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Some pitfalls for the coordination of product standards
under imperfect competition**

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Harmonization versus Mutual Recognition: Some pitfalls for the coordination of product standards under imperfect competition

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Abstract

The present paper examines trade liberalization driven by the coordination of product standards. For oligopolistic firms situated in separate markets that are initially sheltered by national standards, mutual recognition of standards implies entry and reduced profits at home paired with the opportunity to start export sales. In contrast, harmonization, in particular the prospect that one's own national (but not the foreign) standard becomes the only globally accepted standard, opens the foreign market without balancing entry at home. We study these scenarios in a reduced form lobby game with two countries and three firms, where firms first lobby for the policy coordination regime (harmonization versus mutual recognition), and subsequently, in case of harmonization, the global standard is auctioned among the firms. We discuss welfare effects and conclude with policy implications. In particular, harmonized standards may fail to harvest the full pro-competitive effects from trade liberalization compared to mutual recognition; moreover, the issue is most pronounced in markets featuring price competition.

JEL: F12, F13, F15

Key Words: Standard regimes, harmonization, technical trade barriers, NTBs, Cournot competition, Bertrand competition

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1 Introduction

Market integration in general and trade liberalization within different sectors in particular are high on the political agenda. Such deep integration frequently takes place within the framework of supranational bodies or regional trade agreements, like for example the EU with the Internal Market and the North American Free Trade Agreement (NAFTA) as well as worldwide in the activities of the WTO. It is commonly accepted that market integration increases efficiency by inter alia introducing cross-border competition. More recently – and very pronounced in the ongoing US-EU trade talks (TTIP) – the coordination and removal of regulatory differences and technical standards, so-called non-tariff measures (NTMs), have been high on the agenda.¹ Empirical work finds that such NTMs creating substantial costs for firms are on the increase and today constitute far larger barriers to trade – in particular at the extensive margin – than the remaining tariffs (e.g. Chen, 2004; Anderson and van Wincoop, 2004; WTO, 2005, 2012).²

In this paper we analyze the international coordination of product standards as a policy tool for economic integration. Felbermayr and Jung (2011) analyze technical barriers to trade in a model with heterogeneous firms. They focus on how technical barriers affect firm productivity. Closer in spirit to the present paper, yet dealing with the emergence of divergent standards, are Edwards and Poyago-Theotoky (2013). They adapt a model of cross-hauling international duopoly to include potential gains from firms' R&D cooperation. Edwards and Poyago-Theotoky (2013) show that firms may opt out of international technology cooperation and prefer divergent technical solutions (despite potential R&D cost savings from cooperation), such that their domestic governments have the opportunity to exclude foreign firms from the domestic market via product standards, thus granting the domestic firm monopoly status. The focus of the present paper is on the dismantling of divergent standards; i.e., the coordination of standards. Orefice et al. (2012) provide a detailed overview and novel empirical evidence on the gains from such coordination across countries. Orefice and Rocha (2014) show that, inter alia, the emergence of production networks can be linked to the coordination of technical standards. What is central for our point of interest is that standards as well as their coordination – since they are technical in nature – are typically formed in close cooperation with the industry. This opens for a highly relevant but thus far unexplored political economy dimension of the international coordination of standards.

Since the seminal contribution of Grossman and Helpman (1994), the introduction and removal of import/export taxes and subsidies have routinely been viewed through the lense of political economy mechanisms. Related to this, Limao and Tovar (2011) show both theoretically and empirically how the emer-

¹Similarly, within the EU new initiatives have recently been launched to strengthen the integration process and stimulate growth through new actions in the Single Market Act, the so-called Single Market Act I (of April 2011) and Single Market Act II (of October 2012).

²The book by Maskus and Wilson (2001) provides a broad introduction on both theoretical and empirical approaches to technical barriers and trade.

gence of and increase in inefficient NTMs (even if more efficient export tariffs are available) can be linked back to political economy mechanisms and the aim to redistribute resources to special interest groups. Sturm (2006) links the emergence of protective standards to similar mechanisms. Thus, while the emergence of trade policies and tariff liberalization as influenced by industry interests has been addressed in the economic literature, the dismantling of technical standards has so far received limited attention. In particular, the potential pitfalls and special features of the international coordination of standards in the presence of industry interests (i.e. the potential lobbying directed at supranational bodies) have to the best of our knowledge not been examined.

The present paper attempts to close this gap. Central to the debate is the existence of two distinct real-world liberalization schemes in the domain of international coordination of standards and regulations, namely *mutual recognition* and *harmonized standards*.³ The principle of mutual recognition stipulates that if a standard is approved in one country it is accepted in all participating countries, and hence this allows all firms to sell on all markets, and we expect market opening and entry on every market. The principle of harmonization operates differently, in as far as the participating countries agree on one standard as the new commonly accepted standard. For all practical purposes, previous national standards do prevail – at least in the medium run – but what is important is that trade across borders only occurs with products fulfilling the harmonized standard; see e.g. Bau and Qui (2012), Chen and Mattoo (2008), and Orefice et al. (2012). The empirical evidence finds pronounced differences in terms of trade effects from harmonization versus mutual recognition. For example, Chen and Mattoo (2008) include third country effects and find that mutual recognition agreements are more uniformly trade promoting than harmonization policies. This makes it the more so surprising that the literature has little to offer in terms of theoretical exploration of the two different regimes for the coordination of technical standards.

