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International Standards and Trade

A REVIEW OF THE EMPIRICAL LITERATURE

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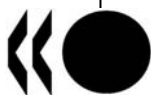**INTERNATIONAL STANDARDS AND TRADE - A REVIEW OF THE EMPIRICAL LITERATURE**

OECD Trade Policy Working Paper No.97

by G.M. Peter Swann

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ABSTRACT

While there is a large literature on the economic theory of international standards, and their presumed effects, we know much less about how international standards work in practice. This paper reviews the body of empirical work that has investigated the specific question: How international standards impact on international trade? Do they help or hinder trade? The work reviewed ranges from econometric studies using a variety of measures of standards derived from e.g. the Perinorm database, diffusion of ISO9000, regional agreements, mutual recognition agreements and harmonisation, to surveys of exporting firms. A mapping of the findings from econometric models shows that there is often, but not always, a positive relationship between international standards and exports or imports, which is in line with the widely held view that international standards are supportive of trade. For national (i.e. country-specific) standards studies find positive as well as negative effects on trade and thus provide only qualified support for the commonly held view that national standards create barriers to trade. Overall, the literature reviewed does not provide a single answer to the question of trade effects, and the explanation for this appears to have to do with how the multiple economic effects of standards interact. The paper summarises some of the existing empirical evidence for some of these effects, which include network externalities, variety, knowledge, quality and trust, and which merit further research in order to understand when standards help trade, and when not.

Keywords

Standards, international standards, harmonisation, harmonisation agreement, mutual recognition, mutual recognition agreements, MRAs, international trade, trade barriers, International Organisation for Standardisation, ISO, technical regulation, econometric model, empirical, exports, imports, trade effect, International Electrotechnical Commission, IEC, International Telecommunication Union, ITU, WTO TBT Agreement, WTO SPS Agreement, Perinorm.

ACKNOWLEDGEMENT

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EXECUTIVE SUMMARY

While there is a substantial body of literature on the economic theory of international standards, and their presumed effects, much less is known about how international standards work in practice. This paper surveys empirical studies investigating the relationship between international standards and trade. The main focus is on econometric studies using secondary data on international standards and trade, but surveys and some of the literature investigating the relationship between standards and other economic measures, such as productivity, growth and welfare are also summarised.

The paper uses a broad definition of ‚standard' and ‚international' standard. This reflects the range of definitions used in the empirical literature. Different studies interpret these terms in a variety of ways. For example, some studies equate international standards with standards published by ISO, IEC, ITU or similar, whereas other studies treat a standard as international if it is common to a group of countries or a region.

Some of the econometric studies reviewed are based on measures of standards computed from Perinorm. Most are models of bilateral trade, but some relate to a country's total exports or imports. Amongst the studies looking at all sectors, especially manufacturing, standards tend to be trade creating. Also, some studies find that the effect of national standards on trade exceeds the effects of international standards. But in the studies of agricultural products, and textiles and clothing, standards (especially national standards) in a country can constrain imports into that country. Overall, the majority of studies find the effect of standards to be trade-creating rather than trade-reducing.

Another subset of studies uses data on the diffusion of ISO 9000 in different countries. They show that use of ISO by an exporter can increase its exports, but the effects on imports are less clear-cut. Other econometric studies use information on mutual recognition agreements (MRAs) and/or harmonisation measures instead of the Perinorm database or data on ISO 9000 diffusion. The overall impression of these studies is that harmonisation and MRAs are mostly favourable to trade. Various other approaches to measuring voluntary (and mandatory) standards for use in econometric models of trade exist. In terms of trade effects the results of these studies are often negative.

A heterogeneous group of studies has attempted to measure directly the relationship between standards and trade by surveying exporting firms. While it is not easy to compare the findings of the different surveys, they contribute an interesting miscellany of insights into how standards impact on trade. The last set of studies summarised are studies that have looked at the impact of a country's stock of standards (whether national or international) on productivity and economic growth, or wages, employment and foreign direct investment. These tend to find a positive effect.

How do international standards impact on trade? Do they help or hinder trade? A key finding of the survey of empirical data is that there is no single answer to this question. If the results of the various studies are taken at face value, the question of why the results differ from case to case needs to be explored.

Part of the reason is that the different studies have referred to different countries, different industries and different measures of standards. But more generally, the relationship between standards and trade is not a simple one and the econometric models surveyed represent, at best, 'black boxes' that disguise a complex of relationships.

The paper sketches some of the available evidence on some of the links within these black boxes. For example, standards sometimes seek to reduce variety in order to exploit economies of scale, and this reduction of variety may in some circumstances lead to a reduction in trade. On the other hand, the reduction in variety may also lead to a reduction in transaction costs. Standards can also serve as an important quality signal in trade and thus help promote the competitiveness of those that meet stringent standards. On the other hand, stringent standards can raise barriers to entry by increasing compliance costs. Also, standards are a mark of trust, and trust helps to reduce transaction costs and therefore supports trade. In sum, there are many possibilities how a standard impacts on an economy. Some effects are positive but others are negative, which may explain the diversity of the results of the empirical literature reviewed here.

If the effect of standards on trade is context specific, as it seems to be, then it seems essential to open up the 'black box' connecting standards to trade performance if we are to understand the complexities of this relationship.

Some conclusions can nevertheless be drawn from the econometric studies that have sought to estimate the relationship between international standards and trade:

- In most studies, when *exporting* countries use *international standards*, this has in most cases a positive (or at least neutral) effect on their export performance.

- When *exporting* countries use *national standards* (i.e. standards specific to country x), that may lead to superior export performance by x.

- When the *importing* countries also adopt *international standards*, the most common effect is also to increase imports. The exceptions can in part be explained.

- When the importing country uses national standards, the results are more diffuse. For studies that relate exclusively to voluntary standards, the effects are distributed quite evenly. For studies that relate to regulations (i.e. mandatory standards), the effects on imports tend to be negative.

**INTERNATIONAL STANDARDS AND TRADE
A REVIEW OF THE EMPIRICAL LITERATURE**

1. Introduction[1]

1. While there is quite a large literature on the economic theory of international standards, and their presumed effects, we know a good deal less about how international standards work in practice. The objective of this study, therefore, is to learn as much as possible from *empirical data* about the ways in which international standards relate to trade and welfare. To put it another way, the objective is to concentrate on studies that make the minimum of theoretical assumptions, to avoid an outcome where supposedly *empirical results* mainly reflect *theoretical assumptions*.

2. For that reason, we have chosen to omit from the survey any of the work which applies computable general equilibrium (CGE) models or partial equilibrium models to predict the effects of harmonizing standards. While this work is clearly very valuable, it does not pass the test described in the last paragraph. For a similar reason, we have left out of our review a number of econometric studies which, while interesting in themselves, don't pass that same test.

3. The specification for this review resulted in the omission of several other areas of standards-related work. First, we were asked to omit any work related to SPS standards. There is in fact quite a large empirical literature about this, and the results in that literature are undoubtedly important.[2] However, that literature contains a fairly firm consensus view about the role of SPS standards, which is probably specific to SPS standards and will *not* apply to *all* standards. Second, we were instructed to exclude any work on services, though in fact, there is very little literature on these.

4. How exactly do we define an 'international standard' for the purposes of this study? In fact, this is really two questions: How do we define 'international', and how do we define 'standard'? The short answer to both parts of the question is that we adopt a broad-minded definition. Given the limited empirical literature available, and given that different studies interpret 'international' and 'standard' in a wide variety of ways, there is really no alternative but to be broad-minded.

5. How should we define 'international'? Some might argue that a standard is only 'international' if it conforms to a standard published by the International Organisation for Standardization (ISO), the International Electrotechnical Commission (IEC), the International Telecommunication Union (ITU) or similar. However, only a sub-set of the available literature uses this 'purist's' definition. Other parts of the literature take a broader view: a standard is treated as 'international' if it is common to a group of countries or region (for example the EU) – regardless of whether it is 'international' by the purist's definition. And some studies of bilateral trade between countries A and B (say) take a very broad view: a standard is 'international' if it is harmonized in countries A and B – again, regardless of whether it is 'international' by the purist's definition. The reader may be unsettled by this lack of standardisation in definitions, but given the small size of the empirical literature at this time, there are pragmatic reasons why we cannot restrict our attention just to the purist's definition, but need to accept studies that take a broader view. However, we shall in all cases flag up exactly what definition of 'international' is used in each study.

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1. This paper has been prepared under contract with the OECD. I am grateful to Barbara Fliess and her colleagues for very helpful comments on preliminary drafts of this paper.

2. The following reviews are broader in scope and cover some of the topics excluded from the present review: Ferrantino (2006), Korinek *et al* (2008), Maskus et al (2001), NIST (2004), WTO (2005).

6.   And how should we define a 'standard'? Trade officials and regulators are accustomed to making a strict separation between standards and regulations. While compliance with standards is voluntary, compliance with technical regulations is mandatory by law. However, much of the existing literature has tended to discuss both of these together. This may reflect a rather casual attitude to an important distinction, but more likely it reflects the fact that these authors believe the economic effects of standards and regulations are not as different as trade officials and regulators think they are. The evidence surveyed here supports that view. Indeed, there is a view that many so-called 'voluntary' standards are not *really* voluntary: even if they are not legal requirements they are commercial imperatives. In this survey we shall discuss the evidence relating to standards and trade and also the evidence relating to regulations and trade, though we separate these studies into different sections. We take this approach for three pragmatic reasons. The first, as mentioned already, is that the empirical literature is limited and we can't really be choosy. Second, there are similarities in the economic effects that warrant investigation. And third, this is the approach taken in much of the research literature.

