in the labor market is accommodated. Notwithstanding the different approaches, underlying hypotheses and purposes of analysis, these models achieve a common result: If firms have the opportunity to invest abroad, they will cause a moderation in wage demands in the bargaining process. Consequently, the position of unions appears to be weakened.

The contribution of the present paper to the previous literature is the following. It widens Naylor's (1998, 1999) analysis by allowing firms to undertake FDI, as is the case in Lommerud, Meland, and Sørgard (2003) and Ishida and Matsushima (2009). However, differently from Lommerud, Meland, and Sørgard (2003) and Ishida

and Matsushima (2009), unionized workforces in both countries are considered in the model in a more realistic reflection of the characteristics of the EU labor market. In doing so, making a link between two issues that the previous literature treated as separate subjects is attempted. Furthermore, the hypothesis of company-wide negotiations conducted by a unique workers' representative body is retained: This is a crucial difference with respect to previous theoretical models. For the scope of the present work, this assumption captured the idea of unions' hoped-for developments in transnational company agreements in Europe.

The implications of this framework are far-reaching. First, like Lommerud, Meland, and Sørgard (2003), it is shown that trade liberalization makes the investment strategy more profitable. In fact, the domestic firm has easier access to the foreign market (product market expansion effect), which implies an increase in the domestic labor demand. At the same time, competition in the domestic country becomes more severe. Nevertheless, the net effect is positive, and the domestic union raises wages, capturing part of the oligopoly rents. However, while for Lommerud, Meland, and Sørgard (2003) high domestic wages give a strong incentive for FDI to success a distributional conflict between unions and firms, in this paper it is shown that when unions are organized at company level in both countries, FDI may occur even if the wage rate in the investing firm is higher than the wage resulting from the export strategy. This is because for some combinations of integration costs, the product market competition in the asymmetric regimes for the exporting firm is harsher than in the case where both firms invest: The beneficial effect on profit of trade cost reductions is more than offset by the adverse effects of market competition and wage increase. Therefore, to undertake FDI is a mutual best-response strategy for firms.

Second, as in Ishida and Matsushima (2009), if firms invest, unions in their domestic countries benefit from FDI because wage rivalry tends to be less intense. However, while union utility increases because wage gains may offset employment reduction, in the present paper, unions gain both from wages and employment increases because of their cross-border, company-wide nature. Furthermore, Ishida and Matsushima (2009) show that, in the asymmetric regime, the union in the exporting firm is induced to decrease wages to facilitate the company remaining in a competitive position in the foreign market. Because wages for the exporting firm are lower for all workers, it will produce at low cost for the domestic market, thus improving its position in the home country. Consequently, the union in the investing country cannot increase the wages of domestic workers because domestic output would be reduced. This, in turn, lowers employment in the investing firm and hence its union utility. Ishida and Matsushima's (2009) results contrast with those in the present paper. In fact, in the asymmetric regime, increasing economic integration (a reduction in trade costs) stimulates exports. Thus, labor demand for the exporting firm increases. This, in turn, implies that the union in the exporting firm raises wages. On the other hand, increasing economic integration implies both a decrease in the total output of the investing firm and a wage reduction for its workers. Nevertheless, wages and employment in the investing firm are higher than those in the exporting firm.

In exploring this topic, an attempt is made to depict the prospects concerning union coordination in MNEs by attempting to give some predictions about the potential implications of transnational bargaining on the development of international businesses in the EU environment. Moreover, given the advances of the new technologies, the proposed framework can be applied to both the manufacturing and service sectors. In fact, due to the development of internet and online technologies, the provision of several services – banking and insurance, for instance – does not necessarily require the presence of a physical subsidiary in a foreign country. In other words, services can be exported towards other countries.

The remainder of the article is organized in the following way. Section 2 outlines the analytical framework. It develops a non-cooperative three-stage game of international duopoly in the presence of unionized workforces at company level. Firms act as first movers, choosing independently whether to invest in the foreign country and paying a certain level of sunk costs. If firms do not invest, they may either export to the foreign country or produce for their domestic country exclusively. Then, in the second stage, company unions select their optimal wage strategies. The usual backward induction method solves the model. Depending on sunk and trade costs, and due to the strategic interaction between firms and unions, different productive structures may arise in equilibrium. A brief discussion of the managerial implications of the model closes the section. Finally, Section 3 brings the paper to its conclusion.

The Basic Model

There are two symmetric countries, A and B. In each country, the economy presents two sectors: A perfectly competitive sector and an imperfectly competitive sector characterized by the presence of a monopolist, Firm 1, located in Country A, and Firm 2, located in Country B. The two firms produce homogeneous goods, denoted x when produced in Country A and y when produced in Country B. Firms consider each country as a separate market (market segmentation hypothesis). Labor is the unique factor of production with linear technology and constant return to scale. By this normalization (without loss of generality), each worker produces one unit of the product: Therefore, production and employment are interchangeable. The perfectly competitive sector represents a buffer where workers can always find employment at the competitive wage (normalized to zero).

Table 1
First stage, the Firms' Game

Firm 1 \ Firm 2	Invest	Not Invest
Invest	$\prod_{1A}^{II}+\prod_{1B}^{II}-F;\ \prod_{2B}^{II}+\prod_{2A}^{II}-F$	$\prod_{1A}^{IN}+\prod_{1B}^{IN}-F;\ \prod_{2B}^{NI}$
Not Invest	$\prod_{1A}^{NI};\ \prod_{2B}^{IN}+\prod_{2A}^{IN}-F$	$\prod_{1B}^{NN};\prod_{2B}^{NN}$

The representative consumer in each country maximizes the following quasi-linear utility function:

$$U=\bar{U}(x,y)+z=(x_{ik}+y_{jk})-\frac{1}{2}(x_{ik}^2+y_{jk}^2+2x_{ik}y_{jk})+z,$$

with $i,j=1,2\ i\neq j;\ k=A,B$, where $\bar{U}(x,y)$ is the quadratic utility derived from the consumption of the goods produced in the imperfectly competitive sector, and z is the linear utility derived from the consumption of the competitive goods.[3] These consumers' preferences imply that the demand schedules are linear. Company level unions operate and organize their activities in the imperfectly competitive sector whose workers are fully unionized.

The model is a three-stage game. In the first stage of the game, firms autonomously choose whether to invest. Each firm has two strategies[4] (see Table 1): not to invest, thus maintaining all productive activities in the domestic country; and to invest abroad, thus setting up a new plant (Greenfield venture). If firms undertake FDI and establish a Greenfield venture in the foreign country, they incur an exogenous sunk cost $F\geq 0$. Otherwise, firms may serve the other country through exports, paying a constant, exogenous cost $t\in[0,1)$ per unit of the commodity exported.[5] Several regimes might arise as a consequence. First, both firms do not invest: Depending on trade costs and the unions' strategic decisions, firms may serve the other market through exports, allowing for IIT.[6] Second, both firms invest (RFDI). Third, only one firm invests (asymmetric regimes). In Table 1, Π^{NN} denotes the profits when both firms do not invest; Π^{II} denotes RFDI profits; Π^{IN} (Π^{NI}) denotes profits when one firm invests abroad while the other does not (and vice versa). In the second stage, monopoly unions (having full bargaining power, see Dowrick, 1989) set their optimal wage strategies, competing with each other in the labor market. Finally, in the third stage, firms engage in a Cournot competition,[7] choosing profit-maximizing quantities separately for each market realizing output. Market segmentation, combined with the constant marginal costs assumption, implies that the price of the goods in each country depends exclusively on the total quantity available in the market.

The model is solved by the backward induction method to derive sub-game perfect equilibriums. The following subsections inspect, for each regime of the productive structures, first the output game among firms in the product market deriving the firms' labor demand functions in terms of wages. Then, in the second stage, given the firms' labor demands, the analysis of the unions' wage setting in the labor markets is presented. Finally, turning back to the first stage of the game, the results of the sub-games allow an evaluation of the firms' payoff functions. According to realized profits, each firm chooses which internationalization strategy should be adopted. After collecting the relevant results, it is possible to derive the conditions under which a particular structure of production arises as equilibrium of the game.

Because the aim of this paper is to derive the productive structure arising in equilibrium when both firms undertake international business, the analysis focuses on a subset of the integration costs, that is, sunk and trade cost levels. First, the scale of the sunk costs is assumed to be small enough that each firm can invest abroad independently from the strategic choice of the rival firm.[8] Second, trade costs are such that international activities are supported as sub-game perfect equilibriums in pure strategies of the two-stage game "unions' wage determination–firms' quantity choices" independently from the firms' strategic choices concerning internationalization. To obtain well-defined solutions in pure strategies, therefore, the subsequent analysis imposes the following restriction on the values of the parameters t and F.

Restriction 1. $t \in [0, 0.310]$, $F < 0.034$.

Restriction 1 defines the range of trade and sunk costs where sub-game perfect equilibriums allow internationalization of firms' activities. The restriction on trade costs limits the analysis to sub-game perfect equilibriums in the two-stage sub-game "unions' wage determination–firms' quantity choices" such that the internationalization of firms' activities is always possible. The parameter's restriction on trade costs is given by $t \leq 0.310$ because, at this level, any union wage combination in the two-stage sub-game "unions' wage determination–firms' quantity choices" is consistent with every configuration of the firms' strategies involving international activities (IIT, RFDI, and asymmetric regimes). The meaning of the restriction on sunk costs is as follows. The profits generated in the foreign market by the investing firm have to be greater than the size of the sunk costs to undertake the investment abroad. The amounts of these profits differ according to the strategy that the rival firm selects.

Regime 1: *Both Firms Do Not Invest*: *Intra-Industry Trade*

This subsection analyzes Regime 1, the situation in which both firms decide not to invest. These results can be found in Naylor (1998, 1999) and Straume (2002), which are the sole references for this part of the paper.[9]

In the last stage of the game, firms compete à la Cournot in the product markets. The profit functions are the following:

$$\Pi_1 = p_A x_{1A} + p_B x_{1B} - w_1 x_{1A} - w_1 x_{1B} - t x_{1B}, \tag{1}$$

$$\Pi_2 = p_A y_{2A} + p_B y_{2B} - w_2 y_{2A} - w_2 y_{2B} - t y_{2A}, \tag{2}$$

where $p_A = 1 - x_{1A} - y_{2A}$ is the price in Country A, which depends both on the quantity produced by Firm 1 for the domestic market, x_{1A}, and Firm 2's exports, y_{2A}. Similarly, $p_B = 1 - x_{1B} - y_{2B}$ is the price in Country B, where x_{1B} is the quantity produced for exports by Firm 1, and y_{2B} is the quantity produced by Firm 2 for the domestic market. Notice that both firms pay a cost of $t \in [0,1)$ per unit of the product exported, representing a basket of costs including tariffs, red tape and, in the case of manufactured goods, transportation and logistics, etc.

The firms' reaction functions are obtained from the first-order conditions for profit maximization. These represent the output produced as well as the firms' labor demands. Thus, in the second stage, each union maximizes its utility function by considering the specific labor demand schedules of the firms, and it is possible to derive the unions' reaction functions. For trade costs below or equal to the threshold value of $t \approx 0.310$, it can be shown that the Bertrand-Nash wage in equilibrium is the following:

$$w_{IIT} = \frac{1}{3} - \frac{1}{6} t .$$

In the case of IIT, unions compete with each other over employment, causing a fall in wage levels compared to the autarky regime. Hence, trade in this model decreases union power. Nevertheless, $dw_{IIT} / dt < 0$ suggests an increase in economic integration (a reduction in trade costs) will induce trade unions to raise wages. The intuition is the following. For values lower than the threshold, IIT occurs between the two countries. A decrease in trade costs will induce harsher competition amongst the participants in the international oligopoly: Firms' outputs rise because exports increase. Consequently, labor demand increases, and therefore, unions will choose to set higher wages, capturing a higher share of oligopoly rents, while firms may experience a loss in profits. Substituting the equilibrium wage into the output expressions, the following values are obtained:

$$x_{1A} = y_{2B} = \frac{2}{9} + \frac{7}{18}t \; ; \; x_{1B} = y_{2A} = \frac{2}{9} - \frac{11}{18}t \, .$$

These represent the Cournot quantities in equilibrium in the presence of IIT. Further substitutions lead to the following union utility and firm profits:

$$\Omega_{IIT} = \frac{1}{27}(2-t)^2 \, , \; \Pi_{IIT} = \frac{8}{81} - \frac{8}{81}t + \frac{85}{162}t^2 .$$

Regime 2: *Both Firms Invest*: *Reciprocal FDI*

Stage 3, firms' quantity choices and labor demands:

The *RFDI* regime is now considered. The firms' profit functions are the following:

$$\Pi_1 = p_A x_{1A} + p_B y_{1B} - w_1 x_{1A} - w_1 y_{1B} - F \, , \tag{3}$$

$$\Pi_2 = p_A x_{2A} + p_B y_{2B} - w_2 x_{2A} - w_2 y_{2B} - F \, , \tag{4}$$

where $p_A = 1 - x_{1A} - x_{2A}$ is the price in Country A, which depends both on the quantity produced by Firm 1 in Country A, x_{1A}, and the quantity produced by Firm 2's branch located in the same country, x_{2A}. Similarly, $p_B = 1 - y_{1B} - y_{2B}$ is the price in Country B. Companies, in theory, may still export to the foreign country instead of serving the foreign market by producing locally. However, having borne the burden of a sunk cost equal to F, firms do not export. The rationale is that firms incur additional costs of t for the quantities exported, and this is less profitable than the option of serving the foreign market with local production alone. It follows that the specification of the firms' profit functions in the presence of RFDI is exactly as indicated in Equations 3 and 4.

Note that, in the present model, multinational firms pay the same wage in both countries because, by assumption, the MNE's workers are organized at company level. Unions act on behalf of overall workers and set a non-discriminatory wage independently from the fact that workers are located in different countries. This hypothesis would reflect the situation of centralized negotiations among unions operating in Works Councils and the general management of firms pursuing international business. It may be argued that this assumption is extremely strong and, undeniably, it is. However, as underlined in the introduction, the purpose is to investigate how international business decisions may be affected if unions' eventual development in transnational company agreements occurs and they are able to coordinate bargaining across countries effectively. This hypothesis is consistent with the idea, usually found in the literature, that a multinational pays a wage rate *different* from that of domestic firms (see, for example, Leahy & Montagna, 2000).

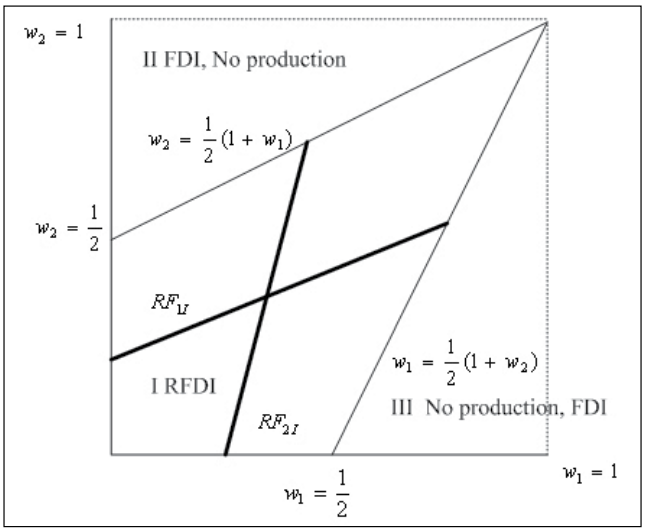

Figure 1. Investment boundaries and unions' reaction functions.