The present paper develops a simple theoretical framework that pairs the two archetypes of policy tools with the strategic interaction of firms under imperfect competition, and the firms' ability to influence the political process and institutions surrounding liberalization results in a series of previously unnoted effects. For example, in our setup the direction of trade triggered by the coordination of standards may go from the higher concentrated, higher price country to the more competitive, lower price country. Moreover, in several constellations only part of the potential welfare gains from liberalization will be harvested. Furthermore, we show that the pitfalls of the international coordination of standards are more pronounced under Bertrand competition. Finally, we find that mutual recognition is more robust in terms of generating trade (at the extensive margin) and avoiding the welfare losses stemming from the influences of industry interests on trade policy.

We present a simple two country model with three firms. In one country there is only a monopolist supplier of a given differentiated good and the other

³See Pelkmans (2012) for an analysis of the rationale of mutual recognition in the EU.

country has two firms in operation. In some initial situation both countries have separate product standards that constitute a barrier to trade. Thus, we focus without exception on the empirically interesting case where the fixed costs of compliance or the costs of manufacturing two separate product lines are so high that initially no trade between the two countries takes place. The countries agree to liberalize trade through the coordination of product standards. While all established domestic standards prevail for the respective home markets throughout, either one (harmonized standard) or all (mutual recognition) of the existing standards can become the global and thus tradable standard(s).⁴ Hence, with a harmonized standard we observe one-way trade, while with the mutual recognition regime two-way trade takes place. From the perspective of the firms, having foreign receiving the harmonized standard amounts to market entry without the simultaneous opportunity to export.

We cast our analysis as a simple reduced form lobby game, where the firms' willingness to pay, which is determined by the profit differences under different scenarios, defines the various outcomes.⁵ In some initial phase the two countries have agreed to liberalize trade by coordinating their product standards through a supranational policy process. First, firms lobby for the policy regime under which the international coordination of standards, either harmonized standards or mutual recognition, takes place. Second, in case of the harmonized regime, the global standard is auctioned among the three firms. Solving the game backwards we find that both under Cournot and Bertrand competition, the monopolist would win the auction ensuring that his domestic standard becomes the global standard since this preserves his monopoly profit at home. This applies as long as products are not too differentiated; that is, we ignore cases where markets are practically separate. Although the duopoly firms would lose the auction of a global standard in the harmonized standard coordination regime, they will in the case of Cournot competition win the first period lobby game and ensure that mutual recognition becomes the policy regime of the international coordination of standards. The driver is that the firms in the country with duopoly gain so much from two-way trade (since their home market moves from two to three firms, compared to accessing an entirely new market) that this gain is larger than the gain of the monopolist moving from being a monopolist in one country to becoming an oligopolist in two countries. Hence, according to our model mutual recognition should be the rule. In contrast, once firms compete on price our model shows that the first stage lobby game may favor the monopolist and

⁴We abstract from the costs of conformity assessment, i.e. the process used to show that a product, service, or system meets the specified requirements.

⁵In order to focus on the problem at hand, we do not explicitly model the political economy setup, but the well known formalizations from Grossman and Helpman (1994) or the structure provided in Limao and Tovar (2011) lend ample motivation to the mechanisms we have in mind. For the present paper all policy decisions are simply auctioned by some supranational body to the highest bidding firm. Thus, whoever has the deepest pocket first wins the bid for the coordination regime and subsequently, if a harmonized standard regime has been put into place, wins the bid for his standard becoming the tradable standard. Moreover, we envisage some collective action problem on the consumer side, such that only the firms' perspectives and profits are considered.

result in the harmonized standards policy regime. Furthermore, the monopolist will win the auction of the standard, such that his product becomes the only tradable product. The reason is that under price competition the duopolistic firms have little to gain from keeping the third firm out and nor are profits on the foreign market attractive under the fiercer Bertrand competition.

We also compute welfare results for the case of homogeneous products and conclude with policy implications. In particular, harmonized standards will not harvest the full welfare gain compared to mutual recognition. Moreover, the issue is most pronounced in markets featuring price competition, and less pronounced if products are highly differentiated. Finally, we show how our findings relate to the empirical evidence on trade generating effects from the coordination of product standards.

The paper is structured as follows. Section two lays out the model. In section three the results are presented. The results are discussed and put into perspective in section four. Section five concludes.

2 The model

We set up a simple Brander (1981)-type, Helpman and Krugman (1989)-type two country model with differentiated products, albeit the countries differ in the initial market structure in terms of the strength of competition and in terms of their domestic product standards. In country A the market is characterized by monopoly, whereas in country B the market is characterized by duopoly.⁶ Products can trade freely internationally with no tariffs or transport costs, but product standards constitute a prohibitive trade barrier; i.e., products have to live up to government set product standards in the destination market. Initially, none of the firms finds it profitable to service the foreign market. Thus, in the initial situation, each of the three products constitutes a legal domestic standard only in their respective home countries and thus there is no trade. In effect, this setup amounts to two different, but permitted, standards in country B – i.e., the two differentiated products of the two duopoly firms – and one standard in country A – i.e., the product of the monopolist. Trade liberalization can come about by coordinating the product standards of the two countries, either through harmonization, making one of the existing standards the only standard accepted globally (i.e., only the product associated with this particular standard can be traded internationally), or through mutual recognition, making all the existing standards globally accepted (i.e., all products can be traded internationally).

