

von Lampe, M., K. Deconinck and V. Bastien (2016-12-20),
“Trade-Related International Regulatory Co-operation: A
Theoretical Framework”, *OECD Trade Policy Papers*, No. 195,
OECD Publishing, Paris.
<http://dx.doi.org/10.1787/3fbf60b1-en>



OECD Trade Policy Papers No. 195

Trade-Related International Regulatory Co-operation

A THEORETICAL FRAMEWORK

Martin von Lampe,
Koen Deconinck,
Véronique Bastien

OECD TRADE POLICY PAPERS

This paper is published under the responsibility of the Secretary-General of the OECD. The opinions expressed and the arguments employed herein do not necessarily reflect the official views of OECD countries.

The publication of this document has been authorised by Ken Ash, Director of the Trade and Agriculture Directorate

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

This document has been declassified on the responsibility of the Working Party of the Trade Committee under the OECD reference number TAD/TC/WP(2016)12/FINAL.

Comments on the series are welcome and should be sent to tad.contact@oecd.org.

OECD TRADE POLICY PAPERS
are published on www.oecd.org/trade.

© OECD (2016)

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgment of OECD as source and copyright owner is given. All requests for commercial use and translation rights should be submitted to rights@oecd.org.

Abstract

Trade-Related International Regulatory Co-operation: A Theoretical Framework

Martin von Lampe, Koen Deconinck and Véronique Bastien
Organisation for Economic Co-operation and Development

This report provides a conceptual foundation for the analysis of international regulatory co-operation (IRC) and its potential benefits through reduced trade costs. Different forms of IRC aiming to reduce specification, conformity assessment and information costs – which can arise from regulatory heterogeneity, costly conformity assessment procedures and insufficient regulatory transparency – are addressed. The report argues that trade costs need to be balanced against the regulatory objectives of mitigating various market imperfections. Integrating these two elements often allows significant gains in terms of national welfare, gains that can be augmented by negotiated outcomes among trading partners. IRC may also have important effects on trade with third countries. Related welfare implications are, however, ambiguous and depend on the specifics of the IRC outcome as well as on third countries' own regulations.

Keywords: Regulation, trade costs, specification costs, conformity assessment costs, information costs, game theory, Nash equilibrium.

JEL Codes: C71, C72, C73, D60, D61, F13, K23, L51.

Acknowledgements

This work was undertaken under the supervision of Frank van Tongeren. The report has benefitted from comments and discussions on previous versions by Ken Ash, Carmel Cahill, Barbara Fliess, Céline Kauffmann, Hildegunn Kyvik Nordås, the OECD Working Party of the Trade Committee and the OECD Joint Working Party on Agriculture and Trade. Helpful discussions with Elizabeth Branson (USTR), Marcus Long (IIOC), Kelly Milton (USTR), Jon Murthy (UKAS) and Henrik Warm (TÜV International GmbH) are gratefully acknowledged. The authors wish to thank Martina Abderrahmane for providing editorial assistance.

The report was declassified by the OECD Working Party of the Trade Committee in October 2016. This work has benefitted from an allocation of OECD Central Priority Funds as well as from a grant from the United States Department of Agriculture.

Table of contents

Executive Summary	4
Background	7
Introduction	7
Convergence and harmonisation in product and production requirements: Potential welfare gains through IRC in a basic case	10
A more general model: Relaxing assumptions	29
Equivalence and mutual recognition as an alternative to regulatory convergence	40
Conformity assessment procedures	41
Information costs for economic agents	50
IRC implications for third-country trade.....	55
Translating theoretical findings into practical IRC.....	56
References	59

Figures

Figure 1. Dimensions of the IRC theoretical framework.....	8
Figure 2. Trade costs for continuous horizontal regulations.....	15
Figure 3. Indifference curves with horizontal regulations	16
Figure 4. Indifference curves in the absence of trade costs.....	17
Figure 5. Indifference curves when trade costs dominate domestic effects.....	17
Figure 6. Steps of rule convergence.....	18
Figure 7. Information sharing and the Nash equilibrium.....	20
Figure 8. Negotiated outcomes: The Pareto set.....	22
Figure 9. Comparison of the Pareto set and the Nash outcome	23
Figure 10. Joint welfare maximization selects a single point on the Pareto frontier.....	25
Figure 11. Three sources of inefficiency.....	28
Figure 12. Trade costs for continuous vertical regulations	30
Figure 13. Indifference curves with vertical regulations.....	31
Figure 14. No information, partial information and information sharing outcomes with vertical regulations	32
Figure 15. Net welfare under discontinuous trade costs	36
Figure 16. Joint welfare optimization with countries of unequal size.....	37
Figure 17. Trade costs of conformity assessment procedures.....	45
Figure 18. Net benefits of switching to alternative conformity assessment systems	47

Boxes

Box 1. Types of heterogeneity-related trade costs	9
Box 2. The role of information in IRC	9
Box 3. Key terms used in this theoretical framework.....	12
Box 4. Objectives for regulations	13

Executive Summary

Reducing unnecessary trade costs is an important aspect of international regulatory co-operation (IRC). But trade costs are only one of the many considerations that countries take into account when engaging in bilateral, plurilateral or multilateral efforts to address non-tariff measures that are related to differences in regulations. They are also concerned about pursuing domestic regulatory objectives. This report develops an analytical framework to help understand the trade-offs between trade costs and domestic regulatory objectives that will determine outcomes of IRC. It shows the possible scope and landing zones of IRC initiatives, ranging from simple information exchange to negotiations to harmonize regulations between countries. The analytical approach is based on economic game theory and provides a basis for regulators and trade negotiators to determine which specific IRC approach would be promising to pursue.

The starting point for the approach developed in this report is that regulations address domestic issues, typically associated with market imperfections related to safety, health, the environment, or consumer protection. Trade costs arise from regulatory heterogeneity, i.e. countries have different ways to address a given regulatory objective. Three types of trade costs can be distinguished:

- Specification costs arise from adapting products and production processes to the different requirements on export markets. Specification costs tend to be greater if regulations are more different.
- Conformity assessment costs relate to the need to demonstrate that exported products comply with the destination country's requirements. They may be due to differences in conformity assessment methods or relate to rigid conformity assessment procedures requiring tests or certificates from conformity assessment bodies in or accredited by the destination country.
- Information costs accrue to firms for identifying, gathering and processing information on the regulatory requirements for offering products on the destination market. The magnitude of information costs depends on both the heterogeneity and the transparency of countries' regulatory regimes: the more regulations are heterogeneous and the more they are opaque, the higher these costs tend to be.

Trade-related IRC needs to balance domestic objectives (including, in particular, the mitigation of the market imperfection in question) against the benefit from enhancing international trade through lower trade costs. The more important trade costs are within countries' overall welfare relative to the domestic effects, the greater the potential scope for gains through co-operation becomes.

Trade-related IRC is particularly important for new regulatory issues, for example related to emerging technologies. In contrast, the administrative and transitional costs can represent a significant obstacle for governments to changing the stock of long-established existing regulations, as they may offset potential gains from reduced trade costs.

The analytical framework distinguishes between the following forms of IRC:

- Information exchange
- Negotiations aiming to achieve regulatory convergence
- (Mutual) recognition of equivalence
- Technical co-operation to harmonize or recognise conformity assessment methods
- Enhanced flexibility and mutual recognition of conformity assessment procedures
- Enhanced transparency in regulations

Reducing specification costs

The reduction of regulatory *information inefficiencies* through information exchange is the most basic form of trade-related IRC. Information sharing promotes regulatory convergence. Even when countries' regulators maintain their sovereignty on final regulations, significant welfare gains can often be realized by taking into account the information on regulatory detail and preferences of trade partners in the regulatory process.

Negotiations to achieve some degree of regulatory convergence between countries can address *co-operation inefficiencies* and may provide additional benefits, provided outcomes are reliable due to mutual confidence or enforcement mechanisms. International standards may represent important focal points for choosing between possible negotiation outcomes. They can also provide a reference for domestic regulators and help to make regulations more transparent.

By bundling related regulatory problems, better outcomes can be obtained still as the scope for trade-offs becomes wider. Countries may accept small disadvantages in one area in exchange for greater benefits in others, thus addressing *bundling inefficiencies*.

When countries differ in the size of their markets, the smaller country is likely to accept greater changes to its regulations than the larger one. In smaller countries, trade costs often play a larger role compared to domestic regulatory effects. In addition, smaller countries may have less negotiation power and could comparatively easily be compensated by bundling with other regulatory issues than larger partners.

The recognition of equivalence in the product and production requirements may be an alternative to regulatory convergence where different requirements are considered to achieve the same regulatory objectives. Equivalence allows maintaining existing regulations while avoiding resulting specification costs. Equivalency agreements are more likely to be achieved in well-defined areas, such as organic food, and between countries with similar regulatory approaches.

Reducing conformity assessment costs

Conformity assessment methods should be based on evidence, including scientific evidence, and need to be appropriate for testing given product characteristics. Technical co-operation can help to identify methods most appropriate to specific product characteristics, and to harmonize methods where possible. Where diverging methods prove to be equally appropriate, mutual recognition of methods can reduce conformity assessment costs.

The choice of conformity assessment systems involves the balancing of resulting trade costs with differences in confidence levels and the perceived risks from non-compliant products entering the market. A fundamental choice is whether conformity assessment can be done in the exporting country or has to be done in the importing country. For products with a higher damage potential, a more rigid conformity assessment system, implying higher costs for suppliers is preferable. Co-operation can help to build confidence in foreign conformity assessment infrastructures, potentially allowing for the mutual recognition of conformity assessment procedures. For products with a low damage potential, cost-saving suppliers' declarations of conformity may be sufficient. This is particularly the case if the importing country has a well-functioning market surveillance system in place, which limits risks of non-compliant products on a market. Co-operation can also reduce costs for such market surveillance.

Reducing information costs

Approaches to reduce information costs in international trade can be grouped in two general categories: first, trade-related IRC resulting in less regulatory heterogeneity or in the recognition of equivalence of product and production requirements can reduce regulation related information requirements for suppliers and traders. Second, dedicated communication and dissemination strategies can help to reduce costs for accessing and processing the information required by

suppliers and traders to comply with regulations. Given the specific requirements of foreign firms such strategies particularly relate to appropriate channels for making information available, and to the language of presenting the information.

Accounting for third-country trade

Finally, effects of IRC outcomes on third-country trade need to be properly accounted for. Lower prices due to reduced trade costs generally divert imports away from third countries, potentially offsetting parts of the benefits arising from successful IRC. At the same time, trade with non-participating countries may be affected by regulatory changes due to the IRC outcome. These may increase or decrease trade with third countries and affect the welfare of both country groups. In particular, if IRC outcomes are non-discriminatory, such as in the case of improved information dissemination, trade costs with third countries may decline, with positive welfare effects on all sides.

Let there be one measure of wine throughout our whole realm; and one measure of ale; and one measure of corn, to wit, "the London quarter"; and one width of cloth (whether dyed, or russet, or "halberget"), to wit, two ells within the selvedges; of weights also let it be as of measures

King John's Magna Carta, 1215

Background

This report is part of more extensive work regarding trade-related international regulatory co-operation (IRC), undertaken by and under the responsibility of the OECD Trade Committee (TC), with input from the OECD Committee for Agriculture (CoAg). It contributes to better understanding of trade aspects of regulatory activity and the importance of IRC in this regard, a perspective which can help ensure that regulatory efforts are firmly rooted in the consideration of both domestic and trade effects of regulations.

A stocktaking on IRC produced by the OECD's Regulatory Policy Committee in 2013 provides "an overview of recent trends, the range of existing regulatory co-operation mechanisms (and actors involved) and preliminary lessons learnt from selected experiences" (OECD, 2013: 3). The Recommendation of the Council of the OECD on Regulatory Policy and Governance provides governments with guidance on principles, mechanisms and institutions to improve their respective regulatory frameworks.

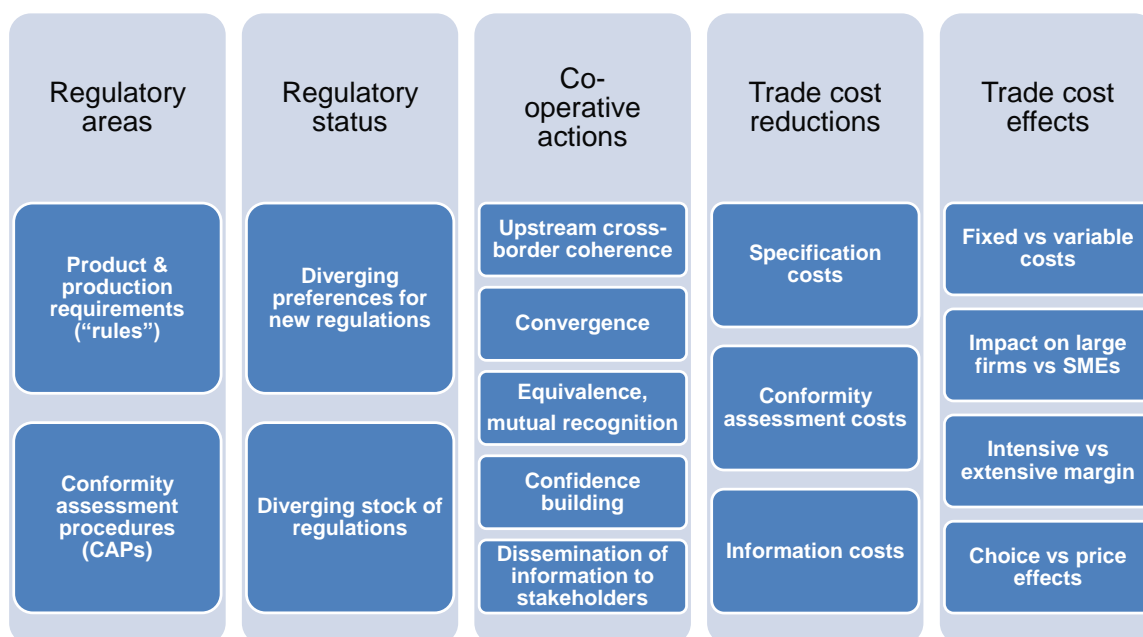
The report provides the fundamental concept used to analyse the implications of regulatory heterogeneity for countries' welfare and the potential gains from IRC outcomes and subsequent trade cost reductions countries can enjoy. While the report is theoretical in nature it carries insights that are relevant for policy makers, and notably to regulators and trade negotiators.

Introduction

Trade-related IRC can be defined as co-operative approaches by two or more countries that aim to reduce costs in international trade of goods and services related to regulations and procedures, without neglecting the objectives which underlie those regulations and countries' "right to regulate". More specifically, and focusing on regulations and procedures considered effective in dealing with domestic problems such as sanitary and phytosanitary issues, safety, environment and health, IRC aims at reducing unnecessary costs relating to regulatory and procedural heterogeneity between trade partners: given social preferences for protection against such threats, trade costs substantially depend on differences in regulatory approaches.

IRC has the potential to achieve a large range of benefits. In addition to better functioning markets through reduced trade costs, IRC can also help to transfer good regulatory practices, to level the playing field, to reduce policy and regulatory costs and to generate benefits for business and societies (OECD, 2013, p.15). In consequence, IRC supports gains in administrative efficiency, knowledge flow between countries and peer learning (op.cit., p.86 f.). Regulation typically takes place at different regional and political levels of governance. For example, environmental policies are ideally set at levels that correspond to the environmental externality at hand: problems related to local soil quality, say, require regulatory oversight and measures at a correspondingly low regional level and the consideration of specific conditions and preferences, often depending on income levels; in contrast, the pollution of cross-border river basins or even global issues such as climate change need to be regulated at international levels. The management of such global goods and risks is therefore an important area of IRC, but even in the area of more regional and local environmental regulations, research and knowledge of the nature and extent of environmental damages and controls – as those related to other market imperfections – can be argued to represent public goods that risk to be underprovided in a system of purely local regulatory settings.

Figure 1. Dimensions of the IRC theoretical framework



In many cases, countries engage in regulatory co-operation with multiple objectives; this report specifically focuses on the potential to reduce unnecessary trade costs.

This document provides a theoretical framework which helps to identify the space in which trade partners can and should reduce trade costs through joint action to reduce such regulatory heterogeneity. As illustrated by Figure 1, it spans various relevant dimensions. Given their different implications for IRC, heterogeneity-related trade costs with a potential for reductions can usefully be categorized in three main groups: specification costs, conformity assessment and certification costs and information costs (Box 1). Conceptualising options for reducing these different groups of trade costs requires different approaches, adapted to the specific nature of each of them.

While IRC is important to reduce unnecessary trade costs resulting from differences in the current stock of regulations across countries, it has a particularly high relevance for avoiding such trade costs when developing new regulations. From a practical perspective, international co-operation in the development of regulations is arguably much easier than for reducing existing heterogeneity-related trade costs. This theoretical framework applies to both: from a conceptual perspective, the main difference between IRC for existing and new regulations is in the relevance of one-off costs related to the change in existing regulations.

While the conceptual analysis provided by this report in principle is equally applicable for goods and services trade, the relative importance of different types of trade costs (Box 1) varies between the two: specification costs can play a major role in goods trade, whereas trade barriers in services are often dominated by conformity assessment costs (e.g. license requirements). Information costs in turn can be significant for providers of both goods and services.¹

1. Despite the applicability of the present analysis for trade in services, it is worth noting that knowledge on trade barriers in the services sector is of a different nature than in goods: the OECD Services Trade Restrictiveness Index STRI does not (directly) assess trade costs arising from diverging regulations across jurisdictions but rather focusses on regulations limiting the market entry of service providers.

Box 1. Types of heterogeneity-related trade costs

Specification costs: The costs incurred by exporters, importers or producers to produce or supply a service in accordance with the product or production requirements of a given market. These might include extra labour and input costs due to different requirements, as well as costs related to a lack of economies of scale. Such costs can also include labelling requirements. To illustrate, costs related to different can sizes requirements in different markets will require a manufacture to have different production lines. Specification costs are also referred to as *substantive compliance costs* (OECD, 2014).

Conformity assessment costs: All costs related to demonstrating that a product or service actually meets the requirements of the importing country. These include fees for laboratory testing, certification costs, inspection and audit costs, and so on. For example, with respect to toy safety the threshold applicable for compression test for toys used by children aged 0 to 36 months varies in different countries: in the EU this is set at 110N, in Australia and Japan at 114N, in the US 89N (for 0 to 18 months) and 111.3N (for 18 to 36 months). Canada does not require any compression test.

Information costs: The direct and indirect costs which businesses incur when regulations are opaque and information regarding procedures is difficult to acquire. These costs represent the costs of obtaining and monitoring information about the regulatory requirements in markets. Transparency affords greater predictability of the business environment and safeguards against arbitrariness. In this case, trade costs do not derive from substantive regulatory differences, but from missing or insufficient information about the regulation and its application. Conformity assessment costs and information costs together are also referred to as *administrative burdens of regulations on traders* (OECD, 2014).

Other costs: These can include, but are not limited to, costs incurred at the border and relate to customs procedure. Other costs are not further discussed in this report.

This theoretical framework first focuses on differences in product and production requirements and related specification costs. The basic framework considers actions that involve changes in the regulations of one or more of the trade partners in order to reduce regulatory heterogeneity (upstream cross-border coherence and convergence of regulations, see Figure 1), while a subsequent discussion concerns the recognition of trade partners' regulations as equivalent. Approaches in the area of conformity assessment procedures aiming to reduce related costs are covered in a separate section of this report, including co-operative actions to converge conformity assessment methods and to build confidence. Finally, information costs to businesses will be discussed. As will be seen, information costs are closely related to specification costs due to regulatory heterogeneity, and related actions also help reducing information costs, while the dissemination of required information to stakeholders can benefit from co-operative action as well. They also have a strong link to the information requirements of governments when designing and amending regulations – and when engaging in trade-related IRC (Box 2).

Box 2. The role of information in IRC

Information plays a crucial role both in the design and implementation of public regulations (or of their changes) and in the way businesses and other agents comply with them. The design and implementation of a regulation addressing a given market failure requires extensive knowledge about the sector in question, including on how businesses could cope with the additional requirements resulting from the regulation. In most cases, such information is gathered by opening up to more or less extensive stakeholder consultations, providing businesses and the general public with an opportunity to review and comment on regulatory proposals. In addition, and with the exception of urgent regulatory needs, both the WTO Agreement on Sanitary and Phytosanitary Measures (Annex B, Paragraph 5) and the WTO Agreement on Technical Barriers to Trade (Annex 3, Paragraph L) require that public regulatory bodies give advance notice of draft regulations so as to give interested parties in other countries an opportunity to comment, in particular if the proposed regulation deviates from existing international standards and risks to have a negative impact on trade. In short, public authorities should take *informed* decisions on whether and how to regulate in response to some market failure.

Trade-related IRC provides for additional opportunities for collecting information relevant for the making of regulations, through the communication of regulations, including their motivations and implementation, in partner countries.

Once regulations are in place, businesses and other stakeholders both within the regulating country and abroad require detailed information on regulatory requirements in order to comply with them. This information requirement is met through a variety of channels, including but not limited to the publication of regulations in official journals. Both abovementioned WTO Agreements (Paragraph 3 of Annex B of the SPS Agreement; Article 10 of the TBT Agreement) require public authorities to ensure that the information on their regulations be made available to other WTO Members, and that enquiry points exist to answer reasonable questions and to provide relevant documents. In short, public authorities should be *transparent* in why specific regulations were adopted and what requirements they entail.

.J.

Trade-related IRC often involves fora for the exchange of information on new and existing regulations that may affect international trade. Examples at the international level include the Committees established by the SPS and TBT Agreements, but IRC based exchange fora may also be less formal.

The types of information involved in these two areas often overlap, and in both cases stakeholders play an important role. For this report, unless stated otherwise, the notion of information refers to the information needs of public authorities in the design and implementation of new or changed regulations.

In addition to the costs incurred by producers and traders, listed in Box 1, regulatory costs also includes other costs for other entities, e.g. by government bodies (OECD, 2014). As such costs do not (directly) impact on trade costs, they are not explicitly considered in this theoretical framework, although they may be important for implementing different IRC approaches. More specifically, the framework abstracts both from operational costs related to the participation of countries in IRC and from costs for making the regulatory changes that may result from such co-operation.

Convergence and harmonisation in product and production requirements: Potential welfare gains through IRC in a basic case

Given the variety of regulations and regulation-related procedures (including, in particular, conformity assessment and certification requirements), it is useful to start the discussion of co-operative approaches with a simplest possible case which abstracts from a number of complications which normally characterise regulations and processes. The exposition of such a stylised regulatory situation, while potentially far from “real” settings in IRC, allows laying out the principal arguments of this theoretical framework: by relaxing the various assumptions taken for the basic case, the analysis is successively expanded and made more “realistic” and applicable.

A distinction is made between the effects of the *level* of national regulations and the effects of regulatory *differences* (Box 3). Effects of the regulatory *level* (i.e., the specific design of a country’s regulations and related processes) can be split in two components: first, the direct *regulatory benefit* corresponds to the effect a regulation has relative to its objectives themselves (see Box 3). This accounts for externalities such as environmental or health effects on citizens that depend on the production and use of goods or services. Second, the *market effects* of a regulation correspond to all other (economic) effects on participants in the domestic markets, such as producers, consumers and taxpayers. Both the regulatory benefit and the market effects are considered in terms of their monetary or welfare value. These two elements are jointly considered as the *domestic effects* of a regulation. While trade is considered to affect the different market participants (and, potentially, the direct regulatory benefit), the domestic effects abstract from any costs arising from regulatory differences relative to the country’s trade partners.

This domestic effect is confronted by *regulatory heterogeneity costs* arising from any *differences* in regulations and processes. These costs are a consequence of the trade costs arising from the fact that regulations and processes in the trade partner’s market are different from those in the home country, making exports to or imports from the partner country more demanding in terms of time, financial and other resources.