The firms' reaction functions are obtained from first-order conditions for profit maximization (see Appendix A). These represent the output produced by each firm in each country. If $(w_1 < 1, w_2 < 1)$, it is possible to show that the solution of the quantity game in Country A as function of the wage rates, call it (x_{1A}^C, x_{2A}^C), is such that:

$$(x_{1A}^C, x_{2A}^C) = \begin{cases} \left(\frac{1+w_2-2w_1}{3}, \frac{1+w_1-2w_2}{3}\right), & \text{iff } w_1 \le \frac{1+w_2}{2}, w_2 \le \frac{1+w_1}{2}; \quad (5a) \\ (0, \frac{1-w_2}{2}), & \text{iff } w_1 \ge \frac{1+w_2}{2}, w_2 < 1; \quad (5b) \\ (\frac{1-w_1}{2}, 0), & \text{iff } w_2 \ge \frac{1+w_1}{2}, w_1 < 1. \quad (5c) \end{cases}$$

while the solution of the quantity game in Country B, call it (y_{1B}^C, y_{2B}^C), is such that:

$$(y_{1B}^C, y_{2B}^C) = \begin{cases} \left(\frac{1+w_2-2w_1}{3}, \frac{1+w_1-2w_2}{3}\right), & \text{iff } w_1 \le \frac{1+w_2}{2}, w_2 \le \frac{1+w_1}{2}; \quad (6a) \\ (0, \frac{1-w_2}{2}), & \text{iff } w_1 \ge \frac{1+w_2}{2}, w_2 < 1; \quad (6b) \\ (\frac{1-w_1}{2}, 0), & \text{iff } w_2 \ge \frac{1+w_1}{2}, w_1 < 1. \quad (6c) \end{cases}$$

If unions fix too high wage levels (Regions II and III in Figure 1), the firms do not find it profitable to exploit the foreign plant, although they have already incurred the sunk cost. High wages set by unions also price out each firm from the domestic market; each firm finds it inconvenient to produce there. The reason is that, given w_1 (w_2), for w_2 (w_1) such that the point (w_1, w_2) lies on the boundary between Regions I and II (III) or is internal to Region II (III), the wage rate is not lower than the price under domestic monopoly (the autarky case).

Stage 2, unions' wage setting

From the above discussion, it follows that, in Stage 2 of the game, each company-level union chooses a wage, allowing firms to pursue both domestic production and exploitation of the plants abroad. Making use of the optimal quantities the utility function for Union 1 is:

$$\Omega_1 = w_1(x_{1A} + y_{1B}), \quad (7)$$

and the utility function for Union 2 takes a similar form. Substitution of Equations 5a and 6a into Equation 7, and solving the maximization problem, leads to the following expression:

$$RF_1(w_2) = w_1 = \frac{1}{4} + \frac{1}{4} w_2,$$

the reaction function for Union 1. A similar result (interchanging w_1 with w_2) pertains for Union 2.

Sub-Game perfect equilibriums of the two-stage game "unions' wage determination–firms' output choices"

Solving the linear system composed by the two unions' reaction functions, the Bertrand-Nash equilibrium wage level is:

$$w_{RFDI} = \frac{1}{3}.$$

It follows that production levels are:

$$x_{1A} = y_{1B} = y_{2B} = x_{2A} = \frac{2}{9}.$$

Comparing w_{IIT} and w_{RFDI}, and production outcomes (and thus employment levels), it is immediately clear that, in the case of international production, both achieve higher values, and therefore, unions in equilibrium have higher utility levels in the RFDI regime than in IIT. The firms' production levels for the domestic market decrease, while those for the foreign market increase. The rationale for the latter result is that, in the case of investment, the marginal cost of serving the market abroad by local production is lower than in the case of exports. Nevertheless, the expansion in the foreign market more than offsets the loss of market shares in the domestic market: Total output (and, therefore, employment), rises. Labor demand increases as well, and therefore, each company-level union may claim for higher wages than in IIT while firms may experience a fall in profit levels. In addition, wage rates increase because the firms' rents in RFDI are larger than those in IIT (due to trade cost savings), and unions are able to capture a share of these enlarged rents. Thus, for unions organized at company level, the investment strategy of the firms is advantageous. After subsequent substitutions, the following expressions for the union utility and firm profits are obtained:

$$\Omega_{RFDI} = \frac{4}{27}, \ \Pi_{RFDI} = \frac{8}{81} - F.$$

Regime 3: *Only One Firm Invests*: *Asymmetric Regimes*

Stage 3, firms' quantity choices and labor demands

The evaluation of firms' profits in asymmetric regimes (one firm invests while the other does not) requires the establishment of a set of game equilibriums. In these asymmetric regimes, different configurations in both the product and the labor markets are possible. Consider, for example, the case that Firm 1 does not invest while Firm 2 undertakes a FDI; in the general case, the firms' profit functions are the following:

$$\Pi_1 = p_A x_{1A} + p_B x_{1B} - w_1 x_{1A} - w_1 x_{1B} - t x_{1B}, \tag{8}$$

$$\Pi_2 = p_A x_{2A} + p_B y_{2B} - w_2 x_{2A} - w_2 y_{2B} - F, \tag{9}$$

where $p_A = 1 - x_{1A} - x_{2A}$ is the price in Country A, which depends both on quantities produced by Firm 1 and the quantities produced by Firm 2's subsidiary in the same country, while $p_B = 1 - x_{1B} - y_{2B}$, the price in Country B, depends on Country B's imports from Firm 1 and the quantity produced by Firm 2 for its domestic market. Notice that, in the case under examination, Firm 2 may export towards Country A. Nevertheless, having undertaken the sunk cost of *F*, Firm 2 does not export because it incurs additional costs of *t* for the quantities exported. Therefore, the choice of simultaneous export and local production is less profitable than the choice of local production only.

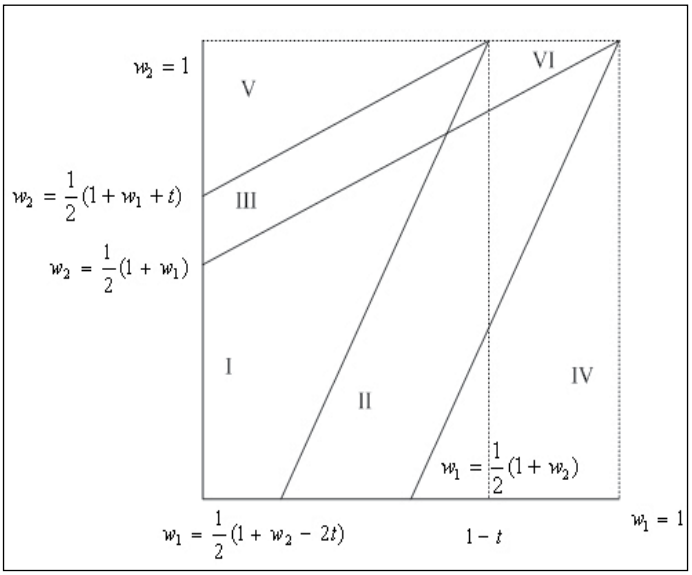

Figure 2. Trade and investment boundaries and possible configurations in asymmetric regimes.

First-order conditions for the maximization of firms' profits lead to the expressions for the Cournot reaction functions (see Appendix A). Then, if $(w_1 < 1, w_2 < 1)$, it is possible to show that the solution in terms of wage rates of the quantity game in Country A, call it (x_{1A}^C, x_{2A}^C), is such that:

$$(x_{1A}^C, x_{2A}^C) = \begin{cases} \left(\frac{1+w_2-2w_1}{3}, \frac{1+w_1-2w_2}{3}\right), & \text{iff } w_1 \le \frac{1+w_2}{2}, w_2 \le \frac{1+w_1}{2}; \quad (10a) \\ (0, \frac{1-w_2}{2}), & \text{iff } w_1 \ge \frac{1+w_2}{2}, w_2 < 1; \quad (10b) \\ (\frac{1-w_1}{2}, 0), & \text{iff } w_2 \ge \frac{1+w_1}{2}, w_1 < 1. \quad (10c) \end{cases}$$

while the solution of the quantity game in Country B, call it (x_{1B}^C, y_{2B}^C), is such that:

$$(x_{1B}^C, y_{2B}^C) = \begin{cases} \left(\frac{1-2t+w_2-2w_1}{3}, \frac{1+t+w_1-2w_2}{3}\right), & \text{iff } w_1 \le \frac{1+w_2-2t}{2}, w_2 \le \frac{1+w_1+t}{2}; \quad (11a) \\ (0, \frac{1-w_2}{2}), & \text{iff } w_1 \ge \frac{1+w_2-2t}{2}, w_2 < 1; \quad (11b) \\ (\frac{1-w_1-t}{2}, 0), & \text{iff } w_2 \ge \frac{1+w_1+t}{2}, w_1 \le 1-t. \quad (11c) \end{cases}$$

Figure 2 depicts all the boundary conditions and possible asymmetric configurations. These boundary conditions generate six qualitatively different regions in the (w_1, w_2) plane, three involving trade, and three involving local production due to the FDI. In the interior of Region I, all quantities are positive. This region relates to values of wages sufficiently low such that both firms may undertake international business, either in the form of exports or using the foreign plant for local production.[9]

In Region II, w_1 is high enough, given t, that Firm 1 cannot export: In this case only Firm 2 undertakes international business because of FDI, while w_1 is still sufficiently low to ensure that Firm 1 produces positive quantities for the domestic market. In Region III, on the other hand, w_2 is such that, given t, Firm 2 cannot exploit the production plant located abroad. However, albeit prohibitive to the exploitation of the foreign plant, w_2 is still sufficiently low to allow domestic production. In Region IV (and similarly in Region V), w_1 (w_2) is so high that Firm 2 (Firm 1) establishes a monopoly in both markets. Regions I, II, III, IV, and V embrace configurations where forms of international activities occur. In Region VI, in contrast, no international business occurs, and firms produce only for the domestic markets.[10]

As will be shown in the next subsection, each union maximizes its utility function taking into account specific firms' labor demand schedules (see Appendix A): The best-reply functions of each union differ according to the wage rate chosen by the rival. Given the purposes of the paper (equilibriums involving international activities for both firms), the relevant candidate for sub-game equilibriums has to be found in Region I. However, some preliminary considerations allow restriction of the field of analysis for the definition of the relevant best-reply functions.

First, for (w_1, w_2) pairs along the boundary between Regions II and IV and in Region IV, Firm 1 neither exports nor produces for the domestic market. A similar reasoning applies for (w_1, w_2) pairs along the boundary between Regions III and V and in Region V: Firm 2 is priced out of the market, and it does not produce. Instead, for (w_1, w_2) internal to Region VI and along the boundaries between Regions II and VI and Regions III and VI, no international business occurs: Each firm produces only for the domestic market. Second, the following result is derived.

Proposition 1: Given the assumption that Firm 2 invests, in asymmetric regimes, at any wage pair (w_1, w_2) internal to Region III or on the boundary between Regions I and III, Union 2 fails to make a best response.

Proof (See Appendix A)

According to Proposition 1, the best reply function of the union of the investing firm is sufficiently low to allow the exploitation of the foreign plant: Union 2 does not play wage levels in Region III. In the case under

examination, the rationale is that, given w_1, for w_2 such that the point (w_1, w_2) is on the boundary between Regions I and III or internal to Region III, the labor demand function for Union 2 is relatively elastic. More specifically, the percentage change in employment is greater than the percentage change in wage, so that in absolute value $\varepsilon = (dl_{2III}/dw_2)(w_2/l_{2III}) > 1$, where $l_{2III} = y^C_{2B} = (1/3)(1 + t + w_1 - 2w_2)$.[11] From this discussion, the field of analysis concerning the determination of sub-game equilibriums in asymmetric regimes can be restricted to Regions I and II.

Stage 2, unions' wage setting

Given the labor demands for each significant region (see Appendix A), it is possible now to define the unions' payoff functions. Union 1's relevant payoff function in asymmetric regimes is as follows:

$$\Omega_1 = \begin{cases} w_1\left[\frac{1}{3}(2 - 4w_1 + 2w_2 - 2t)\right], & \text{(Region I)} \quad (12) \\ w_1\left[\frac{1}{3}(1 + w_2 - 2w_1)\right]. & \text{(Region II)} \quad (13) \end{cases}$$

This function is continuous over the range of Union 1's wage rates, namely, $w_1 \in (0,1)$. Union 1's utility is increasing in w_2, and for a given w_2, it increases in Region I (Firm 1 exports) when t decreases, whilst remaining unaffected by trade costs in Region II (production only for the domestic market). In both regions, $\partial\Omega_1/\partial w_1 \partial w_2 > 0$, wages are strategic complements.

Instead, Union 2's relevant payoff function is:

$$\Omega_2 = \begin{cases} w_2\left[\frac{1}{3}(2 - 4w_2 + 2w_1 + t)\right], & \text{(Region I)} \quad (14) \\ w_2\left[\frac{1}{6}(5 - 7w_2 + 2w_1)\right]. & \text{(Region II)} \quad (15) \end{cases}$$

This function is also continuous over the range of Union 2's wage rates, that is, $w_2 \in (0,1)$. Union 2's payoff function is increasing in w_1. For a given w_1, a reduction in t decreases Union 2's payoff function in Region I, where Firm 1 exports, while in Region II, Union 2's utility function is not affected by trade costs. In addition, in both regions, $\partial\Omega_2/\partial w_2 \partial w_1 > 0$, wages are strategic complements. Depending on $w_2(w_1)$ and t, Union 1 (2)'s payoff function presents one maximum or more relative maxima. Therefore, the unions' payoff functions are analyzed in relation to the respective independent variables' changes in order to derive the relative best-reply functions.

Proposition 2: Unions' reaction functions, call them respectively RF_1 and RF_2, are as follows:

$$RF_1(w_2) = \begin{cases} \textit{for } t < 2/(2+\sqrt{2}) \approx 0.290: \\ w_1 = \frac{1}{4}(1 + w_2 - t), \qquad \textit{iff } w_2 \in [0, (5-t)/7); \\ \\ \textit{for } 2/(2+\sqrt{2}) \le t \le 20/(29+15\sqrt{2}) \approx 0.390: \\ w_1 = \frac{1}{4}(1 + w_2), \qquad \textit{iff } w_2 \in [0, (2+\sqrt{2})t - 1)); \\ w_1 = \frac{1}{4}(1 + w_2 - t), \qquad \textit{iff } w_2 \in [(2+\sqrt{2})t - 1, (5-t)/7). \end{cases}$$

$$RF_2(w_1)=\begin{cases} for\ \forall t\in\left[0,20/(29+15\sqrt{2})\right]: & \\ w_2=\dfrac{1}{8}(2+2w_1+t), & iff\ w_1\in[0,(10-15t)/14); \\ w_2=2w_1+2t-1, & iff\ w_1\in[(10-15t)/14\,,(19-28t)/26); \\ w_2=\dfrac{1}{14}(5+2w_1), & iff\ w_1\geq(19-28t)/26). \end{cases}$$

where $t\leq 20/(29+15\sqrt{2})\approx 0.398$ is the critical value above which intra-industry international activities are not supported in a pure strategy equilibrium.