Thus, in order to focus on the effects of different liberalization regimes, we keep the overall number of firms constant and only consider the situation where the costs to a firm for implementing a new standard are prohibitively high. That is, we deal with a parameter range for which all firms stay in operation and only produce according to their initial (domestic) standard. Obviously, situations where firms – subject to some sunk costs – choose to start production

⁶Obviously, the same mechanisms explored here will be at work in a setup with n and $n+1$ oligopolistic firms in the two countries.

according to foreign standards, will result in trade. Hence, for low enough sunk costs firms will produce according to multiple standards. However, in such situations standards cannot be a barrier to trade in the initial situation. Instead, throughout the present paper we stay with the empirically interesting case, where sunk costs are so sizable that standards are in fact barriers to trade, and accordingly there is room for the coordination of standards as a trade facilitating tool.

What admittedly looks like an extremely simple setup turns out to arrive at a rich set of results once we consider the strategic interaction of firms surrounding their favorite liberalization regime and once we examine the implications of Cournot and Bertrand differentiated products competition, respectively. In essence, the liberalization of product standard driven trade barriers can from the firm perspective result in two things. Firstly, it can open up the foreign market that previously could not be accessed by the firm. Secondly, it can result in an extra competitor showing up on the firm's domestic market, pushing the market structure from monopoly to duopoly or from duopoly to oligopoly.

Consumers in the two countries are identical with respect to preferences. Consumers love variety and consume a variety of brands if possible. We assume in the background a model of product differentiation with a quadratic and strictly concave utility function similar to Spence (1976). Furthermore, to keep the model tractable, we assume that the degree of product differentiation between each pair of varieties is the same. The model can easily be extended to include a homogeneous goods sector. As long as there are no income effects in the imperfect competitive sector, we can perform a partial equilibrium analysis for our industry in question. We analyze both Cournot competition and Bertrand competition within the same model.

The inverse demand for a firm i is, for example, given by:

$$p_i = \alpha - \beta(q_i + \phi q_j + \phi q_k) \quad (1)$$

where q_i, q_j, q_k are the quantities of three firms and p is the price. The parameter ϕ ($0 \leq \phi \leq 1$) measures how the consumers perceive the products to be differentiated. For $\phi = 0$ we have maximum product differentiation; i.e., products are distinct and do in fact not compete on the same market. At the other extreme where $\phi = 1$, products are homogeneous. The demand function in equation (1) gives demand for product i under monopoly by setting $q_j = q_k = 0$ and demand under duopoly by setting $q_k = 0$.

Naturally, in this setup the firms have opposing interests as to the nature and extent of international coordination in product standards. While firms in general would prefer their own product standard to also apply abroad, they prefer the foreign standard to not be accepted in their own home country. However, the firms' ability and willingness to lobby for a certain liberalization regime differ. The two relevant changes to the product standard system that we consider are: i) a harmonized standard and ii) mutual recognition. A harmonized standard captures situations where the two countries agree to set up a uniform standard which every firm must live up to if it wants to trade its products internationally. That is, products fulfilling the harmonized standard can be sold in both

countries, while products fulfilling only a domestic standard are untradable, but the domestic standard prevails.⁷ In our setup, the harmonized standard is one (determined endogenously in the model) of the existing three products. In other words, the standard of one of the countries becomes the global standard and the products of the firms fulfilling this standard will be traded, while all other products can only sell on their domestic market. In contrast, mutual recognition reflects the situation where the countries agree that any standard existing in any one country is also automatically approved in the other country. Hence, with mutual recognition all firms can sell on all markets.⁸

As discussed in the introduction, technical standards and product standards often emerge out of some form of cooperation between the industry in question and the government. We capture this institutionalized lobby game in reduced form. Firms first have to lobby for the liberalization regime (harmonized standard or mutual recognition), and in case of the harmonized standard they have to lobby for their domestic standard becoming the harmonized (tradable) standard (obviously a similar setup could be used in order to capture how the initial domestic standards have emerged). We solve this model backwards, and abstract from the details of the game and lobby process and instead simply compute maximum bids for the firms. This corresponds to a standard decision in an auction setup where firms first make a bid for the liberalization regime they prefer and – in case of a harmonized standard regime – they then bid for their own standard becoming the harmonized, and thus tradable, standard. The preferred type of liberalization and the size of the auction bid among firms and depend on the market structure. The final liberalization regime is determined endogenously in the model and depends on the deep parameters of the model.

The market structure will change according to which firms/country wins the different auctions. Possible market structures under harmonization are the following: in country A, a new firm from country B may enter the market with its product, and hence a duopoly will emerge. In country B an oligopoly with three firms may be the outcome. In contrast, under mutual recognition, both countries will feature a three-firm oligopoly.

We make the analysis both in the case of Cournot and Bertrand competition. From the demand function given in (1) we can easily derive the standard equilibrium results for price, quantity, and firm profit under monopoly, duopoly, and with three firms.

In the case of monopoly (m) we get:

$$p_m = (c + \alpha)/2 \tag{2}$$

$$q_m = Q_m = (\alpha - c)/2\beta \tag{3}$$

$$\pi_m = (\alpha - c)^2/4\beta \tag{4}$$

⁷This is in line with the European policy practice where harmonized standards are voluntary.

⁸This reflects the situation of the Single Market Program in the EU.

In the case with two and three firms we distinguish between Cournot and Bertrand competition. First we analyze the case of Cournot competition.