Regulations can be broadly defined as “the diverse set of instruments by which governments set requirements on enterprises and citizens. Regulations include all laws, formal and informal orders, subordinate rules, administrative formalities and rules issued by non-governmental or self-regulatory bodies to whom governments have delegated regulatory powers” (OECD, 2012). This framework employs a somewhat narrower definition of regulations more or less directly affecting the trade of products. Throughout this document, the term “regulations” is used to denote technical regulations (as defined in the TBT Agreement) and mandatory standards and measures (such as those defined

in the SPS Agreement) including also any other domestic regulations or law which potentially affects trade.²

This section presents the main framework to assess the potential welfare gains through different regulatory outcomes by discussing a basic case with strong and restrictive assumptions. In the basic case, two equal-sized countries independently regulate a specific product characteristic. To keep this first exposition simple, the chapter focuses on the costs and benefits from changing regulations themselves to reduce regulatory heterogeneity. It abstracts from other regulation-related trade costs, such as due to different conformity assessment and certification. This basic case also assumes that trade costs only depend on the absolute difference of regulation and abstracts from any governance and administration costs related to the modification of regulations. By using this highly restrictive case, the exposition in this chapter provides the general framework for assessing the potential welfare gains through different regulatory outcomes that could be achieved through IRC.

In particular, the framework distinguishes five situations: a non-cooperative situation where countries set their regulation in the absence of knowledge about the regulatory state of the trading partner (“no information sharing”); a partial information situation where one country knows about and accounts for the other country’s regulation when setting its own (“partial information”), an information sharing situation where countries set their regulation with full knowledge of the regulation and regulatory preferences in the partner country (“information sharing”); a negotiation allowing for regulatory agreements implemented by both countries (“negotiations”); and the maximization of joint welfare in the two countries (“joint welfare maximization”). This chapter concludes by discussing the implications for IRC choices.

For the basic analysis, a two-country strategic game is modelled: in each country A and B the government sets a regulation which is represented by s_A and s_B respectively. In principle, there are two general types of regulations: they could be “vertically differentiated” with higher levels representing more stringent regulations, or “horizontally differentiated” with different values of s merely denoting regulations that are *different*, not necessarily more stringent. The variable s can then be thought of as describing a continuum of regulatory choices, very similar to the describing a continuum of product attributes in the literature on vertical and horizontal product differentiation (Gabszewicz and Thisse, 1979 and 1986; Hotelling, 1929 and Böckel, 1994). In the simplest case, regulations are horizontal so there is not a more or less stringent regulation, but regulations are simply different. For simplicity in this basic model it is assumed that the difference between s_A and s_B can be interpreted as the “distance” between these regulations.³ This is similar to the approach taken by Nordas (2016) who estimated the trade effects of differences in regulatory requirements in services between country pairs.

To analyse the welfare implications of different regulatory outcomes, a distinction is made between the *domestic effects* related to the *level* of regulation, and the *regulatory heterogeneity costs* following from regulatory differences.

2. In the TBT Agreement, a distinction is made between “technical regulations” (which are mandatory), “standards” (which are not), and “conformity assessment procedures” (which are used to determine whether a product complies with the technical regulations or standards). The SPS Agreement uses the term “measures”. In this framework, the focus is on those measures which are mandatory for market participants.
3. This basic case abstracts from the possibility that one of the countries may not have set a regulation. In this case, trade costs only exist for shipments to the regulating country, similar to the case of vertical regulations with different degrees of stringency.

Box 3. Key terms used in this theoretical framework

Regulatory benefit RB: The monetary value of what an existing or future regulation achieves in terms of its regulatory objectives. This direct regulatory benefit will always depend on the given country's regulation. It may or may not be independent from regulations implemented by trade partner countries. For instance, the regulatory benefit of vehicle safety regulation represents the monetary value of reduced or avoided injuries or fatal accidents. Unless a regulation fails to address its objective, the regulatory benefit is strictly positive.

Market effect ME (of a regulation): The economic welfare effect of an existing or future regulation, accounting for all players within the regulating country while excluding the regulation's effects on other countries. This (indirect) market effect also excludes the (direct) regulatory benefit. For instance, the market effect of a maximum residue level for a harmful substance in some food represents the loss in producer profits due to higher production costs, the loss in consumer surplus due to higher food prices, and the additional regulatory costs borne by public authorities (negative market effects). It may also include the increased consumer surplus due to a positive demand shift related to higher consumer confidence (positive market effect). It excludes, however, the effect related to the regulatory objective, i.e. reduced sickness or death. Given these different effects, the total market effect of a regulation may be of either sign. Unless trade is zero for reasons unrelated to the regulation, the various variables entering the market effect will depend on both domestic and trading partners' regulation. The market effect of a regulation abstracts, however, from any economic welfare losses that might arise from regulatory differences between the regulating country and its trade partners and hence assumes the absence of heterogeneity-related trade costs (either because of the absence of regulatory heterogeneity, or because such heterogeneity is assumed not to generate additional trade costs).

Domestic effect D (of a regulation): The total monetary value of the effects an existing or future regulation has on the regulating country's welfare, not accounting for any losses that might arise from regulatory differences relative to trade partners. As such, the domestic effect corresponds to the sum of the (positive) regulatory benefit and the (positive or negative) market effect: $D = RB + ME$

Heterogeneity-costs T: The loss arising to a country's welfare due to trade costs arising from regulatory differences relative to its trade partners. For simplicity throughout the text, these heterogeneity costs are referred to as trade costs T.

Net welfare W (of a regulation): The welfare effect of an existing or future regulation, accounting for all players within the regulating country, the direct regulatory benefit as well as potential trade costs arising from regulatory differences relative to its trade partners. As such, the net welfare corresponds to the domestic effect of a regulation minus the heterogeneity (trade) costs: $W = D - T$

For most of this Theoretical Framework, the distinction between the (direct) regulatory benefit and the (indirect) market effects of regulations is not required. While it has been added here to improve clarity of the concept, most of the remaining text is based on domestic effects and heterogeneity (trade) costs.

Domestic effects of regulation

Societies have certain preferences for regulation. Regulation may be motivated by the existence of specific market failures, such as negative externalities or information asymmetries (Box 4) which, in the absence of regulation, have welfare reducing impacts on the society. For each country a *domestic regulatory effects function* can be defined that depends on the level of that country's regulation (see also Nicolaides, 2006).⁴

For the producers of the regulated product, a regulation s_A may increase the costs of production (e.g. when a stricter environmental regulation requires more costly production processes) as well as administrative costs. On the other hand, to the extent that a regulation increases demand for a product, the enhanced demand effect may outweigh the additional costs.

The conceptual model does not distinguish explicitly between these different components for most of the analysis but rather can be considered a "reduced form" approach, simplifying all these effects into a single measure of domestic welfare. This "reduced form" approach does not allow the analysis of *distributional* effects of regulations, even though it implicitly allows putting different "weights" to parts of the society.

4. For simplicity, the situation discussed here is deterministic in nature. In reality, regulations also account for risks related to the variability of relevant factors. For example, pesticide residues in a given product will generally vary in time, and tests for measuring the residue content are subject to more or less significant measurement errors. Maximum residue levels (MRLs) for these residues set by the regulations will therefore account for possible measurement errors and for the risk aversion in the society.

From a domestic point of view not considering any heterogeneity-related trade costs, the optimal regulation would strike a balance between opposing forces. No simple conclusions can be drawn about whether a higher level of a regulation (or indeed the generation of a new regulation) *per se* is good or bad for trade. An increase in regulations could act as a catalyst or a barrier to trade. A more stringent regulation could decrease trade while still being welfare-improving.⁵

The domestic effects function captures these effects on consumers, producers and the broader society. The domestic effects for country A as a function of the level of its regulation s_A can be denoted by $D_A(s_A)$, while $D_B(s_B)$ denotes the domestic effects for country B as a result of its regulation at level s_B .⁶ It is assumed that there exists a single regulation s_A^* which maximizes the domestic effects in country A, and a different single regulation s_B^* which maximizes domestic effects in country B. Without loss of generality and for expositional purpose it can be assumed that $s_A^* < s_B^*$. Furthermore it is useful to assume that domestic effects are strictly increasing in s for $s < s^*$ and strictly decreasing in s for $s > s^*$.⁷

Box 4. Objectives for regulations

Regulatory quality can be defined by a number of criteria. Regulations should serve and achieve clearly identified policy goals, be clear and simple, have a sound legal and empirical basis, consistent with other policy measures, produce benefits that justify costs, are implemented in a fair, transparent and proportionate way, minimise costs and market distortions, promote innovation and are as far as possible compatible with competition, trade and investments (OECD, 2015).

Legitimate objectives for regulations are also defined in Article 2.2. of the Agreement on Technical Barriers to Trade (TBT-Agreement) as, *inter alia*, “national security requirements, the prevention of deceptive practices, protection of human health of safety, animal or plant life or health, or the environment”. Similarly, the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS-Agreement) notes the rights of Members “to take sanitary and phytosanitary measures necessary for the protection of human, animal or plant life or health, provided that such measures are not inconsistent with the provisions of this Agreement” (Article 2.1). In particular, such regulations can be summarized as risk regulation or ‘SHEC regulation’ (Pelkmans, 2012b): regulation about safety, health, environment and consumer protection goals.

Regulations can positively affect consumers through resolving problems related to product information asymmetries¹ and by addressing negative externalities. To see the role of product information problems consumers may face, consider the distinction between “search”, “experience” and “credence” characteristics (Nelson, 1970; Darby and Karni, 1973). Search characteristics are those aspects of a product which a consumer can easily verify before purchasing the good (e.g. the colour of an apple). Experience characteristics can only be verified through consumption (e.g. its taste), whereas credence characteristics are those attributes which cannot be verified even after consumption (e.g. pesticide residues). A regulation s_A may reduce search costs for consumers related to “search” and “experience” attributes, and may resolve asymmetric information problems and guarantee a certain level of “credence” characteristics, thus increasing the utility consumers derive from consumption, as well as their demand for the product.

Regulations may also help to overcome product information asymmetries for industrial users of certain products, e.g. where equipment has to meet environmental, safety or interconnectivity standards. On the other hand, regulations can help to internalize external costs potentially affecting consumers, (other) producers or the general society.

1. Note that in the context of IRC information plays a key role in three distinct areas. First and as described in this paragraph, consumers may face incomplete information about the characteristics of a product; this could be described as “product information”. Second, as discussed further below in this chapter, regulating countries should have and use information about their trade partners’ regulations and the motivations behind them, referred to as “regulatory preference information”. Finally, exporters may have incomplete information on regulations and requirements for trading with the destination country; this “regulatory market information” is not discussed explicitly by the theoretical framework but plays an important role in the IRC Diagnostic Tool.

5. For a theoretical discussion, see Swinnen and Vandemoortele (2012) and Swinnen et al. (2015). Disdier and Marette (2010) show how gravity and welfare approaches can be used to evaluate non-tariff barriers. In an application to antibiotic residue rules for crustaceans, they show that the gravity approach indeed identifies a negative trade effect of such standards, while the more comprehensive welfare approach shows a net benefit in most cases of stricter standards. In these approaches, welfare gains come from increases in consumer surplus due to reductions of information problems or reductions of externalities.
6. Recall that the domestic effects of regulation abstract from any welfare losses due to regulatory heterogeneity and hence implicitly assume these losses to be zero.
7. A more restrictive assumption can plausibly be made on the curvature of the function D . Generally, D can be assumed to be convex over the range of possible regulations s .

By construction, the definition of domestic regulatory effects includes all welfare implications of the regulation s_A except for costs related to any regulatory differences between countries B and A. Domestic regulatory benefits thus include consumer surplus and producer profits, as well as any other concerns which enter the social welfare function (such as environmental or social objectives, i.e. the regulatory benefit).

Trade *per se* does not enter the domestic effects function; trade only affects welfare to the extent that it affects consumer surplus (due to changes in prices or choice of products available), producer surplus, the government budget or any of the societal concerns behind regulatory activity.

Regulatory heterogeneity costs

In addition to this function that captures only the domestic effects of regulation, costs related to regulatory heterogeneity have to be considered. For simplicity, these costs are referred to as *trade costs*, even though the welfare effects capture the implications of regulatory heterogeneity for producers, consumers and the society alike. These *trade costs* are defined as $T_A(s_A, s_B)$ incurred by country A when it is dealing with country B's different regulation s_B (and analogously for country B). These costs could for instance be due to higher costs for exporters in country A if they need to comply with a different regulation. By definition trade costs are zero in the case where both countries have the same regulation: $T_A(s_A, s_B = s_A) = 0$. In the basic case, trade costs are assumed to increase continuously with increased distance between the two regulations, and are symmetric for the two trade partners.^{8,9}

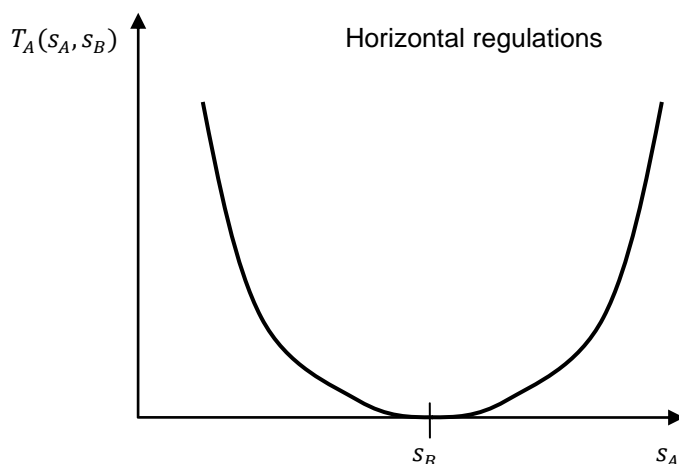
Again to keep this basic case simple, only effects from the regulations on product and production requirements are considered, including differences in the implementation of similar regulations.¹⁰ In reality, costs related to proving compliance with a regulation (conformity assessment and certification costs) may be as important as those related to complying in the first place. Trade costs are also often related to the exporters' requirements for information on the destination market's regulations (Box 1). Such "information costs" may be significant notably if trade partners do not share a common language or if regulatory differences are large (e.g. because the exporting country does not have corresponding regulations at all). While efforts to reduce such information costs are important, this report focuses on costs related to the need to adjust products or production methods to the destination market's regulation (specification costs) and, in a future version, conformity assessment and certification costs (i.e. costs related to prove conformity with the destination market's regulation).

This basic case assumes that the characteristics affected by the regulations concern the product itself or can be clearly communicated with it, as opposed to process characteristics not linked to nor communicable with the product (as it could be the case, for example, for some environmental or labour standards). This implies that a regulation in one country affects all products on the national market, including imported and exported products. Finally, it is assumed that any changes to the regulations (or their new generation) are free of costs themselves.

-
8. While it is quite plausible to assume symmetric costs for exporters in both countries, the welfare loss related to these heterogeneity-related costs will often be different between the exporting and the importing country. The assumption of symmetric trade-cost related welfare losses will be relaxed later.
 9. One may argue that horizontal regulations (where trade costs only depend on the absolute difference in regulations, no matter whether the export market has a "higher" or "lower" regulation than the country of origin) rarely or never comes with trade costs growing continuously with the difference in regulations. Indeed, in the common case of a horizontal regulation (such as different shapes of power plugs), trade costs increase discontinuously as regulations become different. While the case of "discontinuous" trade costs is discussed further below, the discussion of this basic case with continuous trade costs, as will be shown, is relevant also for vertical regulations which generally have continuous trade costs.
 10. OECD (2013) argues that differences in the implementation of similar regulations often generate trade obstacles that may be more important than those from differences in the original rules.

By definition of this basic case, trade costs $T_A(s_A, s_B)$ of dealing with regulatory heterogeneity are incurred by exporters in country A whenever the two countries have a different regulation, regardless of whether the regulation nominally has a higher or lower level in country A relative to country B. For instance, when two countries have different voltage levels for electrical equipment, exporters will need to incur extra costs to adjust their products to the voltage level of the other country, regardless of whether the voltage level is higher or lower than in their own country. Trade costs thus depend on the *distance* between s_A and s_B , and are symmetrical.¹¹ This is depicted in Figure 2.¹²

Figure 2. Trade costs for continuous horizontal regulations



Net welfare

The *net welfare* of country A is then given by: $W_A(s_A) = D_A(s_A) - T_A(s_A, s_B)$. That is, net welfare is the domestic effects of regulation (which depends only on the level of the domestic regulation) minus the heterogeneity (or trade) costs due to regulatory divergence.

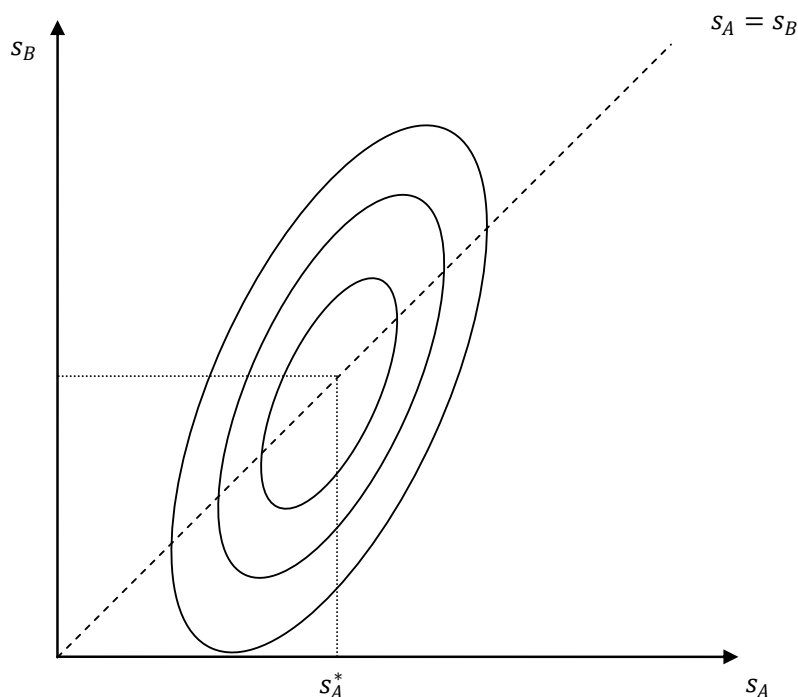
Figure 3 introduces the graphical representation which will be used throughout this theoretical framework. The diagram shows all possible combinations of the regulation in country A (measured on the horizontal axis) and country B (on the vertical axis). The indifference curves represent the combinations of the regulation in countries A and B which result in the same net welfare level for country A.

The 45 degree line corresponds to all points where country A and B have the same regulation. The *ideal point* for country A is where both countries adopt s_A^* , the level of the regulation which maximizes the *domestic effects* of country A. If country B adopts the same regulation, country A benefits from having a regulation which is optimal in terms of its domestic effects while avoiding any trade costs due to regulatory divergence.

11. While the symmetry primarily relate to the costs incurred to export flows, the representation of regulatory heterogeneity costs in Figure 2 and the subsequent discussion implicitly assume that these welfare losses occur irrespectively of whether the country exports or imports the product in question. This assumption will be relaxed further below.

12. The shape of the trade cost function is an empirical question and may differ from the one shown, for expositional purpose, in Figure 2.

Figure 3. Indifference curves with horizontal regulations



For all other combinations of regulations the net welfare of country A will be lower for two reasons. First, if country A is using a regulation different from s_A^* , there will be a loss in the domestic effects of the regulation which depend on the distance between the actual regulation and s_A^* . Second, if country A and country B have different regulations, country A suffers trade costs.

Graphically, the first (“domestic”) effect corresponds to a move *along* the 45 degree line away from the ideal point. The second (“trade cost”) effect corresponds to a move *away* from the 45 degree line. Figure 3 shows possible indifference curves for country A which embody both effects. The farther an indifference curve is from the *ideal point*, the lower the country’s net welfare.

To understand the shape and position of the indifference curves, imagine an extreme case where there are no trade costs related to regulatory divergence, for instance because the two countries are not engaged in any trade activities or because the regulations do not affect trade at all. In this case, differences between the countries’ regulations and hence the level of s_B do not matter to country A, and the indifference curves for country A are vertical, as in Figure 4 (the arrows indicate the direction of increasing welfare).

In the opposite extreme, where the domestic effects of regulations are minor but trade costs dominate, indifference curves would look as in Figure 5. Even small deviations away from the 45 degree line lead to large declines in welfare, whereas large fluctuations in the regulation itself are acceptable as long as they occur along the 45 degree line. In case domestic effects played no role at all, and only trade costs were involved, the indifference curves would be lines parallel to the 45 degree line. In this extreme case, the only motivation for a country to implement a regulation in the first place would be to avoid heterogeneity-related trade costs.

Figure 4. Indifference curves in the absence of trade costs

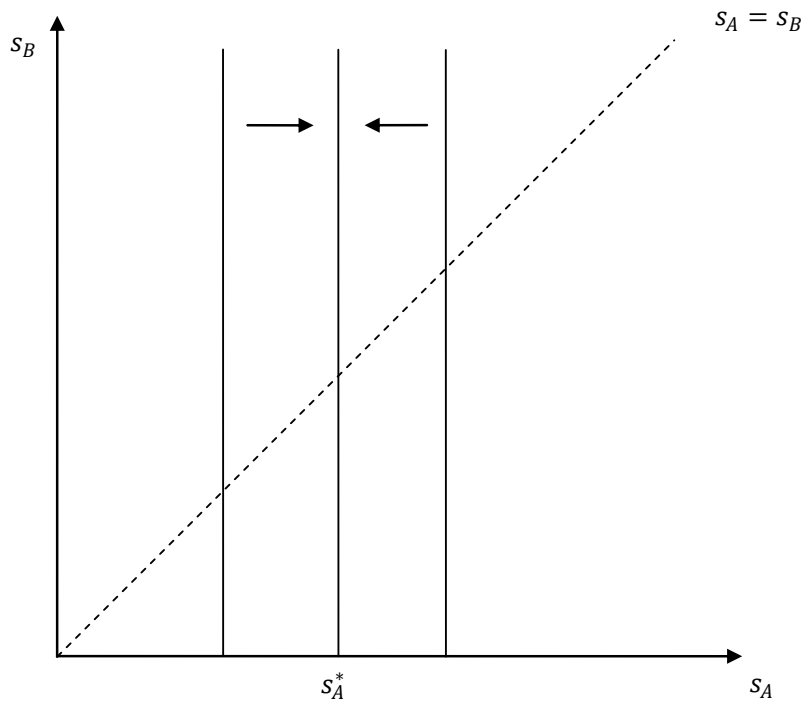
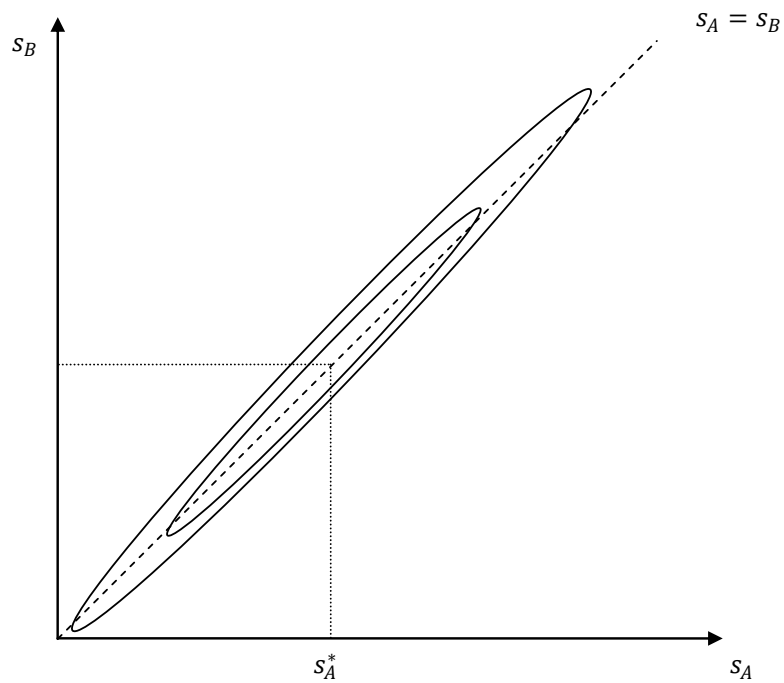
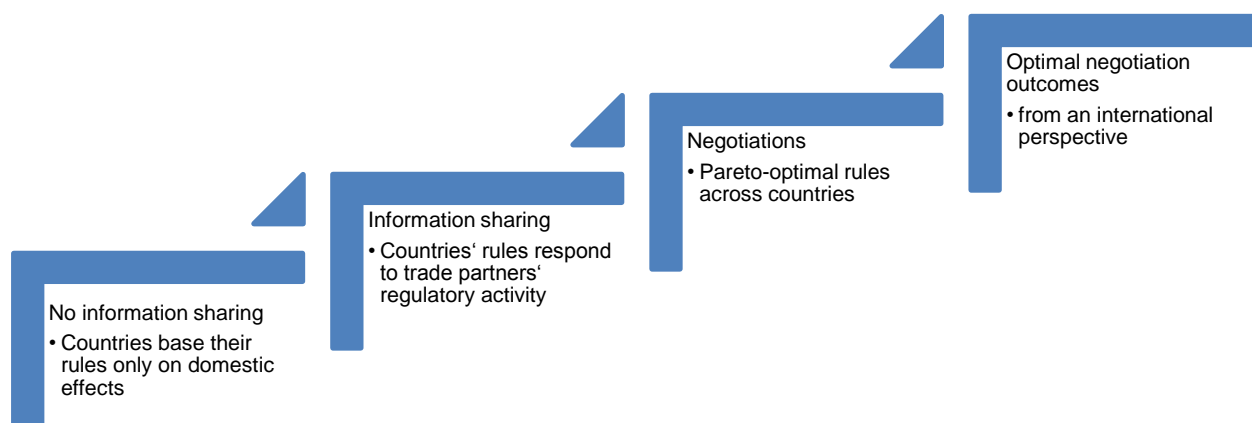


Figure 5. Indifference curves when trade costs dominate domestic effects



Using the generic indifference curves of Figure 3, and assuming that country B has similar-shaped indifference curves, a situation as in Figure 7 can be obtained. Using this graphical representation, different scenarios in terms of IRC through convergence of rules can be analysed (Figure 6).