Proof (see Appendix A)

Figure 3 depicts the two unions' reaction functions for some definite values of t. The left box depicts the case of trade costs such that the two unions' best-reply functions are continuous and intersect in Region I. The center box shows the case of trade costs such that the reaction functions are discontinuous, and the switching wage is lower than the wage at which the two unions' best-reply functions intersect. The right box shows the unions' reaction functions at $t=20/(29+15\sqrt{2})$, the critical value of trade costs supporting intra-industry international activities in a pure strategy equilibrium.

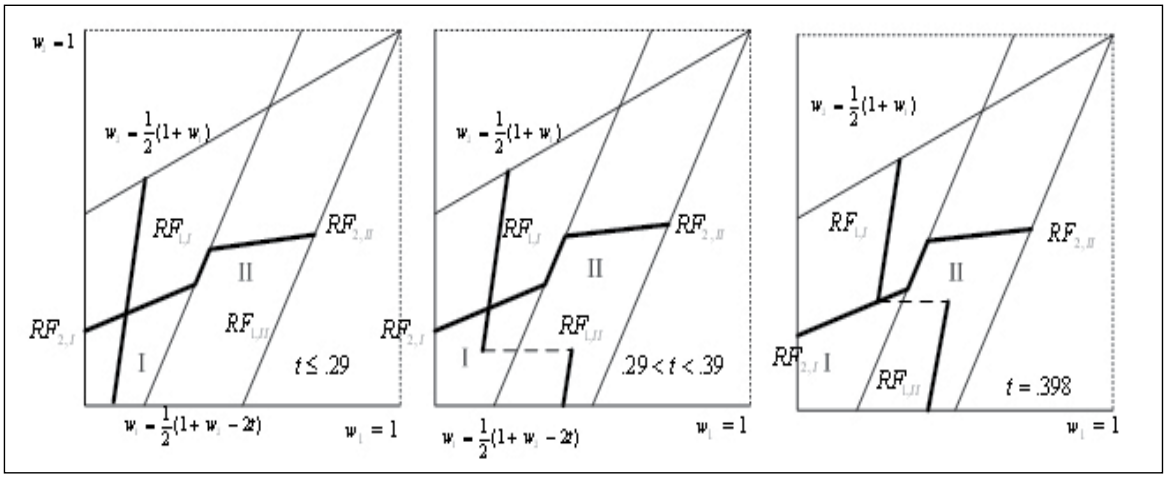

Figure 3. Trade and investment boundaries and unions' reaction functions in asymmetric regimes.

Sub-game perfect equilibria of the two-stage game "unions' wage determination - firms' output decisions"

For trade cost levels less than, or equal to, the threshold of $t\approx 0.390$, the Bertrand-Nash wages in equilibrium are as follows:

$$w_{1,Asy}=\frac{1}{3}-\frac{7}{30}t\,,\ w_{2,Asy}=\frac{1}{3}+\frac{1}{15}t\,.$$

Substitutions of equilibrium wages into quantity expressions yield:

$$x_{1A}=\frac{2}{9}+\frac{8}{45}t\,;\ x_{1B}=\frac{2}{9}-\frac{22}{45}t\,;\ y_{2B}=\frac{2}{9}+\frac{19}{90}t\,;\ x_{2A}=\frac{2}{9}-\frac{11}{90}t\,.$$

It is immediately evident that t plays a different role in wage levels, depending on the international economic activity the firm undertakes. In fact, increasing economic integration (a reduction in barriers to trade) stimulates exports for Firm 1. Consequently, labor demand for Firm 1 increases, and this, in turn, implies that Union 1, which operates in the exporting firm, chooses to set higher wages: Wages in the exporting firm increase. On the other hand, a higher degree of economic integration translates both to a decrease in the total production of Firm 2, the investing firm, and to a wage reduction for its workers. Nonetheless, wages and total output

in the multinational firm are always higher than those in the exporting firm, unless $t = 0$. The union in the multinational captures higher shares of the firm's rents generated by the savings in trade costs. However, trade cost savings imply an expansion in the multinational's output, and, therefore, an increase in its employment levels. The rival firm's decision to undertake FDI shifts the union's reaction function in the exporting firm downward. Despite the strategic effect due to wage complementarities, the labor demand effect outweighs these gains. The rationale is that the exporting firm faces stronger competition in the domestic market when the competing firm produces locally. It follows that, in asymmetric regimes, wages in the exporting firm are lower with respect to the IIT case. Subsequent substitutions of equilibrium wages and quantities lead to the values for union utility level and firms' profit functions in the case of asymmetric regimes:

$$\Omega^{NI}_{1,Asy} = \frac{1}{675}(7t-10)^2,\ \Pi^{NI}_{1,Asy} = \frac{8}{81} - \frac{56}{405}t + \frac{548}{2025}t^2;$$

$$\Omega^{IN}_{2,Asy} = \frac{4}{675}(5+t)^2,\ \Pi^{IN}_{2,Asy} = \frac{8}{81} + \frac{16}{405}t + \frac{241}{4050}t^2 - F.$$

First stage: Firms' Selection Strategy and Game Equilibriums

It is now possible to go back to the first stage of the game to investigate the firms' strategies. Trade and investment costs and the unions' wage setting determine the different productive structures that might arise as equilibriums of the game. In the sub-game defined by firms' strategy profile (*N*;*N*), IIT is supported as the Nash equilibrium in pure strategies in the two-stage sub-game "unions' wage determination-firms' quantity choices" if trade cost levels are below $t \leq 0.310$.

Firms' payoffs in the RFDI regime depend on wage levels set by unions and the amount of sunk costs. Conversely, in the two asymmetric sub-games, depending on *t*, *F*, and the unions' wage strategies, international activities for both firms are supported as the Nash equilibrium in pure strategies in the two-stage sub-game "unions' wage determination–firms' quantity choices" if $t \leq 0.398$. The threshold value for the size of sunk costs derives from $F \in \left[0, \min(\Pi^{II}_{ij,RFDI}; \Pi^{IN}_{ij,Asy})\right)$ with $i = 1,2;\quad j = B,A$, where $\Pi^{II}_{ij,RFDI} = 4/81$ and $\Pi^{IN}_{ij,Asy} = (11t-20)^2/8100$.

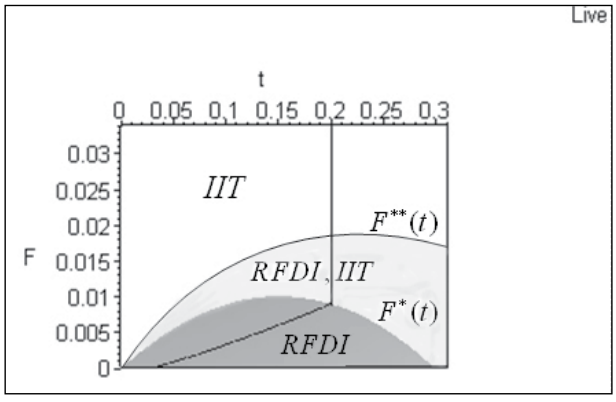

Figure 4. Production structures in equilibrium.

It can easily be checked that, over the range $t \leq 0.310$, $\Pi^{II}_{ij,RFDI} \geq \Pi^{IN}_{ij,Asy}$, with the equality holding only for $t = 0$. Hence, the relevant range of F is $F \in \left[0, (\Pi^{IN}_{ij,Asy} = (11t-20)^2/8100)\Big|_{t=0.310}\right) \approx 0.034$. In fact, for $t \leq 0.310$, profits associated with asymmetric structures of international activities are the lowest for the investing firm. Therefore, this restriction defines the set where the investment strategy can be played by each firm at every value of $t \leq 0.310$ independently from the rival firm's choice as regards its internationalization strategy.[12]

Making use of the results of stages 2 and 3 and Restriction 1, the firms' payoff structure in Stage 1 of the game is $(\Pi^{II}_{1,RFDI}; \Pi^{II}_{2,RFDI})$, $(\Pi^{IN}_{1,Asy}; \Pi^{NI}_{2,Asy})$, $(\Pi^{NI}_{1,Asy}; \Pi^{IN}_{2,Asy})$, $(\Pi^{NN}_{1,IIT}; \Pi^{NN}_{2,IIT})$. As Figure 4 shows, these outcomes generate three different regions in the relevant (t,F)-plane, which represent the equilibriums of the game.

The set $(t \in (F=0) \mid 0 \le t \le 140/471 \approx 0.297) \cup F \le F^{*}(t) = (56/405)t - (314/675)t^2$ defines the first region. Direct comparison of payoffs shows that, in this area, $\Pi^{II}_{i,RFDI} \ge \Pi^{NI}_{i,Asy}$ and $\Pi^{IN}_{i,Asy} \ge \Pi^{NN}_{i,IIT}$, $i = 1,2$. In other words, to invest is a dominant strategy for both firms. Therefore, the RFDI regime arises in equilibrium.

The second region is defined by the following set of points in the (t,F)-plane: $(t \in (F=0) \mid 0.297 < t \le 0.310) \cup F^{*}(t) < F \le F^{**}(t) = (56/405)t - (548/2025)t^2$. In this region, when firm i plays the investment strategy I, the rival firm's j best response is to play the strategy I because $\Pi^{II}_{j,RFDI} \ge \Pi^{NI}_{j,Asy}$, and *vice versa*. That is, to invest is a mutual best response and, therefore, the RFDI regime is a Nash equilibrium. In contrast, when firm i plays the N strategy, the firm's j best response is to play the strategy N given that $\Pi^{NN}_{j,IIT} \ge \Pi^{IN}_{j,Asy}$. The same reasoning applies if firm j plays the N strategy; not to invest is a mutual best response. Therefore, the IIT regime is a Nash equilibrium. Thus, there are combinations of the parameters t and F such that IIT and RFDI regimes arise as simultaneous, symmetric multiple Nash equilibriums of the game.

The rationale for this result can be explained as follows. At first, consider the case that firm i plays the N strategy. If firm j also plays strategy N, profits are $\Pi^{NN}_{j,IIT}$. Analytical inspection reveals that $\partial \Pi^{NN}_{j,IIT} / \partial t \gtrless 0$ if $t \gtrless 8/85 \approx 0.094$. As Naylor (1998) explains, when $t > 0.094$, a decrease of the trade costs implies that profits fall because the product price decreases due to increasing international market competition, while wages increase because of the unions' strategic behavior. These adverse effects on profit more than offset the benefits of the reduced trade costs. The opposite applies for $t \le 0.094$: The cost reduction effect dominates. On the other hand, if firm j plays the strategy I, profits are $\Pi^{IN}_{j,Asy}$. Differentiation shows that $\partial \Pi^{IN}_{j,Asy} / \partial t > 0, \forall t \in [0,0.310]$. Therefore, a fall of the trade costs implies that profits unambiguously decrease. The price decreases because of increasing product market competition (a decrease in t stimulates the exports of the rival firm); wages also decrease because the union faces a lower labor demand. However, the former effect outweighs the latter. For $F = 0$ and $0.297 < t < 0.310$, $\Pi^{NN}_{j,IIT} \ge \Pi^{IN}_{j,Asy}$ because competition in the IIT regimes is less fierce than in the asymmetric regime. Nonetheless, as the magnitude of the sunk costs increases, the profit function associated with the FDI goes down. This implies that for $F^{**}(t) < F$, besides the area with relatively high trade costs, also for low trade costs the profits associated with the export strategy may exceed those related to the investment strategy. The reason is that the investing firm in the asymmetric regime has to cover the sunk costs with a higher negative competition effect on prices than in the case of IIT.

Consider now the case that firm i plays the I strategy. If firm j replies by playing I, the profits are $\Pi^{II}_{j,RFDI}$. It is immediately evident that, in the RFDI regime, trade costs have no effect on firms' profits, which are affected only by the scale of the sunk costs. On the other hand, if firm j replies with the N strategy, the profits are $\Pi^{NI}_{j,Asy}$. Analytical inspection reveals that $\partial \Pi^{NI}_{j,Asy} / \partial t \gtrless 0$ if $t \gtrless 35/137 \approx 0.250$. Similarly to the previous case, when $t > 0.250$, a decline in trade costs leads to a fall in profits due to the price decreases driven by product market competition, while wages rise because of the union's strategic behavior. The adverse effects on profit in the product market competition and wage increase more than counterbalance the beneficial effects of the decline in trade costs, and *vice versa*, for $t \le 0.250$, the cost reduction effect becomes dominant. However, for $(t \in (F=0) \mid 0.297 < t \le 0.310) \cup F^{*}(t) < F \le F^{**}(t)$, $\Pi^{II}_{j,RFDI} \ge \Pi^{NI}_{j,Asy}$ because for these combinations of integration costs, product market competition in the asymmetric regimes is harsher than in the RFDI regime. It is worth noting that, if sunk costs are low enough, namely $F^{**}(t) < F$, the RFDI regime arises not only when trade costs are high (the so-called tariff jumping argument), but also when barriers to trade are low, and IIT is a viable option.

The explanation is as follows. A reduction in trade costs makes the investment option more attractive. In fact, differentiation reveals that $\partial(\Pi^{IN}_{ij,Asy}) / \partial t < 0 \; \forall t \in [0,0.310]$ as t decreases, the profits generated in the foreign country for the investing firm in the asymmetric regime increase. That is, the investing firm may disburse a large amount for the sunk costs to enter the foreign market. In other words, the set of the parameter values for which the investment strategy is feasible enlarges.

Finally, the set of points $(F \in (t=0) \mid 0 \le F \le 0.034) \cup F^{**}(t) < F)$ characterizes the third region. Straight forward evaluation of payoffs reveals that, in this region, $\Pi^{NN}_{i,IIT} > \Pi^{IN}_{i,Asy}$ and $\Pi^{NI}_{i,Asy} > \Pi^{II}_{i,RFDI}$, where $i = 1,2$, not to invest is a dominant strategy for both firms. As the magnitude of the sunk costs increases, the profit function associated with the investment strategy moves downward. Consequently, for $F^{**}(t) < F$ and low trade costs, the profits associated with the export strategy exceed those related to the investment strategy. The rationale resides in the fact that the firm that does not invest in the asymmetric regime faces a less adverse competition effect on prices than in the case of RFDI without the need to cover the sunk costs. Furthermore, the combination of relatively large sunk costs and wage levels higher than in the case of exports does not

overcome the trade cost savings for firms when they invest. Thus, the IIT regime is the only equilibrium of the game. These results can be summarized in the following proposition.