2.1 Cournot competition (C)

The standard market equilibrium for a duopoly (d) is:

$$p_d^C = (c + \alpha + \phi c)/(2 + \phi) \quad (5)$$

$$q_d^C = (\alpha - c)/(2 + \phi)\beta \quad (6)$$

$$Q_d^C = 2(\alpha - c)/(2 + \phi)\beta \quad (7)$$

$$\pi_d^C = (\alpha - c)^2/(2 + \phi)^2\beta \quad (8)$$

The standard market equilibrium in the case of oligopoly with three firms (o) is:

$$p_o^C = (c + \alpha + 2\phi c)/2(1 + \phi) \quad (9)$$

$$q_o^C = (\alpha - c)/2(1 + \phi)\beta \quad (10)$$

$$Q_o^C = (\alpha - c)/(1 + \phi)\beta \quad (11)$$

$$\pi_o^C = (\alpha - c)^2/(1 + \phi)^2 4\beta \quad (12)$$

Given the market equilibrium, consumers' and producers' surplus can be found.

2.1.1 Harmonized standards (H)

We solve the model backwards. Firms bid for their own standard becoming the harmonized, and thus tradeable, standard. The maximum gain from winning the harmonized standard is found by comparing the changes in firms' profit when going from one market structure to another; i.e., going from monopoly to duopoly and from duopoly to the situation with three firms. The maximum gain from winning the harmonized standard for a monopoly firm is given by:

$$\bar{\Omega}_m^C = \pi_m + \pi_o^C - \pi_d^C = (c - \alpha)^2(4 + \phi(4 + \phi)(2 + \phi(2 + \phi)))/4\beta(1 + \phi)^2(2 + \phi)^2 \quad (13)$$

The maximum gain for a duopoly firm is:

$$\bar{\Omega}_d^C = \pi_d^C + \pi_d^C - \pi_o^C = (c - \alpha)^2(4 + \phi(12 + 7\phi))/4\beta(1 + \phi)^2(2 + \phi)^2 \quad (14)$$

By comparing (13) and (14) we can show that (13) is larger than (14) for $\phi > \bar{\phi}^C = 0.58$.⁹ Hence, for sufficiently large ϕ the monopolist wins the standard auction and pays an amount corresponding to the maximum gain given in (14), while for very small ϕ one of the duopolists will win the auction and pay the amount corresponding to (13). Note that for very small ϕ these are two different

⁹The critical ϕ , $\bar{\phi}^C$, is defined by $4 + \phi(4 + \phi)(2 + \phi(2 + \phi)) = 4 + \phi(12 + 7\phi)$.

products, and the duopolist starting a new market abroad generates more profits than the monopolist entering a market where two firms are already present. Put differently, with low ϕ , products are so differentiated that the monopolist does not need to protect his market by imposing his standard (and hence avoid foreign entry).

We focus on the case with sufficiently large ϕ in the remainder of this paper, because for very small ϕ this is like separate product markets. The change in profits for a single firm where the monopoly firm wins the bid is given by:

$$\begin{aligned}\Delta\pi_{mH}^C &= (\pi_m + \pi_o^C - \bar{\Omega}_d^C) - \pi_m \\ &= -(c - \alpha)^2\phi(4 + 3\phi)/2\beta(1 + \phi)^2(2 + \phi)^2\end{aligned}\quad (15)$$

$$\begin{aligned}\Delta\pi_{dH}^C &= \pi_o^C - \pi_d^C \\ &= -(c - \alpha)^2\phi(4 + 3\phi)/4\beta(1 + \phi)^2(2 + \phi)^2\end{aligned}\quad (16)$$

By comparing the two equations we see that the upper expression is larger than the lower; hence the monopolist loses more from economic integration in terms of harmonized standards than does one duopolist.

2.1.2 Mutual recognition (M)

In this case, all firms are allowed to sell on all markets. The change in profits for a single firm is:

$$\Delta\pi_{mM}^C = 2\pi_o^C - \pi_m = (c - \alpha)^2(1 - \phi(2 + \phi))/4\beta(1 + \phi)^2\quad (17)$$

$$\Delta\pi_{dM}^C = 2\pi_o^C - \pi_d^C = (c - \alpha)^2(2 - \phi^2)/2\beta(1 + \phi)^2(2 + \phi)^2\quad (18)$$

By inspection of the two equations it is seen that the monopolist dislikes mutual recognition (the upper expression is negative for large ϕ ; i.e., $\phi > 0.41$). On the other hand, a duopoly firm always likes integration with mutual recognition compared to autarky. This is due to the fact that the firm gains access to a new market while at home the loss is limited because the market "only" goes from two to three firms.

2.1.3 Cournot results

It is now possible to analyze which firm most strongly prefers its favorite standard coordination regime by looking at the differences in the profit changes in the two regimes for the two types of firms. Put differently, how much better off is a firm if its favorite coordination regime comes into place compared to a opposing firm's favorite coordination regime. For the monopoly firm we have that $R_m^C = \Delta\pi_{mH}^C - \Delta\pi_{mM}^C = (c - \alpha)^2(-4 + \phi(4 + \phi))/4\beta(2 + \phi)^2$, and for a duopoly firm we have that $R_d^C = \Delta\pi_{dM}^C - \Delta\pi_{dH}^C = (c - \alpha)^2/4\beta(1 + \phi)^2$. It is evident that the monopolist's difference in the two standard regimes is smaller than the difference for one duopoly firm; hence mutual recognition will be the rule.