Figure 6. Steps of rule convergence



No information sharing

Assume first that the two countries set their regulations without any co-operation and, in particular, without any communication or information on the regulation that would be adopted by the other or on the preferences underlying that regulation (regulatory preference information).¹³ In this case, both country A and country B implement their preferred regulation, and the outcome is (s_A^*, s_B^*) as shown in Figure 7 by the point labelled “NI” (for “no information”). Also shown are a number of indifference curves of country A and B and in particular those going through the point “NI”. While both countries set their regulations such that they maximize their respective *domestic effects*, the resulting regulations create trade costs which lower the net welfare of both countries: for either one, the indifference curve going through “NI” is comparatively far away from its *ideal point*.

Information sharing: Unilateral adjustments and the Nash equilibrium

As highlighted in the typology of IRC in OECD (2013), there is a continuum of IRC approaches from the lightest to the most encompassing and legally binding form of co-operation. At the lower end of the continuum, a minimal degree of regulatory co-operation consists purely of information sharing. In the extreme case, and without engaging in actually co-operative regulation setting, each country would have full knowledge about the other country's regulative preferences and motivations, as well as its costs related to regulatory differences.¹⁴ Thanks to information sharing both countries now

13. Complete absence of information on the other country's regulation represents an extreme and unlikely case. However, the situation described here characterises relatively well the situation of sectors already heavily regulated for a long time.

14. Such information sharing is current practice already now to some degree due to the notification, publication and inquiry point obligations countries have, for example, under the WTO TBT and SPS Agreements. Enhanced information sharing is envisaged in numerous bilateral and regional free trade agreements. Still, information on partner countries' regulative preferences and details often remain incomplete in reality, also because of foreign language issues. On the other hand, perfect information on the partner country's regulatory preferences is likely to be unachievable in practice. Note that, while strictly speaking the co-operation on information exchange is between public authorities, other stakeholders (private sector, civil society, etc.) are likely to be involved in practice. See Box 2 above for a brief discussion of different areas of information exchange.

know about these preferences and costs of other countries. As a result, a country can set its own regulation, taking into account the impact of the other country's regulation (and, hence, of the resulting regulatory heterogeneity) on its own net welfare, as well as of its own regulation on the other country.

In terms of the model, this corresponds to calculating the optimal regulation for country A for a given regulation in country B, and vice versa. For a given regulation s_B in country B, the optimal response s_A^R for country A is defined by¹⁵

$$D'_A(s_A^R) - T'_A(s_A^R, s_B) = 0$$

where D' and T' are the first derivatives of the domestic effects and the trade costs, respectively.

This condition implicitly defines the *reaction function* for country A – the optimal regulation $s_A^R(s_B)$ which country A will set if country B sets a regulation s_B . Graphically, this optimal reaction can be found by drawing a horizontal line at a given level s_B and finding the level s_A where country A would achieve the highest net welfare – or in other words, finding the tangency point with the indifference curve closest to the ideal point of country A. Repeating this exercise for every possible value of s_B yields the reaction function for country A, and a similar exercise yields the reaction function for country B. Both are shown in Figure 7.

To understand the position of the reaction function, first note that the reaction function of country A will always pass through its own ideal point. The reaction function would run vertical if the indifference curves were as depicted in Figure 4, the scenario where there are no trade costs and country A can focus solely on the domestic effects from its own regulation. In this case, no matter which regulation is adopted by country B, the best response of country A is always to set the regulation equal to its ideal point s_A^* . On the other hand, if the indifference curves looked as in Figure 5, corresponding to the case where heterogeneity costs are of overwhelming importance, the reaction function would practically coincide with the 45 degree line. In this case, no matter what regulation is set by country B, the best response of country A would be to aim for harmonization. A similar analysis can be made for country B.

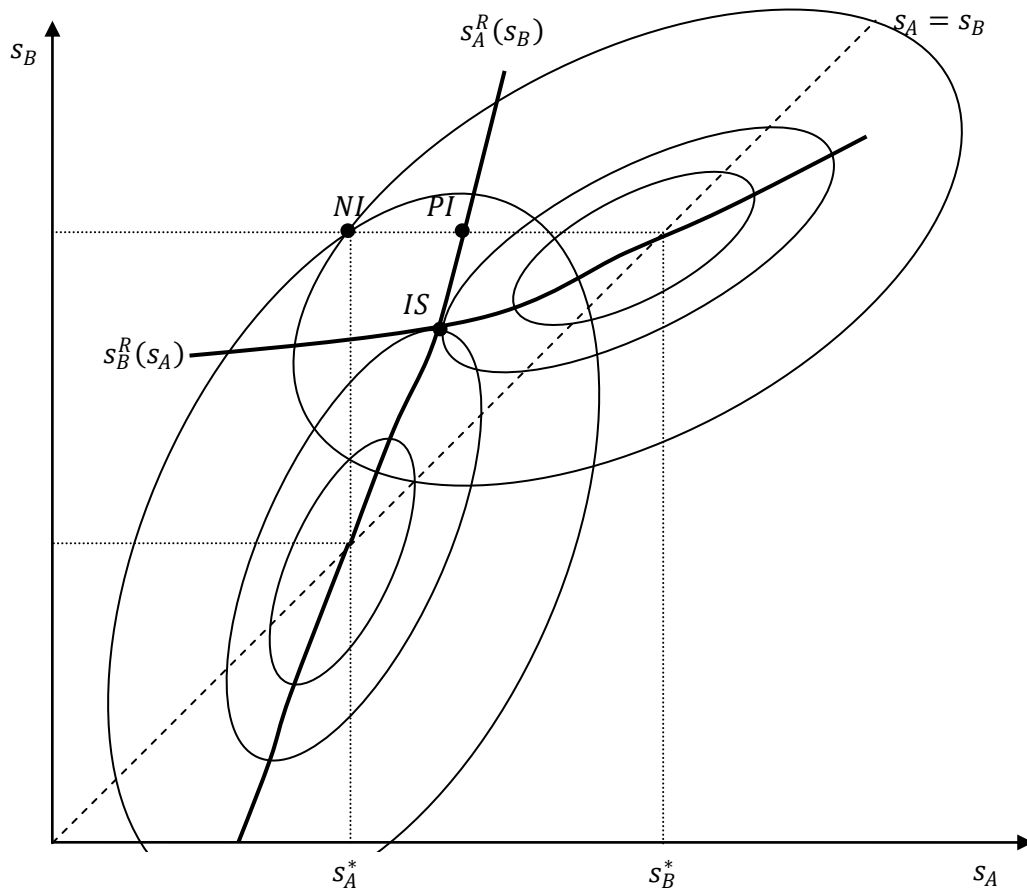
The reaction function of country A suggests that if country B's regulation is known to the regulator in country A and fully integrated in the regulatory process, country A's optimal regulation in general (i.e. if trade costs are non-zero) would no longer be s_A^* . Even without any regulatory changes by the trading partner, country A would be better off by setting its regulation at the level corresponding to the point labelled "PI" (partial information): Given some importance of trade costs to country A, its regulation should be above its preferred level in order to reduce trade costs, even if this implies some (smaller) losses in its domestic effects. In turn, given some importance of the domestic effects of regulation, it will not be in country A's best interest to fully and unilaterally adopt the regulation of country B, but to accept some regulatory heterogeneity costs.¹⁶

Note that even without any adjustments in its regulation, country B also enjoys welfare gains if country A has sufficient information about its regulation and incorporates it in its own regulation setting: while country B's domestic effects remain unchanged relative to the "no information" situation, trade costs are reduced and welfare improves.

15. This first-order condition is necessary, but not sufficient for the net welfare to have its maximum. The sufficient second-order condition is that $D''_A(s_A^R) - T''_A(s_A^R, s_B) < 0$. If D_A is strictly convex (with its maximum in $s_A = s_A^*$) and T is strictly concave (with its minimum in $s_A = s_B$), the net welfare function will always be strictly convex, i.e. its second derivative will always be strictly negative. If the net welfare function is not strictly convex, the second-order condition needs to be explicitly considered as well.

16. Similarly, the optimal choice of regulation for country B with full information on country A's regulation will be where its reaction function intersects with country A's regulatory level, i.e. generally below its own preferred regulation but above that of country A.

Figure 7. Information sharing and the Nash equilibrium



The point where both reaction functions intersect is the Nash equilibrium (Nash, 1951), indicated by *IS* (for “information sharing”). In the Nash equilibrium, none of the two countries can improve its welfare level by unilaterally changing its regulation. Because of the reaction functions' properties, their intersection point (and hence the “information sharing” Nash equilibrium) will always lie in the triangle formed by the ideal points of country A and B and the “no information” equilibrium. As a result, both countries achieve a higher welfare level in the “information sharing” equilibrium. Hence, even an IRC tool as simple as the exchange of information without any further commitments might increase welfare for both countries.¹⁷

In reality, regulators regularly have at least some information on their trade partners' regulatory preferences and existing and forthcoming regulations and are likely to consider this information in the regulatory process. Exchanging information may for instance take the form of a requirement for domestic regulators to take notice of existing international standards and relevant regulations in other countries before drafting new domestic rules. OECD (2013) shows that there is such a cross sectoral requirement in one-third of the 22 OECD countries reviewed for the work, while another third of the sample have a sector by sector approach. Other possibilities include participation in

17. Note that relative to point *PI*, the Nash Equilibrium *IS* with full information sharing will always improve country A's net welfare. In contrast, it is perceivable that additional gains for country B may be very small, nil or, depending on the position of the countries' indifference curves, even slightly negative. While in this latter case, country B would be better off to stick to its preferred regulation s_B^* and hence to point *PI*, the potential for country B to improve its welfare beyond the level achieved in point *PI* makes this point an unstable outcome.

international organisations or networks of regulators. According to OECD (2013), OECD countries belong on average to some 50 international organisations, and transnational regulatory networks have multiplied fast over the last three to four decades.

Detailed information on the trade partners' regulatory preferences are, in contrast, much more difficult to obtain in practice, both because making these available within a country itself is costly,¹⁸ and because they may be changing in time due to technological and other developments. The two equilibria NI and IS therefore represent extreme points which in reality may not exist or be attainable. These caveats notwithstanding, the theoretical outcomes discussed above suggest that an improved exchange of information can yield significant gains for both countries if trade costs matter. In particular, it is quite conceivable that regulators have some information on trade partners' regulations but do not fully appreciate the heterogeneity costs implied by resulting regulatory differences.

Note that in the extreme case where both countries put little value to the exact level of the regulation but would face high losses from trade costs in case of regulatory heterogeneity (i.e. where indifference curves are parallel to the 45°-line – see Figure 5), the Nash equilibrium is not unique. Instead, any agreement on harmonized regulations would suit both countries. While for existing regulations this extreme case is purely theoretical due at least to transitory adjustment costs, this finding suggests that new technical developments requiring regulations but where the level of the regulation is of minor importance would benefit strongly from a rigorous information exchange early-on in the process. This is particularly the case if regulatory options are discrete rather than continuous, and where the benefits of full harmonization (or the costs of regulatory differences) are therefore particularly high.

Negotiations

While the Nash Equilibrium of information sharing is a stable outcome that improves welfare for both countries, in general it is not an optimal outcome. To further improve the regulatory system, country A and country B could decide to negotiate about the specificities of the regulations (and hence about the “distance” between them). Such negotiations would aim at making effective commitments to this effect.¹⁹ Graphically, this implies choosing a combination s_A^O, s_B^O so that the indifference curves of country A and country B are tangent. If this was not the case, it would imply that at least one country could improve its net welfare without hurting the other country. Thus, the outcome of a negotiated solution will be a Pareto optimum.

Importantly, this does not pin down a unique solution to the negotiations. As shown in Figure 8, there will be an entire range of combinations that are Pareto optimal. For every point on this Pareto curve, it is the case that no improvements can be made to the welfare of one party without harming the other.

The shape of the curve showing the Pareto set will depend on the shape of the indifference curves of both countries, and hence ultimately on the relative importance of domestic effects and trade costs. If domestic effects are small and trade costs dominate, so that indifference curves look as in Figure 4, the resulting Pareto set will tend to approach the 45 degree line. However, in the opposite scenario of negligible trade costs but large domestic effects (with indifference curves as in

18. Regulators usually make use of domestic stakeholders hearings and other formal and informal consultation mechanisms through which they receive information about preferences and trade costs from their own and often also from foreign companies, as well as from the civil society. Indeed, input from private stakeholders often represents a key source of information in regulation making.

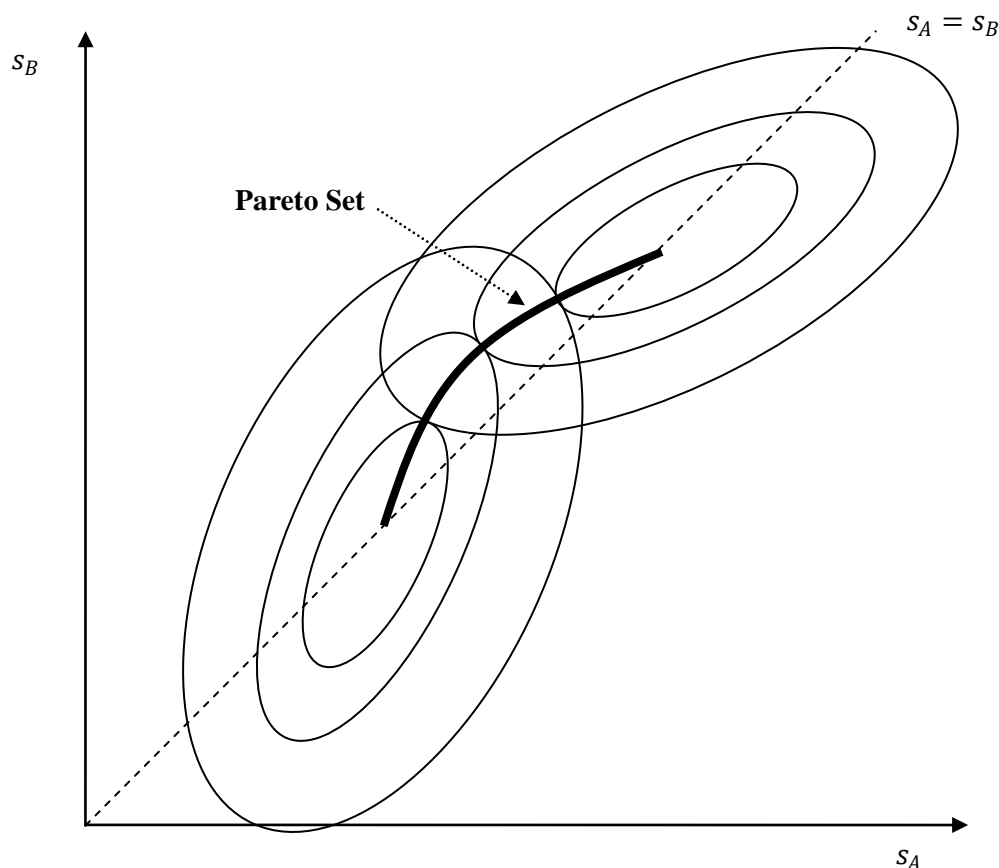
19. An alternative to binding commitments can be best-effort agreements supported by sufficient confidence levels between the regulating countries. This can be facilitated by countries adhering to principles of regulatory quality, as found in the OECD Recommendation of the Council on Regulatory Policy and Governance (OECD, 2012). Confidence may also be built through continued co-operation between countries, similar to “repeated games” where deviations from a mutually beneficial outcome would be “punished” by the trade partner by reverting back to the information sharing regulations. The situation is similar to the “prisoners’ dilemma” (Axelrod and Hamilton, 1981) where both players are better off by co-operating but each has an incentive not to do so.

Figure 3), the resulting Pareto set will be vertical between country A's ideal point and the "no information" point of Figure 5, and horizontal between this point and country B's ideal point.

This result has implications for the desired degree of harmonization. The closer the Pareto set approximates the 45 degree line, the greater the desirability for both countries to engage in harmonization. In the extreme case where the Pareto set exactly coincides with the 45 degree line (which corresponds to a situation where domestic effects are zero in both countries and only trade costs matter, a theoretical construct as in that case neither country would have an interest in regulating in the first place), the negotiated outcome will be perfect harmonization of regulations. By contrast, the further the Pareto set is removed from the 45 degree line, the more heterogeneity will remain after countries have negotiated on IRC.

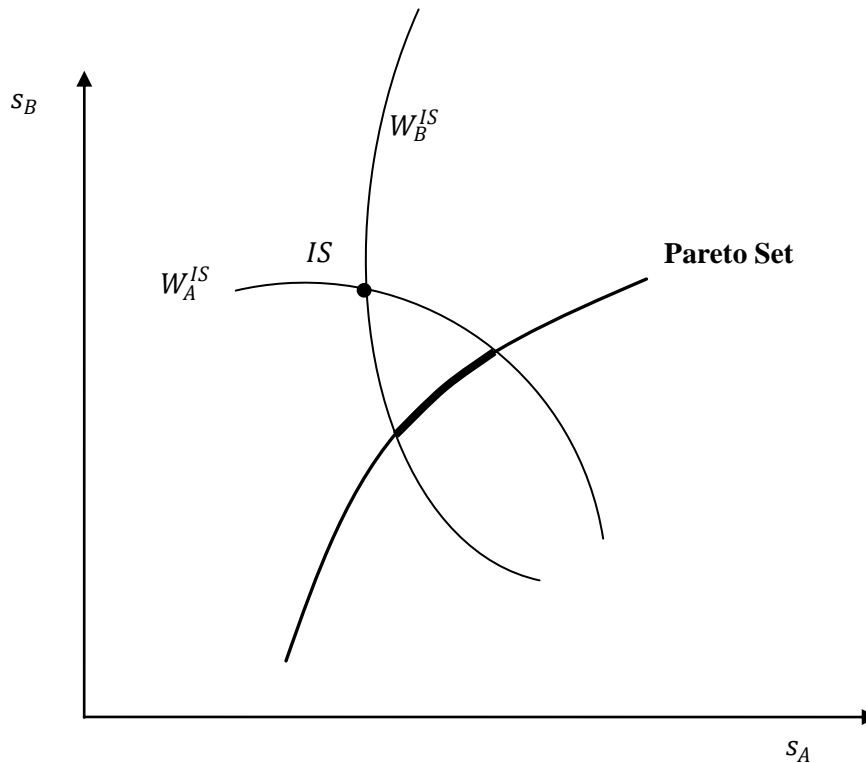
This is an intuitive yet important result: To the extent that trade costs of regulatory divergence are limited but domestic effects of deviating from the preferred regulation are large, it will not be in countries' best interest to negotiate a full harmonization of regulations. In the Pareto optimum, the relative importance of domestic benefits from regulation and trade costs thus determines how much regulatory divergence will remain.

Figure 8. Negotiated outcomes: The Pareto set



A second important observation regarding the negotiated outcome is that the Pareto optimum is not unique, and that different Pareto optimal outcomes could imply very different welfare levels for both countries. The crucial question then becomes on what Pareto optimal point negotiators will settle. A first factor is what the outside options of both parties are. If no agreement can be reached, both countries would revert to the non-cooperative “information sharing” Nash equilibrium discussed previously. Hence, for any country to agree to a negotiated outcome, its net welfare must be at least as high as what can be obtained in this non-cooperative scenario.²⁰ This is illustrated in Figure 9. The point “IS” is the information sharing Nash equilibrium identified previously. This point corresponds to a welfare level W_A^{IS} for country A and W_B^{IS} for country B.²¹ Given that this is the welfare level which both countries can achieve without negotiating, any negotiated outcome will have to lie inside the “lens” formed by these indifference curves. While this still does not identify a single solution, this condition narrows down the range of possible outcomes. Within this “lens” the resulting outcome will depend on the relative bargaining power of both countries.

Figure 9. Comparison of the Pareto set and the Nash outcome



20. In practice, this means that governments need to have estimates of both domestic effects and trade cost effects from such regulatory changes, based on various formal (e.g. simulation models) and informal sources (e.g. stakeholder input).

21. Note that, generally, the Nash equilibrium is not Pareto optimal as the indifference curves through the point “IS” intersect rather than being tangent.

Alternatively, an exogenous standard (e.g. an international standard such as those developed following the principles of the WTO TBT Agreement,²² or others such as those developed by Codex Alimentarius) might serve as a “focal point” to narrow down the range of possible outcomes.²³ If such a standard exists, country B could make the case that country A should at least conform with it. Conversely, country A could argue that it should not be asked to do more than what is required by the international benchmark. As a consequence, country A could set its regulation equal to the international standard while country B would set its own regulation above it, such that the outcome would describe a specific point on the Pareto curve. As long as this point falls within the “lens” formed by the two indifference curves running through the information sharing point IS, such an outcome could provide an obvious choice within the range of Pareto-optimal outcomes.

Optimizing the negotiation outcomes

In the previous paragraph, both countries were negotiating to achieve a better outcome than what would be possible in the non-cooperative approach. However, both countries were still only concerned with their own net welfare.

Ideally, countries could engage in a process of jointly developing the optimal set of regulations taking into account the welfare effects of the countries involved. In other words, countries could aim at maximizing the *joint welfare*, i.e. the regulations are set so as to maximize the *sum* of net welfare in country A and country B. That is, country A and B will jointly choose s_A^O and s_B^O so that²⁴

$$D'_A(s_A^O) - T'_A(s_A^O, s_B^O) + D'_B(s_B^O) - T'_B(s_B^O, s_A^O) = 0$$

Joint welfare maximization will select a single point on the Pareto curve. This is demonstrated in Figure 10. Instead of depicting different levels of regulations, this figure shows different levels of net welfare in country A (on the horizontal axis) and country B (vertical axis). The concave downward-sloping curve corresponds to the Pareto curve and represents a *welfare possibility frontier*. Joint welfare maximization will select a point on the Pareto curve tangent to a straight line with a slope of minus one, as shown in the figure. From this optimal point, not only is it impossible to improve a country's net welfare without reducing that of the other country, but any move away will have greater costs to the second country than benefits for the first.