Proposition 3: Under Restriction 1:

(a) for $F = 0$, in the range $0 < t \leq 0.297$, RFDI is the Nash equilibrium; (b) for $(t \in (F = 0) \mid 0.297 < t \leq \leq 0.310) \cup F^{*}(t) < F \leq F^{**}(t) = (56/405)t - (548/2025)t^{2}$, multiple equilibriums (simultaneous RFDI and IIT) arise; and (c) for $(F \in (t = 0) \mid 0 \leq F \leq 0.034) \cup F^{**}(t) < F)$, IIT is the unique equilibrium of the game.

Managerial Implications

To begin with, the first, relevant result arising from this framework is that, in a highly integrated economic environment characterized by falling trade barriers and slackening regulations in capital markets, the decision to focus exclusively on domestic business in oligopoly sectors with the presence of unionized labor force is not valuable. If integration costs are at a level such that an expansion of the firm's activities abroad is possible (as depicted in this model), the internationalization strategy is unquestionably more profitable than the simple domestic business development. The rationale behind this result is straightforward: The internationalization strategy allows for gaining market shares of the rival companies and, eventually, pricing them out if labor unions do not moderate their wage demands.

Second, Horn, and Wolinsky (1988) suggested firms may aim at taking strategic advantage of an MNE organizational structure to prevent the formation of an encompassing union within a company and thereby, keep wages lower in some plants to reduce the cost of production and gain access to foreign markets. However, if unionized workers are able to coordinate their bargaining activities at the company level effectively, the overall picture changes. In fact, due to wage coordination, labor costs maintain relatively high levels and thus managerial efforts to cut costs to penetrate into a foreign market of the integrated area should be directed toward other sources.

Third, despite the fact that managers in a company dispose of several technical forms to expand business such as licensing and franchising to host country firms, and mergers and acquisitions of an already operating firm into the targeted market, the model in this work focuses on the two alternative internationalization strategies of exporting and establishing a new, wholly owned subsidiary. On one hand, the exporting strategy avoids the substantial cost of setting up manufacturing operations into another country. On the other hand, from a managerial viewpoint, a wholly owned subsidiary in the form of a Greenfield venture, as delineated in the model, is justified by the minimization of the risk of losing control over technological competences and tight control over operations in different countries. However, this entry mode into a foreign market is, in general, the most costly from the point of view of the capital investment (capital costs and risks).

In the case of horizontal FDI, with replication of the same production process at home and in the host country with the presence of company level unions, wage rates keep up high levels because of coordination. In the case of the exporting strategy, declining trade barriers allow unions to raise wage demands because of the effect of the firms' product market expansion. Thus, whatever the internationalization strategy chosen to expand cross-border business, labor costs play a major role. Nevertheless, the integration costs affect in different ways the profitability of the selected strategy. The sunk costs have a direct impact on profits in the case of the investment strategy. The trade costs have both a direct (increasing costs) and indirect impact (due to their effect on the union wage strategy) on firms' profitability in the case of the exporting strategy. The findings in this work imply that, in a situation characterized by elevated wages and deep economic integration, the investment strategy is advantageous when the size of the sunk costs is small. Worth noting is the fact that to invest may be more beneficial than to export for low values of trade costs. On the other hand, for intermediate values of the sunk costs, both internationalization strategies arise in equilibrium while, for excessive sunk costs, only the exporting strategy is gainful for firms. In other words, if lower-cost locations for manufacturing are not available (in this model, labor costs, because of wage coordination), the choice of a FDI should be taken when it is required to have strict control over core managerial competences (for example, marketing skills), and the cost of building and technical equipment to set up a new plant are not extremely large. In contrast, if trade (transportation and tariff) costs are low enough while the cost of manufacturing a plant is significant and core managerial competences can be controlled easily from the domestic country, the exporting strategy should be preferred.

Conclusion

In this paper, through the reduction in trade costs and the possibility to undertake direct investment in a foreign country on firms and unions' strategic behavior, the consequences of the process of international market integration were dealt with and exemplified. A general framework, to analyze how these two aspects of economic integration affect firms' decisions concerning international business and the strategic behavior of company-wide unions in the labor market, is developed. In the model, firms are allowed to choose their internationalization strategy. The basic two-way IIT analytical framework of Naylor (1998, 1999) and the FDI-autarky model of Naylor and Santoni (2003) are complemented. In a three-stage game, firms act as first movers and choose independently whether to invest in a foreign country; monopoly labor unions select their wage strategy in the second stage; in the third stage output is realized. The focus of the model is on a subset of the integration costs (trade and sunk costs), such that firms can initiate international activities. Trade costs affect the union's wage strategy formation, and this, in turn, affects the strategic behavior of firms. Considering the wage strategies of rival unions, the complete set of production structure regimes arising as sub-game perfect Nash equilibriums for different combinations of trade and sunk costs is derived. The main results are as follows.

Whenever a firm invests abroad to start international business, company unions cannot choose a prohibitive wage rate condemning their workers to be priced out of the labor market. Nevertheless, labor unions gain a larger share of the firms' rents than in the IIT regime because of savings in trade costs: Company-wide unions may welcome FDI.

Union wages exclusively influence the firms' payoffs in the RFDI regime. The firms' strategy profile $(N;N)$ defines that IIT is supported as the Nash equilibrium in pure strategies if and only if the trade cost level is below $t \leq 0.310$. This result is also obtained in Naylor (1998). The two sub-games identified by the firms' strategy profiles $(I;N)$ and $(N;I)$, if $t \leq 0.398$, define that the company-level union operating in the exporting firm sets a wage level such that the firm would export in the other country. The union in the investing firm sets a wage such that the company can exploit the production facilities in both countries.

Because of the interdependence of t, F and unions' strategic behavior, equilibriums involving different configurations of international activities arise. Nonetheless, some noteworthy observations can be addressed. First, the RFDI regime also arises as equilibrium for low values of trade costs: To invest is a viable strategic option for a firm not only for the tariff jumping argument, but also when IIT is feasible. The reason lies in the fact that increasing economic integration makes the investment option increasingly suitable. Second, the interdependency between trade and sunk costs and the unions' strategic behavior generates the conditions such that multiple symmetric equilibriums (RFDI and IIT) may arise in the game. Finally, if sunk costs are sufficiently large, IIT is the unique equilibrium of the game: If firms want to invest, the size of the sunk costs and the wage levels higher than in the case of exports do not offset the trade cost savings.

However, caution is advised with respect to the general conclusion of this article. The analysis uses a basic framework. The model presents a certain lack of robustness because of specific functional forms for utility, production and cost functions. These represent all the drawbacks of the model. As Naylor (1999) suggested, a more general right-to-manage model of wage bargaining is a suitable way to develop this work. It would be interesting to test, empirically, if the prospect of company-wide negotiations conducted by unique workers' representatives affects firms' strategic decisions related to international activities. This is left for research in the future.

Endnotes

[1] Recently revised in 2009, Directive 2009/38/EC of the European Parliament and of the Council of 6 May 2009 on the establishment of a European Works Council or a procedure in Community-scale undertakings and Community-scale groups of undertakings for the purposes of informing and consulting employees, OJ EU L. 122 of 16.5.2009.

[2] On collective bargaining in MNEs, see also European Trade Union Confederation (2007), Eurofound (2009), and European Commission (2009, 2011).

[3] Consumers' utility will take similar forms in the case of production in the presence of FDI.

[4] This paper considers only pure strategies.

[5] The condition $t < 1$ represents a "viability condition". In fact, for $t > 1$, exports will never occur.

[6] In principle, there are two additional outcomes in this sub-case, namely the one-way trade regimes. As Naylor (1999) shows, if countries are symmetric and both labor markets are unionized, one-way trade is not an equilibrium regime.

[7] As Brander (1981) pointed out, it might be argued that it is unrealistic to take the quantity rather than the price as the firm's strategic variable. The Cournot setting in the output market has been chosen in this paper for the sake of simplicity.

[8] In fact, profits generated in the foreign market by the firm that invests have to be greater than the size of the fixed costs to undertake the investment in the foreign country. However, these profits differ according to the strategy selected by the rival firm. Therefore, if this restriction does not hold, the investment strategy is not always practicable, and the model collapses in Naylor's (1999) analysis.

[9] Additional analytical details are available upon request from the Author.

[10] The frontier of the area for reciprocal intra-industry international business is the union of the following four sets of points in the (w_1, w_2) plane: (a) $w_1 = (1 + w_2 - 2t)/2, w_1 \leq 1 - (4/3)t$; (b) $w_2 = (1 + w_1)/2, w_2 \leq 1 - (2/3)t$; (c) $w_1 = 0$, $w_2 \leq 1/2$; and (d) $w_2 = 0, w_1 \leq (1 - 2t)/2$; with $(1 - (4/3)t, 1 - (2/3)t)$ being the intersection (the upper vertex of Region I in Figure 2) between the graphs representing the equations (a) and (b). Differentiation of the inequalities in (a) and (b) leads to $dw_1/dt < 0$ and $dw_2/dt < 0$: The graph of the equation in (a) shifts down to the right, while the graph of the equation in (b) moves up to the left. That is, a decrease in trade costs expands Region I, increasing the opportunities for intra-industry international activities. It is worth noting that, with the presence of an investing firm, the range of *t* such that intra-industry international activities take place in asymmetric regimes is wider than that in the case of IIT found in Naylor (1999). To be more precise, for a given level of trade costs *t*, a given (w_1, w_2) pair may not be congruent with positive exports in both countries in the case of IIT, while it may be consistent with a situation of Firm 1's positive exports and the foreign plant's exploitation of Firm 2 in the asymmetric regime under examination. Further analytical details are available upon request from the Author.

[11] Theoretically, there are three other regions that are not depicted in Figure 2 (the axes' length equals 1, and is therefore outside of the surface of the box diagram). The first region is characterized by $w_1 > 1$ and $w_2 < 1$; the second region by $w_1 < 1$ and $w_2 > 1$; the third region by $w_1 > 1$ and $w_2 > 1$. In the first two regions, wage rates are so high that in Country A (B) there is neither production nor consumption, but w_2 (w_1) is sufficiently low so as to make production for the domestic market worthwhile. On the other hand, in the third region wage rates are so high that, in both countries, there is neither production nor consumption.

[12] This result can be checked as follows. The elasticity of the labor demand in Region III, in absolute value, is $\varepsilon_{l_{2III}} = (2w_2/(1 + t + w_1 - 2w_2))$. The inequality $\varepsilon_{l_{2III}} > 1$ holds if and only if $4w_2 > 1 + t + w_1$. Taking into account that $w_1 < 1 - t$ (otherwise the point (w_1, w_2) is outside Region III), this condition may be rewritten as $4w_2 > 1 + t + 1 - t - \delta = 2 - \delta$, where $\delta \equiv 1 - t - w_1 > 0$. However, $4w_2 > 2 - \delta$ always holds true since $4w_2 \geq 2$: The last result follows from the fact that $2w_2 \geq 1 + w_1$ (otherwise the point (w_1, w_2) is certainly outside Region III).

[3] If the restriction on sunk costs does not hold, the investment strategy is not always practicable. Therefore, the results of the analysis are those obtained in Naylor (1998).

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Appendix

Firms' Reaction Functions in the RFDI Regime

From first-order conditions for profit maximization of Equations 3 and 4, the following Cournot reaction functions are derived:

$$x_{1A}(x_{2A}^E)=\begin{cases}\dfrac{1-w_1}{2}-\dfrac{1}{2}x_{2A}^E, \text{for } (w_1,x_{2A}^E): x_{2A}^E \le 1-w_1;\\ 0, \text{otherwise.}\end{cases} \tag{A.1}$$

$$y_{1B}(y_{2B}^E)=\begin{cases}\dfrac{1-w_1}{2}-\dfrac{1}{2}y_{2B}^E, \text{for } (w_1,y_{2B}^E): y_{2B}^E \le 1-w_1;\\ 0, \text{otherwise.}\end{cases} \tag{A.2}$$

$$x_{2A}(x_{1A}^E)=\begin{cases}\dfrac{1-w_2}{2}-\dfrac{1}{2}x_{1A}^E, \text{for } (w_2,x_{1A}^E): x_{1A}^E \le 1-w_2;\\ 0, \text{otherwise.}\end{cases} \tag{A.3}$$

$$y_{2B}(y_{1B}^E)=\begin{cases}\dfrac{1-w_2}{2}-\dfrac{1}{2}y_{1B}^E, \text{for } (w_2,y_{1B}^E): y_{1B}^E \le 1-w_2;\\ 0, \text{otherwise.}\end{cases} \tag{A.4}$$

From Equation A.1, it can be seen that Firm's 1 production for the domestic market is certainly zero, regardless of x_{2A}^E, whenever $w_1 \ge 1$. Each of the Equations A.1 to A.4 also provides an upper limit for the wage facing a firm, a wage not to be exceeded in order for that firm's best response not to be zero, even when the rival is expected to offer zero output in the product market concerned. This upper bound is, for example, $w_2 = 1$ as far as Firm 2's local production in Country A is concerned. These upper bounds for the wages so identified are shown in Figure 3. Equations A.1 and A.3, together with the equations of the realization of expectations, $x_{2A} = x_{2A}^E$ and $x_{1A} = x_{1A}^E$, and Equations A.2 and A.4, with $y_{2B} = y_{2B}^E$ and $y_{1B} = y_{1B}^E$, represent the two independent systems whose solutions determine the Cournot quantities in Countries A and B, respectively.

Firms' Reaction Functions in the Asymmetric Regime

First-order conditions for the maximization of firms' profits of Equations 8 and 9 lead to these expressions for the Cournot reaction functions:

$$x_{1A}(x_{2A}^E)=\begin{cases}\dfrac{1-w_1}{2}-\dfrac{1}{2}x_{2A}^E, \text{for } (w_1,x_{2A}^E): x_{2A}^E \le 1-w_1;\\ 0, \text{otherwise.}\end{cases} \tag{A.5}$$

$$x_{1B}(y_{2B}^E)=\begin{cases}\dfrac{1-w_1-t}{2}-\dfrac{1}{2}y_{2B}^E, \text{for } (w_1,y_{2B}^E): y_{2B}^E \le 1-w_1-t;\\ 0, \text{otherwise.}\end{cases} \tag{A.6}$$

$$x_{2A}(x_{1A}^E)=\begin{cases}\dfrac{1-w_2}{2}-\dfrac{1}{2}x_{1A}^E, \text{for } (w_2,x_{1A}^E): x_{1A}^E \le 1-w_2;\\ 0, \text{otherwise.}\end{cases} \tag{A.7}$$

$$y_{2B}(x_{1B}^E)=\begin{cases}\dfrac{1-w_2}{2}-\dfrac{1}{2}x_{1B}^E, \text{for } (w_2,y_{1B}^E): x_{1B}^E \le 1-w_2;\\ 0, \text{otherwise.}\end{cases} \tag{A.8}$$

From Equation A.5, it is seen that Firm 1's production for the domestic market will certainly be zero, no matter x_{2A}^E, whenever $w_1 \ge 1$, and similarly Firm 1's exports will certainly be zero, no matter y_{2B}^E, if

$w_1 \geq 1-t$. Likewise, Firm 2's production for the domestic market (exports) will certainly be zero, no matter x_{1B}^E (x_{1A}^E) whenever $w_2 \geq 1$. The upper bounds for the wages so identified are shown in Figure 2. In this case, Equations A.5 and A.7, with the relative equations for the expectations' realization, $x_{2A} = x_{2A}^E$ and $x_{1A} = x_{1A}^E$, and Equations A.6 and A.8 with $y_{2B} = y_{2B}^E$ and $x_{1B} = x_{1B}^E$, represent the two independent systems whose solutions establish the Cournot outputs in Countries A and B, respectively.