7.   In what follows, we have organised our discussion of the literature into four main sections. Section 2, which accounts for the greater part of the report, considers *econometric* studies based on the use of secondary data on international standards and trade. Section 3 considers descriptive studies based on *surveys* which attempt to measure directly the relationships between international standards and trade. Section 4 addresses the rather smaller literature on the relationship between standards and various other macroeconomic measures (e.g. productivity, growth and welfare). Section 5 notes that much of what has come before could be described as a 'black box' model of the relationship between standards, trade and welfare, and that to progress in our understanding we need to open up that 'black box'. When we do this, we see that the linkages from standards to trade and welfare are many and complex. This section contains a few examples of empirical work on these many linkages. Section 6 concludes.

8.   Some of the literature has argued for the supremacy of one specific research approach over others. In this survey, we do not offer a critique of the different methods. Our view is that all these different approaches play an important part in building up the full picture, and it would be unfortunate to omit any of them.

2.   Econometric Studies

9.   This section describes econometric studies that use secondary data on international standards and trade. The first paper to be reviewed in this section was published in 1996. Until about five years ago, the econometric literature on standards and trade was very limited, but it has grown rapidly in the last few years – and especially in the last 3-4 years.

10.   One of the greatest challenges in a review of this sort is to assess the comparability of results from different studies. To help in this, we have grouped the econometric work under five headings according to the way in which international standards are measured in that study: (2.1) the Perinorm database; (2.2) diffusion of ISO 9000; (2.3) regional agreements, mutual recognition agreements (MRAs) and harmonization; (2.4) measures notified to the WTO under the TBT and SPS Agreements; (2.5) a miscellany of other approaches. In the first two of these, studies relate to standards and *not* to regulations. In the third, studies relate either to regulations alone, or to standards *and* regulations. In the fourth, the approach taken measures regulations and *not* standards. In the fifth, we find a mixture: some studies relate only to regulations, while others relate to standards *and* regulations.

11.   Many of the studies that follow are sufficiently similar in design that we can plot their results in Tables 1 and 2 below. This will help to compare the results of different studies. Each econometric study attempts to estimate coefficients which describe the effects of standards and/or regulation on trade. In almost all the econometric studies listed, the objective was to estimate the effects of standards in X on

exports from X, and/or the effects of standards in X on imports into X. Tables 1 and 2 summarise the estimated coefficients describing the effects of standards in X on *exports* from X (Table 1) and *imports* into X (Table 2). Tables 1 and 2 both have two parts to them: the top half (Part i) shows the effects of international standards and the lower half (Part ii) shows effects of national standards.

12.   Each part has 5 cells corresponding to five possible values of the relevant coefficients:

- negative and significant ($-2 \geq t$)
- negative ($-1 \geq$ t-statistic > -2)
- negligible ($1 >$ t-statistic > -1)
- positive ($2 > t \geq 1$)
- positive and significant ($t \geq 2$)

where t is the conventional t-statistic for each coefficient, describing the degree of statistical significance. Each study is given an acronym (**M2**, **BJ3**, etc.) and is located in the relevant cell(s) in Tables 1 or 2. The studies to which these acronyms relate are listed in the key on Page 5. As an illustration, let us translate two examples from Table 1. Consider the mark **M2** in the left hand cell in Table 1, Part i. The acronym **M2** refers to a study by Moenius (2006a) which found a negative and significant effect of *international* standards in country X on exports from country X. Now, consider the mark **BL3** in the right-hand cell in Table 1, Part ii. The acronym **BL3** refers to the study by Blind (2001) which found that national standards in country X had a positive and significant effect on exports from X.

Table 1. Effects of Standards and Regulations* on Exports

(i) Effects of **International** Standards* in Country X on **Exports** from X				
(a) Negative and Significant	(b) Negative	(c) Negligible	(d) Positive	(e) Positive and Significant
M2	BJ3	CG2, CG3	BJ1, ST1	BL1, CG1, G1, G2, KR, M1, M3 BA1 HV, VW

(ii) Effects of **National** Standards* in Country X on **Exports** from X				
(a) Negative and Significant	(b) Negative	(c) Negligible	(d) Positive	(e) Positive and Significant
VB, WS	BJ1	BJ3		BL1, M1, M2, M3, ST1

Table 2. Effects of Standards and Regulations* on Imports

(i) Effects of **International** Standards* in Country X on **Imports** into X				
(a) Negative and Significant	(b) Negative	(c) Negligible	(d) Positive	(e) Positive and Significant
G1, M2 CM3, MH2		CG1, CG2, CZ, ST2, TU BA3	CG3	BL2, BJ2, BJ4, G2, M1, M3 BA1, BA2, CM1, CM2, MH1 HV, VW

(ii) Effects of **National** Standards* in Country X on **Imports** into X				
(a) Negative and significant	(b) Negative	(c) Negligible	(d) Positive	(e) Positive and Significant
CZ, M2 CW1, CW2, SA VB, D2, F2	BJ2, TU	BJ4 D1, F1	BL2 F3	M1, M3, ST2

* Studies marked in light grey refer to standards
Studies marked in dark grey refer to standards *and* regulations
Studies not marked refer to regulations

Key to Tables 1 and 2

BA1	Baller (2007, p. 38, Appendix VI.2) Effect of MRAs on Trade
BA2	Baller (2007, p. 38, Appendix VI.2) Effect of Harmonization on OECD→Region Trade
BA3	Baller (2007, p. 38, Appendix VI.2) Effect of Harmonization on non-OECD→Region Trade
BJ1	Blind & Jungmittag (2001) – cited in Blind (2004, p. 255, Table 17.9, Column 3)
BJ2	Blind & Jungmittag (2001) – cited in Blind (2004, p. 256, Table 17.10, Column 3)
BJ3	Blind & Jungmittag (2002) – cited in Blind (2004, p. 266, Table 17.13, Column 4)
BJ4	Blind & Jungmittag (2002) – cited in Blind (2004, p. 267, Table 17.14, Column 2)
BL1	Blind (2001) cited in Blind (2004, p. 281, Table 17.20, Column 4)
BL2	Blind (2001) cited in Blind (2004, p. 282, Table 17.21, Column 3)
CG1	Clougherty & Grajek (2008, Table 3, Column 1): LDC→DC Trade
CG2	Clougherty & Grajek (2008, Table 3, Column 2): DC→LDC Trade
CG3	Clougherty & Grajek (2008, Table 3, Column 3): DC→DC Trade
CM1	Chen & Mattoo (2004, p. 22, Table 3) Effect of MRAs on Trade
CM2	Chen & Mattoo (2004, p. 22, Table 3) Effect of Harmonization on OECD→Region Trade
CM3	Chen & Mattoo (2004, p. 22, Table 3) Effect of Harmonization on non-OECD→Region Trade
CW1	Chen *et al* (2006, p. 15, Table 2) Testing procedures, Information difficulty, Inspection times
CW2	Chen *et al* (2006, p. 20, Table 4) Standards
CZ	Czubala *et al* (2007, p. 32, Table 13). In this case, 'international' means standards harmonized to ISO, while 'national' means EU standards *not* harmonized to ISO.
D1	Disdier *et al* (2007, p.27, Table 6, Columns 5, 6 & 7) OECD↔OECD Trade
D2	Disdier *et al* (2007, p.27, Table 6, Columns 5, 6 & 7) Other Trade
F1	Fontagné *et al* (2005, pp. 27-28, Appendix 3) Agriculture exports from OECD
F2	Fontagné *et al* (2005, pp. 27-28, Appendix 3) Agriculture exports from LDCs & DCs
F3	Fontagné *et al* (2005, pp. 27-28, Appendix 3) Manufacturing exports
G1	Grajek (2004, p. 23, Table 3, Column 3) – estimate for all countries

G2	Grajek (2004, p. 25, Table 5, Column 19) – estimate for OECD countries only
HV	Henry de Frahan & Vancauteren (2006, p. 351, Table 3)
KR	Kim & Reinert (2009, p. 18, Table 3, Column 5 & p. 19, Table 4, Column 5)
MH1	Michalek *et al* (2005, p. 101, Table V-1) Harmonisation & New Approach
MH2	Michalek *et al* (2005, p. 101, Table V-1) MRA
M1	Moenius (2004, p. 31, Table 5)
M2	Moenius (2006a, p. 19, Table 3)
M3	Moenius (2006b, p. 62, Table 2)
SA	Sánchez *et al* (2008, p. 26, Table 7)
ST1	Swann *et al* (1996, p. 1305, Table 3, Column 9)
ST2	Swann *et al* (1996, p. 1305, Table 3, Column 5)
TU	Temple & Urga (1997, p. 220, Table 2, Column i)
VB	van Beers & van den Bergh (1997, p. 40, Table 3)
VW	Vancauteren & Weiserbs (2005, p. 18, Equation 13)
WS	Wilson *et al* (2002, Table 5)

2.1 Studies based on Perinorm

13. Perinorm is a database of the standards published by the principal national and international standards authorities. When, in 1993-4, Perinorm was used as a research tool for the first study listed below, it covered only AFNOR, BSI and DIN standards. Today it covers the national standards bodies of 23 countries,[3] as well as the leading international authorities (ISO, IEC, ITU) and European authorities (CEN, CENELEC, ETSI).

14. Perinorm has sometimes been described as offering an inventory of standards. It tells us how many standards are available in each country for each sector, but does not measures the extent to which they are used. The studies that have constructed standards measures using Perinorm tend to have done so by counting the number of standards relevant to each industrial sub-sector or each category of traded goods and services. These count measures suffer from what is often called the 'mixed bag' problem. It may be that a collection of 100 standards includes a few of essential importance, and some of moderate importance, but the majority are not very important. Moreover, the standards differ not just in importance, but also in type: compatibility standards, quality standards, measurement standards, variety reduction standards, and so on. The collection is therefore a veritable 'mixed bag'. In econometric terms, this means that the count variable is not a very accurate measure of the underlying concept of *standards-richness* that we want to measure. This is hardly a new problem, however, because exactly the same problem arises with other count variables: patent counts, innovation counts, and so on.