The dotted lines show the net welfare levels corresponding to the “information sharing” Nash equilibrium. As mentioned in the previous paragraph, any negotiated solution²⁵ must give both countries at least this welfare level. As drawn, the joint welfare optimum indeed satisfies this criterion. However, this is not necessarily the case. It is possible that the joint welfare optimum results in very unequal welfare effects. Depending on the welfare levels in the non-cooperative “information sharing” outcome, it is possible that the joint welfare optimum will be worse than the non-cooperative outcome for one country. *A priori*, that country is unlikely to accept such an outcome. It is, however, conceivable that co-operation on a given regulatory issue is not isolated from that on other regulatory issues. In such a setting where countries negotiate about sets of regulations, it is possible to agree to bundles of regulations which together provide welfare benefits to both countries beyond the sum of what would be achievable without individual countries' welfare losses for individual regulations.

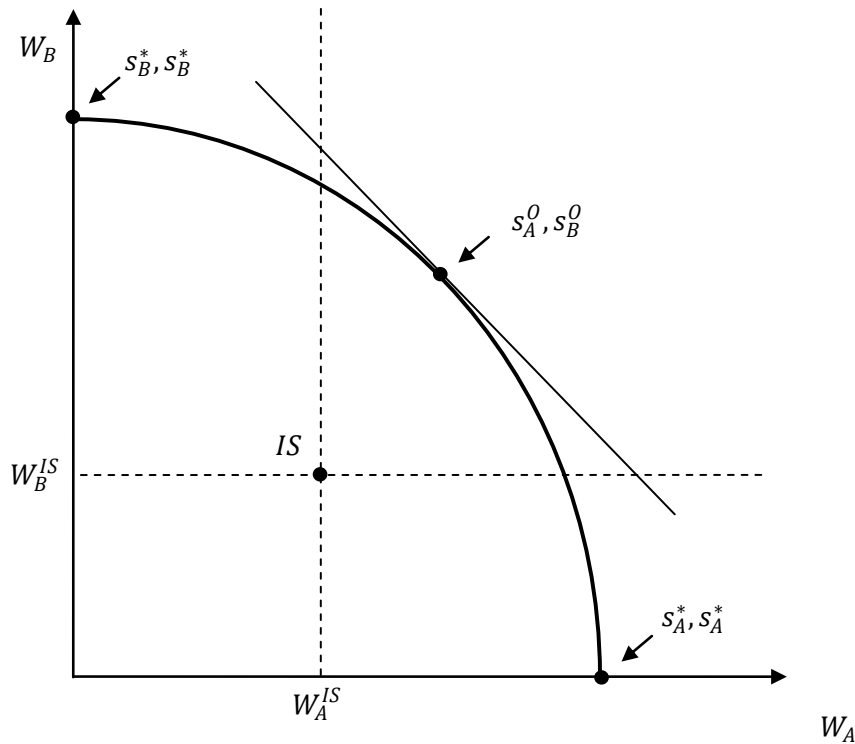
22. WTO (2015), Section 3 and Annex 2.

23. International standards can serve other purposes. In particular, in the context of good regulatory practice and regulatory governance, countries should give due consideration to relevant international standards (OECD, 2012, Recommendation 12; WTO SPS Agreement Art. 3, 12; WTO TBT Agreement Art. 2).

24. As discussed for each country's response function, the sufficient second-order condition is always met if the net welfare functions of both countries are strictly convex.

25. As noted earlier, the term “negotiation” is used for any co-operation aiming at reliable commitments and may include best-endeavour agreements supported by sufficient confidence between countries.

Figure 10. Joint welfare maximization selects a single point on the Pareto frontier



Fixed versus variable trade costs

So far, the discussion has looked at heterogeneity-related trade costs without distinguishing between fixed and variable costs. Fixed costs may, for instance, be related to the need of upgrading production facilities for compliance with an export market's requirements, or to the need to invest in the establishment and maintenance of testing laboratories within an export-oriented firm. In contrast, variable costs can be related to the use of additional or more expensive inputs in the production process, or to the enhanced monitoring of the production line to ensure the required production quality.

In general, regulatory heterogeneity generates additional trade costs of both fixed and variable type, but the relative importance of the two may vary significantly. For instance, different requirements for professionals mainly generate fixed costs for traded services: professionals may need to provide additional certificates related to degrees or working experience before being admitted to another country's service market, implying potentially large upfront costs while there may be no additional costs for the actual provision of the service in the foreign market. In general, regulatory heterogeneity in services frequently comes in the form of licenses, qualification or other requirements representing one-time investments for service providers (Kox and Lejour, 2005).

In turn, heterogeneity with respect to pesticide residues in food products can imply significant variable trade costs: producers wishing to export to different countries may need to adjust their pesticide use to other, potentially more expensive or less effective products. Different standards for power plugs force exporting producers of electrical appliances to equip their products with different plugs depending on the destination country, potentially generating both fixed (additional production line) and variable costs (additional use of intermediate products).

Depending on the type of costs induced by regulatory heterogeneity, the effects of regulatory co-operation and reduced heterogeneity will therefore differ. In particular, fixed and variable costs have different effects on different firms. Dimensions of effects include those on small and medium-sized enterprises (SMEs) versus those on large companies as well as the extensive versus the intensive trade margin.

Variable trade costs have a horizontal effect on the marginal cost of trading in that they increase the costs of each product unit exported. As such, they affect firms differently only in as much as the degree to which firms are able to increase their prices accordingly, a question that depends more on the competitive nature of the market than on specific firm characteristics. Where profit margins are small, however, variable costs are likely to affect foreign firms' choice to participate in the market. Therefore, while IRC mechanisms reducing variable trade costs will predominantly affect the intensive trade margin (i.e. the amount of products exported by firms already participating in the market), the extensive trade margin may also be affected by inciting new firms to export. In any case, however, the main direct effect is that of lower prices for imported products.

Fixed costs, in contrast, do not (directly) change the marginal cost of trading, but represent a necessary *investment* firms need to incur in order *to be able to export* to a given market. As investments need to be recovered by the profits made from resulting additional sales, they are more likely to be made by firms with sufficiently large export expectations. As a consequence, they likely represent a greater barrier for SMEs than for large firms. In turn, IRC reducing fixed trade costs removes barriers which originally have prevented certain firms (notably SMEs) from exporting. Hence, such IRC efforts tend to result in trade expansion at the extensive margin, i.e. increase the number of firms exporting to the foreign market. Given the resulting more intensive competition, prices tend to decline, potentially causing reduction effects at the intensive trade margin. Eventually, this generally results in both greater choice and lower prices for imported products in the import market.

As in most cases, both fixed and variable costs are affected by regulatory heterogeneity and, hence, by successful regulatory co-operation, the effects on trade are likely to be found both at the extensive and at the intensive margin. For example, Fontagné et al. (2015) have analysed the effects of SPS measures brought forward as specific trade concerns to the SPS Committee, affecting exports by French firms and found that such measures both reduced the probability for exporters to be present in SPS-imposing foreign markets (extensive margin) and that they reduce quantities sold notably by larger firms (intensive margin).

Implications for IRC

The preceding analysis leads to a number of conclusions with regards to the feasibility and desirability of IRC aiming at the reduction of heterogeneity-related trade costs while ensuring the achievement of the regulatory objectives.

First, there are typically good reasons (such as different societal preferences) why two countries would prefer a different regulation. The desirable degree of co-ordination is crucially determined by the relative importance of benefits from keeping current (or, in the case of new regulatory issues, domestically preferred) regulation versus the costs stemming from regulatory heterogeneity between countries. The more important such domestic effects are relative to economic losses related to trade costs, the more divergent optimal regulation will remain. In other words, if trade costs are small but domestic preferences for a certain type of regulation very strong, it may not pay off to engage in costly international regulatory co-operation processes. Conversely, where trade costs are high relative to the benefits of keeping current regulation in place, the optimal outcome of IRC may be a strong reduction of regulatory divergence. However, given that the societal preferences and hence domestic effects will always be important (otherwise, the countries would not consider regulating),

full harmonization is not a theoretically optimal outcome in this basic regulatory case unless the regulatory preferences in the two countries are identical.²⁶

Second, significant gains can often be realized already by an improved exchange and consideration of information on regulatory preferences across countries. In the absence of information about trade partners' regulations and regulatory preferences, regulators are bound to set their regulations solely on the basis of the domestic welfare component. Resulting regulations are therefore likely to be more different and to result in higher trade costs than necessary. If a country is fully aware of its trade partners' regulations when setting its own one, considering this information allows to significantly reduce any trade costs and related welfare effects for both that country and its trade partners. With full information sharing on regulatory preferences, even a non-cooperative process of regulation setting will be welfare improving. While full information can help to improve existing regulations, it is most efficiently used already at the stage of regulatory design. The exchange of information on preferences of different countries, and developments in their regulation-setting, is thus an important way to obtain efficiency gains, and the earlier in the regulatory process information is shared across countries, the easier it can be used to design optimal regulations that account for possible trade effects. Even if countries may still choose to set their regulations differently, the resulting regulatory heterogeneity – and hence trade costs – are likely to be reduced as countries inform each other's regulative process.²⁷

Third, negotiations (or other forms of confidence-building co-operation) between countries can achieve regulatory outcomes which further improve their welfare beyond a non-cooperative outcome.²⁸ In particular, from a welfare perspective the best approach would be for countries to set their regulations to maximize their joint surplus. If bundles of regulations are agreed upon jointly, the set of potential trade-offs is broadened and some redistribution of the resulting gains is possible.

An important question is whether actual regulatory heterogeneity is caused by an absence of information sharing on regulations and regulatory preferences (i.e. the "no information" outcome) or whether it is the Nash equilibrium of conscious strategic responses in the absence of co-operation (i.e. the "information sharing" outcome). While it is common to interpret government policies as resulting from strategic considerations, and indeed significant efforts are made to improve the flow of information on existing and planned regulations,²⁹ a case can be made that much regulatory heterogeneity in fact is caused by a lack of information sharing. Decisions regarding domestic regulations are made by a variety of actors (legislators, regulatory agencies, and so on), not all of whom have trade concerns in mind when deciding on a policy. Given this distribution of decision-

26. This finding is contingent on the assumption of continuously rising trade costs as regulations move further apart, an assumption that in many real-world regulatory circumstances notably for horizontal regulations does not hold. Implications of non-continuous trade costs are discussed in the next chapter.

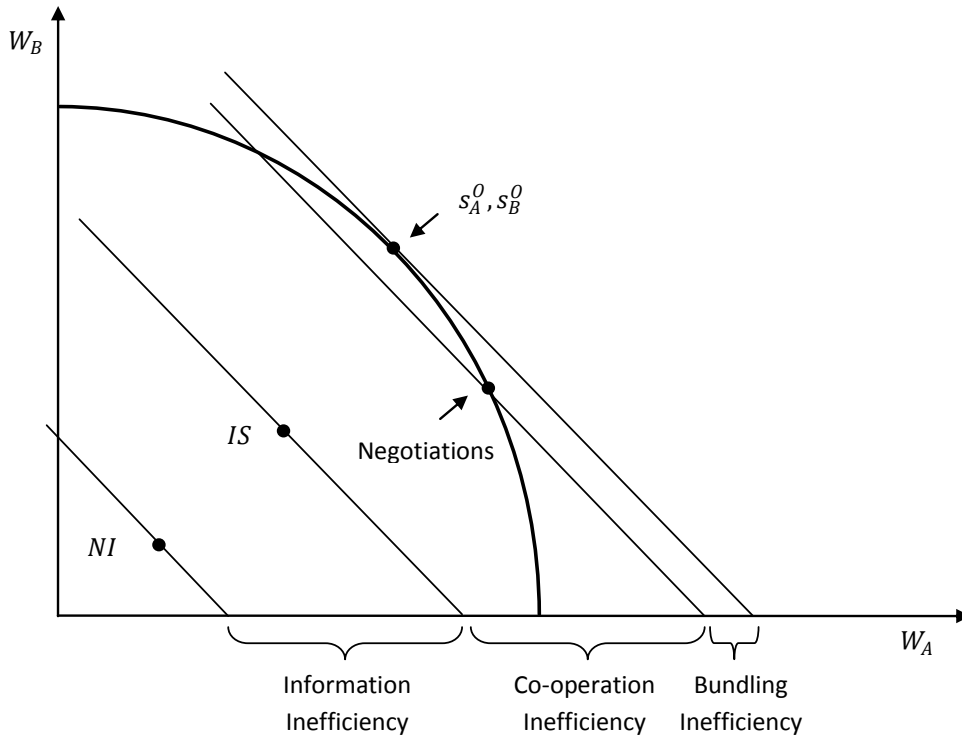
27. It should be noted again that such an information exchange reduces trade costs through differences in the final regulatory outcomes. To the degree final regulations remain different across countries, exporters still face the need to obtain knowledge about regulatory requirements in their destination market, requiring full transparency.

28. These results are based on the assumption that regulators aim to maximise national welfare. A possible extension of this conceptual work would consider industry lobbies providing contributions towards specific outcomes, which could influence governments' policy preference function. This extension could build on Grossman and Helpman (1995) who develop a lobby-government model in the context of negotiations towards a free trade agreement. It goes, however, beyond the scope of the present theoretical framework.

29. Due to the obligation to notify regulatory changes under WTO rules (enshrined in the TBT and SPS Agreements), there is some information on regulations across countries available. In addition it can be argued that the TBT and SPS Committees provide a forum for clarification and hence for a step closer to the Nash Equilibrium IS. In 2013, for example, in the TBT Committee, "further clarification" was the type of concern most often raised, followed by "unnecessary barriers to trade" and "transparency". Also it should be noted that specific trade concerns raised relate mostly to notified regulations (of the concerns raised at the TBT Committee during 1995-2013, 278 out of 406 concerns were related to notified measures, compared to 56 concerns related to conformity assessment procedures). This suggests that trade costs related to technical regulations may be more significant than those related to conformity assessment procedures. See WTO G/TBT/34 (March 2014).

making responsibilities, co-ordination failures resulting in regulative situations closer to the “no information” outcome than necessary are quite plausible.

Figure 11. Three sources of inefficiency



An implication of this analysis is that, whenever heterogeneity-related trade costs are important, IRC has the potential to reduce *three* different sources of inefficiencies, shown in Figure 11. Using the welfare diagram introduced earlier, the figure shows the no-information outcome, the information-sharing outcome, a negotiated solution, and the joint welfare maximizing outcome. The downward sloping lines represent different combinations of welfare in country A and B which sum up to the same level of aggregate (global) welfare. This allows us to read the joint welfare levels on the horizontal axis and hence to read the horizontal distance between the lines as the differences in joint welfare between the different outcomes. In other words, the graph shows how different levels of IRC can overcome the three sources of inefficiency related to regulatory heterogeneity. A first source of inefficiency is that caused by a lack of information sharing on regulations and regulatory preferences (“information inefficiency”). This could also include inefficiencies related to a lack of capacity to generate or communicate the information on regulatory preferences to the partner country, or to process and properly incorporate such information received from the partner country. IRC as basic as the exchange of information on countries regulations and regulatory preferences thus can create significant welfare gains. A second source concerns the welfare loss due to non-cooperative outcomes (“co-operation inefficiency”), again potentially including the lack of resources and capacity to engage in and fully commit to negotiations and its outcomes. Such negotiations therefore represent a second important form of IRC to achieve efficiency gains. Finally, the third source is the global welfare loss which occurs when countries try to avoid small losses when these could be overcompensated by larger gains from related regulatory negotiations (“bundling inefficiency”). IRC efforts related to a wider set of regulations may therefore have the potential for additional efficiency gains beyond what can be achieved for each individual regulatory problem. The relative importance of these three inefficiencies, and hence of different levels of IRC, in reality is an empirical question, although the preceding discussion suggests that “information inefficiencies” are likely to be important in practice.

A more general model: Relaxing assumptions

This chapter generalizes the theoretical discussion on potential gains from collaborative setting of regulations by opening up the restrictive assumptions taken to illustrate the basic case. In particular, the assumptions to be relaxed include the following ones:³⁰

- Symmetric trade cost and related welfare losses for both countries if regulations are different.
- Continuously increasing trade costs and related welfare losses as regulations become more different.
- Trade partners are of roughly equal economic size.
- Collaboration involves only two trade partners.

Trade costs and related welfare losses are not symmetric between the trading partners

The most generic case has assumed that welfare losses related to trade costs originating in regulatory heterogeneity are symmetric for the trading partners. In reality, this need not be the case. Even if the trade costs themselves may be symmetric for exporters of both trading partners, the economic implications for the two countries may be very different depending on the direction of the trade flow. If the trade flow is (largely) from one country to the other, the importing country may be affected quite differently than the exporting one.

In principle, however, this difference in the welfare effects between the two trading partners does not alter the arguments made in the preceding section. Given that, for a given country and given its trade status vis-à-vis its trading partner, the welfare losses due to heterogeneity-related trade costs are still symmetric with respect to the regulations in the two countries, the only modification to the general discussion is that the weight of these trade-related welfare losses within the two countries' net welfare functions now may be quite different. *A priori*, these losses may be either greater or smaller for the importing country when compared to its exporting trading partner, but given that this weight may also differ between the countries for other reasons (e.g. related to the social preference structure), both the line of arguments and the conclusions drawn for IRC remain intact.

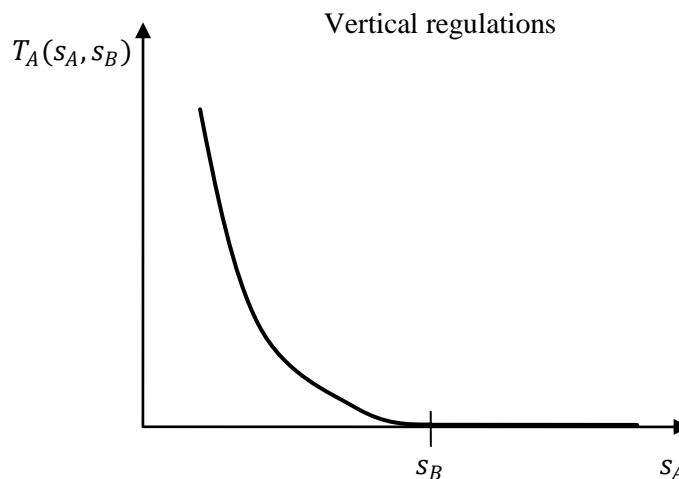
"Vertical" regulation: Zero trade costs for the country with the more stringent regulation

The line of arguments changes if the assumption of symmetric trade costs is dropped. In many circumstances, differences in regulations can be associated with different levels of *stringency*. This generally applies to many sanitary and phytosanitary (SPS) measures, such as maximum residue levels (MRLs): if two countries regulate the residues of a certain harmful substance, e.g. of chemicals originating in pesticide use, the regulation with the lower MRL can be seen as more stringent than that with a higher MRL. In contrast to horizontal regulations discussed so far, this type of regulations has a "vertical" interpretation. While vertical regulations are most common in the area of SPS measures, there are also many vertical regulations in the area of technical barriers to trade (TBT measures), such as maximum or minimum content of certain substances in a product or in the packaging material, or maximum or minimum characteristics (e.g. breaking strength, defect frequency, energy performance etc.) of the product.

30. In addition, the complexities in trade-related IRC may further be increased by differences in countries' negotiation power. The different weights of co-operating countries often relate to economic factors such as relative market sizes or different exposure to heterogeneity-related trade costs which are discussed in this section, or to a mix of regulatory issues discussed in parallel which could help addressing bundling inefficiencies discussed above. Instead, however, negotiation powers may be influenced by factors such as (geo-) political weights. While potentially important for the outcomes of IRC, the discussion of such factors is beyond the scope of this theoretical framework.

Actual trade costs resulting from such regulatory differences are no longer symmetric for both regulating countries. Instead, a country A may face additional trade costs when trying to export to another country B that has implemented more stringent regulations, while there are no additional trade costs for country B when exporting to country A with less stringent regulations.³¹ As a consequence, exporters in a country with more stringent regulations can export without heterogeneity-related trade costs to a country with less stringent regulations, but exporters in the country with less stringent regulations need to incur costs to upgrade their products to the more stringent regulations of their export market. Put differently, if country A has more stringent regulations than country B, its heterogeneity-related trade costs are zero; however, if its regulations are below that of country B, there are positive trade costs which are increasing in the distance to s_B . This case is depicted in Figure 12, which directly compares to Figure 2. Therefore, while differences in horizontal regulations generate symmetric trade costs for both countries, differences in vertical regulations generate asymmetric trade costs only for the country with the less stringent regulation. As in the discussion of horizontal regulations, for the time being these asymmetric trade costs are assumed to result in similarly asymmetric welfare losses for the two countries, i.e. zero trade-cost related welfare losses for the country with the more stringent regulation but positive losses for the country having the less stringent regulation.

Figure 12. Trade costs for continuous vertical regulations



Graphical representation

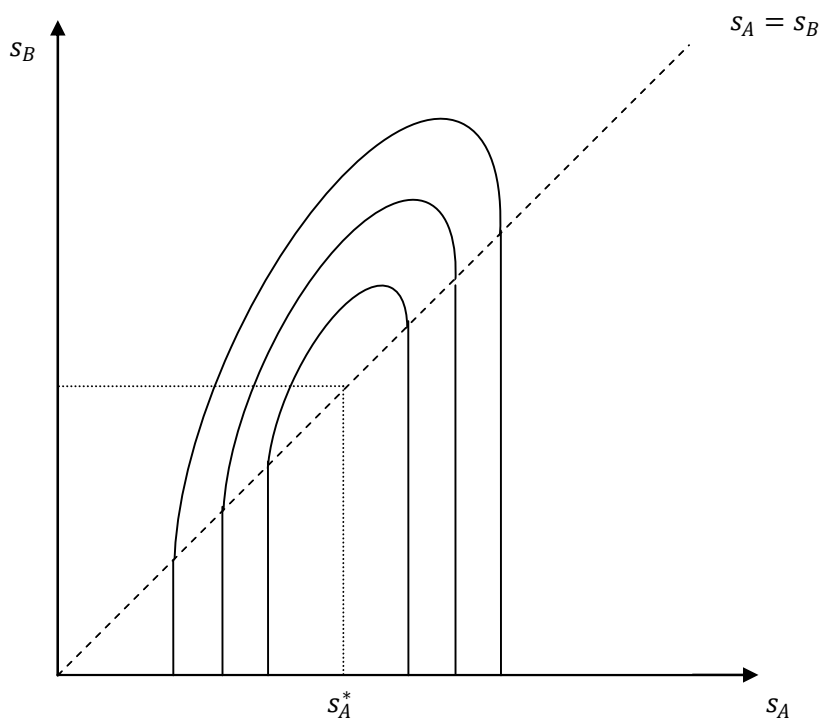
As for the horizontal regulations, this analysis assumes zero trade costs if the export market has the same regulation as the exporting country, and increasing trade costs as the regulation in the export market becomes increasingly stringent compared to that in the exporting country. In contrast to the horizontal regulation case, however, trade costs are zero if the regulation in the export market is less stringent than in the exporting country.³² When trade costs are zero, the indifference curves are as drawn in Figure 4. With positive trade costs, indifference curves look as in Figure 3. For country A, trade costs are zero in the area below the 45 degree line (i.e. where $s_A > s_B$) but positive

31. In reality, exporters from a country with more stringent regulations may still face regulatory barriers related to a lack of recognition of these regulations. The following discussion abstracts from such complications which will be returned to further below.

32. A specific case of vertical regulations is the absence of the regulation in one of the two countries. As noted above, even a regulation that would otherwise be horizontal in nature becomes *de facto* vertical if present only in one of the two trade partners, because its implications for heterogeneity-related costs resemble those of a vertical regulation.

above it, and the resulting indifference curves will be a combination of those depicted in Figure 4 and Figure 3. Hence, indifference curves will look as in Figure 13. Likewise the indifference curves for country B (not shown here) are horizontal in the area left of the 45 degree line (where $s_A < s_B$) and resume their “normal” shape to the right of the 45 degree line.