2.2 Bertrand competition (B)

Using standard methods we invert the inverse demand functions given in (1) to get the direct demand. The calculations are done in a separate appendix available from the authors by request. The standard market equilibrium for Bertrand duopoly is given by:

$$p_d^B = (c + \alpha - \alpha\phi)/(2 - \phi) \quad (19)$$

$$q_d^B = (\alpha - c)/(2 - \phi)\beta(1 + \phi) \quad (20)$$

$$\pi_d^B = (c - \alpha)^2(1 - \phi)/(-2 + \phi)^2(1 + \phi)\beta \quad (21)$$

The market equilibrium in the case of three firms with Bertrand competition is given by:

$$p_o^B = (c + \alpha - \alpha\phi + c\phi)/2 \quad (22)$$

$$q_o^B = (\alpha - c)(1 + \phi)/2(\beta + 2\beta\phi) \quad (23)$$

$$\pi_o^B = (c - \alpha)^2(1 - \phi^2)/4(\beta + 2\beta\phi) \quad (24)$$

2.2.1 Harmonized standards

Again we solve the model backwards. Firms bid for their own standard becoming the harmonized, and thus tradeable, standard. The maximum gain from winning the harmonized standard is found by comparing the changes in firms' profit when going from one market structure to another; i.e., going from monopoly to duopoly and from duopoly to the situation with three firms. The maximum gain from winning the harmonized standard for a monopoly firm is given by:

$$\begin{aligned} \bar{\Omega}_m^B &= \pi_m + \pi_o^B - \pi_d^B \\ &= (c - \alpha)^2(4 - \phi(-4 + \phi(2 + \phi(4 + (-5 + \phi)\phi))))/4\beta(-2 + \phi)^2(1 + \phi)(1 + 2\phi) \end{aligned} \quad (25)$$

The maximum gain for a duopoly firm is given by:

$$\begin{aligned} \bar{\Omega}_d^B &= \pi_d^B + \pi_o^B - \pi_o^B \\ &= 1/4(c - \alpha)^2(8(1 - \phi)/\beta(-2 + \phi)^2(1 + \phi) + (-1 + \phi^2)/(\beta + 2\beta\phi)) \end{aligned} \quad (26)$$

By comparing the two equations it is evident that for large enough ϕ (i.e., $\phi > \bar{\phi}^B = 0.54$) the monopolist wins the standard auction and pays an amount corresponding to (26). The change in profits for a single firm in the case of large enough ϕ (such that the monopolist wins) is:

$$\begin{aligned} \Delta\pi_{mH}^B &= (\pi_m + \pi_o^B - \bar{\Omega}_d^B) - \pi_m \\ &= -(c - \alpha)^2\phi(4 + \phi(-1 + \phi(-1 + (-3 + \phi)\phi)))/2\beta(-2 + \phi)^2(1 + \phi)(1 + 2\phi) \end{aligned} \quad (27)$$

$$\Delta\pi_{dH}^B = \pi_o^B - \pi_d^B$$

$$= 1/4(c - \alpha)^2(4(-1 + \phi)/(\beta(-2 + \phi)^2(1 + \phi)) + 1\phi^2/(\beta + 2\beta\phi)) \quad (28)$$

By inspection of the two equations it is evident that both types of firms lose from integration, but the monopolist loses the most.

2.2.2 Mutual recognition

In this case, all firms are allowed to sell on all markets. The change in profits for a single firm is:

$$\begin{aligned} \Delta\pi_{mM}^B &= 2\pi_o^B - \pi_m \\ &= (c - \alpha)^2(1 - 2\phi(1 + \phi))/48\beta + 2\beta\phi \end{aligned} \quad (29)$$

$$\begin{aligned} \Delta\pi_{dM}^B &= 2\pi_o^B - \pi_d^B \\ &= 1/2(c - \alpha)^2(2(-1 + \phi)/\beta(-2 + \phi)^2(1 + \phi) + (1 - \phi^2)/(\beta + 2\beta\phi)) \end{aligned} \quad (30)$$

2.2.3 Bertrand results

It is now possible to analyze which firm prefers the favorite mode of standard the most by looking at the differences in the profit changes in the two regimes for the two types of firms. For the monopoly firm we have that $R_m^B = \Delta\pi_{mH}^B - \Delta\pi_{mM}^B = (c - \alpha)^2(-4 + \phi(8 + (-3 + \phi)\phi))/4\beta(-2 + \phi)^2(1 + \phi)$, and for a duopoly firm we have that $R_d^B = \Delta\pi_{dM}^B - \Delta\pi_{dH}^B = (c - \alpha)^2(1 - \phi^2)/4(\beta + 2\beta\phi)$. A comparison of the two expressions shows that the monopolist is willing to bid the most to get a regime of harmonized standards under Bertrand competition for $\phi > 0.72$.

3 Results

Figure 1 illustrates the main conclusion of our analysis.¹⁰ The two upper panels show the firms' willingness to pay for their preferred regime of standard coordination; i.e., the first stage of the lobby process. The monopolist favors a harmonization of standards, while a duopoly firm will lobby for mutual recognition. The lower panels show the case of harmonization with only one globally traded standard. This gives the indication of a firm's willingness to pay for making its existing product standard the globally traded (i.e., harmonized) standard.