15. For a particular country X, Perinorm can be used to construct three types of measure:

1. The number of national standards that are unique to country X

2. The number of national standards in X that are identical to or equivalent to an International standard (from ISO, IEC, ITU)

3. The number of national standards in X that are identical to or equivalent to those in a trading partner (Y).

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3. For 22 countries, Perinorm covers one national standards body per country. For the 23rd, the USA, Perinorm covers: ANSI, API, ASME, ASTM, EIA, IEEE, NEMA, SAE and UL.

Swann, Temple & Shurmer (1996) – ST1 and ST2

16.   While it may seem immodest to start a literature review with one of our own papers, we do so because, so far as we are aware, this was the first econometric attempt to quantify the relationship between standards and trade performance. Swann *et al* (1996) tried to assess the relationship between standards and trade performance by adding standards variables into simple econometric models of UK exports and UK imports. Note that these are models of total UK trade with the rest of the world and *not* bilateral trade between pairs of trading partners.

Figure 1. Trade between One Country and Rest of World
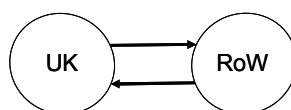
17.   The study had two additional objectives: first, to assess the relative importance of international and national standards; and second, to compare four theoretical perspectives on the effects of standards and see which if any of these received support. These perspectives were: (a) standards as a source of competitive advantage; (b) standards as an unwelcome constraint (hence a source of competitive disadvantage); (c) standards as a support for trade; and (d) standards as a constraint on trade.

18.   Swann *et al* distinguished between national and international standards as follows. We used the Perinorm 'International Reference' field to check if each BSI standard was classed as either 'identical to' or 'equivalent to' a European or an International standard. If so, then the standard was considered to be an *international* standard; if not, then it was counted as a *national* standard. For each industrial sector, we identified all BSI standards that were relevant to that standard and produced a count of the number of relevant standards – national and international.

19.   As two of the hypotheses under consideration need to assess the relative number of standards in the UK (compared to its trading partners), it was necessary to have an international comparator. The ideal measure would have been a *weighted* measure of the standards of several different countries (weighted by the volume of trade with the UK's different trading partners). But the construction of such a measure was impossible, not least because at the time the research was done (1993-94), Perinorm only covered the standards of three countries (UK, Germany, France). Instead, we used the standards counts for DIN standards as a measure of international best practice – the justification being that the DIN catalogue could be considered the 'state of the art' in national standards at that time.

20.   Swann *et al* (1996, Table 3, Columns 5 and 9) found that UK national standards had a positive and significant effect on UK exports and UK imports,[4] while UK international standards had a positive and

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4.   While the general principle in the paper is not to provide a detailed critique of each research approach, it is useful here to clarify one possible misunderstanding. In reviewing the Swann *et al* (1996) study, Maskus et al (2001) argued that the coefficients quoted in the Swann *et al* study were implausibly elastic, and suggested that Swann *et al* may have misinterpreted the units in which the data were measured. In fact, I believe that there is no error by Swann *et al*. The parameters (48% and 34%) estimated in the export and import equations refer to the effects of 100 more national standards in a particular 3-digit sector on the exports and imports *of that 3-digit sector* – and *not* exports and imports of the economy as a whole. At the end of our sample period (1991), the total count of British national standards summed across our 83 sectors was 5,736. A crude average per sector would be 69 national standards. A 100 unit increase in British national standards in a 3-digit sector is

weakly significant effect on UK exports and a negligible effect on UK imports. In Table 1 (exports), this study is marked **ST1** and located in Part i (Column d) and Part ii (Column e). In Table 2 (imports) this study is marked **ST2** and located in Part i (Column c) and Part ii (Column e).

21.   On the face of it, these results are most compatible with hypothesis (c) above: standards promote intra-industry trade. But from that point of view, it is perhaps surprising that the coefficients for the national standards are both larger and of greater statistical significance than the coefficients for international standards. In what follows, however, we shall find other similar examples.

Temple and Urga (1997) – TU

22.   This study has some similarity to the Swann *et al* (1996) import model. It takes an import equation and adds the same four standards count variables as above – computed in the same way as in Swann *et al*. However, there are two important differences between the income and relative price variables used by Temple and Urga and by Swann *et al*, and these two new variables are highly statistically significant. Moreover, Temple and Urga include two *additional* variables that measure capacity constraints and labour shortages and in their various formulations, at least one of those parameters emerges as *highly* significant.

23.   Temple and Urga find rather different parameter estimates from Swann *et al*. Their estimated coefficients for UK national and international standards are numerically small and statistically insignificant. In Table 2, this study is marked **TU** in Part i (Column c) and Part ii (Column b).

24.   How important are the differences between Swann *et al*, on the one hand, and Temple and Urga on the other? They could imply that the Swann *et al* (1996) results are not very robust. Or it could be that the four other econometric differences listed above constitute enough of a change to the model that the reduced coefficients on standards variables can be understood. To assess these possibilities, it is useful to compare these with a series of related studies by Blind and colleagues, and by Moenius, which also use Perinorm.

Blind and co-Authors (several studies, 2000-2002)

25.   Blind (together with colleagues) has carried out a substantial number of empirical studies on the economic effects of standards. Several of these studies provided the evidence base for the influential report by DIN (2000) on the *Economic Benefits of Standardization*. All of these studies are conveniently gathered together in Blind's book (2004). In all cases, Blind computes the standard count variables (national standards and international standards) in the same way as Swann *et al* (1996).

Blind (2000)

26.   Blind (2000) offered two improvements on Swann *et al*. First, he analysed bilateral trade flows between pairs of countries. Second, his analysis looked at trade involving a total of 8 exporting countries (German, Austria, Switzerland, UK, France, Netherlands, USA, Japan) and 3 importing countries (Germany, Austria and Switzerland). He was also able to offer a disaggregated analysis at sectoral level (for 33 sectors).

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therefore (on average) a 145% increase in national standards in that sector. If that 145% increases imports in that sector by 34% and exports by 48%, those increases represent elasticities of about 0.23 and 0.33 respectively. These are perhaps higher than some might expect, but are in fact remarkably close to those in Moenius (2006b).

27.   Blind used two different specifications. The first was a model of the *balance of trade* between two countries (A, B) as a function of the differences in their standards stocks. The second was a model of the *combined volume of trade* between A and B (exports from A to B plus imports to A from B) as a function of the combined numbers of standards of in countries A and B. These cross section models obviously exclude a number of other important factors, but are nonetheless quite interesting.

28.   The significance levels of results are not strong, given the low number of observations, but the patterns are interesting. Whichever model we take, all estimates suggest either a positive relationship between standards and trade or a statistically insignificant relationship, close to zero.[5] As these models are balance of trade and combined volume of trade, however, we cannot plot them in Tables 1 or 2.

29.   One interesting observation is that when trade involves the UK, national standards stocks seem more important than in those cases involving other countries. This observation could suggest that the result in Swann *et al* (1996) is, as conjectured above, specific to the UK. However, before jumping to that conclusion we wait to look at the results from the other studies in this section.

Blind and Jungmittag (2001)[6] – BJ1 and BJ2

30.   Blind and Jungmittag (2001) go beyond the Blind (2000) study by estimating panel models of trade. There are two models in their paper. One is an overall model of how German trade with the rest of the world is related to the German standards stock. The second, and more interesting in the present context, is a model of bilateral trade between Germany and the UK. The results for this are somewhat different from those in Swann *et al*. They are marked as **BJ1** and **BJ2** in Tables 1-2. German adoption of international standards has (at least) a weakly positive effect on exports and imports while German adoption of national standards has a weakly *negative* effect on both. This would be in line with the commonly held view that international standards are supportive of trade while national standards create barriers to trade.

Blind and Jungmittag (2002) – BJ3 and BJ4

31.   This is equivalent to Blind and Jungmittag (2001), but this time relating to trade between Germany and France. This paper just contains a single model of bilateral trade between Germany and France. The results are somewhat different both from those in Swann *et al* (1996) *and* those in Blind and Jungmittag (2001). They are marked as **BJ3** and **BJ4** in Tables 1-2. The results suggest that German standards, whether national or international, do *not* play a role in promoting exports to France, but German adoption of international standards is associated with a higher level of imports from France.

Blind (2001) – BL1 and BL2

32.   This final study by Blind examines Switzerland's trade with Germany, France and UK in one specific sector: instruments for measurement and testing. The results are marked as **BL1** and **BL2** in Tables 1-2. Switzerland's stocks of standards (whether national or international) are positively associated with imports into Switzerland from these three countries, and exports from Switzerland to these three countries. The effects are somewhat weaker for national standards than for international standards. In this

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5.   Blind also provides estimates for different sectors instead of different country pairings. As with the country pairings, the relationships between trade balance and differences in standards counts are positive or statistically insignificant for most sectors. There are a few exceptions, but no particularly interesting conclusions can be drawn from these sectoral differences.

6.   A revised version of this was later published as Blind and Jungmittag (2005).

regard, the results in Blind (2001) are the closest to those in Swann *et al* above and the results by Moenius to follow.

Moenius (1999/2004) [7] – M1

33.   This is the first of three valuable contributions to the literature by Moenius. All three of his studies use a gravity model of bilateral trade between pairs of countries.