Figure 13. Indifference curves with vertical regulations

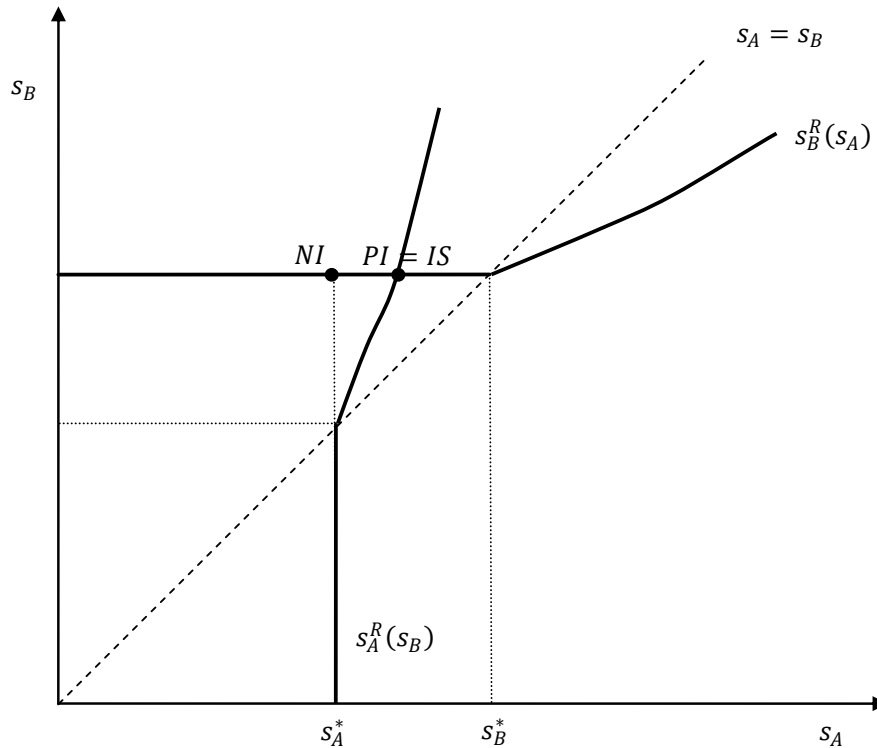


“No information” outcome, unilateral adjustments and information sharing

As before, the “no information” outcome would still be the situation where A and B choose their ideal points, i.e. s_A^* and s_B^* respectively. To find the optimal regulation for country A if the regulation in country B is already set and known (unilateral adjustment), or optimal regulations for the two countries with full information sharing on regulatory preferences, the countries’ reaction functions are required again. For country A, this reaction function will be identical to that in the previous section in the area above the 45 degree line. Below the 45 degree line (i.e. for $s_B < s_A$), the optimal reaction of country A is to always set its regulation equal to its ideal point s_A^* , and hence its reaction function will be a vertical line at s_A^* . Similarly, for country B the reaction function to the right of the 45 degree line is the same as before, while the reaction function is a horizontal line at s_B^* to the left of the 45 degree line ($s_A < s_B$). This situation is shown in Figure 14, which modifies Figure 7 for the case of a vertical regulation. (For simplicity only the reaction functions and not the indifference curves are shown).

As this figure shows, if country B has the higher preferred regulation s_B^* , the intersection of the two reaction functions must always happen in the horizontal part of country B’s reaction function. The Nash equilibrium or “information sharing” outcome thus implies that *the country with the most stringent preferred regulation will in fact maintain its regulation at this level*: in the information sharing outcome, country B still sets its regulation at s_B^* . By contrast, country A will set its regulation somewhere between s_A^* and s_B^* depending on the relative importance of trade costs and domestic welfare. Consequently, country A will choose that same level of regulation if country B’s regulation is already set and known at a level above A’s preferred level, i.e. outcomes PI and IS coincide.

Figure 14. “No information”, “partial information” and “information sharing” outcomes with vertical regulations



Negotiations

As in the case of horizontal regulations, regulatory negotiations should ideally lead to a point on the Pareto frontier, i.e. countries will negotiate a situation such that no country can be made better off without making another country worse off. Graphically, the Pareto frontier is the set of all points where the indifference curves of both countries are tangent. However, because of the particular shape of indifference curves with vertical regulations, the Pareto frontier in this case coincides with the reaction function of country A in between its ideal point and the Nash equilibrium.³³

The practical implication of this analysis is that country B, the country with the more stringent regulation, cannot improve its situation by engaging in negotiations. In the Nash equilibrium, country B already sets its preferred regulation without incurring any trade costs. For any other point on the

33. This can be seen as follows. To find the reaction function of country A, we start from a given value for s_B , which corresponds to drawing a horizontal line and finding the indifference curve of A just tangent to this line. However, in the area above the 45 degree line, the horizontal line is also the indifference curve of country B, and therefore the Pareto frontier in this area coincides with country A's reaction function. To see that the Pareto frontier starts in country A's ideal point, first note that for any point below the 45 degree line, there exists a point on the 45 degree line that would give country A the same welfare (graphically, this follows from the fact that indifference curves for country A are vertical in this area) while giving country B an increased welfare (as country B's preferred regulation is at a higher level). However, for every point on the 45 degree line except the ideal point, there exists a point strictly above the 45 degree line which gives the same welfare level to country A (graphically, this follows from the elliptical indifference curves in this area), while still giving country B a higher welfare. Hence, with the exception of country A's ideal point, for any point below or on the 45 degree line there exists another point which will give the same level of welfare to country A but which gives a higher welfare to country B. Therefore, the Pareto frontier must start in country A's ideal point. To see that the Pareto frontier ends in the Nash equilibrium, note that in the Nash equilibrium country B sets its preferred standard s_B^* and incurs no trade costs, so that its welfare cannot be improved at all. Any point to the north of the Nash equilibrium can therefore not be on the Pareto frontier.

Pareto frontier, it would incur welfare losses because it would need to reduce its regulation below its preferred level. However, by making the information on its regulation and its regulatory preferences available to its trading partner, it allows country A to achieve gains by bringing its regulation closer to that of country B.

Implications for IRC

In terms of the distinction between the “no information” outcome and the “information sharing” Nash equilibrium, Figure 14 demonstrates that the difference between these two outcomes depends only on the actions of country A. This is in contrast to the situation with the basic case of horizontal regulations, where the inefficiency related to a lack of information sharing was caused by suboptimal regulations in both A and B. Welfare-improving unilateral changes are possible by full disclosure of countries’ information on their regulations and regulatory preferences.

A second implication for IRC is that country B cannot improve its own situation by changing its regulation. As a result, the different scenarios – no information, partial information, information sharing, and negotiated outcomes – all result in the same regulation for country B unless negative effects for country B can be offset by higher gains in related regulatory areas.³⁴ The only welfare-improving measures – apart from information sharing – are those undertaken by the country with the less stringent regulations, country A. These conclusions only hold, however, if the costs related to regulatory heterogeneity are borne only by the country with the less stringent regulation. The next section discusses how these findings change if this is no longer true.

Differences in welfare losses depending on the direction of the trade flow

The assumption of welfare losses being independent of the direction of the trade flow generally does not hold. While the absence of such losses can be assumed for an exporting country B with a stringent regulation and which trades with a country A with less stringent rules, as in this case no specific adjustments are required at the process or product level, the same country B is negatively affected by regulatory heterogeneity if it is a net importer. As in this case, the heterogeneity-related additional costs initially occur to the exporting trading partner, these costs will generally increase the price of the imported product. The fact that exporting companies in the partner country are facing the more stringent regulation in their export market may also result in some of these companies not willing to actually export to country B. As a consequence, consumers in the importing country B with the more stringent regulation (or industries using the product in question as an input) will face either higher prices or less choice of the imported product, or both, thus reducing their welfare.

Welfare effects for country A with the less stringent regulation will equally depend on the direction of the trade flow. As an exporter, it will face the costs and welfare losses discussed above, while as an importer its welfare may well be unaffected as the difference in regulations does not affect their ability to import (indeed, if consumers value the higher quality that may be attached with meeting the more stringent requirements in the exporting country, their welfare may actually improve).

The analysis above therefore needs to be modified to take into account the implications of regulatory heterogeneity for importers. Two main situations can be distinguished: if the country with the more stringent regulation is the exporter (and provided the direction of trade does not depend on the difference in regulations, e.g. because the importing country with the less stringent regulation does not produce the product in question), neither of the two countries faces welfare losses related to the regulatory heterogeneity. Hence, the optimal choice of either country is to set its regulation at the own preferred level, irrespective of the regulation in the trading partner, and the resulting regulatory heterogeneity does not imply any market inefficiencies.³⁵

34. If lowering the standard in country B leads to a small welfare loss in B but to a relatively larger gain in A, country A may be willing to give similar concessions in other regulatory areas.

35. If the direction of the trade flow is determined by the regulatory heterogeneity, e.g. because the resulting trade costs for exports from the less stringently regulating country to the more stringently regulating country are

In the second situation, the country with the more stringent regulation (B) is the importer of the product exported by the less stringently regulating country A. In this case, the regulatory heterogeneity creates additional costs which, while first occurring to the exporting companies in country A, have welfare reducing effects in country B as well. As discussed for horizontal regulations, these effects relate to either increased prices or reduced choice for the imported product, or both. Here as well, an *a priori* assessment of whether these welfare losses are larger or smaller than those incurred by the exporting (less stringently regulating) country is not possible as these depend on the social preferences of the importing country. The analysis of this case is similar to that of heterogeneity in horizontal regulations with a unidirectional trade flow: the only adjustment required relative to the discussion above is related to the relative importance of trade-cost induced welfare losses within the net welfare calculation, which however does not alter the line of argument nor the conclusions drawn for IRC in the case of horizontal regulations.

If trade flows in both directions, the welfare effects of regulatory heterogeneity are between the first and the second situation. Again the arguments made for the case of horizontal regulations apply, but as only a share of trade actually faces the additional regulatory heterogeneity costs, the weight of these costs in the countries' net welfare functions is correspondingly smaller.

These findings have some potentially important implications for the current debate on the comparatively stringent requirements e.g. for agricultural exports from developing to developed countries. In contrast to the outcomes discussed above, and subject to the significance of trade costs relative to the domestic effects, maintaining its more stringent preferred regulation may no longer be in the importing developed country's best interest when the costs for imports from developing country exporters are accounted for. Instead, depending on the weight of related losses within the developed country's net welfare function, it may be better off by regulating at a level below its preferred one and hence closer to the less stringent regulation of the exporting developing country. Even if the less stringent regulation reduces the purely domestic effects, this can be more than offset by lower trade costs which lower prices (and potentially increase choice) for the imported product.

In practical terms, this implication strongly hinges on the relative importance of trade costs compared to the domestic effects of potential regulatory changes. In particular, as risk regulation often concerns the health and safety of consumers, an increase of such risks as a price for reduced trade costs may be unacceptable. This would imply a (potentially very) high weight of domestic effects relative to that of trade costs. In such cases, the scope of trading such risks against the economic benefits of reduced trade barriers may be very limited. In turn, such scope may be wider where regulation targets less significant risks.

Trade costs are not continuous

In the basic case of horizontal regulations, trade costs $T_A(s_A, s_B)$ were assumed to increase continuously with a larger distance in regulations $|s_A - s_B|$. While this assumption of continuous trade costs simplifies the analysis, in many cases trade costs will be discontinuous. For instance, differences in the size and shape of electric power plugs will lead to significant trade costs as soon as they are different. Frequently, the trade costs do not differ significantly when these differences become "larger". Hence, trade costs that are zero when regulations are equal discontinuously jump to a significant level even for small differences between the regulations, but remain more or less unchanged as the regulatory heterogeneity increases further.

Such discontinuous trade costs imply that the resulting indifference curves become discontinuous as well: for all regulations $s_A \neq s_B$, the indifference curves take the shape as shown in Figure 4 (or, if trade related welfare costs additionally increase with the distance between regulations, in Figure 3). If for every point off the 45 degree line, a change in standards does not have any *extra* effect on trade costs, the preferences of country A are determined only by domestic preferences; indifference

prohibitive, the exact analysis requires detailed information and a (partial) market model. Broadly speaking, however, this situation potentially generates incentives for both countries to reduce the regulatory heterogeneity, along the lines of the subsequent discussion.

curves are thus vertical lines. As on the 45 degree line, i.e. for $s_A = s_B$, however, trade costs (and hence related welfare losses) discontinuously fall to zero, net welfare is higher than on the points immediately surrounding it. As a consequence, the point on the 45 degree line belonging to a specific indifference curve is located further distant from the preferred level of regulation. In other words, for a country A to enjoy the net welfare of any point on the 45 degree line (i.e. a regulatory outcome without regulatory heterogeneity), an outcome with even a small regulatory heterogeneity would require both countries' regulations to be much closer to A's preferred level.

This in turn changes the optimal response of country A to a given standard in country B. For any standard s_B in country B, the net welfare of country A as a function of its own standard will look as follows.

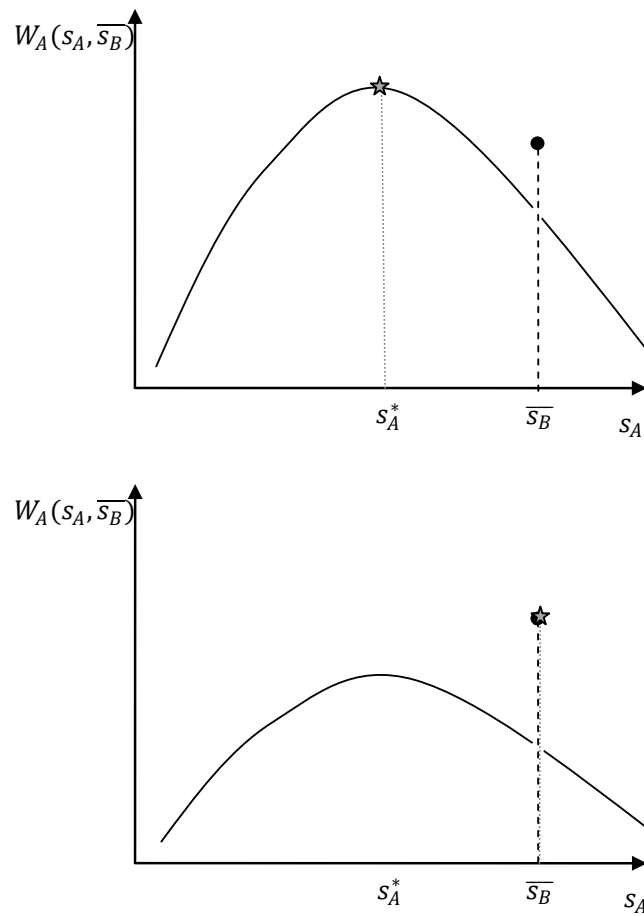
Depending on the magnitude of the trade costs and the domestic effect implied by deviating from its preferred regulation to adopt the one set by the trade partner, the optimal response may be to simply set s_A^* (the standard which maximizes domestic welfare only), as in the top panel, or to adopt \bar{s}_B , i.e. harmonize the standard on the level set in country B, as in the bottom panel, as these maximize country A's net welfare in either case (as indicated by the grey asterisk). In other words, the reaction function of country A will be perfectly vertical at s_A^* for all \bar{s}_B as long as the implied trade cost related welfare loss is lower than the domestic effects that would be implied by moving to $s_A^* = \bar{s}_B$, i.e. provided that either the fixed trade costs are comparatively small or the distance between the two regulations is comparatively large. Alternatively, i.e. if domestic effects are small relative to the trade costs, the reaction function coincides with the 45 degree line. Assuming that country B also has discontinuous trade costs and therefore faces the same situation as country A, its optimal choice of standard s_B will either be its own domestic preferred standard s_B^* or the standard set by country A.

As a consequence, while the partial information equilibrium is necessarily well defined (as outlined above, country A will, depending on domestic effects and fixed trade costs, choose its preferred regulation or adopt the regulation of country B), the Nash-Equilibrium may or may not be unique. If both countries strictly prefer their own standard, the outcome will be (s_A^*, s_B^*) . If one country prefers its own standard while the other prefers to follow, the result will be harmonization. However, if both countries prefer matching the standard of the trading partner, both reaction functions coincide with the 45 degree line. In this case, countries A and B agree that any harmonized standard is better than divergent standards, but there is a clear conflict of interest since country A would still prefer harmonization on s_A^* while B would prefer harmonization on s_B^* . To summarize, with discontinuous trade costs, the result will either be (i) divergence with each country implementing its own preferred standard, (ii) harmonization with one country implementing its preferred standard and the other country following, or (iii) harmonization with countries negotiating over the exact level of the standard.

This outcome is quite different from the findings for continuous trade costs discussed above, for which some more or less profound yet incomplete convergence in regulations was found to be preferable for both countries. In reality, most horizontal regulations are likely to incur discontinuous rather than continuous trade costs. For many of these regulatory problems, IRC could therefore aim at some form of harmonization if trade costs are sufficiently significant.

A related problem of discontinuities exists if regulatory options are discrete. In such cases, regulations can take the form of a limited number of options rather than a point in a continuous range of options. In this case, both the domestic effects and the trade costs show discontinuities. Here, too, co-operative outcomes may differ from those discussed for continuous functions: with a discrete choice of options, a country may be best off by sticking to its preferred regulation even in the presence of trade costs, if a trade cost-reducing option induces too big a loss in domestic effects. Similarly, even in the presence of different domestic preferences, full harmonization may become optimal if an option closer to the preferred regulation induces losses in terms of trade costs that are not compensated by better domestic effects.

Figure 15. Net welfare under discontinuous trade costs



Trading partners are of unequal (economic) size

So far, the analysis essentially assumed that the two countries concerned are of roughly equal economic size.³⁶ If the two countries are of significantly different size (e.g. in trade relations between a large economic area such as the United States or the European Union and a comparatively small country like Mexico or Switzerland), this may affect the discussion of regulatory heterogeneity and co-operation in two ways: the relative importance of trade-cost related welfare effects within the net welfare of each country, and the relative weights of the two countries within a joint welfare aggregate. In this illustration, it is assumed that country A is small relative to the larger country B, and that regulations are of a horizontal type with continuous trade costs, but the argument can be easily extended to other constellations.

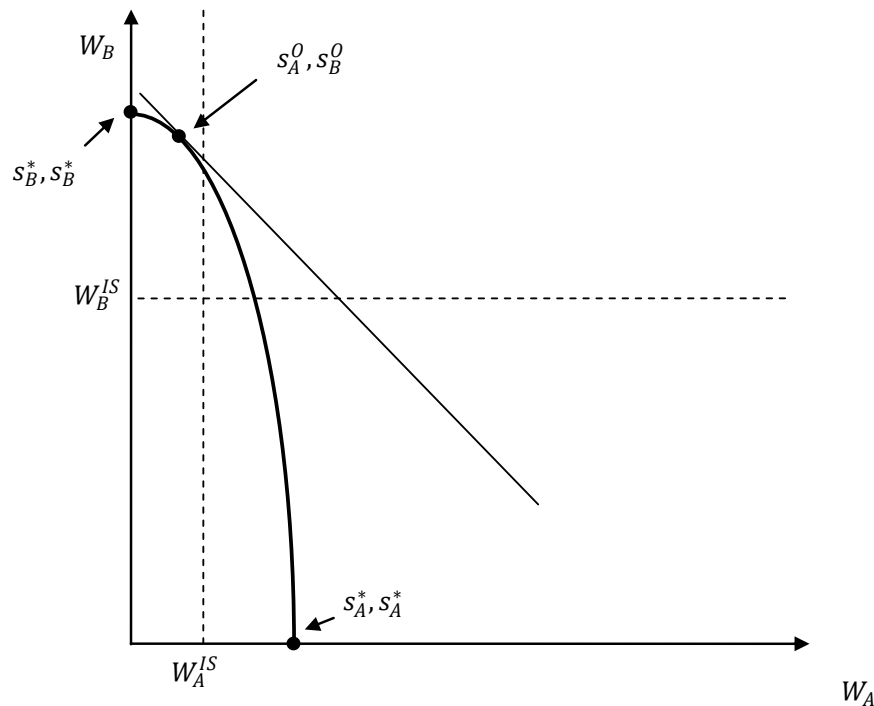
First, in terms of the relative importance of domestic effects and trade costs, it is plausible that for a large country B, the trade costs of dealing with a small country A will be minor. Presumably, trade flows with country A will be of minor importance for country B, and hence the trade costs of regulatory heterogeneity between the two countries will be minor compared to the large domestic effects in country B of a change in regulations.

In country A, the situation is reversed: presumably trade with a large country B will be quite important, so that trade costs of regulatory heterogeneity may be relatively more important than domestic effects.

36. More specifically, the “size” of countries relevant for this analysis relates to the markets for the product in question.

In an extreme case, the indifference curves of the small country A can be represented as being almost parallel to the 45 degree line, i.e. given the importance of trade with country B, the small country is prepared to accept large changes in its regulation as long as trade costs can be minimized. On the other hand, for country B the indifference curves would be almost horizontal, reflecting the fact that domestic effects would carry much more weight than trade costs. The reaction function of country A would thus practically coincide with the 45 degree line while the reaction function of country B would approximate a horizontal line at its ideal regulation s_B^* . In this case, the Nash equilibrium would be for country A to unilaterally adopt the regulation of country B: the smaller country becomes a standard taker. As the Pareto curve would also be close to the 45 degree line, there would be little that could be gained through negotiations as country B would have to accept welfare losses should it deviate from its preferred regulation. In a less extreme case, the Nash equilibrium will differ from unilateral adoption and the Pareto curve no longer coincides with the 45 degree curve, but outcomes will still be relatively close to the unilateral adoption of B's regulation by country A while allowing for some remaining regulatory heterogeneity.

Figure 16. Joint welfare optimization with countries of unequal size



A second way in which the relative size of trading partners affects the analysis is in terms of the joint welfare maximizing outcome and the possibility of compensation through package negotiations. If the weights of trade costs within the two countries' net welfare functions are not very different, outcomes related to (partial) information sharing are similar to those discussed in the generic case, and the Pareto curve falls into the triangle defined by the countries' preferred regulations and the Nash equilibrium of full information sharing. The resulting welfare frontier, however, now looks quite different from the one of equally-sized countries (see Figure 16 in comparison to Figure 10). The Pareto set shows all points where the welfare of one country cannot be improved without reducing that of the other. However, given differences in the size of the countries, the *levels* of welfare are now quite different.

As shown in Figure 16, the larger country B's net welfare is affected much more by the regulation in the given market than that of the smaller country A. As a consequence, the point on the Pareto curve that is tangent to a straight line with slope negative one, which denotes the joint welfare maximum and which is indicated by (s_A^O, s_B^O) , will be comparatively close to country B's "ideal point" where both countries implement country B's preferred regulation. As before, it is quite possible that this joint welfare maximum would leave one of the countries worse off than the Nash equilibrium (shown in Figure 16 by the dotted lines), and hence that country would accept this outcome only if it were compensated, e.g. within a package deal involving another set of regulations where the joint welfare maximum could bring larger additional welfare benefits.

To summarize, when trading partners are of very unequal size, two effects alter the analysis. First, since trade costs will be relatively more important for the smaller country while domestic effects will be relatively more important for the larger country, the resulting combination of regulations will be closer to the ideal point of the largest country. Second, even if there is no major difference in the relative importance of trade costs and domestic welfare, the unequal size makes it likely that a negotiated outcome will be closer to the ideal point of the larger country. These two effects hence affect the outcome in the same direction: the unequal size of the countries involved will shift any outcome towards the ideal point of the largest country.³⁷

Co-operation involves more than two trade partners

The analysis thus far has been limited to a world of two countries. While implications for third countries (i.e. countries not directly involved in the regulatory co-operation, but potentially affected by its outcomes) are discussed further below, this section looks at whether and how the findings apply to IRC cases with three or more participating countries. The simple case of two *groups* of countries, within which each country has the same regulatory preferences, can be seen as a different interpretation of two trading partners discussed above: in such a case, the two country groups would behave and regulate as a unified economy. In other words, the conclusions drawn so far also hold for co-operations involving more than two countries, provided these form two groups that can act together. Differences in group sizes then correspond to unequally sized trading partners.