Firms' Labor Demand Schedules in the Asymmetric Regime

Under the assumptions adopted in subsection 2.3 (Firm 1 does not invest and Firm 2 invests), Union 1 faces the following labor demand functions:

$$x_{1A} + x_{1B} = \frac{1}{3}(2 - 4w_1 + 2w_2 - 2t), \quad for \quad w_2 \leq \frac{1+w_1}{2}, w_1 \leq \frac{1+w_2-2t}{2}; \qquad \text{(Region I)} \qquad \text{(A.9)}$$

$$x_{1A} = \frac{1}{3}(1 + w_2 - 2w_1), \quad for \quad \frac{1+w_2-2t}{2} < w_1 \leq \frac{1+w_2}{2}, w_2 \leq \frac{1+w_1}{2}; \qquad \text{(Region II)} \qquad \text{(A.10)}$$

while Union 2's labor demand functions are:

$$y_{2B} + x_{2A} = \begin{cases} \frac{1}{3}(2 - 4w_2 + 2w_1 + t), & for \quad w_2 \leq \frac{1+w_1}{2}, w_1 \leq \frac{1+w_2-2t}{2}; \qquad \text{(Region I)} \qquad \text{(A.11a)} \\ \frac{1}{6}(5 - 7w_2 + 2w_1), & for \quad \frac{1+w_2-2t}{2} < w_1 \leq \frac{1+w_2}{2}, w_2 \leq \frac{1+w_1}{2}. \qquad \text{(Region II)} \qquad \text{(A.11b)} \end{cases}$$

With these elements, the analysis derives the unions' best-reply functions and the value of the trade costs allowing intra-industry international activities to be supported in equilibrium in pure strategies.

Proof of Proposition 1

To prove Proposition 1, Union 2's payoff function is analyzed in relation to changes of the independent variables w_1 and t in Region III. Union 2's payoff in that region is the following:

$$\Omega_2 = w_2\left[\frac{1}{3}(1 + t + w_1 - 2w_2)\right].$$

This function is continuous over the range $w_2 \in (0,1)$. Union 2's payoff function in Region III is: (a) increasing in w_1; (b) for a given w_1, a reduction in t decreases Union 2's payoff; (c) $\partial\Omega_2/\partial w_2 \partial w_1 > 0$, namely wages are strategic complements; and (d) $\partial^2\Omega_2/\partial w_2^2 < 0$, the payoff function is concave with respect to w_2.

Suppose now that Union 2 chooses to set a wage rate in Region III. In this region, Firm 2 does not exploit the foreign plant while Firm 1 exports. For $w_1 \in [0, 1-(4/3)t]$, the left derivative of Union 2's payoff function, evaluated at w_2 such that the (w_1, w_2) pair is on the boundary between Regions I and III, is equal to:

$$\partial\Omega_{2III}/\partial w_2\big|_{w_2=(1/2)(1+w_1)} = -1 + t - w_1 < 0, \ \forall t \in (0,1).$$

Since the derivative is non-positive at the boundary between Region I and Region III, it will be non-positive for any w_2 such that (w_1, w_2) lies in Region III, given the concavity of Ω_2 with respect to w_2 in Region III. The payoff function is decreasing across Region III and, therefore, Union 2's reaction function cannot be in that region.

Proof of Proposition 2

a.0) First, let us consider Union 1's payoff function. Notice that, for $t < 3/4$, $1/2 < 1-(2/3)t$: The value of the positive, vertical, intercept of the line $w_2 = (1/2)(1+w_1)$ (the boundary between Regions I and III in Figure 2), lies below the value of w_2 at the point of intersection between the boundaries $w_2 = (1/2)(1+w_1)$

and $w_1 = (1/2)(1 + w_2 - 2t)$ (the upper vertex of Region I in Figure 2). Region I exists in the first quadrant of the Cartesian plan if and only if $t < 3/4$. This implies that for $w_2 \in [0,1/2]$, every (w_1, w_2) pair belongs neither to Region III nor to Region VI.

a.1) The analysis begins by taking into account $w_2 \in [0,1/2]$ and $t \leq 1/4 = 0.250$. For $w_2 \in [0,1/2]$ and $t \leq 1/4 = 0.250$, the reaction function cannot be in Region II so long as the right derivative of the Union 1 payoff function, evaluated at w_1 such that (w_1, w_2) lies along the boundary between Regions I and II, is negative. This occurs for:

$$\partial \Omega_{1II} / \partial w_1 \big|_{w_1 = (1/2)(1 + w_2 - 2t)} = -1 - w_2 + 4t < 0 \Rightarrow w_2 > 4t - 1.$$

Thus, for $t \leq 1/4$, because the derivative is non-positive at the boundary between Region I and Region II, it will be non-positive for any w_1 such that (w_1, w_2) lies in Region II; given the concavity of Ω_1 with respect to w_1 in Region II, no interior maximum exists in Region II. Instead, along the boundary between Regions I and II, it can be checked that the left derivative $\partial \Omega_1 / \partial w_1 < 0$. Given the concavity of Ω_1 with respect to w_1, a relative maximum in Region I exists if and only if this condition holds: For $(w_1 = 0, w_2 \leq 1/2)$, namely for the points below or equal to the value of the vertical intercept of the line representing the boundary between Regions I and III, $\partial \Omega_1 / \partial w_1 > 0$. This can be confirmed easily to be always the case, however small w_2 may be.

a.2) Let us continue by considering $w_2 \in (1/2, 1 - (2/3)t]$ and $t \leq 1/4 = 0.250$. For $w_2 \in (1/2, 1 - (2/3)t]$, some (w_1, w_2) pairs reside in the interior of Region III and along the boundary between Region I and Region III, while some other (w_1, w_2) pairs are in the interior of Region I. An interior maximum in Region I exists if and only if, for w_1 such that the (w_1, w_2) pair is on the boundary between Region I and Region III, the right derivative $\partial \Omega_1 / \partial w_1 > 0$. This holds for:

$$\partial \Omega_{1I} / \partial w_1 \big|_{w_1 = 2w_2 - 1} = (5 - 7w_2 - t) \geq 0 \Rightarrow w_2 \leq (5 - t)/7.$$

Further analytical inspection reveals that $(5 - t)/7 < 1 - (2/3)t$ as long as $t < 6/11 \approx 0.540$. Summarizing, because for $w_2 \in [0,1/2]$ and $t \leq 1/4 = 0.250$ every (w_1, w_2) pair is always outside Regions III, V, and VI, it follows that the reaction function is $RF_1(w_2) = w_1 = (1 + w_2 - t)/4$ because, for these values of w_2, $\Omega_{1II}(w_1, w_2) < \Omega_{1I}(w_1 = (1 + w_2 - t)/4, w_2)$ (from part a.1). On the other hand, for $w_2 \in (1/2, 1 - (2/3)t)$ and $t \leq 1/4$, the reaction function is $RF_1(w_2) = w_1 = (1 + w_2 - t)/4$ for wage rates $w_2 \in (1/2, (5 - t)/7))$. For $w_2 > (5 - t)/7$, Union 1 plays a wage level such that the resulting (w_1, w_2) pair will be interior to Region III. Given that trade costs are $1/4 < 6/11$, according to Proposition 1, this wage combination cannot be an equilibrium of the unions' wage setting sub-game because Union 2 fails in making a best-response in Region III.

a.3) For $w_2 \in [0,1/2]$, as t increases marginally above $1/4$, there are levels of w_2 such that Union 1's utility function, Ω_1, has an interior relative maximum in Region II. In fact, for trade costs marginally above $t = 1/4$, the right derivative of the Union 1 payoff function, evaluated at w_1 such that (w_1, w_2) lies along the boundary between Regions I and II, is positive (or equal to zero) if:

$$\partial \Omega_{1II} / \partial w_1 \big|_{w_1 = (1/2)(1 + w_2 - 2t)} = -1 - w_2 + 4t \geq 0 \Rightarrow w_2 \leq 4t - 1.$$

Thus, for $w_2 \in [0, 4t - 1]$, the first-order conditions of Equation 13 yield that, in Region II, a relative maximum is reached at $w_1 = (1 + w_2)/4$. Nevertheless, it can be checked that, for trade barriers marginally above $1/4$ and $w_2 \in [0, 4t - 1]$, $\Omega_{1II}(w_1 = (1 + w_2)/4, w_2) < \Omega_{1I}(w_1 = (1 + w_2 - t)/4, w_2)$. Moreover, for $w_2 \in (1/2, 1 - (2/3)t]$ and trade costs marginally above $1/4$, the analysis conducted in a.2 for this range of w_2 remains unaffected. This, in turn, implies that for $w_2 \in [0, (5 - t)/7))$, the reaction function is in Region I and is equal to $RF_1(w_2) = w_1 = (1 + w_2 - t)/4$.

a.4) The discussion in part a.3 has shown that for trade barriers marginally above $1/4$, there are levels of w_2 such that Ω_1 has an interior relative maximum in Region II. As trade cost levels increase, there comes a point such that, for $w_2 \in [0, 1 - (2/3)t]$, the relative maximum in Region II equals or is higher than the relative maximum of the payoff function in Region I. That is:

$$\Omega_{1II}(w_1 = (1 + w_2)/4, w_2) = (1/24)(1 + w_2)^2 \geq \Omega_{1I}(w_1 = (1 + w_2 - t)/4, w_2) = (1/12)(1 + w_2 - t)^2.$$

This occurs if and only if $w_2 \leq (2 + \sqrt{2})t - 1$, representing the switching wage level in the asymmetric regime. This, in turn, implies that for $t \geq 1/(2 + \sqrt{2}) \approx 0.290$, there are levels of w_2 sufficiently low that

the relative maximum of Ω_1 in Region II is equal to or higher than the relative maximum of Ω_1 in Region I. Differentiation of the switching wage shows that $dw_2/dt > 0$: As trade cost decreases, the range of w_2 such that Union 1's best reply is a wage allowing Firm 1 to export gets smaller. Summarizing, for $w_2 \in [0,1-(2/3)t]$ and trade cost levels marginally above $1/(2+\sqrt{2}) \approx 0.290$, the analysis shows that Union 1's reaction function is $RF_1(w_2) = (1+w_2)/4$ for $w_2 \in (0,(2+\sqrt{2})t-1]$, while for $w_2 \in ((2+\sqrt{2})t-1,(5-t)/7))$, the reaction function is $RF_1(w_2) = w_1 = (1+w_2-t)/4$.

a.5) For $w_2 \in [0,1-(2/3)t]$, as t rises and reaches $t > 1/3$, the left derivative $\partial\Omega_{1I}/\partial w_1$ for Union 1's wages, such that the (w_1, w_2) pair is along the boundary between Regions I and II, is negative if:

$$\partial\Omega_{1I}/\partial w_1\big|_{w_1=(1/2)(1+w_2-2t)} = -1-w_2+3t < 0 \Rightarrow w_2 > 3t-1.$$

Given that $t > 1/3$, there are sufficiently high levels of w_2 that the previous condition is satisfied. This condition says simply that, in the range $w_2 \in (0,3t-1)$, the function Ω_1 is increasing in Region I. The analysis carried out in parts a.3 and a.4 has shown that there is a range of values of w_2 such that the utility function Ω_1 has a relative interior maximum in Region II. Thus, for $w_2 \in [0,1-(2/3)t]$, if trade barriers are marginally above $1/3$, an interior relative maximum exists in Region I for $w_2 \in (3t-1,(5-t)/7))$, and an interior maximum is in Region II for $w_2 \in (0,4t-1)$. Moreover, because $0 < t$, the switching wage $(2+\sqrt{2})t-1 > 3t-1$. Therefore, for $w_2 \in (0,3t-1)$, the function Ω_1 has a relative maximum in Region II, and direct payoff comparison shows that, for $w_2 \in (3t-1,(2+\sqrt{2})t-1]$, $\Omega_{1II}(w_1 = (1+w_2)/4, w_2) \geq \Omega_{1I}(w_1 = (1+w_2-t)/4, w_2)$; for wages $w_2 \in ((2+\sqrt{2})t-1,(5-t)/7))$, $\Omega_{1II}(w_1 = (1+w_2)/4, w_2) < \Omega_{1I}(w_1 = (1+w_2-t)/4, w_2)$. Thus, Union 1's reaction function is $RF_1(w_2) = (1+w_2)/4$ for $w_2 \in (0,(2+\sqrt{2})t-1]$, and $RF_1(w_2) = w_1 = (1+w_2-t)/4$ for $w_2 \in ((2+\sqrt{2})t-1,(5-t)/7))$.

a.6) For $w_2 \in [0,1-(2/3)t]$, as t increases, there comes a point when the values of $w_2 = 3t-1$ and $w_2 = (5-t)/7$ equal $w_2 = 1-(2/3)t$. This occurs at $t = 6/11 \approx 0.540$. For t above this level, Ω_1 is increasing across Region I and thus this function has a relative maximum only in Region II. Therefore, the reaction function is $RF_1(w_2) = (1+w_2)/4$ for $w_2 \in (0,5/7]$. The value of $5/7$ is the value of the intersection of the reaction function with the boundary between Regions II and VI.

b.0) Let us now consider Union 2's payoff function. The analysis starts by taking into account the case of $w_1 \in [0,(1-2t)/2]$, where $w_1 = (1-2t)/2$ is the intercept of the line representing the boundary between Regions I and II in Figure 2, given by $w_1 = (1/2)(1+w_2-2t)$. Notice that, for $t \in (0,1)$, $(1-2t)/2 < 1-(4/3)t$. This implies that, for $w_1 \in [0,(1-2t)/2]$, every (w_1, w_2) pair does not belong to Regions II and VI. Notice also that for $t < 3/8$, $1/2 < 1-(4/3)t$, where $w_1 = 1/2$ is the intercept of the line representing the boundary between Regions II and IV in Figure 2, given by $w_1 = (1/2)(1+w_2)$.

b.1) Proposition 1 has shown that the right derivative of Union 2's payoff function, evaluated at w_2 such that (w_1, w_2) lies along the boundary between Regions I and III, is negative $\forall t \in (0,1)$. Thus, because the derivative is non-positive at the boundary between Region I and Region III, it will be non-positive for any w_2 such that (w_1, w_2) lies in Region III; given the concavity of Ω_2 with respect to w_2 in Region III, no interior maximum exists in Region III.