Figure 2. Bilateral Trade between a Pair of Countries
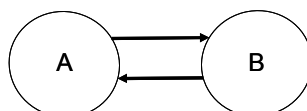
However, Moenius computes his standards counts in a slightly different way from preceding studies. Instead of counting 'national' and 'international' standards for country A and B, he computes the following:

1. a count of standards in A that *are not* equivalent to those in B

2. a count of standards in B that *are not* equivalent to those in A

3. a count of standards in A that *are* equivalent to those in B

4. a count of standards in B that *are* equivalent to those in A

Of course, (3) and (4) are the same, so this leaves us with three measures: a count of standards unique to A, a count of standards unique to B, and a count of standards shared by A and B. Moenius estimates a gravity model using these three standards count variables.

34.   Moenius uses an especially large data set, covering 471 4-digit SITC classifications in 12 OECD countries. Starting with the overall results – referring to all SITC classifications – he finds that *all three* types of standards promote trade. That is: (i) bilaterally shared standards are favourable to trade; (ii) country-specific standards of country A can serve to increase exports from A; and (iii) country-specific standards of country A can serve to increase imports into A. In Tables 1 and 2, his results are marked **M1** in the right hand column (e) in each case. Note that these findings are all broadly consistent with those in Swann *et al* (1996), although the way standards are counted is slightly different.

35.   Results (ii) and especially (iii) may surprise some readers. Moenius offers the following compelling explanation. National standards that are not harmonized may impose adaptation costs on would-be exporters, but the existence of these standards provides the exporter with valuable information to make such adaptations. In the absence of these national standards, this information could be costly to gather. Standards reduce transaction costs even if they impose adaptation costs, and the positive effect of the former seems (across all trade sectors) to outweigh the latter.

36.   Moenius also disaggregates his results into 10 sectors. Here there is an important difference across the sectors. In 4 sectors (food, beverages, crude materials and mineral fuels) country-specific importer standards act as a barrier to trade and reduce imports into that country. But in the other sectors

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7.   The original version of this working paper was produced in 1999, but the most up to date version readily available on the internet was produced in 2004.

(including oils, chemicals, manufacturing, machinery – the more advanced industries, technologically speaking) country-specific importer standards seem to support imports into that country. Moenius (2004, p. 26) explains further. "Under the assumption that transaction costs are greater in industries that are more technologically sophisticated, country-specific standards are more important for manufacturing industries." In the relatively low-technology industries, the adaptation costs imposed by standards may exceed the beneficial effect from reduced transaction costs, so the net effect of country-specific importer standards is to reduce imports. But in the relatively high-technology industries, the adaptation costs imposed by standards are less than the beneficial effect from reduced transaction costs, so the net effect of country-specific importer standards is to increase imports.

Moenius (2006a) – M2

37.   The second study by Moenius applies a similar methodology but this time just to trade in agricultural products. Here he seeks to assess three common hypotheses:

1. country-specific agricultural standards discourage trade

2. harmonization of standards promotes trade in agricultural goods

3. within a trade block, harmonized *and* country-specific standards have different implications for insiders and outsiders

38.   Moenius (2006a) uses a similar dataset to Moenius (1999/2004), but this time relating to 5 EU countries (Belgium, France, Germany, Netherlands and UK) and 9 other OECD countries, and restricted to agricultural trade. Taking all agricultural products together, the overall effect of country-specific importer standards and *shared* importer standards is to reduce imports. Equally, the effect of standards in country X (shared with country Y) on exports from X to Y is negative. But the overall effect of country-specific standards (in X) on exports to Y is positive. In Tables 1 and 2, his results are marked **M2**. Moenius also shows that the estimated coefficients for different agricultural products vary substantially across different sectors – so much so that hypotheses 1 and 2 cannot be said to hold for all types of agricultural products.

39.   Moenius also disaggregates his results according to whether the exporting countries are in the EU or not. (In his sample, the importing countries are always in the EU.) He finds that importer standards (EU standards) have a modest positive effect on imports from other EU countries but have a clear *negative* effect on imports from most non-EU countries.[8] On the other hand, he finds that for the period 1980-1990, shared importer standards tend to *increase* imports from non-EU countries. That effect gets weaker over time, however, and during the period 1991-1995, it is negative (though insignificant) – suggesting that the protective effects of EU standards are growing over time.

40.   Moenius summarises the implications as follows. Country-specific agricultural standards don't always block trade, nor does harmonization always increase trade. Hypotheses 1 and 2 above are too simplistic. There are two effects at work here. First, as discussed before, the net effect of country-specific standards depends on the balance between the beneficial information effect and the detrimental adaptation cost. Second, while harmonization may reduce trade costs, there is a consequent reduction in variety and that may reduce trade. Finally, Moenius concludes that standards within a particular standardisation regime will affect insiders and outsiders in different ways.

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8.   For simplicity, we omit the results where the US is the exporter.

Moenius (2006b) – M3

41.   The third study by Moenius again uses a similar methodology to the first two, but this time focuses only on electrical products. The first part looks at the effects of *a subset* of standards (the basic electricity specifications such as voltage, hertz and different plug types) on trade amongst a sample of 159 countries. The second part looks at the effects of *all* standards relevant for those goods for a subset of 14 OECD countries.

42.   Moenius finds three main results. First, national and international standards both increase trade flows in electrical products, and indeed (by comparing the results with those from his earlier studies) he concludes that this effect is more important for electrical products than the average manufactured product. Second, national (or country-specific) standards seem to have more pronounced effects on trade than international (or shared) standards. Thirdly, the size of these coefficients depends on the sizes of the importing and exporting countries. In particular, smaller countries benefit more (than large countries) from international harmonization. These results are marked **M3** in Tables 1 and 2.

43.   The first and third conclusions are consistent with much of what we have found before. But the second conclusion may need further discussion. Referring back to the discussion above (in the context of the first study by Moenius) it would seem that the product adaptation costs faced by a would-be exporter are on average lower when facing a harmonized standard than when facing a country-specific standard. If so, how can the trade creating effects of the latter exceed the trade-creating effects of the former? One answer would be that the offsetting information effects are greater for country-specific standards than for international standards. This is by no means implausible: country-specific standards can (and do) give information on specific market conditions in that country, while, almost by definition, international standards cannot do that.

Czubala, Shepherd, and Wilson (2007) – CZ

44.   Most of the studies that use the Perinorm database are studies of trade between rich countries. For that reason Czubala *et al* (2007) is a particularly welcome study, as it uses this approach to examine exports of textiles and clothing from 47 Sub-Saharan countries in Africa to the EU-15.[9] Their approach is broadly similar to that of Moenius except that there is a difference in the way they compute the standards variables. For each product type, they compute the number of EU standards recognised by Perinorm and split these into two groups: those that are harmonized to an ISO standard, and those that are not. These two groups are used to create two variables: a count of international standards and a count of European standards. These two variables are included in a gravity model of EU-15 imports from the 47 African countries.

45.   The authors find that EU standards which are not harmonized to ISO standards reduce African exports of clothing and textiles (the coefficient is negative and significant), but EU standards which are harmonized to ISO standards are much less restricting (the coefficients is close to zero with a t-statistic of less than one). They note, however, that while the share of EU standards that are harmonized to ISO grew until 1999, it started to decline from 2000 onwards. This study is marked **CZ** in Table 2, but cannot be entered in Table 1, as there are no data on exporter standards.

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9.   Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

Shepherd (2007)

46.   Shepherd's (2007) study also uses Perinorm in a similar way to Czubala *et al* (2007) but estimates a somewhat different trade model. Whereas all the models so far have looked at aggregate trade or bilateral trade, this model looks at the relationship between trade *variety* and standards, with specific reference to textiles, clothing and footwear. (For that reason, it is hard to locate this study in Table 2.)

47.   Shepherd's model examines the variety of imports to the EU-15 from approximately 200 countries. The model uses two standards variables which are slightly different from those in Czubala *et al*: the first is the (natural log) of the total number of EU standards relevant to a particular product; the second measures the proportion of that total which is harmonized with an ISO standard.

48.   Shepherd makes two main findings. First, a 10 percentage point increase in the proportion of EU standards which are harmonized to ISO standards is associated with a 0.2 percent increase in the variety of imports from each trade partner. This is perhaps a relatively small effect, but statistically significant, and it is found to be somewhat higher for imports from low income countries. Second, a 10 percent increase in the total number of EU standards is associated with about a 6 percent decrease in product variety. As Shepherd argues, the results are consistent with the view that diverse product standards impose fixed costs of adaptation, but that harmonization reduces the size of these fixed costs.

Summary

49.   Table 3 summarises the above studies. All are based on measures of standards (*not* regulations) computed from Perinorm. Most are models of bilateral trade, but some relate to a country's total exports and/or imports. Amongst the studies looking at all sectors, especially manufacturing, standards tend to be trade creating. But in the studies of agricultural products, and textiles and clothing, standards (especially national standards) in a country can constrain imports into that country. Most relate to OECD countries, but the one study that focuses on exports from Sub-Saharan Africa finds that if EU countries have standards that are not harmonised to ISO standards, then these can deter imports from Sub-Saharan Africa.

50.   The reader may also wish to look back to Tables 1 and 2. The studies listed above (**BL1**, **BL2**, **BJ1**, **BJ2**, **BJ3**, **BJ4**, **CZ**, **M1**, **M2**, **M3**, **ST**) are all highlighted in light grey. From these it is evident that the majority of studies listed above are located on the right hand side of each table. This means that amongst these studies, the effects of standards tend to be trade-creating rather than trade-reducing. The most notable exception is the effect of national standards in country X on imports into X, which are finely balanced on both sides of Table 2.