Starting with the situation of Cournot competition, we note that, even if the monopoly firm would win the bid for making its standard the global standard when products are sufficiently homogeneous ($\phi > \bar{\phi}^C = 0.58$), it is one of the duopoly firms that dominates the first stage. This means that the duopoly firms' willingness to pay for a regime of mutual recognition is higher than the monopolist's willingness to pay for making harmonization the coordination rule. The intuition is that for the monopolist, the difference between going from a

¹⁰The curves shown are R_m^C , R_d^C , R_m^B , R_d^B , $\bar{\Omega}_m^C$, $\bar{\Omega}_d^C$, $\bar{\Omega}_m^B$, and $\bar{\Omega}_d^B$. The plot has set $c = 1$, $\alpha = 5$, and $\beta = 2$, but note that, as shown in the main text, the intersections of curves are independent of α , β , and c .

monopoly at home plus an oligopoly abroad (i.e., having harmonization and winning the standard) to being part of two oligopolies (i.e., mutual recognition) is less than the difference when a duopolist firm from goes from oligopoly at home (i.e., harmonization and the foreign monopolist winning the standard) to two oligopolies (one at home and one abroad).

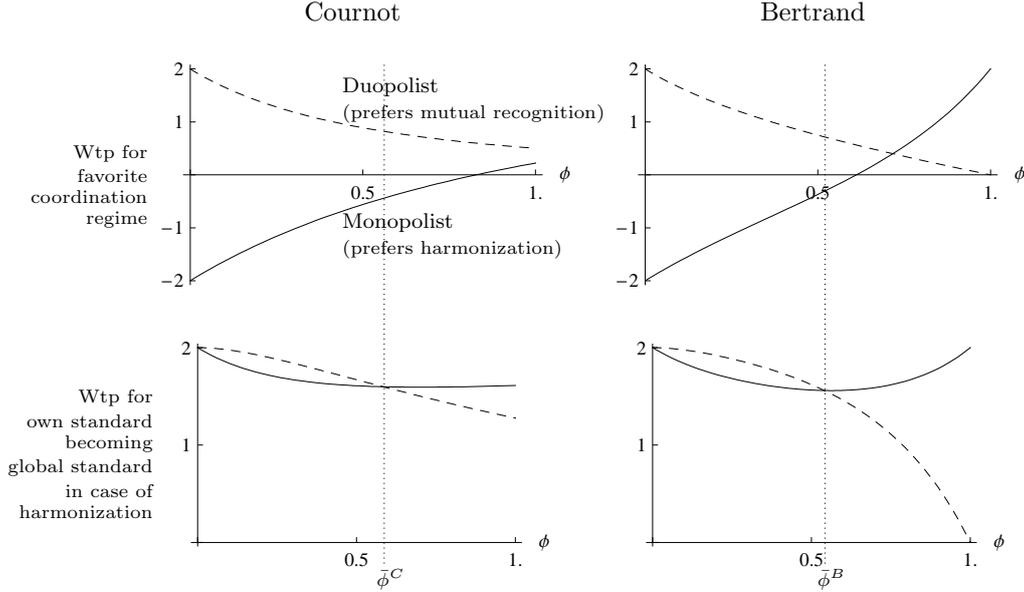


Figure 1: Willingness to pay (Wtp) depending on ϕ and mode of competition.

Thus, with an endogenous decision for deciding the coordination regime the duopolist firms have so strong preferences in favor of the multilateral recognition regime (such that they have access to both markets) that no harmonization auction takes places. This is the case despite the fact that there is a level of high ϕ such that the monopolist would win the auction for making his standard the harmonized global standard. Thus, in a situation where the actual coordination regime is exogenously determined, the lower left-hand panel depicts that either the monopolist firm's standard becomes the new harmonized standard for $\phi > 0.58$, or otherwise one of the duopolists wins. In the first case, the duopoly market becomes a oligopoly, while the monopoly market stays unchanged, and the trade flow will go from the monopoly market to the market with two firms initially. In the latter case (i.e., for lower ϕ) one of the duopolists will win the auction and the market situation becomes a duopoly in both countries with goods flowing from the initial duopoly market to the initial monopolistic market.

In the case of Bertrand competition, the situation for an auction of the global standard (assuming that a harmonization regime is chosen) resembles that under Cournot competition, albeit the critical ϕ is now slightly lower at 0.54. We also

immediately note in the lower right-hand panel that the willingness to pay falls dramatically once products become more homogeneous. This is so because price competition is a particularly harsh form of competition, and with almost homogeneous products, even with two firms, prices will be close to marginal costs. Accordingly, keeping the third firm out of the home market, which is the motive of the duopoly firms when bidding for the harmonized standard, is not creating much value to the firm.

Turning to the upper right-hand panel, however, we see that under Bertrand competition, it is not obvious which coordination regime will win. In fact, for sufficiently homogeneous products (fierce competition, i.e. $\phi > 0.72$) the monopolist's willingness to pay outperforms the duopolists' willingness to pay, arriving at a harmonization regime. Notice also that for this case the monopolist will always win the bid for the global standard. In the interim range (ϕ between 0.54 and 0.72) the monopolist will lose the lobby game but would win the auction for his standard becoming the global standard if harmonization became the coordination regime (for example determined through some exogenous policy process).