b.2) Let us consider, for $w_1 \in [0,1-(4/3)t)$ and $t < 3/8$, the behavior of the function Ω_2 due to changes in w_2 for (w_1, w_2) pairs belonging to Region I. Given the concavity of Ω_2 with respect to w_2, Ω_2 has a relative maximum in Region I, if and only if the two following conditions hold: First, for $(w_2 = 0, w_1 \leq (1-2t)/2)$, that is, for points to the left of or equal to the intercept on the horizontal axis of the boundary between Regions I and II, $\partial\Omega_2/\partial w_2 > 0$. This can be checked to always hold true. Second, for $w_1 \in ((1-2t)/2, 1-(4/3)t)$, the right derivative of Ω_2 with respect to w_2 is positive for w_2 such that the (w_1, w_2) pair is along the boundary between Region I and Region II. This holds for:

$$\partial\Omega_{2I}/\partial w_2\big|_{w_1=(1/2)(1+w_2-2t)} = (10-14w_1-15t) \geq 0 \Rightarrow w_1 \leq (10-15t)/14.$$

Because $t < 1$, it follows that $(10-15t)/14\, t < 1-(4/3)t$. Thus, for $w_1 \in [0,(1-2t)/2]$, an interior relative maximum exists for Ω_2 in Region I. For $w_1 \in ((1-2t)/2, (10-15t)/14))$, a relative maximum of this function at the interior of Region I exists. Given that for $w_1 > (10-15t)/14$ the right derivative $\partial\Omega_2/\partial w_2 < 0$ for w_2 such that the (w_1, w_2) pair is along the boundary between Region I and Region II, Ω_2 has a relative maximum on the boundary between Regions I and II. For $w_1 \in ((10-15t)/14, 1/2)$, given the concavity of

Ω_2 with respect to w_2, this function has an interior maximum in Region II if and only if the left derivative $\partial\Omega_2/\partial w_2$ along the boundary between Regions I and II is negative. This occurs when:

$$\partial\Omega_{2II}/\partial w_2\big|_{w_2=2w_1-1+2t} = (19-26w_1-28t) \leq 0 \Rightarrow w_1 \geq (19-28t)/26 .$$

Because $t<1$, it follows that $(10-15t)/14 < (19-28t)/26 < 1-(4/3)t$. Consequently, Union 2's reaction function is as follows: For $w_1 \in (0,(10-15t)/14))$, first-order conditions of Equation 14 lead to $RF_2(w_1) = w_2 = (2+2w_2+t)/8$; for wages in the range $w_1 \in ((10-15t)/14),(19-28t)/26))$, the best-reply function is $RF_2(w_1) = w_2 = (2w_1-1+2t)$; for $w_1 \in ((19-28t)/26),1-(4/3)t)$, first-order conditions of Equation 15 lead to $RF_2(w_1) = w_2 = (5+2w_1)/14$.

b.3) For $t > 3/8$, $1-(4/3)t < 1/2$, the intercept of the line representing the boundary between Regions II and IV in Figure 2, given by $w_1 = (1/2)(1+w_2)$, is greater than the value of w_1 representing the upper vertex of Region I in Figure 2. Nevertheless, the shape of the reaction function is as in part b.2, adding only that for $w_1 \in (1-(4/3)t,1/2)$ the reaction function is still $RF_2(w_1) = w_2 = (5+2w_1)/14$. Indeed, it can be verified that this is Union 2's best-reply for $w_1 \in (1-(4/3)t,16/27)$, where the latter value represents the value of the point of intersection of the segment of Union 2's reaction function in Region II with the boundary between Regions II and IV.

c.0) The two unions' reaction functions in Region I, $RF_1(w_2) = w_1 = (1+w_2-t)/4$ for Union 1 and $RF_2(w_1) = w_2 = (2+2w_1+t)/8$ for Union 2, intersect at:

$$w_{1,Asy} = 1/3-(7/30)t \text{ , } w_{2,Asy} = 1/3+(1/15)t .$$

These values represent the Bertrand-Nash wages in equilibrium allowing both firms to undertake international business in the asymmetric regime where Firm 2 invests. Intra-industry international activities are supported as pure strategy equilibrium until trade costs are such that the level of w_2 representing the switching wage for Union 1, is satisfied concurrently with the Bertrand-Nash equilibrium wage for Union 2, that is:

$$1/3+(1/15)t \geq (2+\sqrt{2})t-1.$$

It follows that the critical value of t above which intra-industry international activities in asymmetric regimes are not supported as pure strategy equilibrium is equal to:

$$t \leq 20/(29+15\sqrt{2}) \approx 0.398.$$

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Positions on Regulations Affecting Auditing and Nonauditing Activities

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Abstract

The change in regulations that occurred in Spain in the domain of auditing has led to the analysis of regulations according to the positions adopted by different groups involved in the auditing market. The purpose of this study was to investigate the positions taken by professionals involved in this sector regarding those aspects of the law that regulate the provision of services other than the auditing of annual accounts, with a view to obtaining relevant conclusions for the regulation of the auditing activity. Findings show the existence of three professional subgroups according to the level of global prohibition of the incompatibilities analyzed and the level of importance assigned to the prohibitions in two important groups of prohibitions. The difference between these professional groups is analyzed in terms of their level of prohibition in comparison with the law. Other results show the most important variables for measuring a firm's degree of independence.

Keywords: Auditing, independence, incompatibilities, regulation, non-auditing services

JEL Classification codes: M420, K220

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The auditing services market today includes, in addition to the traditional auditing of accounts, a relatively wide range of services depending on the prohibitions and exceptions established by the regulations of the country in which auditing firms operate. This reality of the auditing market stands in sharp contrast to the position adopted by some researchers on the strictest prohibition of services carried out by these firms (Abbott, Parker, Peters, & Raghunandan, 2003; Ashbaugh, Lafond, & Mayhew, 2003; Bartlett, 1993; Basioudis, Papakonstantinou, & Geiger, 2008; Davis & Hollie, 2008; Duh, Lee, & Hua, 2009; Felix, Gramling, & Maletta, 2005; Gonzalo, 1995; Lowe & Pany, 1995; Pany & Reckers, 1988; Sharma, 2001). Regulators have shown themselves aware of the controversial effects on auditing firms' independence of those firms' offering both nonauditing services (NAS) and auditing services. Hence, there have been many legislative efforts and actions to solve this conflict worldwide, such as the Sarbanes-Oxley Act in the United States, the reform of the Auditing Law in Spain, and others.

The Spanish context provides an opportunity to study the effects of the change in rules produced by reforms to Auditing Law in the years 2002 and 2010, one of the consequences of which is the increasing number of incompatibilities with regards to the professional activities carried out by firms. Different investigations of this issue have produced conflicting results. Some studies have shown that these activities can harm the independence of the auditors (Basioudis et al., 2008; Davis & Hollie, 2008; Duh et al., 2009; Frankel, Johnson, & Nelson, 2002; Ye, Carson, & Simnett., 2011), while others show opposite results (Antle, Gordon, Narayanamoorthy, & Zhou, 2004; Ashbaugh et al., 2003; Chung & Kallapur, 2003; Monterrey & Sánchez, 2007).

The purpose of this study was to analyze the provision of NAS through an empirical investigation of the positions of academics and auditors on the legal aspects that regulate the execution of auditing services. In particular, the purpose was to determine the degree of agreement or disagreement with the current legislation and to provide relevant conclusions that could be of interest for future reforms to auditing regulations. The research method used was a questionnaire sent to the professionals enrolled in the Registry of Spanish Auditors (REA) and academics enrolled in the Spanish Accounting Professors' Association (ASEPUC).

The study first reveals the existence of subgroups with similar perceptions about regulating incompatibility regarding the level of importance they assign to such incompatibilities. These groups should be taken into account in future regulations of auditing activities. Findings indicate that those incompatibilities should be controlled by more regulations. The evidence is in accordance with other movements on an international level toward stricter incompatibilities with auditing activities, such as the Sarbanes-Oxley Act in the United States.

In the second section, the review of the literature provides an analysis of the most important consequences of auditors' offering multiple services and the modifications made to auditing law which affect the joint provision of auditing and other additional services. The third section of the paper describes the methodology and the research design used in the study. The next section describes the main results obtained from the empirical investigation. The final section outlines the conclusions obtained from the study and its most important implications for future research and limitations.

Background of the Research

According to Beattie and Fearnley (2004), one of the main concerns that have emerged following a number of financial scandals occurring in the last decade of the 20th century and the beginning of the 21st century is related to the execution of multiple and varied services by auditors. Fees charged for these services grew even faster than those charged for auditing services. All of this led to the general belief that the execution of other services could cause these professionals to compromise their independence.

Two main concerns arose. On the one hand, auditors tend to avoid disagreements with the management of companies in order to maintain the abundant income derived from the provision of services not related to auditing (Ashbaugh et al., 2003; Basioudis et al., 2008; Nice & Trompeter, 2004; Ruddock, Taylor, & Taylor, 2006; Van Der Plaats, 2000). On the other hand, the offering of a wide array of services could lead auditors to identify too closely with the management of businesses, thus ultimately losing the neutrality needed for auditing functions (Cahan, Emanuel, Hay, & Wong, 2008; Caplan & Kirschenheiter, 2000; Firth, 1997; Myring & Bloom, 2003; Ruddock et al., 2006).

The supply of NAS has been the most debated topic of all the threats to independence identified in the literature (Bartlett, 1993; Canning & Gwilliam, 1999; Callagan, Parcas, & Singhal, 2009; Habib & Islam, 2007). Many authors have argued that the provision of services is a practice that has negative consequences on the functioning of the auditing market (Ashbaugh et al., 2003; Bloomfield & Shackman, 2008; Quick & Warming-Rasmussen, 2009; Windmöller, 2000). The following negative consequences of this practice have been identified:

- It increases the economic dependence of the client (European Commission, 2000 a,b, 2003; International Federation of Accountants - IFAC, 2001a; Khurana & Raman, 2006);
- It provokes a loss in auditing quality (Felix et al., 2005; Francis, 2006; Gonzalo, 1995);
- It increases familiarity and trust with the client (Chen, Elder, & Liu, 2005; European Commission, 2000 a,b, 2003; Gul, Jaggi, & Krishnan, 2007; IFAC, 2001a,b);
- It creates complicated situations for self-revision (IFAC, 2001a,b; Myring & Bloom, 2003);
- It harms the prestige of the auditing profession (Francis & Ke, 2006; Gonzalo, 1995; Law, 2008).

However, other authors have also pointed out a number of positive effects of the practice of joint service provision and the execution of other types of work by auditors:

- It increases knowledge of the client (Asare, Cohen, & Trompeter, 2005; Beck & Wu, 2006; Gul et al. 2007; Seunghan, 2006);
- It improves competition within the market of auditing firms (Ruiz, 2002; Wu, 2006);
- It benefits auditors' independence (Arruñada, 1999; Lennox, 1999; Myungsoo, 2005);

- It improves the satisfaction of clients of auditing firms (García, Garrido, Vico, Moizer, & Humphrey, 1999; Lee, Mande, & Son, 2009; Malley, 2000);
- It increases the chances of attracting and retaining personnel in auditing firms (Hillison & Kennelley, 1988).

On the whole, though both negative and positive consequences exist, expressions of alarm and concern are more frequent than those of praise for the positive consequences.

As far as legislation on incompatibilities within auditing activities is concerned, a comparative study of the statements and measures taken by different international agencies shows that the agency adopting the strictest and most severe position on prohibitions is the Securities Exchange Commission (SEC) through the Sarbanes-Oxley Act (2002). Greater consensus exists between the positions of the International Federation of Accountants (IFAC) and the General Accounting Office (GAO). Lastly, the American Institute of Certified Public Accountants (AICPA) is the least stringent agency in this respect (López, 2005).

The modification of the legislation on auditing in Spain was a long-awaited event desired by all the groups involved, as many topics required revision and updating in the context of the new panorama affecting the auditing services market. This situation was especially urgent with regards to the provision of nonauditing services by auditors because, given the evolution of the auditing market, it was a topic needing specific modifications and, above all, broader and more precise regulations. The previous rules established only a few sparse references on the topic of confronting the issue of joint provision of auditing and other services.

Through the terms of Law 44/2002, the legislation on auditing was modified, with the aim of resolving existing conflicts and deficiencies. Specifically, Article 8.2 indicates the following:

> *It is established that the auditor does not possess sufficient independence in the exercise of his functions in relation with a business or entity, when he or she provides the following services or when a series of circumstances occur: the execution of services of design and launching of financial information technology systems, evaluation services, services of internal auditing, maintaining business relations, advocacy services, participation in the hiring of executives or key personnel for the auditing client, and the provision by the signing partner of services other than auditing to the audited entity, as well as the payment of fees for providing auditing and non-auditing services to the same client, if the latter constitute an unduly high percentage of the total annual income of the account auditor in relation to the average of the last five years. (Law 44/2002)*

Moreover, in the same article, the law also establishes that the calculation period for incompatibilities will include the year in which the work was carried out as well as the third year previous to the tax year to which the financial statements being audited refer.

Methodology and Research Design

To carry out this investigation, a system of email surveys was chosen in order to compile the opinions of auditors and the academic community. This procedure was chosen because it is a straightforward research method for collecting opinions, and it allows researchers to reach quickly a large number of elements of the population under study. In addition, it provides many other advantages, such as the rapid reception of responses from those being surveyed, the possibility of broadening the study's geographical scope, and a considerable reduction of research costs. Nonetheless, it also presents some disadvantages, such as difficulty in obtaining certain email addresses, the fact that some people do not use email, and the loss of some responses because the survey arrives along with a large number of spam messages.

With regards to the participating population, the choice of participants was based on the twin concepts of knowledge and professional work. Thus, auditors chosen had a direct interest in the regulated matter, together with a high knowledge of auditing and accounting. The selection of academics was based on the fact that it is logical to think that they have a good knowledge of auditing and that the regulated activity could influence their professional work as they must incorporate changes in rules into the classes that they teach; moreover, their opinion on those changes must be considered free of partisan bias. These two groups were thus considered to be an excellent proxy for those involved in auditing functions, as they initially present disparate positions, and both groups' opinions are supported by their knowledge of the regulated area.

In this study, the usual steps were followed for this type of research: definition, design of the study, selection and definition of variables, design of the questionnaire, selection of the sample, validation and testing of the questionnaire (Ruiz et al., 1998). Next, the process carried out is briefly summarized.

Definition and Purpose of the Study

The purpose of the study was to assess whether changes made in the auditing legislation are likely to contribute to a reduction of the existing controversy surrounding the execution of various services by auditors. If this is not the case, the study findings may serve to ease the conflict by proposing alternatives. Hence, the potential effect of the changes was investigated via the opinions of two groups of users involved in and committed to auditing activities. The target population was composed of auditors belonging to the Registry of Spanish Auditors (REA) and academics belonging to the Spanish Accounting Professors Association (ASEPUC).

The objective of this investigation was to raise a debate on the modifications to auditing law with the purpose of reaching a consensus on such questions. With regards to those parts of the law which have undergone change, the aim of this study was to find empirical evidence of the level of acceptance shown by the individuals involved. With regards to those parts of the law which have not been modified, the aim of the study was to provide additional evidence related to matters not changed or treated in the reform but which individuals believe should have been taken into consideration.