Table 3. Summary of Studies in Section 2.1

Author(s)	Date	Dependent Variable(s)	Standards or Regulations?	Data	Trade Effect	Sectors	Countries
Swann *et al*	1996	Total UK trade	Standards	Perinorm	UK standards are trade creating, especially national standards.	Economy wide	UK
Temple & Urga	1997	Total UK imports	Standards	Perinorm	No significant evidence that standards are trade creating.	Economy wide	UK
Blind	2000	Bilateral trade	Standards	Perinorm	Standards are either trade-creating or neutral.	Economy wide	9 OECD Countries
Blind & Jungmittag	2001	Bilateral trade	Standards	Perinorm	German international standards increase exports and imports; German national standards reduce both.	Economy wide	Germany, UK
Blind & Jungmittag	2002	Bilateral trade	Standards	Perinorm	German standards play no role in exports to France, but German international standards increase imports from France.	Economy wide	Germany, France
Blind	2001	Bilateral trade	Standards	Perinorm	Standardisation promotes trade.	Measurement instruments	Switzerland, Germany, France, UK
Moenius	2004	Bilateral trade	Standards	Perinorm	Standards are all (on average) trade creating, but some important sectoral differences.	Economy wide	12 OECD Countries
Moenius	2006a	Bilateral trade	Standards	Perinorm	Country-specific agricultural standards do not always block trade, and harmonization does not always increase trade.	Agricultural products	14 OECD Countries
Moenius	2006b	Bilateral trade	Standards	Perinorm	Standardisation promotes trade.	Electrical products	Part 1: 159 Countries; Part 2: 14 OECD Countries
Czubala *et al*	2007	EU-15 imports	Standards	Perinorm	Standards in EU-15 not harmonized to ISO standards can be a barrier to trade; EU standards harmonized to ISO standards are not.	Textiles and clothing	EU-15 and 47 Sub-Saharan countries in Africa
Shepherd	2007	Variety of exports	Standards	Perinorm	Internationally harmonized standards in the importing country increase the partner country's export variety.	Textiles, clothing and footwear	approx. 200 countries

2.2 Studies based on ISO 9000 Diffusion

51.   In this sub-section, we focus on three studies, by Grajek (2004), Clougherty and Grajek (2008) and Kim and Reinert (2009).

Grajek (2004) – G1 and G2

52.   Grajek's study is in some respects similar to those by Moenius and others, discussed in the previous section, but it takes a different approach to measuring the standards variables. Instead of using standards variables derived from Perinorm, Grajek uses data on the diffusion of ISO 9000 in different countries as a measure of the *standards richness* of those countries.

53.   Grajek estimates a gravity equation for bilateral trade using data on 101 countries (including all OECD countries) over the period 1995-2001. In the regressions using data on all countries, he finds that the diffusion of ISO 9000 in country A promotes exports from A but reduces imports into A. But in the regressions using data on just the OECD countries, he finds that the diffusion of ISO 9000 in country A promotes *both* exports from A *and* imports into A. Grajek argues that asymmetry between the overall coefficients and the OCED coefficients can be explained by a substitution effect. He argues that ISO 9000 certified firms are more likely to trade with each other more than with other firms, and for that reason the positive impact of ISO 9000 on trade is more pronounced among the OECD countries (which make heavy use of ISO 9000).

54.   Grajek notes that the literature has been divided on the role of ISO 9000. Some see it as a "common language" that lowers information asymmetries between firms, and hence eases trade between firms. Others see it as a device to raise rivals' costs and hence it acts as a barrier to market entry and to trade. Grajek considers that his results on balance support the "common language" hypothesis.

55.   These results are marked **G1** (for the whole sample) and **G2** (for OECD countries only) in the upper parts (i) of Tables 1 and 2.

Clougherty and Grajek (2008)

56.   Clougherty and Grajek's study has a similar design to that of Grajek, but is broader in scope. In addition to assessing the implications of ISO 9000 for trade, they also examine the implications of ISO 9000 for foreign direct investment (FDI). Here we concentrate just on the first part of the study, but we shall return to the second part of the study in Section 4 below.

57.   Clougherty and Grajek estimate a gravity model of trade using OECD panel data on imports into OECD nations from a total of 52 countries over the period 1995-2002. The standards variables are computed in the same way as in the Grajek study. They segment their data into three sub-samples: a sample to model exports from developed countries to other developed countries (DC→DC, in their notation); a sample to model exports from developing countries to developed countries (LDC→DC); and a sample to model exports from developed countries to developing countries (DC→LDC).

58.   Their regression results find that ISO 9000 diffusion in developed nations does not appear to enhance trade between nations. That is, diffusion in *developed* countries has no apparent effect on DC→DC, LDC→DC, or DC→LDC. But on the other hand, ISO 9000 diffusion in *developing* nations does appear to enhance exports to developed nations (LDC→DC).

59.   It is worth noting in passing that these results are somewhat different from those in Grajek (2004), where using the present notation, ISO 9000 diffusion in *developed* countries has a positive effect

on DC→DC exports and DC→LDC exports, but a negative effect on LDC→DC exports. But the positive effect of ISO 9000 diffusion in *developing* countries on LDC→DC exports *is* also found in Grajek (2004).

60.   As with the previous study, these results are marked **CG1** (LDC→DC), **CG2** (DC→LDC) and **CG3** (DC→DC) in the upper parts (i) of Tables 1 and 2.

Kim and Reinert (2009) – KR

61.   This study is somewhat different in scope from the other two in this section, but we have included it here because it uses ISO 9000 diffusion as one of its key variables.

62.   Kim and Reinert explore the hypothesis that developing countries cope better with stringent developed country standards in food and agricultural products when they have a stronger institutional capacity.   They measure four aspects of institutional capacity: information, conformity, enforcement, and international standard-setting. They estimate a gravity model of trade in food and agricultural products – specifically, cereals and cereal products, and preserved or prepared nuts including groundnuts. Their data relate to 52 countries (including 30 developing countries) for cereals and cereal products, and 49 countries (including 25 developing countries) for nuts and nut products.

63.   Their measure of informational capacity draws on three indicators: the proportion of Internet users per thousand inhabitants, an Education Index from UNDP, and an online service delivery index from the World Market Research Centre Global e-Government Survey. Their measure of conformity capacity is the proportion of establishments in each country which have ISO 9000 certification. Their measure of enforcement capacity is derived from numbers of SPS enquiry points, TBT enquiry points, and a National Plant and Protection Organization. And finally, their measure of international standards-setting capacity is derived from data on membership and participation in relevant international standards-setting organisations.

64.   Kim and Reinert's econometric results find that informational capacity and conformity capacity have strong and significant effects on developing country exports, but the effects of enforcement and international standard-setting are less clear. They confirm the negative and statistically significant impact of Aflatoxin B1 standards on developing country exports, as found in earlier studies, but show that to some degree, at least, informational and conformity capacity can offset this. In short, there is some evidence to support the hypothesis that developing countries do cope better with stringent standards in food and agricultural products when they have a stronger institutional capacity.   We have marked this study as **KR** in Part i (Column e) of Table 1.

Summary

65.   Table 4 summarises the three studies of this sub-section. All are based on measures of standards (*not* regulations). In each case, the studies count the use of ISO 9000 in a country as the measure of standards use in that country. All three studies estimate models of bilateral trade. All find that use of ISO by an exporter can increase its exports, and this seems especially relevant to exports from developing countries. The use of ISO 9000 by an OECD importer can act as a barrier to entry to imports from non-OECD countries, but can actually serve to increase imports from other OECD countries.

66.   The reader may again wish to look back to Tables 1 and 2. The studies listed in this section (**CG1**, **CG2**, **CG3**, **G1**, **G2**, **KR**) are again highlighted in light grey. The effects on exports (Table 1, Part i) are either positive or neutral, but the effects on imports (Table 2, Part ii) are finely balanced.

Table 4. Summary of Studies in Section 2.2

Author(s)	Date	Dependent Variable(s)	Standards or Regulations?	Data	Trade Effect	Sectors	Countries
Grajek	2004	Bilateral trade	Standards	Use of ISO 9000	ISO 9000 use in country X increases exports from X and reduces imports into X. But amongst OECD countries, importer use of ISO 9000 leads to increased imports from other OECD countries.	Economy wide	101 countries (incl. all 30 OECD countries)
Clougherty & Grajek	2008	Bilateral trade	Standards	Use of ISO 9000	ISO 9000 use in developed nations does not enhance trade. But ISO 9000 use in developing nations enhances exports to developed nations.	Economy wide	52 countries
Kim & Reinert	2009	Bilateral trade	Standards	Measures of institutional capacity (e.g. use of ISO 9000)	Institutional capacity (e.g. use of ISO 9000) helps to overcome trade barriers from stringent regulations.	Cereals, cereal products, nuts	Up to 30 developing countries and 22 developed countries

2.3 Regional Agreements: MRAs and Harmonization

67.   Chen and Matoo (2004), Vancauteren and Weiserbs (2005), Henry de Frahan and Vancauteren (2006), and Baller (2007) have taken a rather different approach to these questions. Instead of using the Perinorm database or using data on ISO 9000 diffusion, they use information on mutual recognition agreements (MRAs) and harmonization agreements to assess the degree of international harmonization of regulations and standards. Moreover, while all the studies in sub-Sections 2.1 and 2.2 referred to standards and *not* to regulations, this is no longer the case. The studies by Chen and Mattoo (2004) and by Baller (2007) refer to standards *and* regulations, while the studies by Vancauteren and Weiserbs (2005) and by Henry de Frahan and Vancauteren (2006) refer to regulations *only*.

68.   To understand these studies, it is helpful to think of them as using a slightly different model to the studies reviewed in sub-Sections 2.1 and 2.2.