Thus, under Bertrand competition, unless products are sufficiently differentiated, the monopolist has both the ability to win the policy game, such that a harmonized standard will inure, and to win the subsequent auction, such that his domestic standard becomes the new and only internationally accepted standard (i.e., the product associated with this standard is the only internationally traded product). This situation occurs under Bertrand competition, allowing the monopolist to keep his home market uncontestable. For highly differentiated products the monopolist would not win the auction that would make his standard the harmonized global standard. The reason is that the goods are sufficiently differentiated, such that no agent wants to pay a lot of money to keep competition away; i.e., product differentiation allows all firms to act as small monopolists anyway. Now the duopolists' preferences for mutual recognition dominate and become the outcome of the policy game. Under Cournot competition, where firms in any case have more room to generate profits, this latter effect of insulation from competition is sufficient to ensure that the duopolists' preferences determine the policy game throughout.

3.1 A remark on welfare

In the above framework with differentiated products a comparison of welfare is not meaningful since the market size, and hence the total welfare potential, increases with the degree of product differentiation. However, the fundamental mechanism that we have identified, in particular the different outcomes of a coordination of standards as a means of NTM reduction under Bertrand and Cournot competition, respectively, also occurs in the homogeneous goods case (simply setting $\phi = 1$ in the above). In the homogeneous goods case a simple welfare measure is the sum of consumer surplus, producer surplus, and the

lobby flows or auction bids that are paid by firms in the game.¹¹ Computing the welfare (w) for one individual market, we have the following possibilities: monopoly (m), duopoly (d), and oligopoly with three firms (o) under Bertrand (B) and Cournot (C) competition, respectively, and the standard ranking: $w_m^C = w_m^B < w_d^C < w_o^C < w_d^B = w_o^B$. Composing from this the global welfare W of the two countries under autarky, harmonization, and mutual recognition, we can accordingly state:

$$W_{aut}^C (= w_m^C + w_d^C) < W_H^C (= w_m^C + w_o^C) < W_M^C (= 2w_o^C) \quad (31)$$

$$W_{aut}^B (= w_m^B + w_d^B) < W_H^B (= w_m^B + w_o^B) < W_M^B (= 2w_o^B) \quad (32)$$

Adding in the result from above we note that in the Cournot case, where mutual recognition is the likely outcome, the highest possible welfare level will be achieved through the coordination of standards. In contrast, with the mechanisms studied here, we note that under Bertrand competition, where the system settles on the harmonization regime, the full welfare potential of liberalization through the removal of NTM will not be obtained.

4 Discussion and perspectives

What the above results imply is that if otherwise symmetric countries are not symmetric in their initial level of competition (here monopoly and duopoly, respectively), then trade liberalization through the international coordination of standards may fail to harvest the full benefits for certain market conditions. In particular, if the market in question for liberalization is featuring price competition and a certain degree of product differentiation or if policy makers have simply decided to aim at harmonized standards, then such liberalization may bring along some odd results. Firstly, the standard and the associated product that will become the tradable product will be the initially higher priced product (note that for the simple benchmark of pure arbitrage trade the goods would flow from the lower price market to the higher price market). Secondly, and more importantly, the resulting trade flow goes from the higher concentrated market to the lower concentrated market. That is, the pro-competitive effect of trade liberalization occurs on the market that had the lesser problem, while the initially monopolistic market stays monopolistic. These effects will not take place for highly differentiated products (because strategic interaction between firms – the driver of these liberalization pitfalls – has been switched off) or if the international negotiations can pre-commit to mutual recognition as the only means of coordination of standards.

Our results also hint at the ease of bringing about reductions in NTM, such as the coordination of product standards. When firms' favorite mode of the coordination regime is coming through, they will actually have higher

¹¹Note that, in effect, we do not need to include the latter item explicitly since it comes out of the producer surplus.

profits subsequent to the liberalization (i.e., they access a new market). Thus in principle, at least in a Cournot world, the industry will not unanimously be opposed to the prospect of coordinating standards. However, the tools by which this is achieved make a great difference to the involved firms. Moreover, the mechanisms of our model have been derived for countries of equal size. It is obvious that with asymmetric countries, in particular if the monopolist is located in the larger market, the above problems and pitfalls in the coordination of product standards will be exacerbated.

Several policy recommendations emerge. As a rule, countries are not symmetric in their initial industry structure and feature different price levels and different degrees of industry concentration for industries that are sheltered from international competition through NTM. Nevertheless, territories with different initial conditions for competition on a given product market can still benefit from integrating their markets. International negotiations on the coordination of standards should for markets featuring price competition and/or fairly homogeneous products pre-commit to the tool of mutual recognition. Aiming at harmonization standards should be reserved for markets that mirror competition in quantities or where product/producer differentiation is high.

A caveat is in place. Our analysis ignores the fact that standards and technical regulations may well have emerged for good reasons – apart from the bad reason of serving as trade barriers. Accordingly, many standards undoubtedly generate consumer benefits in terms of ensuring compatibility, consumer safety, environmental protection, etc., and international standard coordination should take these considerations into account.

The findings of this paper are compatible with the findings in the empirical literature on the trade generating effects from the coordination of product standards.

First, the most surprising insight from our analysis is that since harmonized standards open the possibility for one-way trade, they may (driven by strategic interaction) result in wrong-way trade. Thus, products may flow from the highly concentrated, high price territory to the lower price higher competition territory. The European electricity market makes an intriguing example of such wrong-way trade. Albeit not cast in a setting of product standards, limited transnational grid capacity creates a very similar structure (and much richer data). Bunn and Zachmann (2010) show this effect in a theoretical model with an auction for network access and provide empirical evidence based on data from the Anglo-French trans-Channel cable. This Anglo-French interconnector is the only link between France and the UK and hence the only way to trade electricity between the two countries. Furthermore, electricity can only be sold in one direction, and therefore there is no "free of loop flows". France is the highly concentrated, high price territory market compared to a much more competitive UK market. Bunn and Zachmann (2010) show evidence of trade against price differentials. The dominant French electricity supplier is exporting electricity to the UK – in other words, exercising the advantage of the market power in the bidding auction.