Selection and Definition of the Variables

The next step was the selection and definition of different items of interest to gather relevant information to meet the aims of the study. Starting with the key auditing and legal concepts, a set of variables was constructed that would ultimately constitute the complete questionnaire. The variables analyzed correspond to the different incompatibilities that are described in the extract from Article 8.2 of the Auditing Law quoted above. Table 1 shows a list of these variables and the modalities taken into consideration.

Table 1
Variables and Modalities under Consideration

Nomenclature	Variables analyzed	Modalities considered
IncD	Incompatibility related with "Design Services and Implementation of Financial Information Technology Systems".	NP = No prohibition. −E = Less strict than Law. IL = In accordance with Law. +E = Stricter than Law. RP = Radical Prohibition.
IncAS	Incompatibility related with "Assessment Services".	The same.
IncIA	Incompatibility related with "Internal Auditing Services".	The same.
IncRM	Incompatibility related with "Maintenance of Managerial Relationships".	The same.
IncLS	Incompatibility related with "Legal Services".	The same.
IncTM	Incompatibility related with "Top Manager or Key Personnel Recruiting".	The same.
IncSP	Incompatibility related with "Signatory Partner of auditing report carrying out any type of nonauditing service".	NP = No Prohibition. IL = Prohibition only signatory partner = In accordance with Law. RP = Prohibition all members = Radical Prohibition.

The level of prohibition equal to the law, for each starting variable, was established as 0.5, the minimum value as 0, and the maximum as 1. Other values of each variable were rescaled according to those values.

Design of the Questionnaire and Selection of the Sample

The questionnaire used was of a mixed, structured type, using both open and closed questions. A codification phase facilitated the subsequent statistical treatment of data obtained through this survey. The representative sample was composed of 1 610 members of REA who were sent a questionnaire by email. The rate of response was around 12.3%. In the case of the academics, the sample was composed of 900 individuals belonging to ASEPUC. The index of responses received was approximately 10.4%. In both cases, the number of responses achieved was satisfactory in relation to the minimum standards established in the literature for similar studies (Assessing the representativeness of public opinion surveys, 2012). Once the data were purged, the final participants were 80 academics and 186 auditors.

Validation and Test of the Questionnaire

For the validation and final test of the survey, a pretest was administered to a group of 15 academics in the Department of Accounting and Financial Economics of the University of Seville. Additionally, a pilot survey was carried out with the following groups: students in a Master Degree Program in Bank Management and auditing professionals, two from large auditing firms and one from a medium-size local firm.

Statistical Methodology

First, a statistical analysis of the variables included was carried out in order to make sure there were no anomalies in the data. Next, a principal components analysis (PCA) was executed to achieve the segmentation of the individuals involved and determine the number and type of groups into which the individuals could be subdivided. This process enabled us to find groups of variables in such a way that the behavior of individuals in each professional segment was similar in variables of the same group and different in those of different groups.

Once the segments of professionals and groups of variables were determined, such segments of professionals were characterized depending on their behavior in the original variables. For this characterization, several confidence intervals were carried out. These are summarized as follows:

- Determination of the confidence intervals for the average level of prohibition of each professional segment in each principal component (PC). Hence, it was then possible to see whether statistically significant relationships existed between the degree of prohibition for each of the groups of incompatibilities studied and for each professional segment.
- Determination of the confidence intervals for the average level of prohibition of each professional segment for each of the incompatibilities studied.

In accordance with those confidence intervals, the objective of the study was to determine the position of each professional segment for each of the incompatibilities under study, in terms of agreement or disagreement regarding the level of prohibition established in the regulation.

Results

A multivariate study was carried out in order to determine unobserved relationships between the variables. For this purpose, a PCA was applied in order to construct latent variables to explain the joint behavior of the variables IncD, IncAS, IncIA, IncRM, IncLS, IncTM, and IncSP (see Table 1).

Next, the existing correlation between the different variables was verified in order to discover whether it was of interest to conduct the analysis. Table 2 shows the correlation matrix that reveals that all correlations are highly significant; hence, common factors must be causing these high correlations, and, thus, PCA could be carried out. Retaining the first three principal components, it was possible to retain 74.62% of the information provided by the original variables.

Table 2
Correlation Matrix

	IncD	IncAS	IncIA	IncRM	IncLS	IncTM	IncSP
IncD	1	0.663**	0.416**	0.357**	0.360**	0.355**	0.441**
IncAS	0.663**	1	0.438**	0.409**	0.368**	0.355**	0.546**
IncIA	0.416**	0.438**	1	0.509**	0.446**	0.477**	0.327**
IncRM	0.357**	0.409**	0.509**	1	0.562**	0.447**	0.274**
IncLS	0.360**	0.368**	0.446**	0.562**	1	0.501**	0.379**
IncTM	0.355**	0.355**	0.477**	0.447**	0.501**	1	0.341**
IncSP	0.441**	0.546**	0.327**	0.274**	0.379**	0.341**	1

Note. (**) Significant Value for $p < 0.05$.

Table 3 shows the component score coefficient matrix: For each professional, the score in each component is obtained by multiplying the standardized variables values for the case by the weights or component's score coefficients.

Table 3
Component Score Coefficient Matrix

	Component		
	PC1	PC2	PC3
IncD	0.202	-0.423	-0.448
IncAS	0.213	-0.446	-0.244
IncIA	0.203	0.219	-0.498
IncRM	0.200	0.393	-0.305
IncLS	0.203	0.353	0.416
IncTM	0.194	0.324	0.375
IncSP	0.183	-0.419	0.806
% of Variance Explained	50.982	65.492	74.622

The first component is interpreted as a joint level of prohibition of all the concepts analyzed; in other words, a new variable was obtained explaining the level of global prohibition for each item of the set of variables analyzed. The second component represents a contrast between the level of prohibition manifested in the variables IncD, IncAS, and IncSP, on the one hand, and the variables IncIA, IncRM, IncLS, and IncTM, on the other. Thus, the first group of variables could be considered to represent additional services directly related to the financial information verified by the auditing activity (SDA) whereas the second group of variables would indicate services indirectly related to the financial information verified by the auditing activity (SIA). Thus, the second principal component could be interpreted as a contrast between the importance granted to prohibitions on SDA and the relevance granted to prohibitions on SIA.

In the third component, the variable whose weight far exceeds that of the others is the one that measures which members of an auditing team are incompatible with the realization of any other type of service provided by the firm (IncSP). In other words, the third component represents the level of importance assigned to the prohibitions, namely which members of the auditing team are incompatible with the realization of other services provided by the firm.

Figure 1 shows where the original variables are represented in the space of the first two principal components. There are two groups of variables: on the one hand, variables IncD, IncAS, and IncSP and, on the other, variables IncIA, IncRM, IncLS, and IncTM.

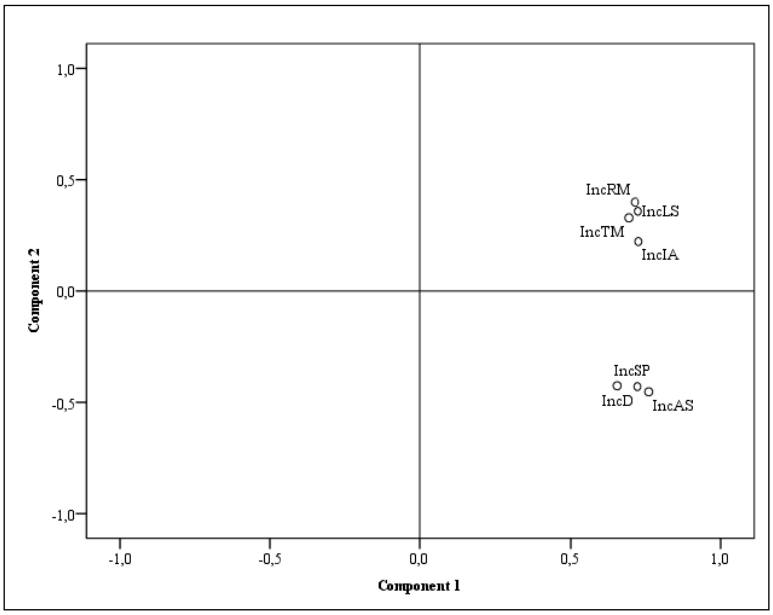

Figure 1. Representation of the initial variables in the space of first and second principal components.

Next, in Figure 2, the original variables are represented in the space of the first and the third principal component. The variable which is at a greatest distance from the others and from the origin of the coordinates is IncSP, which indicates that it is the most significant variable in this PC3.

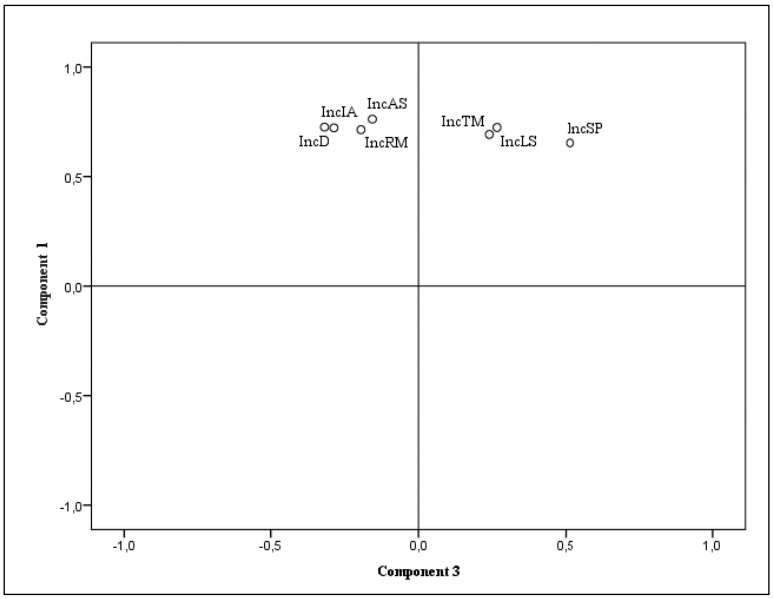

Figure 2. Representation of the initial variables in the space of the first and third principal components.

Moreover, analysis showed that among auditors, two subgroups could be defined according to the function of the type of auditor and his or her experience. On the one hand, 147 partners with considerable experience (five years or more) and individual auditors with even more experience (10 years or more), who have been called consolidated auditors (CA). On the other hand, 39 partners who do not have considerable experience (less than five years) and individual auditors who do not have much experience (less than 10 years), who have been called nonconsolidated auditors (NCA).

Figure 3 shows the centroids of the three groups obtained in the spaces of the first and second principal component, and Figure 4 shows the same centroids in the space of the first and the third principal component.

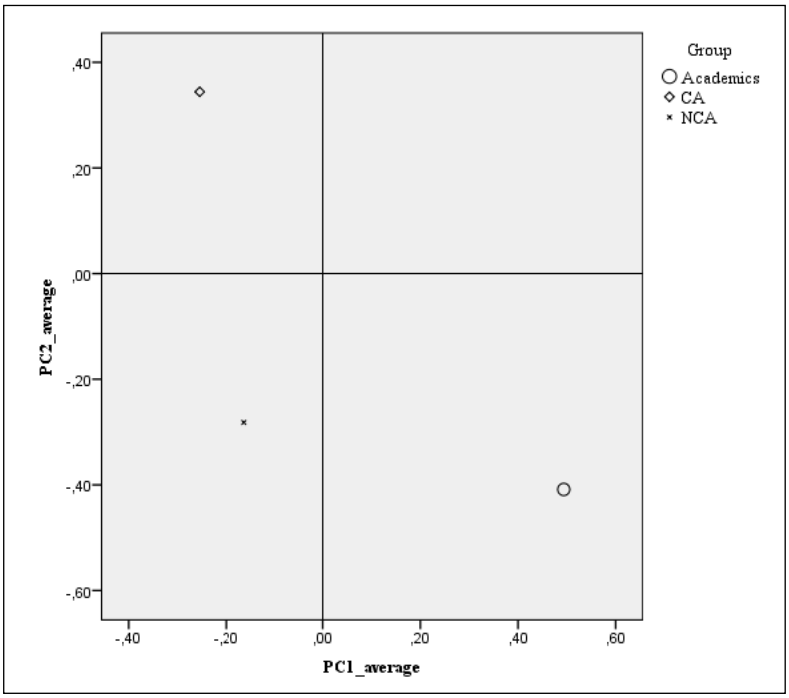

Figure 3. Centroids in the space of first and second principal components.

In Figure 3, consolidated auditors are located in the second quadrant, nonconsolidated auditors in the third quadrant, and academics in the fourth. These positions show the following evidence: academics have a greater tendency to prohibit than auditors (CA and NCA), and CA tend to prohibit more in variables IncIA, IncRM, IncLS, and IncTM than in variables IncD, IncAS, and IncSP. In the case of NCA and academics, the tendency is in the opposite direction: they tend to prohibit more or equally in variables IncD, IncAS, and IncSP than in variables IncIA, IncRM, IncLS, and IncTM. Later, we show that NCA and academics prohibit to the same degree in the two groups of variables.

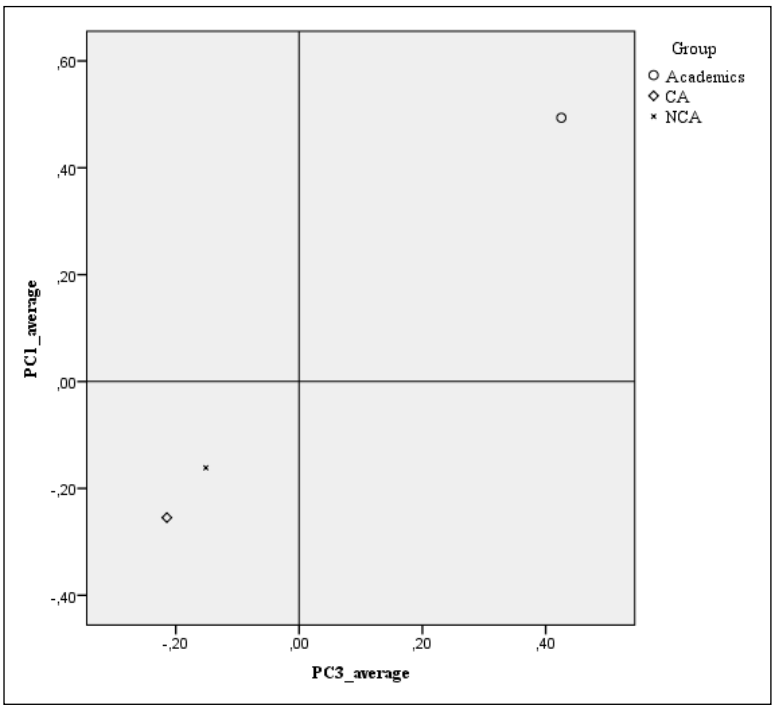

Figure 4. Centroids in the space of first and third principal components.

In Figure 4, academics are located in the first quadrant and NCA and CA in the third quadrant. Considering, as indicated previously, that PC3 comes to represent the behavior of variable IncSP, these positions show the following evidence: Academics tend to prohibit much in the variable IncSP, but in the case of NCA and CA, the tendency is in the opposite direction: they tend to prohibit little in the variable IncSP. Later, we show that NCA have an intermediate degree of prohibition in IncSP and that CA have a very low level of prohibition in this variable.