Figure 3. Regional Agreements and Trade
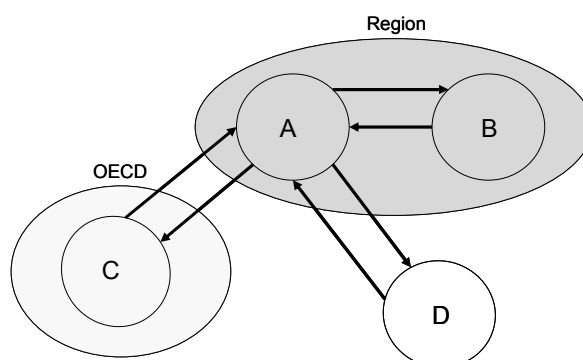
69.　　In Figure 3, we identify a region in which a regional agreement (MRA or harmonisation) exists. We also recognise two types of outsider: those in rich countries (marked here as OECD) and those in other countries. The implication of this model is that the effect of the MRA or harmonisation within the region, as drawn, will have different effects on the trade between A↔B, A↔C and A↔D.

Chen & Mattoo (2004) – CM1, CM2 and CM3

70.　　Chen and Mattoo estimate a gravity model of bilateral trade between pairs of countries. They use data on 28 OECD countries and 14 non-OECD countries covering 3 digit SITC product categories from all sectors of the economy. They create 'standards' measures from data on MRAs and harmonization agreements. The MRA variables are simple binary variables which indicate whether there is (1) or is not (0) an MRA between two countries (say I and J) for product R in year T. Several different MRA variables are constructed to capture MRAs with and without associated rules of origin. The harmonisation variables count the *total number* of harmonisation directives that impinge on trade between the two countries (I and J) for product R in year T. Several different MRA variables are constructed to capture MRAs *with* and *without* associated rules of origin.

71.　　Chen and Mattoo find that such harmonisation agreements can increase trade between participating countries (A and B in the above diagram) but will not necessarily increase trade with other countries (C and D). They find that harmonization increases the exports from excluded *developed* countries (C in the above diagram) to the region, but reduces exports from excluded *developing* countries (D) to the region. They explain this difference as follows. The harmonised standard in the region is likely to be quite strict compared to what country D is used to, and as a result any benefits of harmonisation in the form of economies of scale are outweighed by the increased costs of meeting a stricter standard. By contrast, for those countries that are already familiar with strict standards (C, for example) the benefits of harmonisation outweigh the costs. Hence the net effect of harmonisation in a region is to increase exports from C and reduce exports from D to the region.

72.　　By contrast, Chen and Mattoo find that Mutual Recognition Agreements (MRAs) tend to have more symmetric benefits to countries B, C and D. This means that intra-regional trade (A↔B), exports from developed countries outside the region (C→A) and especially exports from developing countries (D→A) all increase, unless the MRAs contain restrictive rules of origin. When the MRAs do contain restrictive rules of origin, however, the benefits are confined to countries within the region, and at the expense of the rest of the world – especially developing countries.

73.　　These studies are located in Table 2 Part i, because they relate to the internationalisation of standards and regulations. The implications of MRAs are marked **CM1**. The implications of harmonization

on trade from OECD countries to the region are marked **CM2**, and the implications of harmonization on trade from non-OECD countries to the region are marked **CM3**.

Vancauteren and Weiserbs (2005) – VW

74.   This study and the next are important because they focus on an issue of particular policy interest: the effect of harmonisation of EU regulations on intra-EU trade. This study refers to manufacturing while the next refers to trade in food products.

75.   As part of a wide-ranging application of the gravity model to intra-EU trade in manufacturing, Vancauteren and Weiserbs analyse the effects of EU harmonization of technical regulations. Their data on technical regulations come from European Commission (1998). This indicates, at the NACE 3-digit level, whether trade is affected by technical regulations and also lists the main approach used by the Commission to remove such barriers. From this data they construct a trade-weighted coverage variable which measures the proportion of a country's exports that satisfies the EU's harmonization of regulations. This variable is normalised to measure the extent to which a country shows greater than average compliance with EU harmonization. Using data for total manufacturing and for the period 1990-1998, they estimate a gravity model for intra-EU trade which includes this coverage variable.   Their regression results find that harmonization of EU regulations has played a strongly positive and statistically significant role in explaining growth of intra-EU trade in manufacturing. Their study is marked **VW** in Table 1 Part i and Table 2 Part i.

Henry de Frahan and Vancauteren (2006) – HV

76.   Henry de Frahan and Vancauteren estimate a gravity model of bilateral trade in a total of 1284 8-digit products taken from 10 NACE sub-sectors covering food products. The data relate to 10 importing countries and 14 exporting countries in the EU. They compute regulation variables from a very detailed database on the harmonisation of technical regulations (described in Brenton *et al*. 2001). In the database, harmonisation of TBT is described by a binary variable. For each product, this takes the value 1 if harmonization rules apply to the bilateral trade in that product, and 0 otherwise. The variable is also set to 0 if one or more of the following conditions hold: (i) harmonisation is not applied and countries keep their own national regulations, (ii) national regulations are not considered important and/or (iii) a mutual recognition agreement is observed. The binary variables are aggregated to form export-weighted trade coverage ratios which are used in their model as a measure of harmonisation.

77.   Their regression results find that these harmonisation variables have positive and significant coefficients for overall intra-EU trade in food products and, at a more disaggregated level, for trade in 9 out of the 10 categories of food product. They conclude that harmonisation in food regulations has increased intra-EU trade in all food products by about ⅔, and in fruits and vegetables by around ⅓ during the period 1990–2001. This study is marked **HV** in Table 1 Part i and Table 2 Part i.

Baller (2007) – BA1, BA2 and BA3

78.   Baller's study examines bilateral trade in two sectors, telecommunications equipment and medical devices, between 26 OECD countries and 22 non-OECD countries. She estimates a gravity model using trade data at the 3-digit level. Baller's database contains information on 8 MRAs relevant to medical devices and 14 MRAs relevant to telecommunications equipment. It also contains information on 22 EU harmonisation agreements and 19 ASEAN harmonisation agreements. She constructs several variables to represent the relevance of MRAs and harmonization agreements to bilateral trade between a particular pair of countries. The MRA variable is a binary measure indicating if two countries have an MRA with each other at a particular time (1) or not (0). The main harmonization measure is a binary variable taking the

value 1 if two countries have a relevant harmonization agreement at a particular time. She also creates two other binary variables to measure whether (in the notation of Figure 3): (i) country A is part of a harmonizing region and C is not, and C is an OECD country; (ii) country A is part of a harmonizing region and D is not, and D is *not* an OECD country.

79.   Baller's results indicate that MRAs have a positive influence on the export probabilities *and* trade volumes for those countries in the MRA. The results for harmonization are less clear-cut. Baller distinguishes three cases. First, the extent of harmonization between partners to a harmonization agreement (A↔B) does not appear to have a significant effect in their model. Second, those third-party OECD countries, marked C in Figure 3, benefit from the regional harmonization agreements through increased exports (C→A). Thirdly, those third-party developing countries, marked D in Figure 3, do not seem to benefit from the regional harmonization agreements through increased exports (D→A). The MRA results are marked **BA1** in Tables 1 and 2. The harmonisation results for exports from C→A are marked **BA2** in Table 2, and the harmonisation results for exports from D→A are marked **BA3** in Table 2.

80.   These results are consistent with those of Chen and Mattoo (2004). In light of these results, Baller (2007) argues that MRAs would be a more supportive policy instrument in encouraging trade with non-OECD countries than harmonization per se. Baller observes that at present few of these countries are parties to MRAs.

Summary

81.   Table 5 summarises the four studies of this sub-section. Two are studies of the effects of regulations (Vancauteren and Weiserbs, 2005; Henry de Frahan and Vancauteren, 2006) while two seem to focus on both the effects of standards and/or regulations (Baller, 2007; Chen and Mattoo, 2004). All four studies estimate models of bilateral trade. Three use variables based on data on MRAs and/or harmonisation measures. One uses a variable describing the EU policy approach to dealing with technical barriers to trade (TBTs).

82.   Two of the studies found that harmonization of EU regulations led to more intra-EU trade, whether in manufactured goods or in food products. The other two studies found that MRAs tend to be more uniformly trade-creating than are harmonisation measures. These latter also found that harmonisation in a region tends to help outside OECD countries to export to the region, but may prevent outside developing countries from exporting to the region.

83.   The reader may again wish to look back to Table 2. Two of the studies listed in this section (**HV**, **VW**) are not highlighted (related to regulations) while the others (**BA1**, **BA2**, **BA3**, **CM1**, **CM2**, **CM3**) are highlighted in dark grey (related to standards *and* regulations). These studies are all located in Table 2 Part i because they relate to the internationalisation of standards and regulations. The overall impression of these studies is that harmonization and MRAs are mostly (though not unanimously) favourable to trade.

Table 5. Summary of Studies in Section 2.3

Author(s)	Date	Dependent Variable(s)	Standards or Regulations?	Data	Trade Effect	Sectors	Countries
Chen & Matoo	2004	Bilateral trade	Both	Data on MRAs and harmonization	Harmonization in a region boosts exports of excluded developed countries to the region but reduces exports of excluded developing countries. MRAs are more uniformly trade promoting unless they contain restrictive rules of origin.	Economy wide	28 OECD countries & 14 non-OECD countries
Vancauteren and Weiserbs	2005	Bilateral trade	Regulations	EU policy approach for dealing with TBT for new member states	Harmonisation of EU regulations has led to more intra-EU trade.	Manufacturing	10 importing countries and 14 exporting countries (all EU)
Henry de Frahan & Vancauteren	2006	Bilateral trade	Regulations	Measures of harmonisation of technical regulations	Harmonisation of EU regulations has led to more intra-EU trade.	10 categories of food product	10 importing countries and 14 exporting countries (all EU)
Baller	2007	Bilateral trade	Both	Data on MRAs and harmonization	MRAs have a positive influence on trade. The impact of harmonization on excluded OECD exporters is large and positive - but this beneficial market integration effect does not extend to non-OECD exporters.	Telecoms equipment & medical devices	26 OECD countries & 22 non-OECD countries

2.4 Studies based on Measures Notified to WTO Under TBT and SPS Agreements

84.   While studies exclusively related to SPS regulations fall outside the scope of the study, it is useful to include a couple of studies, for two reasons. First, the scope of these two is broader than SPS regulations alone. Second, it is useful for the reader to understand the different approach to measuring regulation employed in these studies. Note that these studies refer strictly to regulations and not to standards. Moreover, the studies chosen are two amongst many of this sort, and in choosing these we have passed over some important earlier studies.[10] But the particular attraction of these two is that they are broad in scope, as compared to many other studies of SPS standards that have a much narrower focus.