In the more general case, a larger number of countries with different regulatory preferences face the problem of identifying optimal regulatory outcomes either by ensuring full exchange of information and considering this information in individual regulatory decisions (the *Information Sharing* outcome) or by finding an agreement that benefits all (or at least benefits some while hurting none). From the theoretical perspective taken in this report, the questions therefore are whether a Nash equilibrium of Information Sharing exists, if so, whether it is unique, and whether negotiations can lead to Pareto-optimal outcomes.

37. A similar argument can be made for the number of similarly regulated countries: if many countries already regulate in the same way while one country regulates differently, optimal outcomes will generally be closer to the common regulation of the many countries. This effect may therefore offset the effects arising from different market sizes: If many small countries with the same regulation trade with one large country regulating differently, the size effect can be partly or fully eliminated.

The existence of a Nash equilibrium depends on the set of actions at disposal to the individual countries and on the shape of their preference function (Osborne and Rubinstein, 1994: 20). Provided these remain as well-behaved as they were assumed to be for the basic case (i.e. the domestic effect function D is strictly convex and the trade cost function T is strictly concave), the existence of a Nash equilibrium therefore does not change with the number of participating countries. Instead, Nash (1951) has shown that for finite games with any number of players, Nash equilibria must exist.

Indeed, as discussed above the Nash equilibrium is defined as the point where the reaction functions of the participating countries intersect. With more than two countries involved, these functions would become surfaces in an n -dimensional space if depicted graphically. The reaction function takes the value s^* (that is, the country's preferred regulation) where all other regulations average, weighted by their respective impact on trade-cost induced welfare losses, at that same value s^* . In all $n-1$ dimensions, the reaction function of any country has a slope greater than or equal to unity: in the extreme cases, a country's regulation should be independent of another one's regulation (if differences in regulations would not generate any significant welfare loss relative to the regulation's domestic effect) or follow it one-to-one (if the domestic effect were insignificant relative to the trade-costs).

As in the case of two countries, the Nash equilibrium does not need to be unique, however. If different regulations on the same issue can generate the same domestic effect in either country, the reaction functions coincide with the 45°-surface (i.e. with full harmonization across countries; indeed, a strictly preferred regulation would no longer exist) and any point on them would serve as a Nash equilibrium. For such regulations, a harmonized system across all countries would be both a Nash equilibrium and a Pareto-optimal outcome.

In general, with both domestic effects and trade costs being significant, Pareto-optimal outcomes always include those "extreme" ones where all countries harmonize on any of the regulations preferred by at least one country A . Given that that country A maximizes its welfare with such an outcome and would be worse off by any other outcome (due either to trade costs or to losses in domestic effects), other countries cannot improve their welfare relative to that outcome without harming country A . Furthermore, a negotiated outcome that maximizes joint welfare (e.g. in the context of bundled negotiations) necessarily also represents a Pareto-optimal outcome: given the joint (combined) welfare being maximized, any deviation from that point, while possibly increasing some countries' welfare, must reduce the welfare of others. If both regulatory choices of the countries and their respective welfare functions are continuous, the Pareto-set of optimal outcomes also includes some surface combining the above-mentioned "extreme" outcomes and the one maximizing joint welfare.

In conclusion, the findings from the analysis undertaken above for two-country co-operation generally also hold for IRC involving more than two countries. While the possibility of multiple Nash-Equilibria depends on the continuity of regulatory options and the shape of welfare functions rather than on the number of players involved, a larger number of participating countries may increase the number of possible Information Sharing outcomes. Such outcomes may hence become more path-dependent: countries moving first may have the possibility to induce a stable outcome in their favour.

Equivalence and mutual recognition as an alternative to regulatory convergence

So far, this framework has focused on regulatory adjustments as a means to reduce trade costs resulting from regulatory heterogeneity (or, in case of new regulations, to avoid unnecessary regulatory heterogeneity). For this, regulators and trade officials have to strike the balance between the domestic effects of regulations that diverge from domestically preferred ones (most notably, the possible increase in risks that the regulations are targeted at) and the reduction of trade barriers and related economic benefits. In practical terms, the scope for such regulatory convergence may, however, be limited.

An alternative approach consists in recognising the partner country's regulations as achieving the importing country's regulatory objectives in terms of reducing the potential costs of market imperfections. If such recognition is reciprocal among two or more countries, both producers and users of traded products can enjoy the benefits from lower trade costs.

Such recognition can play out at different levels of the compliance chain. The recognition of the trade partner's product and production requirements as achieving the importing country's regulatory objectives to a sufficient degree (although specifications may differ) can be referred to as *equivalence*; for example, the US-EU Organic Equivalency Agreement.³⁸ In contrast, mutual recognition more often refers to various aspects of conformity assessment procedures, including testing methods as providing the same information, the recognition of labs or certification bodies, or of the trade partners' accreditation bodies such as the Electrical and Electronic Equipment Mutual Recognition Arrangement (EEE MRA), an annex to the New Zealand-China Free Trade Agreement.³⁹ This is discussed in greater detail in the section on conformity assessment procedures below.

Equivalence and mutual recognition would seem to be squaring the circle: trade costs could be reduced without the need for regulatory changes and, hence, without the (generally negative) domestic effects that such regulatory changes away from preferred regulations would bring. Work towards equivalence of measures is encouraged in both the SPS-Agreement (Art. 4) and the TBT-Agreement (Art. 2.7). The TBT-Agreement also encourages the use of mutual recognition of conformity assessment procedures (Art. 6), which can be seen to be implicitly included in Article 4 of the SPS Agreement.

There are, however, costs associated with these mechanisms. Most importantly, equivalence or mutual recognition agreements require that regulatory product, production or conformity assessment requirements indeed achieve the same objectives. In other words, co-operating countries need to agree both on what should be achieved with regulations, and on the performance of different regulatory approaches relative to these objectives.⁴⁰ This may also require sufficient levels of confidence in the regulatory system of the trade partner: while each partner maintains its regulatory

38. Note that such equivalency agreements may often, including in the example of the US-EU Organic Equivalency Agreement, *de facto* include both the equivalence of product and production requirements and the recognition of conformity assessment procedures. In this case, the trading partners recognize that if a product or service can be on the market lawfully in one jurisdiction than it can be sold in the partner's jurisdiction. Nicolaidis and Shaffer (2005) in this context talk about "mutual recognition" as a contractual norm which pertains to the effective transfer of regulatory authority from the importing location to the home production location. In other words, mutual recognition allows to "safeguard" regulatory sovereignty but opening global markets.

39. Elsewhere, the terms equivalence and mutual recognition are used differently. For example, the SPS Agreement makes no distinction between recognizing product requirements and recognizing conformity assessment procedures (indeed, it does not use the term conformity assessment procedures, but refers to, among others, "testing, inspection, certification and approval procedures" as part of SPS measures (Annex A)), but covers both within the concept of "equivalence". This report uses the term "equivalence" in the context of product and production requirements, while "mutual recognition" refers to conformity assessment procedures.

40. While equivalence and mutual recognition may be partial, i.e. concern some of the requirements related to a specific product, such individual requirements may conceptually be separated. As a consequence, requirements are either equivalent or not, but they cannot be partially so.

sovereignty, it has no direct control over the continued implementation or amendments of the regulations in the trade partner.

Under equivalence, the importing country accepts that imported products do not comply with its preferred domestic regulation. This deviation creates an economic loss to the importing country. To the degree the regulations in the two countries are indeed equally adapted to achieving the importing country's regulatory objectives (e.g. the protection of consumers' health, the avoidance of invasive pests or insect species), such losses may be very small or nil. In the specific case of vertical regulations, where the exporter has a regulation that is more stringent than that of the importer, no such losses are faced by the importing country as indeed the exporter's regulation can be seen to "overachieve" its own regulatory objectives. In that case, the importing country could unilaterally recognize the exporting country's regulation as equivalent to its own.

Negative domestic effects may also include the potential confusion of consumers and industry users of the imported product as to whether a product used complies with the domestic or an equivalent regulation. Pelkmans (2012a) identifies a number of other potential costs related to recognition of regulatory requirements⁴¹ in the context of the internal market of the European Union. Depending on how it is implemented, economic agents may not always be sufficiently aware of, and clear about, which regulations are recognised to be equivalent. Identifying the (parts of the) the regulations that are deemed equivalent can be tedious and hence grey areas risk to remain. In addition, if the importing country's authorities refuse market access of products not matching local regulatory requirements, the enforcement of rights for business may be costly, time consuming and potentially damaging for a firms' reputation in the foreign market.

In sum, the net effects for an importing country are not known *a priori* – they may be positive or negative, depending on the relative size of domestic versus trade cost effects. As a consequence, any decision for them is a trade-off just as decisions in favour of regulatory convergence are. At the same time, the exporting country necessarily benefits from its regulations being recognised by the importing country as equivalent, as heterogeneity-related trade costs are reduced. As a consequence, mutuality will generally improve the outcomes notably if trade flows are bi-directional. In this case, equivalence is hence more likely than if considered unilaterally.

Given these costs, equivalence of product and production requirements can be efficiently pursued under specific conditions. Due to the required agreement on regulatory objectives, equivalency agreements are more likely to be achieved in well-defined areas, such as organic food, or between countries with similar regulatory approaches, e.g. due to similar political histories.

Conformity assessment procedures

So far, this report has looked at the convergence of product and production requirements, also referred to as "rules" (Sykes, 1995, as quoted by Veggeland and Elvestad, 2004). A second key element concerns conformity assessment procedures, i.e. conditions related to demonstrating that a product or service actually meets the requirements of the importing country.

Differences in conformity assessment procedures between exporting and importing countries, just like differences in product and production requirements, can generate significant additional costs for traders. In order to analyse such costs, this report makes a distinction between two broad questions related to conformity assessment. These include:

- What needs to be done in order to demonstrate compliance with technical regulations or standards? This includes issues such as methods to be applied for testing, examination and inspection, including requirements related to sample sizes, documentation.

41. What Pelkmans refers to as mutual recognition relates to product and production requirements and hence, in the definitions of this report, falls under equivalence.

- Who should be charged with the provision of such demonstration? This relates among others to the different types of conformity assessments, accreditation of conformity assessment bodies and recognition of accreditation bodies.

This distinction is motivated by the fact that the analysis of the two questions requires different approaches. Broadly speaking, the first question is of a technical nature that can be addressed by evidence— although in practice other factors play roles as well such as historical pathways and views. In principle, however, testing methods can be shown to be more or less appropriate for demonstrating compliance with a given requirement. Together with possible cost considerations, such appropriateness should therefore drive the choice between alternative methods. The following sub-section will look at this question and ways to reduce trade costs related to it.

In contrast, the second question is strongly related to the perceived risks related to erroneous certificates of compliance. The degree to which a country accepts a move away from its preferred conformity assessment requirements for imported good in exchange for reduced trade costs will depend on three factors:⁴² the (perceived or experienced) probability of erroneous certificates of compliance, the expected damage non-compliant imports do to the society, and the degree of risk aversion. In addition to a static assessment of such risks, a dynamic dimension can be added: as in a “repeated game”, the importing country should account for the trade history when setting conformity assessment requirements (WTO, 2004). Positive experience may therefore lead to less costly requirements. In contrast, an importing country will respond to erroneous certificates with more restrictive conformity assessment requirements as well as with direct sanctions for producing erroneous certificates. The subsequent sub-section analyses questions related to such risks.

The “what” in conformity assessment procedures

Conformity assessment involves a large number of methods which depend on the characteristics of products as well as the product or production requirements. Such methods, also known as conformity assessment techniques (ISO/UNIDO, 2010: 29) include testing and inspection, audits of production facilities, and other activities aiming to determine the compliance of products or production processes with existing regulatory requirements.

In principle, conformity assessment methods should be considered less contentious than questions related to conformity assessment types, as the methods are meant to provide objective measurements of a product. Evidence, including scientific evidence, therefore arguably plays a bigger role than countries' preferences. The elimination of testing redundancies by reducing the heterogeneity in conformity assessment techniques would therefore seem to be comparatively easy. Where preferences for diverging but equally appropriate methods persist, countries could, in principle, recognize different assessment methods as equivalent to their own, potentially by accepted conversion across such methods.

Nonetheless, testing requirements and in particular the imposition of different types of tests for different markets were identified as relevant trade barriers in a survey of conformity assessment bodies across OECD countries (Fliess and Schonfeld, 2006; AFGC, 2015).

In analogy to the product and production requirements discussed above, and provided that methods in question are indeed appropriate for verifying the compliance with a given product or production requirement, the requirements on conformity assessment methods may be considered “horizontal” with little benefits arising from the application of one method rather than another one. In the extreme case, one method is identified as the most suitable, resulting in the absence of reasons for a deviating one. As a consequence, the situation can be represented as in Figure 4. Countries can avoid unnecessary trade costs by harmonizing their conformity assessment procedures to that

42. In preparation of the fourth triennial review, the WTO TBT Committee (WTO, 2005) lists four elements to be considered when deciding on the type of conformity assessment procedures. These include: a) the incentives for producers; these will be dealt with further below; b) the level of risk, decomposed here into the potential damage and the country's risk aversion; c) the costs, which here are contrasted with the domestic effects; and d) the specific characteristics of the sector, which here are subsumed in the potential damage.

most suitable set of methods. If different methods are found to be equally suitable yet preferences differ across countries, the mutual acceptance of each other's methods would provide for equally reduced trade costs (see section on equivalence and mutual recognition below).

The "who" in conformity assessment procedures: Balancing costs with confidence

Different types of conformity assessment can create very different costs. For instance, the self-declaration of conformity is established and signed by the producer or supplier without the involvement of a third party. This type of conformity assessment may allow for additional flexibility in the firms' choice between testing laboratories if tests are required,⁴³ since this choice can rest with the supplier or manufacturer. While the verification of conformity will still require the appropriate testing, inspection or other methods, not having to resort to (accredited) conformity assessment bodies will often yield significant cost savings. In turn, third party conformity assessment and certification may add costs, notably if some or all of the testing and inspection is done by the exporting firm in any case to ensure the required product characteristics. Furthermore, if samples need to be sent to the destination country as only certificates from conformity assessment bodies there are accepted by the importing country's regulator, costs further increase both in monetary and other terms.

On the other hand, these different types of conformity assessment may be perceived by importers as providing different levels of certainty about the certified products. As regulators have no direct control over individual exporting firms, self-declarations of conformity may be seen as less reliable (i.e. with a higher probability of erroneous certificates). In contrast, conformity assessment bodies accredited by the importing country's accreditation bodies are at least indirectly controlled and hence perceived to provide more reliable and trustworthy certificates.⁴⁴

If there is a lack of confidence in the conformity assessment bodies across countries, again the situation is analogue to that of horizontal regulations, but with significant domestic effects, as represented in Figure 3 or even Figure 4. In contrast to the product and production requirements, however, no partial convergence is possible. Conformity assessment generally has to be done in the origin or destination country. Given the significance of domestic effects (due to the lack of confidence), a common approach avoiding additional trade costs is unlikely, although assessments in third countries are possible if conformity assessment bodies there are accredited by the importing country.⁴⁵

On the other hand, if one country is known to have more reliable conformity assessment procedures (i.e. the probability of erroneous certificates of conformity is particularly low), the other country may have sufficient confidence to unilaterally accept its results. This would be similar to "vertical" regulations, with lower or zero additional trade costs for exports from the first to the second country.

43. Requirements for SDoCs may or may not include the need to have products tested by third-party laboratories, or to register laboratory equipment if such testing is done in-house (WTO, Committee of Participants on the Expansion of Trade in Information Technology Products, 2005; Fliess et al., 2008).

44. In total, three types of conformity assessment procedures are distinguished, including 1st-party (i.e. self-declaration), 2nd-party (i.e. assessment by the buyer) and 3rd-party assessment (i.e. assessment by an independent body). Public decisions on conformity assessment procedures focus on 1st-party and 3rd-party assessments, while 2nd-party assessments have their relevance mainly in privately organised business-to-business relationships. This report therefore does not discuss 2nd-party conformity assessment procedures.

45. An exception to this may be the accreditation of laboratories and certification bodies, for which international accreditation agreements exist and could be extended. These include the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Agreement and the International Accreditation Forum (IAF) Mutual Recognition Arrangement. These agreements allow for an accreditation of laboratories and certification bodies at an international level, which then is accepted by signatory countries.

Conformity assessment costs: The space for trade cost reductions

The space for reductions in conformity assessment procedures generally spans three dimensions: first, by harmonizing or recognizing testing methods; second, by having an increasingly large part (or all) of the conformity assessment procedure done in the exporting country or even by the supplier itself;⁴⁶ and third by moving the authority of accreditation to the exporting country's accreditation body (or even waiving the obligation of conformity assessment bodies to be accredited). The relative magnitude of cost savings in each of these dimensions generally differs from case to case in function of the product and requirements considered, proximity, common language and other similarities between exporting and importing countries, etc.

This section focusses on the two latter dimensions, i.e. the localisation of conformity assessment activities and the accreditation of conformity assessment bodies. For simplification, the discussion particularly concentrates on the localisation, although the same arguments can be made in the context of accreditation systems. As indicated, both moving the conformity assessment activity closer to the supplier and moving the authority of accreditation to the exporting country will reduce costs, while at the same time reducing the importing country's direct control. Looking at both dimensions in parallel, however, complicates the argument by no longer permitting to assign a clear order to the list of options.

At the practical level, conformity assessment procedures generally involve two distinct agents or bodies, and costs arise at each of these steps. In particular, these include the sampling and testing in a laboratory (or inspection of production facilities), and the establishment of the required certificates, based on the test or inspection results and the requirements of the targeted market, by a certification body. At the accreditation level, several other layers are involved, including the accreditation of laboratories, certification and other conformity assessment bodies by the accreditation body and the peer review across conformity assessment bodies; and the peer review across accreditation bodies.⁴⁷ Figure 17 shows a stylised scale of declining conformity assessment costs depending on the importer's conformity assessment procedures.

At each of these levels, confidence is critical, and duplication of efforts – and hence of costs – may result if confidence is not sufficient. In principle, insufficient confidence results in the conformity assessment to be undertaken for and in each country targeted by the exporting firm, generally including its home country. In addition, costs may arise from shipping samples to the destination country for testing, as well as in terms of additional delays arising from both this shipment and the additional conformity assessment (“time-to-market”). In consequence, such a “Least-Acceptance” conformity assessment system (first column in Figure 17) generates significant duplication and, hence, costs likely hampering trade.

Depending on the level of confidence, however, the importing country may accept parts of all of the conformity assessment procedure to be undertaken in the exporting country and under the control of its authorities. A first step towards a reduction of conformity assessment costs could be for an importing country to accept tests undertaken by a laboratory in the exporting country, accredited by the importing country's authority (second column of Figure 17). Key savings would be related to the avoidance of shipping samples to the destination country for testing, involving both expenditures and delays, although the certification by a body in the importing country may cost some additional time if testing is done in the exporting country. The laboratory, which could be accredited by other partner countries as well in addition to the exporting country, would ideally perform all tests required to confirm compliance of a product with the regulations of target countries. The testing done within

46. Conformity assessment costs comprise a variety of expenses, and some of those that firms may incur in the case of suppliers' declarations of conformity, such as internal testing facilities, the engagement of technical experts or additional staffing, may not apply in the case of third-party assessments. Given that firms generally choose the most cost efficient option available, restricting such options away from the supplier will, on average, result in higher costs.

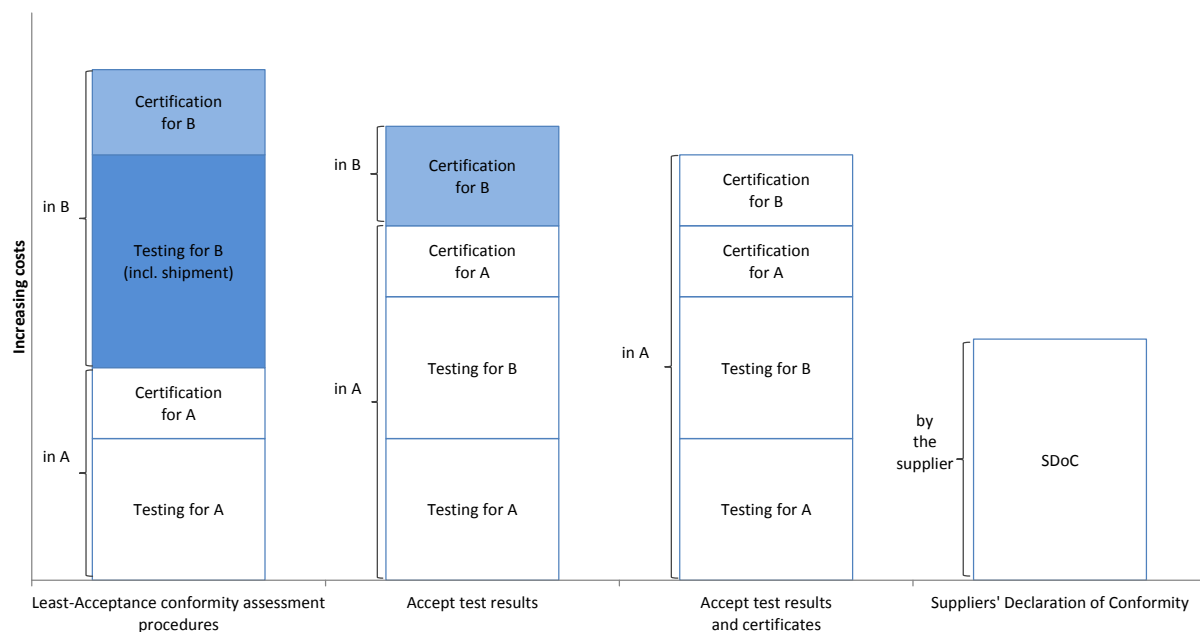
47. The list may additionally include the countries' metrological institutions which ensure precision and reliability of the laboratories' measurements.

the exporting country and accepted for certification by the importing country is also referred to as “off-shore testing”.

In addition, laboratories and other testing facilities may no longer need the explicit accreditation by the importing countries' bodies, but could be accredited by the exporting countries accreditation body and recognised by the importing country. In the extreme case, accreditation of the laboratory may not be required at all. Both of these simplifications would directly reduce or eliminate accreditation costs originally born by the laboratories, but as such costs are generally included in the fees charged to firms, trade costs would be reduced in the end.

A second step would be for the importing country to accept conformity certificates established by certification bodies (CBs) in the exporting country (third column of Figure 17).⁴⁸ This again could either mean that the CBs are accredited by the importing country or by the exporting country. Given that the CB in the exporting country could establish certificates valid for different markets, cost reductions may related to simplified administrative procedures as well as gains in processing time. To the degree a single certificate is valid in several destination markets (including the home market), this would lead to further cost reductions as the number of certificates required by suppliers would decline.

Figure 17. Trade costs of conformity assessment procedures



Note: Countries A and B refer to the exporter and importer, respectively. The location of the individual conformity assessment elements is represented by different shadings: white (in the exporting country A) and blue (in the importing country B).

48. For instance, the Comprehensive Economic and Trade Agreement (CETA, http://trade.ec.europa.eu/doclib/docs/2016/february/tradoc_154329.pdf) between Canada and the European Union includes the Protocol on the mutual acceptance of the results of conformity assessment. Building on the Mutual Recognition Agreement of 1998, the Protocol allows European certification bodies to certify EU products from an extended list of sectors including, for example, toys according to the rules in conformity with the Canadian market (and vice-versa).

Finally, importing countries may not require certificates established by accredited conformity assessment bodies at all. Instead, they may rely on declarations made by the producer or supplier, so-called Suppliers' Declarations of Conformity (SDoCs, last column of Figure 17). As firms generally verify their products' quality and characteristics in their own interest, avoiding the need to add a third-party certificate for showing compliance with the importing country's requirements can further reduce costs, both monetary, in terms of flexibility (adaptable more easily to design changes and innovative approaches) and in terms of time-to-market (including its reduced variability).

Domestic costs of less “rigid” conformity assessment systems

Conformity assessment procedures essentially are about the generation of confidence in products complying with the relevant regulations. Put differently, regulators aim to reduce the *perceived certainty-equivalent damage* of non-compliant products in their country's market. This perceived certainty-equivalent damage can be interpreted as a function of three distinct factors:

- the perceived probability of a marketed product not being compliant,
- the (estimated) damage of a non-compliant product to the society's wellbeing, and
- the level of risk aversion in the society (as represented by the regulator).