The overlap in the scores of academics, nonconsolidated auditors and consolidated auditors is shown graphically in three box/plot diagrams, namely Figures 5, 6, and 7.

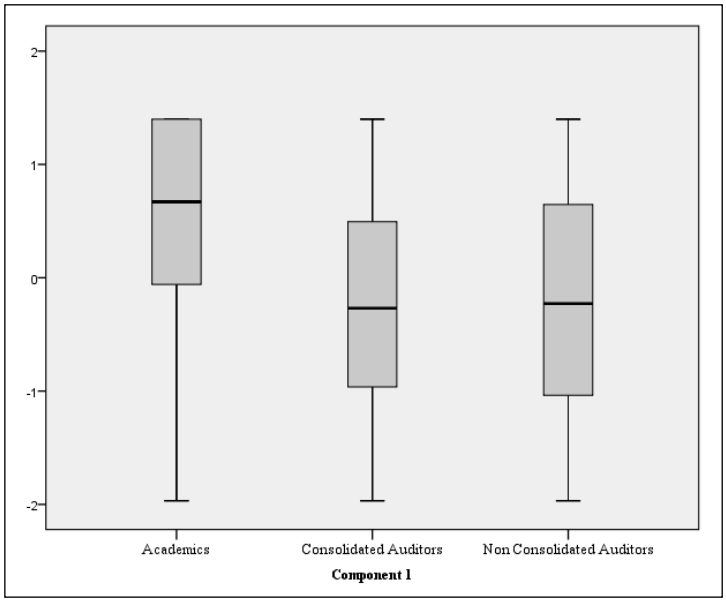

Figure 5. Box/plot graph of the principal component 1.

Figure 5 shows that the scores for the first component are higher in academics than in auditors (CA and NCA). In addition, academics' scores are asymmetric on the left; in other words, there are academics who clearly differ from the general behavior of the group in the sense that they assign a lower prohibition. With regards to auditors, there is no significant asymmetry.

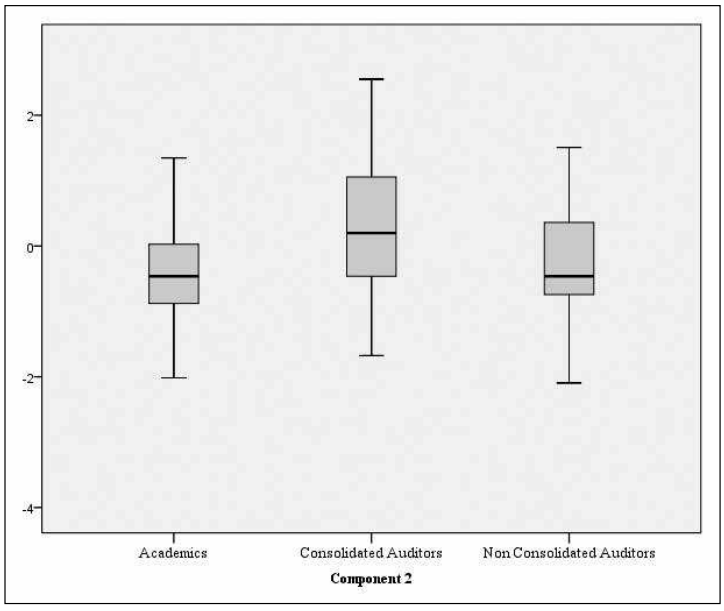

Figure 6. Box/plot graph of the principal component 2.

Figure 6 shows that for the second component, the auditors' score (CA and NCA) is higher than that of the academics. The auditors' scores are asymmetric on the right: There are auditors who have a preference for SIA as opposed to SDA prohibitions, which is more pronounced than in the case of other auditors in their group.

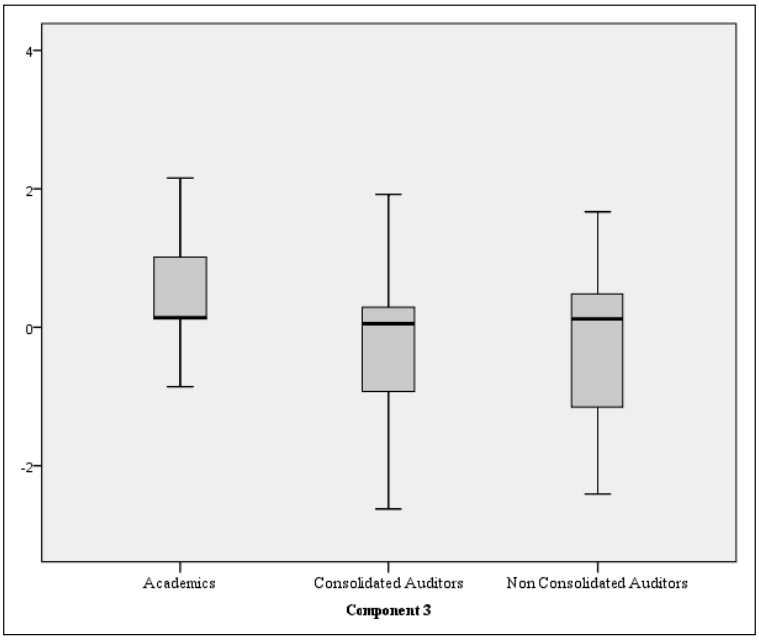

Figure 7. Box/plot graph of the principal component 3.

Figure 7 shows that in the third component, the scores are fundamentally positive for academics and negative for auditors (CA and NCA). In other words, academics grant more importance to IncSP prohibition, whereas auditors do the opposite, giving little priority to IncSP prohibition. In addition, academics' scores are clearly asymmetric on the right and auditor's scores (CA and NCA) are clearly asymmetric on the left, which shows that there are people in the three groups who have much more extreme opinions than the rest of their group.

The next step was to corroborate through a confidence interval (CI) the graphical observations made earlier on academics and auditors, CA and NCA, in the three principal components. An alternative procedure would be hypothesis tests. In general, a confidence interval for the parameter θ with $100(1-\alpha)\%$ confidence level will be defined as any interval that contains all numbers θ_0 for which the corresponding null hypothesis, $H_0: \theta_0 = \theta_0$, is not rejected with a significance level of $100\alpha\%$. Thus, a 95% confidence interval for the mean equals a significance level of 5% for the corresponding hypothesis test $H_0: \mu_0 = \mu_0$. Hence, Tables 4 to 6 show the analysis of confidence intervals for PC1, PC2, and PC3 (namely for IncSP), respectively:

1. CI for Average level of prohibition in each PC by academics;
2. CI for Average level of prohibition in each PC by consolidated auditors;
3. CI for Average level of prohibition in each PC by consolidated auditors.

Table 4
Confidence Interval for the Mean in PC1

		Average	95% confidence interval for the mean	
			Lower limit	Upper limit
PC1	Academics	0.4937	0.2807	0.7067
	CA	-0.2546	-0.4081	-0.1010
	NCA	-0.1615	-0.5024	0.1795
	Law	-0.2848		

Table 4 shows the following consequences regarding PC1:

- The level of prohibition in the legislation is less than the lower limit of CI of the academics in PC1, such that academics prohibit globally more than the legislation.
- The CI of CA and NCA are totally overlapping in PC1, such that NCA and CA globally prohibit on a similar level.
- The CI in PC1 of academics is superior to the CI of NCA and CA, such that academics prohibit globally more than auditors (CA and NCA).
- The level of prohibition in the legislation is contained in the CI of CA in PC1, such that CA have a level of global prohibition similar to that of the legislation.
- The level of prohibition of the legislation is in the CI of NCA in PC1, such that NCA have a level of global prohibition similar to that of the legislation.

Table 5
Confidence Interval for the Mean in PC2

		Average	95% confidence interval for the mean	
			Lower limit	Upper limit
PC2	Academics	-0.4086	-0.6030	-0.2143
	CA	0.3443	0.1848	0.5037
	NCA	-0.2820	-0.5663	0.0024

Table 5 shows the following consequences regarding PC2:

- The upper limit of CI of academics is less than zero in PC2, such that academics prohibit more in SDA than in SIA.
- 0 is within the CI of NCA in PC2; thus, NCA can be considered to prohibit on a similar level in SDA as in SIA.
- The lower limit of CI of CA is greater than zero in PC2; thus, CA can be considered to prohibit more in SIA than in SDA.

Table 6
Confidence Interval for the Mean in IncSP

		Average	95% confidence interval for the mean	
			Lower limit	Upper limit
IncSP	Academics	0.8000	0.7216	0.8784
	CA	0.2449	0.1806	0.3091
	NCA	0.4359	0.2774	0.5944

Table 6 shows the following consequences regarding IncSP:

- The mean of IncSP for CA is less than the lower limit of the CI for NCA, such that CA prohibit less than NCA in IncSP.
- The mean of IncSP for NCA is less than the lower limit of the CI for academics; thus, NCA prohibit less than academics in IncSP.

The summary of these conclusions in that in the variable IncSP, CA prohibit less than NCA, and the latter less than academics.

Next, the behavior in the initial variables of the three groups of professionals was analyzed. Specifically, the level of prohibition of each of these variables for each group was compared with level 0.5 of the legislation. In other words, the 95% confidence interval for the mean was carried out for each starting variable and for each professional segment.

Table 7
Confidence Interval for Mean Level of Prohibition in Original Variables

		Average	95% confidence interval for the mean	
			Lower limit	Upper limit
IncD	Academics	0.6728	0.586	0.7596
	CA	0.4184	0.3543	0.4824
	NCA	0.5385	**0.413**	**0.6639**
IncAS	Academics	0.7037	0.6171	0.7903
	CA	0.3537	0.2887	0.4188
	NCA	0.4744	**0.3432**	**0.6056**
IncIA	Academics	0.6563	0.5579	0.7546
	CA	0.5986	0.5301	0.6672
	NCA	0.6282	**0.4917**	**0.7647**
IncRM	Academics	0.7938	0.7177	0.8698
	CA	0.6888	0.6254	0.7522
	NCA	0.5833	**0.4541**	**0.7126**
IncLS	Academics	0.7531	0.6685	0.8378
	CA	0.5799	0.5107	0.6492
	NCA	0.5897	**0.4513**	**0.7282**
IncTM	Academics	0.7563	0.6700	0.8425
	CA	0.631	0.5621	0.6998
	NCA	0.4872	**0.3558**	**0.6186**
IncSP	Academics	0.8000	0.7216	0.8784
	CA	0.2449	0.1806	0.3091
	NCA	0.4359	**0.2774**	**0.5944**

The following conclusions may be drawn from Table 7:

- In the case of the academics, the level of prohibition of the legislation, 0.5, is less than the lower limit of the seven CI. For this reason, it can be assumed that this group prohibits more than the legislation in all variables.
- In the case of CA, the level of prohibition of the legislation, 0.5, is less than the lower limit of CI for the variables IncIA, IncRM, IncLS, and IncTM (SIA) and greater than the upper limit for the variables IncD, IncAS, and IncSP (SDA). Thus, it can be assumed that AC prohibit more than the legislation in SIA and, in contrast, prohibit less than the legislation in SDA.
- In the case of NCA, the level of prohibition of the legislation, 0.5, is within the seven CI, and, thus, NCA appear to prohibit on the same level as the legislation in all variables.

These findings provide a clear characterization, using the original variables, of the three professional segments found through the analysis of principal components.

Conclusions and Avenues for Future Research

The research study was based on the firm conviction that the auditing profession is necessary and useful to the economy of any country, given that it can provide an important added value to the economic and financial information provided by firms. In this context, an analysis of the quality of independence of auditors was carried out. Specifically, the investigation focused on an issue that has generated controversy in the auditing profession during recent years: the regulation of the joint offering of auditing and other multiple services.

The research study shows the positions maintained by both auditors and academics regarding the legislation governing this type of activities. Within the two targeted professions, three groups of individuals were identified: academics, nonconsolidated auditors, and consolidated auditors. Findings show a considerable

difference in criteria between the two professions. The joint analysis of the variable of experience and the type of professor/auditor indicates that CA diverge significantly from academics. However, NCA have a clearly intermediate opinion on prohibitions, between academics and AC. In addition, the starting variables were subdivided into two groups: SDA and SIA.

The characterization of the three groups of participants, using the original variables representing different prohibited services, provides the following evidence:

- Academics tend to prohibit more than the legislation on all variables.
- NCA prohibit on the same level as the law regarding both SDA and SIA.
- The level of global prohibition of CA appears similar to the law even though it is not. This group opts to prohibit more than the law in SIA and less in SDA, and both situations cancel each other out, such that the final result is deceptive.

More specifically, the results demonstrate that academics show a high level of prohibition in SDA when compared to SIA, CA show a high level of prohibition in SIA when compared to SDA, and NCA prohibit on the same level for both SDA and SIA. In addition, in the case of IncSP, the relevant variable that measures the level of importance assigned to the prohibitions, namely which members of the auditing team are incompatible with the realization of other services of the firm, findings show that academics show a high level of prohibition in IncSP, CA show a low level of prohibition in IncSP, and NCA have an intermediate level of prohibition in this variable.

It thus appears that the most important variables for the independence of auditing work are those that have been grouped under the heading of services directly related to auditing (SDA), and the least important are grouped under the heading of services indirectly related to auditing (SIA). This finding is consistent with the professional reality of each group. Academics are in an impartial position that allows them to see the need to reinforce auditors' independence through regulation, a fact that is reflected in their high level of prohibition, actually more elevated than the current legislation. In contrast, CA, probably influenced by their line of work, consider that a high level of prohibition in regulation is detrimental to their professional activity. NCA are located in an intermediate position between the other two groups, demonstrating agreement with the level of prohibition stipulated in the regulations. Given that they have not yet consolidated their position in the auditing profession, they share certain features of neutrality with academics, and they do not yet show a pessimistic view of the influence of the regulations on their professional activity.

Finally, the results obtained in this investigation, convergent in great measure with statements made at international level regarding stricter incompatibilities with auditing activity (for example, the Sarbanes-Oxley Act in the United States), provide important conclusions that could usefully be taken into account for future legislation in auditing markets.

The study showed a number of limitations:

- The use of a questionnaire as a method for obtaining empirical evidence has inherent limitations. Notable among these limitations are the participation of people who give random responses, problems in interpretation, and difficulties in responding to questions related to specific topics.
- The conclusions obtained have full validity in reference to the two groups providing the sample data. Thus, the criteria of other groups such as firms, financial analysts, and so on cannot necessarily be extrapolated. For this reason, future research could incorporate the opinion of these groups to give the results more perspective.
- The opinions shown in the questionnaire could contain a considerable amount of subjectivity, especially in reference to one of the groups surveyed: auditing professionals.

Future lines of investigation could focus on the following avenues:

- Analyzing whether the current legislation serves to encourage the independence of the auditing profession or, on in contrast, is too permissive.
- Investigating whether earning excessively high payment in NAS can affect the independence of the auditing profession.
- Analyzing in depth and in more detail the role played by the variable IncSP in the independence of auditing firms.

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