Disdier, Fontagné and Mimouni (2007) – D1, D2

85.   The study by Disdier *et al* (2007) examines bilateral trade in a total of 690 agricultural products. They estimate a gravity equation using data from 154 importing countries and 183 exporting countries. Their specific objective is to examine the impact on trade of measures notified under the SPS and TBT Agreements.

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10.   Again, we refer the reader to some of the earlier literature reviews listed in Footnote 2: Ferrantino (2006), Korinek *et al* (2008), Maskus et al (2001), NIST (2004), WTO (2005).

86.   WTO members are obliged to notify non-tariff measures, and these are analysed by UNCTAD. Disdier *et al* point out that while, in theory, 115 measures could be imposed for environment, wildlife, health or safety purposes, in practice only 43 of them are enforced. Countries can cite six different objectives when imposing measures on agricultural trade, and the distribution of these 43 measures across the six objectives is shown in parentheses: protection of the environment (9); protection of wildlife (5); protection of human safety (7); protection of plant health (6); protection of animal health (6); protection of human health (10). While a majority of these relate to SPS concerns (outside the scope of this study) a significant number relate to other objectives.

87.   Disdier *et al* use three approaches to measuring the significance of these notifications. The first is a binary variable equal to one if the importing country notifies at least one barrier. The second is a frequency index defined by the proportion of disaggregated (HS6) product items notified within a more aggregated (HS4) product category. The third is an ad-valorem equivalent using the data in Kee *et al*. (2006).

88.   Disdier *et al*'s results suggest that, overall, SPS and TBT measures have a negative impact on trade in agricultural products. However, they do find that OECD to OECD exports are not significantly impeded by these measures. (This result is marked **D1** in Table 2 Part ii.) But exports from developing to OECD countries are certainly reduced by these regulations. (This result is marked **D2** in Table 2 Part ii.) And moreover, the negative impact of these measures is greatest in exports to the EU market.

Fontagné, Mimouni and Pasteels (2005) – F1, F2 and F3

89.   The study by Fontagné *et al* (2005) is also broad in scope. It examines bilateral trade data at the 6-digit level for some 5,000 products in 61 product groups (including agricultural products *and* manufactured products). In their sample, there are 61 importing countries and 114 exporting countries. Their specific interest is in the trade effects of environment related measures (ERMs) notified under the SPS and TBT Agreements. Their econometric approach is to use a censored Tobit model with random effects.

90.   Fontagné *et al* construct a standards variable similar to the frequency index used by Disdier *et al* (2007). They count the number of 6-digit products notified by the importer and divide that number by the total number of product items belonging to the 4-digit product category. They distinguish between the effects of this ERM standards measure on imports from OECD countries (OECD), developing countries (DC) and least developed countries (LDC).

91.   Fontagné *et al* present detailed results for their 61 different product groups. They find that for trade in fresh and processed food, these ERM measures tend to restrict trade from developing countries (DCs) and least developed countries (LDCs). This result is marked **F2** in Table 2 Part ii. But exports from OECD countries are not restricted (this is marked **F1** in Table 2 Part ii). On the other hand, for the majority of manufactured products, these ERM measures have either no significant effect or a positive effect, and that observation applies to LDCs, DCs and OECD countries. This last result is marked **F3** in Table 2 Part ii. [11]

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11.   However, they find that reported measures in some product categories are suspiciously low, which suggests that there may be under-reporting of such measures to WTO.

Table 6. Summary of Studies in Section 2.4

Author(s)	Date	Dependent Variable(s)	Standards or Regulations?	Data	Trade Effect	Sectors	Countries
Disdier *et al*	2007	Bilateral trade	Regulations	Measures notified under SPS and TBT agreements	Such regulations have on the whole a negative impact on trade in agricultural products. These measures do not deter OECD→OECD exports, but do constrain exports from developing and least developed countries to the OECD.	Agricultural products	154 importing countries and 183 exporting countries
Fontagné *et al*	2005	Bilateral trade	Regulations	Environmental measures notified under SPS and TBT agreements	Such regulations tend to have a negative impact on trade in food products, while for manufactured products, an insignificant or even a positive impact is observed.	Agricultural products and manufactured products	61 importing countries and 114 exporting countries

Summary

92.   Table 6 summarises these two studies. Given that the measures of regulations used here are notifications under the TBT and SPS agreements, it is not surprising that they are, on the whole, not very supportive to trade. In Table 2, these results (codes not highlighted) are located further to the left than the majority of studies considered so far.

2.5 Other Measures of Standards

93.   In this final sub-section, we note five further studies that use other approaches to measuring standards and regulations for use in econometric models of trade. Note that, as in Section 2.3, some studies refer only to regulations (van Beers and van den Bergh, 1997; Wilson et al, 2002) while the rest refer to standards *and* regulations (Michalek *et al*, 2005; Chen *et al*, 2006; Sánchez *et al*, 2008).

van Beers and van den Bergh (1997) – VB

94.   This pioneering study examined the impact of strict environmental regulations on a country's exports and imports. Van Beers and van den Bergh construct their own measures of the strictness of environmental regulations. This is an output-oriented measure, which they argue is a better indicator than input-oriented measures. Their 'narrow' measure is closely connected to the 'polluter pays' principle while their 'broad' measure is constructed from several environmental indicators. Van Beers and van den Bergh estimate gravity models of bilateral trade for 1992, using data for 21 OECD countries. There are three versions of their model: (i) total bilateral trade flows; (ii) bilateral trade flows in pollution-intensive sectors; and (iii) bilateral trade flows in pollution-intensive sectors that are 'non-resource based' (or 'footloose', as described in their paper).

95.   The first set of results refers to the effect of a country's own regulations on its exports. In the case of model (i), they find that the broadly defined variable does not have a significant effect on exports, while the narrow one does have a significant negative impact on exports. In case (ii), they find no evidence that a strict environmental policy has an impact on 'dirty' exports. In case (iii), which refers to non-resource based (or 'footloose') bilateral trade, they find a significant negative effect on exports. They argue that results (ii) and (iii) are consistent with theoretical predictions. The second set of results refers to the effect of a country's own regulations on its imports. Here they find that irrespective of which of the

three models is considered, strict environmental regulations have a significant negative impact on imports. These results are summarised by the mark **VB** in Table 1 Part ii, and in Table 2 Part ii.

Wilson, Otsuki and Sewadeh (2002) – WS

96.   Wilson *et al* explore the link between trade and environmental regulations in major pollution–intensive industries, including metal mining, nonferrous metals, pulp and paper, iron and steel, and chemicals. Their data refer to 6 OECD and 18 non–OECD countries over the period 1994 to 1998, and their econometric framework follows the Heckscher–Ohlin–Vanek (HOV) model.

97.   Wilson *et al* use data on environmental regulations collected by Dasgupta *et al* (2001). The latter carried out a survey using 25 questions to analyse environmental awareness, legislation, and control mechanisms for environmental enforcement in each country. From these Dasgupta *et al* developed a cross-country index of stringency in environmental regulation, where a higher score in the index implies greater stringency.

98.   Wilson *et al* construct two variables from the Dasgupta *et al* data. One is a measure of the state of environmental legislation, and the other is a measure of the control mechanism for environmental enforcement. They find that the effect of 'state of legislation' variable (in country X) on net exports (from country X) is negative and significant in all industries but one. This result is marked **WS** in Table 1 Part ii. This is in line with the view that stricter environmental standards mean lower exports from pollution–intensive industries. They also find that a harmonization agreement on common environmental regulations will cause a greater reduction in *developing* (as opposed to *developed*) country exports of pollution-intensive goods.

Michalek et al (2005) – MH1 and MH2

99.   Section 5 of Michalek *et al* (2005) offers another novel approach. Rather than count or quantify standards or regulations as such, they analyse the effects of three different generic EU policy approaches for dealing with technical barriers to trade for the new member states (CEEC) and the Mediterranean countries. These three approaches are: harmonization; the new approach; and mutual recognition.

100.   Michalek *et al*'s econometric model uses bilateral trade data for the European Union at the 8-digit level. Their data on technical barriers to trade is taken from European Commission (1998) which reports what approach the European Single Market program is taking to reducing technical barriers to trade in each 3-digit industry. For each industry they construct dummy variables reflecting the use of one (or more) of these approaches: harmonization, new approach, mutual recognition. (In several industries, more than one approach is used.)

101.   Their results find that when the approach to removing TBT is harmonisation or the new approach, then that is successful in increasing trade flows. This is marked **MH1** in Table 2 Part i. But when the approach is mutual recognition, the estimated effect is to reduce trade flows. This is marked **MH2** in Table 2 Part i.

102.   They note that the last of these results is surprising since common sense (and other results, described above) suggest that the mutual recognition approach is a most effective method to overcome technical barriers to trade. Their interpretation of this result is that the observed association is not a causal connection from the choice of policy to the effect on trade but the reverse direction of causation. The mutual recognition approach may be introduced in sectors when trade flows are relatively low but there are few technical barriers to trade. In that case, there would be little to be gained from a policy other than mutual recognition.