The choice of the conformity assessment system directly affects the first of these factors, but has little (if any) effect on the other two. The damage of a non-compliant product mainly depends on the product in question and the specifics of the regulation, including the market imperfection addressed. For simplicity, and as the level of risk aversion can be seen as an exogenous factor to the decision making process, the rest of this section will subsume it into the perceived probability of non-compliance.

In general, the perceived probability of non-compliance is increasing as the regulator shifts the conformity assessment procedure from Least-Acceptance CAP (i.e. relying only on its own 3rd-party conformity assessment bodies) towards more co-operative forms, along the horizontal axis of Figure 17. Conversely, the level of confidence is likely to increase as a regulator moves from the SDoC to a 3rd-party conformity assessment and hence further to the left in Figure 17.⁴⁹ As discussed above, this ordering with respect to probabilities of non-compliance (or confidence) does not include the option of harmonized or recognized testing methods.

The choice between conformity assessment systems

Based on the conformity assessment systems identified in Figure 17, including least-acceptance, the acceptance of test results, the acceptance of certificates (including the test results) and the acceptance of suppliers' declarations of conformity (SDoCs), and assuming that the rankings with respect to conformity assessment costs and probabilities of erroneous certificates are as discussed above, the regulator will have to choose the system that maximizes the country's welfare.

Let T_i be the benefits from reducing conformity assessment related trade costs by choosing a conformity assessment system i ($i \in \{\text{acceptance of test results, acceptance of certificates, SDoC}\}$) rather than the Least-Acceptance CAP. Similarly, let p_i be the associated increase in the probability of erroneous certificates. Finally, let D_g be the valued damage of non-compliant goods g entering the importer's market. In analogy to the case of product and production requirements above, a net welfare effect W_i can then be defined as $W_i = T_i - p_i \cdot D_g$.⁵⁰

49. See for instance IEC (undated).

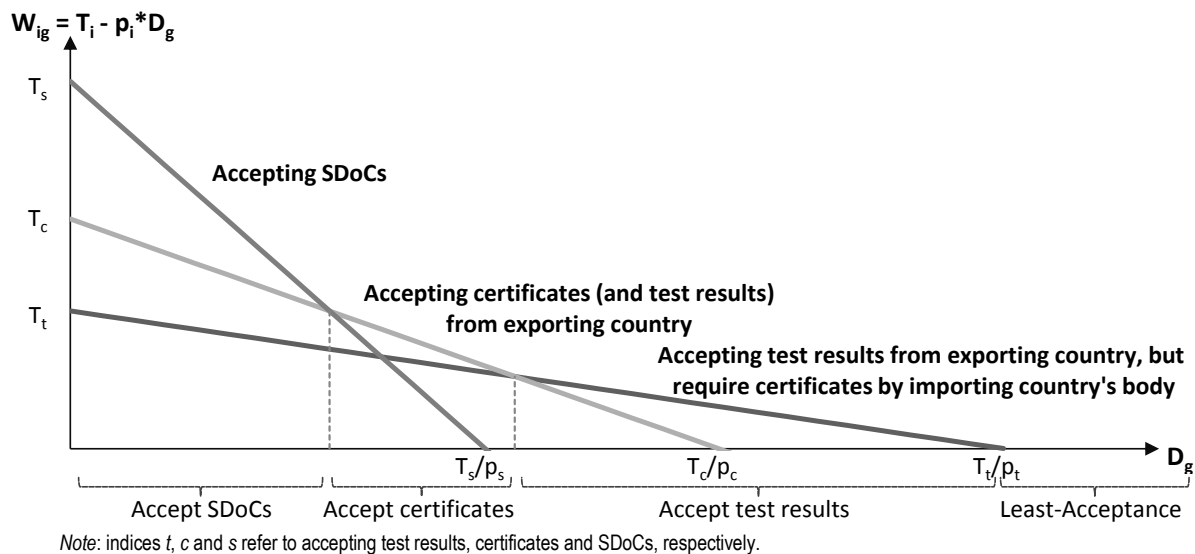
50. As noted above, the level of risk aversion also affects the net welfare function, but is assumed to be integrated in the given equation as p is assumed to represent an effective perceived probability, and hence $p \cdot D$ represents the perceived certainty-equivalent risk of non-compliant goods.

The problem faced by the regulator is hence to choose the conformity assessment system that maximizes this net welfare gain. Without any differences in perceived probabilities of erroneous certificates (i.e. if all p_i were zero), or if non-compliant products would generate no damage at all (i.e. $D_g = 0$), the choice would be entirely based on trade costs, with the least costly option to be chosen, as it would maximize the welfare benefits. By assumption above, therefore, the regulator would accept SDoCs. Similarly, without differences in costs, the regulator would choose the system with the lowest perceived probability of erroneous certificates, which by assumption is the Least-Acceptance CAP approach of all testing and certification being done in (and under accreditation of) the importing country. Given that both costs and perceived probabilities differ across conformity assessment systems.

Figure 18 presents this problem graphically, with the horizontal axis showing the good-specific damage non-compliant products on the market would generate. In turn, the vertical axis shows the net welfare benefit from using a conformity assessment system other than the least-acceptance one not based on co-operation. The intercepts of the individual lines with the vertical axis correspond to the reduction in trade costs (i.e. the welfare effects of lower conformity assessment costs), whereas the (negative) slopes of the lines correspond to the increase in probability of erroneous certificates.

As visible in Figure 18, the choice of the best conformity assessment depends on the damage that a non-compliant product would generate when erroneously admitted to the market. For products with a potentially high level of damage to the society, a Least-Acceptance CAP approach involving testing and certification by accredited bodies within the importing country is optimal, whereas less problematic goods would allow for less costly options. Products with the lowest potential damage would optimally be declared as compliant by the supplier, as the least-cost option.⁵¹

Figure 18. Net benefits of switching to alternative conformity assessment systems in international trade



51. In the regulatory process, the choice between accepting SDoCs and requiring certificates affects domestic producers as well as foreign suppliers and is of a more general nature, while the decision on where tests and certificates should be established is relevant mainly for international trade. The representation here abstracts from this additional complexity by combining the two decision levels from the perspective of international trade only.

The potential damage D_g of non-compliant products entering the market strongly depends on the products' characteristics and use (for instance, highly perishable food products have a greater inherent probability of posing a health risk to consumers than non-perishable ones). Market surveillance can, however, reduce such risks, as the damage of non-compliant products that did enter the market becomes less likely to materialize.⁵² In consequence, enhanced market surveillance both by public authorities and by private business (e.g. in supermarkets) can help to mitigate the potential damage and may hence offer opportunities to switch to less rigid conformity assessment systems involving lower trade costs. On the other hand, the less third-party conformity assessment bodies that are accredited by the importing country are involved, the greater the need is for well-functioning market surveillance and remedial actions in case of non-compliance. International co-operation in the field of market surveillance may further improve the efficiency of national efforts, e.g. by exchanging information, hence reducing the need for more expensive conformity assessment systems.

The perceived probability of erroneous certificates of compliance also has direct implications for the optimal choice of conformity assessment systems, as visible in Figure 18. A lower probability, equivalent to a greater reliability of the conformity assessment system, flattens the curves shown, thus reducing the need for more rigid conformity assessment systems in favour of less costly ones. If probabilities were not different between the systems (i.e. $p_i = 0$ for all i) the lines shown would become horizontal, and the least costly system would become optimal, saving T_i in losses compared to a Least-Acceptance CAP solution. The other extreme is defined by a situation in which the Least-Acceptance CAP is failure-proof while an alternative system is unable to discriminate between compliant and non-compliant products (a perfectly unreliable system, i.e., $p_i = 1$ for some i). In that case, the net benefits of switching to that alternative system would be $W_{ig} = T_i - D_g$, i.e. the alternative system would only be an option if the gains from reduced trade costs exceed the damage of non-compliant goods on the market.⁵³

In addition to the specifics of different conformity assessment systems, the perceived probability of erroneous certificates may also be linked to the institutional setting in an exporting country or firm. As a consequence, regulators in an importing country may view a conformity assessment undertaken by some exporting countries as better as or more reliable than those undertaken by others.⁵⁴ In particular, such views may be based on historical performance of the conformity assessment system, the degree of transparency and verifiability. For exports from a more reliable country, the lines in Figure 18 would be flatter than depicted, suggesting that less costly conformity assessment systems could be acceptable even for more "dangerous" products. Conversely, if the regulator has less confidence in the exporter, the lines in Figure 18 would be steeper, narrowing the space for less costly systems. While an importer cannot discriminate between domestic and foreign

52. An example of integrated market surveillance is the EU Rapid Alert System for non-food dangerous products (RAPEX) to ensure product safety and alert among 31 European countries and the European Commission. When a product is identified as dangerous after investigation, either the business or the national authority can recall, withdraw the product from the market or issue warnings. Under the RAPEX, the EU has also engaged into bilateral and trilateral co-operation to ensure surveillance and product safety. For example, the EU-China Regulatory Cooperation Framework focuses on product safety. See http://ec.europa.eu/consumers/consumers_safety/safety_products/rapex/index_en.htm for more details.

53. As such a system would offer no benefits over no conformity assessment procedure at all, it remains without practical relevance.

54. Algebraically, this could be represented by extending the above model to include an additional country specific factor p_c , such that $W_{ig} = T_i - p_i p_c D_g$. This additional factor potentially scales the perceived probability of erroneous certificates up or down depending on the general level of confidence with respect to the certificates of a given country (including SDoCs). A value of $p_c > 1$ would reduce the overall perceived probability of erroneous certificates, making it less different from a non-cooperative conformity assessment system; a very large p_c would imply that certificates from the exporting country receive no less confidence than a full 3rd-party conformity assessment within and under the control of the importing country, so that the cheapest system (i.e. the system with the largest trade cost gain T_i) would be chosen. A value of $p_c = 1$ would imply that $W_{ig} = T_i - p_i D_g$ as before, while a value of $p_c < 1$ implies less confidence: if $p_c = 0$, the importer would have no confidence at all in the exporter's system.

suppliers, nor between suppliers from different foreign countries (other than from within and outside FTAs), the experience with the conformity assessment systems of partner countries may have direct implications for the accreditation of partner country conformity assessment bodies by the importer, or for co-operation between countries' accreditation bodies.

Mutual recognition of conformity assessment procedures

As mentioned above, Mutual Recognition Agreements (MRAs) are international agreements by which two or more countries accept each other's conformity assessments as sufficient for complying with their own conformity assessment requirements. MRAs often relate to the conformity assessment of goods, most frequently for specific sectors (e.g. the Electrical and Electronic Equipment Mutual Recognition Arrangement, EEE MRA, an annex to the New Zealand-China Free Trade Agreement; the Food Safety Systems Recognition Arrangement between the US Food and Drug Administration, the Canadian Food Inspection Agency and the Department of Health of Canada⁵⁵), but may also have a broader coverage (e.g. the ILAC Mutual Recognition Arrangement⁵⁶). However, a number of countries have established (bilateral) MRAs to enhance the free movement of services, or of professionals for providing their services in partner countries; for instance, the (North American) International Qualifications Appraisal Board IQAB has established MRAs for accountants with corresponding bodies in Canada, Mexico and a number of other countries.⁵⁷

MRAs can help to reduce conformity assessment costs by allowing exporters to rely on their own countries conformity assessment bodies, thereby avoiding duplications in laboratory testing, shipment of samples to the destination country's bodies and related costs in expenditures and time delays.

Implications for IRC

Conformity assessment aims to generate confidence in products complying with the regulations that apply to the destination market. While different conformity assessment systems generate different costs that eventually can hamper trade, they often provide different levels of confidence to the import market. To a large extent, greater confidence comes at higher trade costs. The regulator therefore needs to choose the optimal conformity assessment system that maximises national welfare.

If the costs of different conformity assessment systems are given by technology, the administrative infrastructure and other factors that cannot be influenced by the regulator, the choice largely depends on two factors: the potential damage of non-compliant products if erroneously admitted to the market, and the perceived probability of this happening. International co-operation can play a role to reduce both, thus offering opportunities to reduce trade costs by choosing less costly conformity assessment systems.

Options to reduce the damage non-compliant products can generate are multi-fold and often depend on the characteristics of both the product and the threat addressed by the regulation. They include, among others:

- effective liability laws, including their enforceability along the supply chains and across borders;
- education of consumers and the provision of product- and risk-specific information;
- market surveillance, including co-operation of market surveillance agencies across countries, and involving public and private agents as appropriate.

55. <http://inspection.gc.ca/food/safe-food-production-systems/recognition-arrangement/eng/1461855282008/1461855380043>.

56. <http://ilac.org/ilac-mra-and-signatories/>.

57. <https://nasba.org/international/mra/>.

An increase of the confidence in foreign conformity assessment bodies can come through three distinct channels: first, the likelihood of erroneous certificates can be reduced through an improvement of the technical and administrative conformity assessment infrastructure of the exporting country. Capacity-building, technical assistance and exchange of best-practices in testing, inspection and certification can be important elements in this respect.

Second, this probability can also be reduced through adequate incentive structures that deter firms from moral hazard. While much of the discussion above remains static in nature, real-life regulatory decisions, their impact on trade as well as their being motivated by trade, are dynamic. Confidence in foreign conformity assessment bodies or firms thus also includes the consistency in how conformity assessment procedures are applied over time. As a consequence, decisions on the required conformity assessment system for a given product requirement have to be seen in a repeated game context, in which decisions by market players – in particular exporting firms in partner countries – may not always be foreseeable. To avoid moral hazard, regulators in the importing country need to dispose of sufficient control as well as sanctioning systems that allow penalizing non-compliance. Appropriate market surveillance is therefore as important as an exchange of information between market surveillance agencies. In addition, sanctioning may come in the form of liability of firms, as well as by the possibility of making conformity assessment procedures more rigid.

Third, enhanced co-operation and transparency between countries' regulators, accreditation and conformity assessment bodies may allow an importing country's regulator to more adequately judge the exporter's capacity to ensure a well-functioning conformity assessment. Accreditation through international agreements and the application of internationally accepted conformity assessment procedures (e.g. in terms of data and documentation requirements) may further increase confidence.

Finally, for trade costs related to conformity assessment systems, while the requirements imposed by the destination country can make a great difference in conformity assessment costs incurred by exporters, the heterogeneity in conformity assessment systems between home and destination market is not a cost determining factor on its own. For any trade flows from one country A to another country B, the conformity assessment system imposed by the home country A has no specific effect on the trade costs. In turn, irrespective of the system applied by country A, a less restrictive system imposed by the destination country B reduces trade costs. This makes conformity assessment costs fundamentally different from specification costs which may independently depend on both the level of regulatory requirements and their differences between home and destination market.

Information costs for economic agents

Information costs constitute an integral and non-negligible part of the costs of international trade (Gray, 1976, p. 25). Next to specification and conformity assessment costs, finding the relevant information on the requirements for exports to foreign markets represents the third important source of trade costs related to regulations in the destination country. In order to respond to regulatory requirements, firms need to have full information about them. Correspondingly, firms aiming to place their products on different markets, including for example their home market and export markets, require information on a multitude of regulations. Related costs for firms can include staff time or third-party services for finding and interpreting relevant information from official and other documents (online or offline) in destination countries, including their translation if available only in a language foreign to the firm. In addition, complexity in rules and conformity assessment procedures may result in incomplete or misunderstood information on relevant requirements, increasing the risk of non-compliance of products and hence non-entry to the destination market.

Information-related trade costs (information costs) related to both product and production requirements (rules) and conformity assessment procedures (Figure 1) can be affected by a range of different co-operative actions. Even in the case of fully harmonised regulations, information costs for exports to the destination market are not zero unless harmonisation is broad enough in coverage so that exporters can take the equality of regulatory requirements between home and destination

market for granted. Nonetheless, information costs tend to become exacerbated with regulatory heterogeneity.

Regulatory heterogeneity is likely to add information costs in two distinct ways: first, costs for finding and processing relevant regulatory information may increase as requirements for the export market differ from those for the home market. Similar to specification costs, these information costs may contain *discontinuous* elements: already small deviations in regulatory requirements generate the necessity for careful collection and processing of detailed information. More precisely, this necessity arises unless there is explicit clarity about the equality between regulations in home and export markets. On the other hand, greater differences in regulations arguably also raise information requirements if the increased heterogeneity results in more complexity of details, generating a cost element that grows *continuously* with heterogeneity. Second, the risk of basing export decision on incomplete or misunderstood information on the regulatory requirements may increase with the distance between the two regulations, causing non-compliance and non-entry to the destination market. This, too, tends to increase costs in a *continuous* manner.

Co-operative approaches to reduce information costs in international trade therefore can be grouped in two general categories. First, IRC initiatives reducing regulatory heterogeneity also diminish the requirements of trading firms for regulatory information. Similarly, the recognition of equivalence of rules may eliminate the need for foreign firms to obtain detailed information on the destination market's regulations. Second, joint efforts to improve the dissemination of required information on regulatory differences further reduce the costs of accessing and processing it. The following sections discuss, respectively, the implications that regulatory convergence or harmonisation, the recognition of equivalence or mutual recognition, and improved dissemination of information can have on information costs.

Convergence and harmonisation of rules and conformity assessment procedures

Heterogeneity in rules and conformity assessment procedures across different home and export markets creates additional information requirements and, hence, costs to producers and traders. In the context of *requirements for products and production processes*, these information costs add to specification costs which are generated by the same differences in regulations. As for specification costs, the information costs may be discontinuous or increase continuously with the regulatory heterogeneity. Generally, information costs apply where specification costs do, i.e. in both directions of trade for horizontal regulations and for exports to a more stringently regulating country for vertical ones, although even for vertical regulations differences alone between countries may generate perceived uncertainty as to which requirements apply, and a corresponding need for more detailed information.

As such, the analysis undertaken above is altered essentially in terms of the relative magnitude of the trade cost effects, and adds a horizontal cost element to vertical regulations. In particular, considering the indifference curves which connect combinations of regulations in countries A and B that generate the same net welfare for country A as shown in Figure 3, the additional existence of information costs will modify these indifference curves towards those densely grouped along the 45 degree line (Figure 5). As a consequence, and all other factors being equal, the explicit consideration of information costs moves both the “Partial Information” point and the Nash equilibrium shown in Figure 7 closer to that 45 degree line, suggesting a higher degree of regulatory convergence to be optimal than what would be the case with specification costs only. The additional information costs also move the Pareto set (Figure 8) closer to the 45 degree line, i.e. the countries participating in IRC have a greater interest in converging their regulations, and the result will be less heterogeneity across participating countries. Finally, this also holds for any negotiated outcome aiming to maximise joint welfare.

Information costs related to *conformity assessment procedures* are similar to those information costs related to product and production requirements (rules): differences in conformity assessment procedures and in particular in requirements related to third-party assessment and certification generate the need for detailed information on these requirements for destination markets. As such,

the economics of information costs are quite different from those of conformity assessment costs discussed above.

Equivalence and mutual recognition

Equivalence and mutual recognition imply, respectively, that products compliant with the home country's regulations or certified by the home country's conformity assessment bodies can be shipped to and placed in the export market without further requirements with respect to rules or conformity assessment procedures. In principle, such agreements therefore substantially reduce the need for suppliers to collect and process detailed information on the destination country's regulatory requirements: while differences in rules or conformity assessment procedures may persist, the details of regulations in the destination country no longer matter for the exporter's access to that country's market.

As noted in the context of specification costs, however, this requires that suppliers are fully informed about which (parts of) regulations or conformity assessment procedures are recognised by the partner country. Particularly in cases of partial equivalence or recognition agreements, firms need to find out what exactly is covered.

Whether and to what degree costs for finding information on the coverage of equivalence or mutual recognition agreements may reduce the benefits of such agreements in terms of information costs is an empirical question that will depend on the details of the agreement. While the costs of finding and processing the information on the requirements for accessing the export market arguably decrease continuously as the coverage of such agreements becomes broader, this may theoretically be true for the costs of finding and processing the information on the coverage itself only from a certain coverage level. In principle, this could suggest that savings in information costs for exporting firms are generated only by equivalence or mutual recognition agreements exceeding a specific coverage, provided that below that coverage the identification of requirements that export products need to comply with is as costly as the identification of requirements for which requirements within the exporting country are recognised by the importing country.

Dissemination of regulation-related information to foreign firms

Given the exporter's need to know with which requirements to comply to make its products exportable to the destination market, the dissemination of related information has a key role to play for reducing trade costs to business. In this context, dissemination of regulation-related information refers to all public activities that help economic agents, such as producers and traders, to find, access and process information related to the requirements suppliers of export products have to comply with in order to access a given foreign market. This definition excludes activities exclusively undertaken by private agents, but includes any public involvement in, or assistance for, such activities, as this framework focuses on trade-related regulatory co-operation between governments. While closely related, it also distinguishes such dissemination of information from the *information sharing* among governments, a key element in reducing specification costs through regulatory convergence (Box 2). Note that the dissemination of information forms an important part of transparency, a term widely used in the context of good regulatory practice as well as in international agreements related to regulatory measures. In contrast to the dissemination of information, the concept of transparency is broader and in particular also includes notifications, stakeholder consultations and other processes *prior* to the adoption of new or amended regulation.

Dissemination of information in particular involves that information on rules and conformity assessment procedures are made available not just for domestic but also for foreign firms. This has a number of dimensions.⁵⁸

58. Other dimensions relate to domestic firms as much as for foreign firms, such as the timeliness and completeness of disseminated information – apart from the more general transparency requirements within good regulatory practices, including making draft regulations and related analysis available early in the regulatory process and inviting and considering comments from stakeholders.

- **Channel:** the information needs to be made available in a form that is accessible from outside the country. Given modern information technologies and notably the quasi-omnipresence of the internet this channel generally provides such access. In turn, the internet and other modern information technologies represent cost-efficient means for sharing information.
- **Location:** while information available online is widely accessible, it may be difficult to find the relevant information unless it is stored centrally and structured in a coherent manner. This may generate additional costs for the regulating country if more than one agency is involved in the regulatory process or if regulations differ within the country. Detail information should also be searchable within the central database.
- **Language:** information is generally published in the official language(s) of the jurisdiction concerned. Particularly if these are less common languages, this may create a major barrier for stakeholders of other countries. Providing regulatory information in additional and more commonly spoken languages may therefore significantly reduce information costs for foreign suppliers. Similarly, the use of "plain language" in published information also contributes to reducing costs for firms both within the regulating country and abroad. The provision of such information notably in additional languages generates, however, additional costs for the regulating administration.

Conceptually, the provision of details on regulatory requirements for accessing a country's market to foreign suppliers therefore generates costs to the regulating country, while creating benefits in terms of lower information costs which are originally borne by the foreign supplier. Economic theory suggests that information costs can often be considered as fixed costs. While it reduces foreign firms' profits from exporting to the regulated market and hence creates a disincentive for doing so, marginal costs are not affected.

The provision of regulation-related information to private stakeholders can be seen as an investment, with costs occurring after the adoption of a new or amended regulation, while the benefits arise over a (potentially long) period thereafter. However, a significant share of the negative effect of regulation-induced information costs is external; markets do not necessarily provide good outcomes to overcome the problem of information asymmetry. As such, finding the optimal level of transparency requires the internalisation of such costs or, as this is rarely possible, international co-operation.

Co-operation on transparency and the reduction of information costs takes different forms. The WTO Agreements on Sanitary and Phytosanitary Measures (SPS) and on Technical Barriers to Trade (TBT) require regulating countries to make draft regulations available at an early stage for comments from both domestic and foreign stakeholders, and to publish adopted regulations 'promptly' and in a way allowing interested members to become acquainted with them. Finally, each of the two agreements obliges each member countries to maintain an "enquiry point" responsible for the provision of reasonable questions from other member countries, and for the provision of relevant documents. The WTO also runs databases of SPS measures⁵⁹ and TBT measures⁶⁰ notified by member countries. Together with the World Bank, it also has developed the Integrated Trade Intelligence Portal (I-TIP), which allows for an "integrated analysis and retrieval of notified non-tariff measures"⁶¹ and is synchronised with the SPS and TBT databases.