Second, the findings in Chen and Mattoo (2008) are compatible with the

findings in this paper. They use a constructed panel data set based on official EU directives on harmonization and mutual recognition agreements, respectively, together with trade data from COMTRADE to investigate the effects from integration through harmonization and mutual recognition on trade at the industry level. They analyze a three country setup with discriminatory effects on the third country. In accordance with our model and supportive for our results, they find that mutual recognition agreements are more uniformly trade promoting than harmonization policies.

And finally, the empirical literature on the effects of standard coordination also includes studies on firm level data. Chen et al. (2008) look at developing countries and use the World Bank Technical Barriers to Trade Survey Database to investigate and compare different types of standards (e.g., quality, design, and labeling standards) and their importance for firms' export decisions. They show that different types of technical standards should be addressed differently. In line with our theoretical predictions, they find that the extensive margin might increase with mutual recognition regimes.

5 Conclusions

This paper examines trade liberalization driven by the coordination of product standards as a policy tool for economic integration. Central to our point of interest is that standards as well as their coordination are typically formed in close cooperation with the industry. Hence, we set up a political economy model where two distinct real-world liberalization schemes in the domain of standards – i.e., mutual recognition and harmonization – are analyzed. Paired with strategic interaction of firms under imperfect competition we find new and unexplored effects. For example, in our setup the direction of trade triggered by the coordination of standards may go from the higher concentrated, higher price country to the more competitive lower price country. Moreover, in several constellations only part of the potential welfare gains from liberalization will be harvested, and we show that the pitfalls of the international coordination of standards are more pronounced under Bertrand competition. Furthermore, we find that mutual recognition is more robust in terms of generating trade (at the extensive margin) and avoiding the welfare losses stemming from the influences of industry interests on trade policy. Finally, the findings in this paper are compatible with the empirical literature.

6 References

- Anderson, James E. and Eric van Wincoop (2004), Trade Costs, *Journal of Economic Literature*, vol. 42, 691–751.
- Bau, Xiaohua and Larry D. Qiu (2012), How Do Technical Barriers to Trade Influence Trade?, *Review of International Economics*, vol. 20, 691–706.

- Brander, James A. (1981), Intra-Industry Trade in Identical Products, *Journal of International Economics*, vol. 11, 1–14.
- Bunn, Derek and Georg Zachmann (2010), Inefficient Arbitrage in Inter-regional Electricity Transmission, *Journal of Regulatory Economics*, vol. 37, 243–265.
- Chen, Natalia (2004), Intra-national versus International Trade in the European Union: Why Do National Borders Matter?, *Journal of International Economics*, vol. 63, 93–118.
- Chen, Maggie X. and Aaditya Mattoo (2008), Regionalism in Standards: Good or Bad for Trade?, *Canadian Journal of Economics*, vol. 41(3), 838–863.
- Chen, Maggie X., John S. Wilson, and Tsunehiro Otsuki (2008), Standards and Export Decisions: Firm-level Evidence from Developing Countries, *The Journal of International Trade & Economic Development*, vol. 17(4), 501–523.
- Edwards, Huw and Joanna Poyago-Theotoky (2013), Regulatory Protection When Firms Decide First on Technical Collaboration and R&D, *Review of International Economics*, vol. 21(4), 750–764.
- Felbermayr, Gabriel J. and Benjamin Jung (2011), Sorting it Out: Technical Barriers to Trade and Industry Productivity, *Open Economic Review*, vol. 22, 93–117.
- Grossman, Gene M. and Elhanan Helpman (1994), Protection for Sale, *American Economic Review*, Vol. 84(4), 833–850.
- Helpman, Elhanan and Paul R. Krugman (1989), *Trade Policy and Market Structure*, Cambridge, MA: MIT Press.
- Limao, Nuno and Patricia Tovar (2011), Policy Choice: Theory and Evidence from Commitment via International Trade Agreements, *Journal of International Economics*, vol. 85(2), 186–205.
- Maskus, Keith E. and John S. Wilson (eds.)(2001), *Quantifying the Impact of Technical Barriers to Trade: Can It Be Done?*, The University of Michigan Press.
- Orefice, Gianluca and Nadia Rocha (2014), Deep integration and Production Networks: An Empirical Analysis, *The World Economy*, vol. 37(1), 106–136.
- Orefice, Gianluca, Roberta Piermartini, and Nadia Rocha (2012), Harmonization and Mutual Recognition: What Are the Effects on Trade? *Mimeo*, CEPII, Paris, France.
- Pelkmans, Jacques (2012), Mutual Recognition: Economic and Regulatory Logic in Goods and Services, *Bruges European Economic Research Papers*, 24/2012.
- Spence, Michael A. (1976), Product Differentiation and Welfare, *American Economic Review*, vol. 66, 407–414.
- Sturm, Daniel M. (2006), Product Standards, Trade Disputes, and Protection-

- ism, *Canadian Journal of Economics*, vol. 39(2), 564–581.
- WTO (2005), *World Trade Report 2005: Trade, Standards and the WTO*, WTO.
- WTO (2012), *World Trade Report 2012: Trade and public policies: A closer look at non-tariff measures in the 21st century*, WTO.