The two WTO agreements mainly govern the exchange of information between WTO member countries on a government-to-government basis. The two databases allow private stakeholders to find information on TBT and SPS measures; they also provide the information in a centralized way and easily accessible. Information available in these databases is, however, limited to regulations

59. SPS Information Management System, <http://spsims.wto.org/>.

60. TBT Information Management System, <http://tbtims.wto.org/>.

61. <https://i-tip.wto.org/>.

notified by member countries, complemented by specific trade concerns, documents circulated at the WTO, enquiry points and other information. By encouraging member countries to provide translations for regulations be in one of the official languages of the WTO (English, French and Spanish), the databases also address, to some degree, the language problems notably for regulations published in less common languages. However, as Josling and Roberts (2011) noted for the SPS-IMS, notifications may not be sufficiently detailed to identify distinct regulatory measures, and the notification obligations only cover measures proposed after the SPS Agreement came into effect in 1995.

A second type of sources for regulatory trade barriers across countries and sectors includes joint efforts by several international organisations. For example, both the World Integrated Trade Solution (WITS⁶²) and the Trade Analysis and Information System (TRAINS⁶³) also include non-tariff measures. Information on regulatory trade restrictions in services trade can be found in the OECD Services Trade Restrictiveness Index (STRI) Regulatory Database.⁶⁴

Other databases on regulations relevant for trade in specific sectors are developed by the industry itself. For example, the FIVS-Abridge⁶⁵ database covers regulations relevant for the trade in wine in a searchable manner, and allows subscribing users to compare specific regulatory issues across markets.

Transparency could be further improved by benchmarking national regulations to international standards where these exist. As information requirements and related costs arise not mainly from the existence of rules and conformity assessment procedures, but to a significant extent from their differences across countries, stakeholders would benefit from an explicit acknowledgement of differences between national regulations and their international counterparts.⁶⁶

Finally, co-operation can directly improve the dissemination of regulatory information by involving the industry in IRC activities. Industry representatives from participating countries are in the position to liaise between governmental regulators within IRC initiatives and their member firms active or interested in exports, and provide the latter with required information on regulatory requirements in destination markets, collected within the co-operative process.

Implications for IRC

Information requirements, and hence information related trade costs, primarily arise from regulatory heterogeneity with respect to rules and conformity assessment procedures. Trade-related IRC aiming to reduce this heterogeneity or targeting mutual recognition and equivalence therefore also reduces information costs. The greater information costs are relative to other trade costs, the more the integration of information costs will strengthen incentives to reduce regulatory heterogeneity or to move towards agreements on equivalence or mutual recognition.

Information costs have a strong element of economies of scale: in most cases, they represent fixed costs that firms encounter independent of the quantity of products they wish to ship to a given destination market. This means that information costs are particularly burdensome for SMEs, but also for firms wishing to serve relatively small markets. Co-operative approaches to overcome information costs therefore have the potential to improve the overall efficiency of providing the relevant regulatory information to firms. This may involve central databases (held by International Organisations or the industry), some involvement of industry representatives in IRC initiatives, or the

62. <http://wits.worldbank.org/>.

63. <http://databank.worldbank.org/data/reports.aspx?source=UNCTAD---Trade-Analysis-Information-System-%28TRAINS%29>.

64. www.oecd.org/tad/services-trade/regulatory-database-services-trade-restrictiveness-index.htm.

65. www.fivs-abridge.com.

66. Such an acknowledgement may be more challenging in a dynamic setting, where international standards and similar benchmarks are amended over time.

channelling of information obtained in IRC processes through dedicated public agencies to the domestic industry.

As stated above, the involvement of firms and other stakeholders in IRC (by way of their direct implication or through regular stakeholder consultations) serves a double purpose by both informing the IRC process and national regulation setting, and transmitting relevant information on foreign regulations to the industry. Stakeholder consultations are widely recognised as a key element of good regulatory practice (OECD, 2012). They allow governments to both inform the public about regulatory activities and receive input from industry and civil society essential for the appropriate design of regulations. The participation of stakeholders in IRC initiatives can help on both fronts as well. Both regular stakeholder consultations and their involvement in IRC initiatives can increase the incentives for governments and stakeholders to maintain a high level of interaction throughout the regulatory process and the free flow of information. Governments in co-operation with the private sector need to establish the institutions and infrastructure required to ensure this continued involvement.

IRC implications for third-country trade

If IRC efforts focus on a limited set of countries (e.g. on a bilateral basis or in the context of RTAs) rather than a multilateral setting (e.g. at the WTO), effects on trade and trade costs may be different for trade between the participating countries from those for trade with third ones. Two effects can be distinguished: price effects and cost effects.

Given the reduction in trade costs between participating countries, prices for imported products and, in consequence, of domestic ones are likely to decrease in the importing market, be it due to lower marginal costs or due to greater competition, or both.⁶⁷ Exporters from third countries will likely respond to lower prices by reducing their supplies to that market. In addition, less profitable firms may find it difficult to continue their presence in this more competitive market. Both effects result in reduced imports from third countries, partially offsetting some of the trade enhancing effects the IRC efforts are targeting in the first place (trade diversion).

A second and less straightforward impact on third-country trade arises from potential changes in their trade costs. For instance, if product requirements across participating countries converge or are harmonised, this will generally affect the “distance” between those requirements and the ones regulated in third countries and, hence, the resulting trade costs.

The direction and magnitude of these changes in third-country trade costs⁶⁸ will depend on a number of factors. First, for such costs to be affected, the IRC mechanism needs to result in changes to the participating countries' regulations. If no changes are made to a country B's regulation (e.g. because it is very large relative to the IRC partner countries and hence effectively acts as a standard setter, or due to IRC mechanisms that do not require regulatory changes at all), trade costs between that and any third country will not change.

Second, benefits of the IRC mechanism may be non-exclusive, e.g. in the case of improvements in the generation and communication of relevant information to trading firms. Simplifications in conformity assessment procedures often also apply to third countries due to the general principle of non-discrimination, e.g. a move towards the acceptance of Suppliers' Declarations of Conformity. To the degree exporters from third countries can enjoy the same benefits, this will reduce trade costs for related flows as well, further increasing the overall welfare improvements for participating countries as identified above.

67. See the section on fixed versus variable trade costs above.

68. For convenience, the term “third-country trade costs” refers to heterogeneity-related trade costs between countries participating in a given IRC mechanism and third countries, excluding trade costs among third countries which, a priori, are unaffected.

Third, where requirements from regulations in participating countries do change, e.g. through joint development or harmonization, the impact on trade with third country trade partners will depend on what their regulations require relative to those of the participating countries. Changes in these trade costs can, *a priori*, be of either size. In the basic case of horizontal regulations with continuous trade costs discussed above, third-country trade costs will increase if the IRC mechanism results in greater distance in regulations. In contrast, if the IRC mechanism results in a reduced distance in regulations between a participating country and a third one, third-country trade costs will decline.

Changes to third-country trade costs have consequences for both participating and third countries' economic welfare. Such indirect effects on participating countries' welfare in particular will need to be factored in any decision that might arise from the IRC effort. The importance of such indirect effects will generally be larger if the IRC effort excludes key trade partners of one or several participating countries. An example may be IRC efforts between neighbouring but comparatively small countries which have important trade links with larger and more distant markets. With third countries sufficiently important, it is conceivable that positive welfare effects from lower trade costs across participating countries are offset or even turned negative when effects from third-country trade costs are accounted for. In turn, relatively modest gains may become more significant in a more globally focused view.

Finally, IRC efforts among a selected group of countries and resulting changes in third-country trade costs may also affect the welfare of third countries. This is particularly important if negative welfare effects concern developing or least developed countries. Considering the effects on third countries therefore is important for IRC aiming at changes in national regulations.

Translating theoretical findings into practical IRC

The theoretical considerations in this report have highlighted several important findings for international co-operation on regulations. Two broad areas can be distinguished in regulatory requirements, including those related to product and production requirements (or rules) and those related to conformity assessment procedures. Heterogeneity in regulations generates additional costs for traders, in particular specification costs, conformity assessment costs and information costs. Trade-related IRC aims to reduce these costs, but the approaches for addressing them need to account for the differences in nature.

Related to **product and production requirements**, two general types of regulations can be distinguished: **horizontal and vertical** regulations. While horizontal regulations are simply “different”, no levels of stringency can be associated. In contrast, such levels of stringencies can be associated with vertical regulations. The implication of this distinction is that differences in horizontal regulations creates trade costs for exports in either direction between the countries, those in vertical regulations generate additional costs only for exports from the country with the less stringent regulation to the country with the more stringent regulation. In this case the exporter needs to adjust the product or the production process to meet the more demanding requirements of the destination market. Higher trade costs negatively affect both the exporter's and importer's welfare. IRC should aim at reducing these welfare losses without compromising on the legitimate objectives behind countries' regulatory activities.

Different regulatory situations can be analysed with respect to optimal regulatory outcomes, depending on whether, in setting its own regulation, one country accounts for the other country's regulation, both countries account to full information about regulatory preferences in the other countries, or countries engage in negotiations to find a regulatory agreement that is implemented by both. The analysis shows that in many cases, countries are better off if they reduce the regulatory heterogeneity even if this implies abandoning their preferred level of regulation.

Full information about the trading partners' regulatory preferences already allows for significant welfare gains if the information and its implications for heterogeneity-related welfare losses are incorporated when regulations are set. In addition to information sharing, direct negotiations can

yield superior outcomes in terms of participating countries' welfare, although this requires either reliable commitments or sufficient confidence levels between countries.

The degree to which a country may want to choose a regulation that is different from its preferred one in order to reduce the regulatory differences with its trading partners generally depends on a multitude of factors. Importantly, it will be greater the larger the heterogeneity-related trade costs are relative to the domestic effects. On the one hand, if significant trade costs exist, choosing or maintaining the “ideal” regulation may not be in a country's interest. On the other hand, if moving away from the preferred regulation is “costly” in terms of domestic effects, full harmonization of regulations is not an optimal outcome either. If, however, regulatory choices or trade costs are discrete rather than continuous, “compromise solutions” may not exist or be optimal; in this case, both full harmonisation and persistent regulatory heterogeneity with countries maintaining their preferred regulations may be optimal outcomes even if both domestic effects and trade costs are relevant and significant.

Another important factor driving eventual outcomes of regulatory co-operation is a possible asymmetry between participating countries. Other things being equal, smaller countries will generally find it more profitable to change their regulation, or to set it to a level different from the preferred one, than bigger countries, related to differences in the relative importance of trade costs as well as in the possibilities to compensate smaller losses through greater gains in bundled regulatory issues.⁶⁹

The benefits of information sharing and negotiated outcomes, but also those of mutual learning, are arguably best exploited at an early stage of the regulatory process. While conceptually similar, the design phase of regulations is likely to provide an easier opportunity for avoiding unnecessary trade costs due to regulatory heterogeneity than situations where trade partners have already and differently regulated their respective markets. In practice, the potential of trade-related IRC for working towards regulatory systems in participating countries that are as conducive to well-functioning markets and trade without compromising regulatory objectives is likely to be highest if employed as early as possible in the regulatory process.

International co-operation can play a key role for providing the evidence base related to conformity assessment methods, i.e. metrology, laboratory testing methods etc. OECD (2013, p. 102, based on OECD, 1994) identifies “programmes which are essentially science driven and based on irrefutable facts [...] and] more generally, areas involving technical assessment or measurement and which benefit from shared methodologies” as one of the particularly successful areas of IRC.

The **choice of conformity assessment** systems generally represents a trade-off between risks of non-compliant products on the domestic market and costs for suppliers, including foreign ones. Regulators should favour more restrictive conformity assessment systems (based on accredited conformity assessment bodies) where the potential damage of non-compliant products is high, e.g. related to public health, and where variations in regulation-relevant product characteristics are more difficult to control for by the supplier. On the other hand, low-damage products with a low probability of non-compliance propose themselves for conformity assessment systems providing a maximum of flexibility to suppliers, including reliance on suppliers' declarations of conformity. Given the flexibility, suppliers (including foreign ones) can choose the most cost efficient mode for demonstrating the compliance of their products, thus reducing trade costs and, hence, prices for importers. International co-operation can play a role in building confidence in foreign conformity assessment infrastructures. In addition, better and faster exchange of information can reduce the costs for market surveillance, an important tool to limit risks of non-compliant products on the market. Better market surveillance can, to some degree, reduce the need for more rigid and costly conformity assessment systems, thus reducing costs in international trade.

IRC can address information costs in international trade essentially along two distinct but complementary lines. First, as information requirements for foreign suppliers generally increase with the regulatory differences between home and export markets, approaches aiming to reduce the regulatory heterogeneity through convergence or harmonisation tend to decrease such requirements

69. Possible differences in negotiation powers are not covered by the present analysis.

and related costs as well. Similarly, information requirements may shrink due to the recognition of partner countries' regulations as equivalent. In both these approaches, information costs add to specification costs and increase the incentives for participating countries to co-operate. Second, co-operation can improve the ways regulation-related information is disseminated to firms and other stakeholders, thus reducing their costs for accessing and processing the information. This may include co-ordinated or joint communication and dissemination strategies, as well as the direct involvement of industries and other stakeholders in the co-operation initiatives.

Finally, and given that IRC often takes place among a limited set of countries, it is important to account for the effects that **IRC outcomes may have on third-country trade**. Price effects, but also indirect changes in third-party trade costs, may affect trade between participating and third countries. While this may increase or decrease the gains from IRC for participating countries, it may also benefit or disadvantage third countries, including developing ones.

This theoretical framework represents one important element aiming to help regulators and trade negotiators to better balance domestic regulatory interests with an open and well-functioning trading system. Given its conceptual nature, however, it abstracts from the specificities that tend to govern the actual regulatory activity and which therefore are relevant for IRC as well. In particular, it abstracts from costs for participating in IRC activities, as well as from those related to the design and implementation of regulations. These may often be significant, particularly for revising existing regulations. Such costs also include adjustment costs which occur for a limited period of time and which are not due to the new regulation, but due to the *change* in regulations. These adjustment costs often prevent optimal solutions even if in the longer run efficiency gains could pay them back multiple times.

To increase its use for regulators and trade negotiators, this theoretical framework has to be complemented by an empirical analysis of actual IRC initiatives. Additional work is therefore undertaken by the OECD that analyses the way in which different trade costs have been addressed in a number of IRC initiatives. Both the case studies and this theoretical framework will help to identify steps for governments to choose the IRC mechanisms appropriate for addressing heterogeneity-related trade costs without compromising their legitimate regulatory objectives.

Overall, international co-operation by regulators and trade negotiators has the potential to reduce trade costs in a number of different ways. Resolving information inefficiencies by better exchanging details on regulations and regulatory preferences, reducing co-operation inefficiencies by converging regulations in a collaborative manner, and tackling bundling inefficiencies through packages of related regulatory solutions can reduce specification costs. Harmonising or mutually accepting tests and other conformity assessment methods can help to avoid duplication of conformity assessment needs, as can the building of confidence in conformity assessment procedures across trade partners. Improved dissemination of information on regulatory requirements to firms active or possibly interested in exporting their products can reduce entry barriers to destination markets. Many of these options do not risk compromising the effectiveness of domestic regulations. Where they do, this framework, and the complementing work within this project, will help regulators and trade negotiators to balance trade costs and domestic effects to maximise benefits for their societies.

Trade-related IRC needs to be seen in the wider context of regulatory co-operation more broadly defined. In addition to addressing heterogeneity-related trade costs based on a situation where participating countries have (or consider designing) regulations which reflect their respective regulatory preferences, IRC importantly also has the potential to reduce regulatory inefficiencies through a process of peer reviewing and mutual learning.

References

- AFGC - Australian Food & Grocery Council - (2015), *International Trade Report - Non-Tariff Barriers Facing Australia's Agri-Food Exports*, www.pc.gov.au/data/assets/pdf_file/0004/195871/sub028-agriculture-attachment.pdf.
- Axelrod, R. and W.D. Hamilton (1981), "The Evolution of Cooperation", *Science*, New Series, Vol. 211, No. 4489, pp. 1390-96. www-personal.umich.edu/~axe/research/Axelrod%20and%20Hamilton%20EC%201981.pdf.
- Böckel, S. (1994), "A Generalized Model of Horizontal Product Differentiation", *The Journal of Industrial Economics*, Vol. 42 No. 3, pp. 287-298, www.jstor.org/stable/2950571.
- Bolton, P. and M. Dewatripont (2005), *Contract Theory*, Cambridge and London: The MIT Press.
- Darby, M.R. and E. Karni (1973), "Free Competition and the Optimal Amount of Fraud", *Journal of Law and Economics*, Vol. 16 No. 1, pp. 67-88.
- Disdier, A.C. and S. Marette (2010), "The Combination of Gravity and Welfare Approaches for Evaluating Nontariff Measures", *American Journal of Agricultural Economics* Vol. 92 No. 3, pp. 713-726, <http://ajae.oxfordjournals.org/content/92/3/713.full.pdf+html>.
- Fliess, B., F. Gonzales and R. Schonfeld (2008), "Technical Barriers to Trade: Evaluating the Trade Effects of Supplier's Declaration of Conformity", *OECD Trade Policy Working Papers*, No. 78, OECD Publishing, <http://dx.doi.org/10.1787/235814036326>.
- Fontagné, L. et al. (2015), "Product Standards and Margins of Trade: Firm-Level Evidence", *Journal of International Economics*, Vol. 97, pp. 29-44, <http://dx.doi.org/10.1016/j.jinteco.2015.04.008>.
- Gabszowicz, J.J. and J.-F. Thisse (1979), "Price Competition, Quality and Income Disparities", *Journal of Economic Theory*, Vol. 20, pp. 340-359, www.stern.nyu.edu/networks/Gabszewicz_Thisse_Price_Competition_Quality_and_Income_Disparities.pdf.
- Gabszowicz, J.J. and J.-F. Thisse (1986), "On the Nature of Competition with Differentiated Products", *The Economic Journal*, Vol. 96 No. 381, pp. 160-172, www.jstor.org/stable/2233431.
- Gray, H.P. (1979), *A Generalized Theory of International Trade*, The MacMillan Press, London and Basingstoke.
- Grossman, G.M. and E. Helpman (1995), "The Politics of Free-Trade Agreements", *American Economic Review*, Vol. 85 No. 4, pp. 667-690, www.jstor.org/stable/2118226.
- Hotelling, H. (1929), "Stability in Competition", *The Economic Journal*, Vol. 39 No. 153, pp. 41-57, <http://www.jstor.org/stable/2224214>.
- Kox, H. and A. Lejour (2005), *Regulatory Heterogeneity as Obstacle for International Services Trade*, CPB Discussion Paper No. 49, CPB Netherlands Bureau for Economic Policy Analysis, The Hague, www.cpb.nl/en/publication/regulatory-heterogeneity-obstacle-international-services-trade.
- IEC (undated), *Types of Conformity Assessment*, International Electrotechnical Commission, www.iec.ch/conformity/what/ca_types.htm. Accessed February 2016.
- Josling, T. and D. Roberts (2011), "Measuring the Impact of SPS Standards on Market Access", ITC Policy Brief for the IPC-OECD Seminar on "Non Tariff Measures on Food and Agricultural Products: The Road Ahead", www.oecd.org/tad/ntm/48632882.pdf.
- Nash, J. (1951), "Non-Cooperative Games", *Annals of Mathematics*, Vol. 54 No. 2, <http://lcm.csa.iisc.ernet.in/gametheory/Classics/NCG.pdf>.
- Nelson, Ph. (1970), "Information and Consumer Behavior", *Journal of Political Economy*, Vol. 78 No. 2, pp. 311-329, <http://www.jstor.org/stable/1830691>.
- Nicolaides, K. and G. Shaffer (2005), "Transnational Mutual Recognition Regimes: Governance Without Global Government", *Law and Contemporary Problems*, Vol. 68, pp. 263-318, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=723150.

- Nicolaides, Ph. (2006), "A Theory of Regulatory Integration", *Intereconomics*, Vol. 41 No. 1 January/February 2006, pp. 37-43, <http://archive.intereconomics.eu/year/2006/1/>.
- Nordas, H. (2016), "Services Trade Restrictiveness Index: The Trade Effect of Regulatory Differences", *OECD Trade Policy Papers*, No. 189, OECD Publishing, Paris. <http://dx.doi.org/10.1787/5jlz9z022plp-en>
- OECD (2015), *OECD Regulatory Outlook 2015*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264238770-en>.
- OECD (2014), *OECD Regulatory Compliance Cost Assessment Guidance*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264209657-en>.
- OECD (2013), *International Regulatory Co-operation: Addressing Global Challenges*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264200463-en>.
- OECD (2012), *Recommendation of the Council on Regulatory Policy and Governance*, <http://www.oecd.org/gov/regulatory-policy/49990817.pdf>
- OECD (1994), *Regulatory Cooperation for an Interdependent World*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264062436-en>.
- Osborne, M.J. and A. Rubinstein (1994), *A Course in Game Theory*, MIT Press, Cambridge and London.
- Pelkmans, J. (2012a), *Mutual Recognition: Economic and Regulatory Logic in Goods and Services*, Bruges European Economic Research Papers 24/2012, Brugge, College of Europe, https://www.coleurope.eu/system/files_force/research-paper/beer24.pdf.
- Pelkmans, J. (2012b), *The Economics of Single Market Regulation*, Bruges European Economic Policy Briefings 25/2012, Brugge, College of Europe, https://www.coleurope.eu/system/files_force/research-paper/beep25.pdf.
- Swinnen, J., K. Deconinck, T. Vandemoortele and A. Vandeplass (2015), *Quality Standards, Value Chains and International Development: Economic and Political Theory*, Cambridge University Press, forthcoming.
- Swinnen, J. and T. Vandemoortele (2012), "Trade and the Political Economy of Standards", *World Trade Review*, Vol. 11, pp. 390-400.
- Sykes, A.O. (1995), *Product Standards for Internationally Integrated Goods Markets*, Washington, D.C.: The Brookings Institution. Quoted in Veggeland, F. and Chr. Elvestad (2004), *Equivalence and Mutual Recognition in Trade Arrangements – Relevance for the WTO and the Codex Alimentarius Commission*, Oslo: Norwegian Agricultural Economics Research Institute.
- Veggeland, F. and Chr. Elvestad (2004), *Equivalence and Mutual Recognition in Trade Arrangements – Relevance for the WTO and the Codex Alimentarius Commission*, Oslo: Norwegian Agricultural Economics Research Institute. www.regjeringen.no/globalassets/upload/kilde/fkd/red/2004/0009/ddd/pdfv/228920-nilf_rapport_2004_9_s.pdf.
- WTO (2015), *Decisions and Recommendations Adopted by the WTO Committee on Technical Barriers to Trade Since 1 January 1995*, 12th revision, Document G/TBT/1/Rev.12, Geneva, World Trade Organization, https://docs.wto.org/dol2fe/Pages/FE_Search/DDFDocuments/129845/q/G/TBT/1R12.pdf.
- WTO (2012), *World Trade Report 2012 – Trade and Public Policies: A Closer Look at Non-Tariff Measures in the 21st Century*, Geneva, World Trade Organization, www.wto.org/english/res_e/booksp_e/anrep_e/world_trade_report12_e.pdf.
- WTO (2005), *Preparation of the Fourth Triennial Review: Conformity Assessment Procedures*, Background Note by the Secretariat, www.wto.org/english/tratop_e/tbt_e/tbt_wrkshop_note_16march06_e.doc (accessed March 2016)
- WTO (2004), *Decision on the Implementation of Article 4 of the Agreement on the Application of Sanitary and Phytosanitary Measures*, WTO Committee on Sanitary and Phytosanitary Measures, Document G/SPS/19/Rev.2, 23 July 2004.
- WTO, Committee of Participants on the Expansion of Trade in Information Technology Products (2005), *Guidelines for EMC/EMI Conformity Assessment Procedures*, G/IT/25 17 February, https://docs.wto.org/dol2fe/Pages/FE_Search/DDFDocuments/52311/Q/G/IT/25.pdf.