Chen, Otsuki and Wilson (2006) – CW1 and CW2

103.   The study by Chen *et al* (2006) uses the data from the World Bank Technical Barriers to Trade Survey to estimate a firm-level model of exporting by firms in developing countries. They use this model to estimate how standards impact on the decision to export to developed countries. The sample contains data from 619 firms in 25 agricultural and manufacturing industries located in 17 developing countries and considers five developed country export markets (EU, USA, Canada, Japan and Australia).

104.   Five specific questions in the survey generate variables of particular importance in this study:

   1. "Have quality/performance standards impacted your ability to export products?"

   2. "Have testing procedures impacted your ability to export product?"

   3. "Have labelling requirements impacted your ability to export products?"

   4. "Do you have difficulty obtaining information about applicable regulations in the countries listed?"

   5. "How many days does the conformity assessment inspection usually take?"

The answers to Questions 1-4 are used to create binary variables. The answer to 5 provides an average time in days. These variables are included in models of export shares and market diversification (the number of export markets in which a firm is active).

105.   Chen *et al* find from their model of export shares that firms answering "yes" to the above questions about testing procedures (2) and information (4) tend to have a significantly lower propensity to export. They also find that lengthy inspection times (Question 5) will significantly reduce the propensity to export. In particular, they find that it is agricultural rather than manufacturing firms that find these testing procedures and inspection times especially burdensome. These results are marked **CW1** in Table 2 Part ii.

106.   Turning to the model of market diversification, Chen *et al* find that firms answering "yes" to Question (1) above (about standards) tend to be active in a significantly lower number of export markets. This result is marked **CW1** in Table 2 Part ii. This observation is especially relevant to firms that outsource the production of essential inputs. Chen *et al* interpret this to mean that the existence of multiple standards in export markets is a challenge to would-be exporters and that may discourage the firm from entering a particular export market. They also find that larger firms tend to export to more countries than smaller firms: this suggests that larger firms find the need to comply with multiple standards less challenging.

Sánchez et al (2008) – SA

     Sánchez *et al* (2008) also use data from the World Bank TBT survey to estimate a firm-level model of exports from the manufacturing sector in Argentina to OECD countries. In the absence of detailed standards data, they use a difference in difference estimator to capture the effect of the increased stringency of standards and regulations in OECD countries on their imports. Their results find a marked reduction in export shares resulting from the more stringent OECD standards and regulations.

Summary

107.   The five studies listed here are summarised in Table 7. They are all rather different, using a variety of measures and approaches. In general however, there are many more negative results amongst this last group of studies than in most of the earlier studies. That is quickly confirmed when we take another look at Tables 1 and 2. In the case of strict environmental regulations, that is not surprising. It is

also unsurprising that the measures used in Chen et al. (2006) would have a negative effect on trade. It seems that the mainly negative results here are not specific to particular sectors.

Table 7. Summary of Studies in Section 2.5

Author(s)	Date	Dependent Variable(s)	Standards or Regulations?	Data	Trade Effect	Sectors	Countries
van Beers and van de Bergh	1997	Bilateral trade	Regulations	Environmental regulations	Strict environmental regulations have a significant negative impact on trade	Economy wide	21 OECD countries
Wilson *et al*	2002	Heckscher-Ohlin-Vanek (HOV) model	Regulations	Environmental regulations	Strict environmental regulations have a significant negative impact on trade	5 pollution-intensive industries	6 OECD countries and 18 non-OECD countries
Michalek *et al*	2005	Bilateral trade	Both	EU policy approach to correcting TBT	Harmonization and new approach to dealing with TBTs tend to increase trade; MRAs tend to reduce trade	Economy wide	EU – including new member states
Chen *at al*	2006	Export shares and market diversification	Both	TBT Survey on impact of standards and regulations	Some of the standards variables lead to reduced exports and reduced market diversification (activity in fewer export markets)	25 agricultural and manufacturing industries	Exporters from 17 developing countries; importers are EU, USA, Canada, Japan, Australia
Sánchez *et al*	2008	Argentina exports to OECD	Both	Difference in difference approach to measuring structural shifts	Structural shift has led to large reduction in Argentine exports to OECD countries	Manufacturing	Exporter is Argentina; importers are OECD countries

3.   Surveys

108.   The econometric evidence of the last section is often described as *indirect inference*. The studies described there seek to measure the effects of relationship between standards and trade indirectly from the pattern of correlation between them. In this section, we summarise some of the studies that have attempted to measure *directly* the relationship between standards and trade, by surveying exporting firms.

109.   The studies listed below are very heterogeneous, and ask rather different questions in different contexts. For that reason, it is not easy to compare the findings of the different surveys. They should not be seen as a series of attempts to answer a particular question, but rather they should be seen as contributing a miscellany of important insights into how standards impact on trade. Some of these surveys are, in the main, looking for the ways in which standards can act as barriers to trade (OECD, 1999; Wilson and Otsuki, 2004), while others (DIN, 2000) are, in the main, looking at the constructive side of standards.

United States International Trade Commission (1998)

110.   The purpose of this USITC study was to assess the importance of standards-related barriers to trade in the computer hardware, software, and telecommunications equipment sectors.   The particular focus was on the following factors:

- duplicative conformity assessments

- onerous quality registration

- testing, certification, marking and labelling requirements

- strategic standards policies of some countries.

111.   The study aims to provide 'illustrative examples' rather than attempt the more ambitious task of establishing exactly which countries, barriers, and products are most affected. The survey draws on an extensive literature search and a series of personal and telephone interviews in the United States, Europe, Asia, and Latin America. The interviewers sought the views of US and foreign-based companies, officials from government and trade associations, analysts and consultants about the importance of standards-related measures in these sectors.

112.   Duplicative conformity assessment requirements emerge as a particular matter for concern. Suppliers of telecommunications and computer equipment often have to go through repeated conformity assessments if they wish to sell in different countries. The problem does not lie with the technical requirements themselves, which are usually quite reasonable, but with the cost of repeating this exercise even for similar technical regulations, or slight variations in such regulations. Similar concerns relate to proliferation of quality registration, testing, and certification requirements, and to inconsistent marking and labelling requirements. The study evaluates some recent attempts to overcome some of these standards-related barriers by the use of mutual recognition agreements (MRAs).

OECD (1999)

113.   The aim of this study was also to investigate the extent to which trade is constrained by technical standards and conformity assessment procedures. The study aimed to collect data on compliance costs in export markets, and assess to what extent these impede trade. The study was concerned with three product groups (telecommunications equipment, dairy products and automotive components) in trade between four countries (the United States, the United Kingdom, Germany and Japan). Firms were questioned through interviews and a structured questionnaire.

114.   Different mandatory technical requirements exist in all four countries and in all three product categories. However, the interviews suggested that for the majority of firms these differences are at most a minor problem. Harmonisation of standards is generally found to be very helpful in reducing costs of product re-design and testing, but some companies said that genuine harmonisation is quite rare. Mutual recognition agreements (MRAs) are considered to have beneficial effect in reducing compliance costs. MRAs increase the number of approval agencies and the competition between agencies reduces the costs of obtaining approval.

115.   The survey identified two specific compliance strategies adopted by would-be exporters. One is described by OECD as, "incorporating into the initial product design many features demanded by target countries". This strategy makes it easier to export promptly to target countries. The other is "initial design for the domestic market only". This strategy keeps initial design expenditures low, but runs the risk of greater product re-design costs downstream if a suitable export market is identified.

116.   Conformity assessment costs could be substantial. Sometimes just initial approval is required before any exporting can begin. But in the dairy sector, *products* must be tested both prior to export and at the port of entry. The additional cost can be substantial for small specialist manufacturers. Time is an additional factor in the cost of conformity assessment. When product lifecycles are short, the additional time taken in conformity assessment can damage sales prospects. This was especially relevant to telecommunications equipment manufacturers where life cycles could be only 18 months.

117.   For many firms, moreover, the issue of meeting non-mandatory product standards was just as much of a challenge, *if not more so*. This is of particular importance when a product is a component in some other system (for example automotive components in the OEM market).

DIN (2000)

118.   The DIN summary report (2000) brings together the results of a company survey and some econometric work. The latter (by Blind and colleagues) has been discussed above. Here we concentrate on the former.[12]

119.   The survey selected ten sectors of industry; in eight of these, standardisation is of particular importance. The survey questionnaire (containing 49 questions) was sent to some 4,000 companies in Germany, Austria and Switzerland, and of these, 707 completed the questionnaire. The survey focused in particular on the effects of standards on companies, and their interaction with the business environment. Consumer interests and government interests in standardisation were assessed also in interviews carried out with ten experts each in Germany and Austria.

120.   The survey demonstrated the strategic significance of standardisation is not fully appreciated by most decision makers. Despite this, 75% of the businesses surveyed said they were involved in the activities of DIN, ON or SNV (as relevant)[13] and that 60% of this involvement is in practice at a European or international level. The survey showed that businesses which are actively involved in standards work see benefits in terms of costs and competitive success.

121.   Of the businesses surveyed, a third could succeed in export market with products that conform to their own national standards, but 27 per cent adapt products to foreign standards. Harmonized European and International Standards could result in significant reductions in trading costs and simplified contractual agreements. Over a half of the businesses surveyed stated that European and International Standards had lowered trade barriers in their sector, and that national standards were sometimes used as non-tariff barriers. Respondents indicated that standards have substantial and beneficial effects on transaction costs, as they act as a source of information and are accessible to all interested parties.

122.   The existence of standards means that there are a collection of harmonized technical rules. This can help businesses cooperate with each other and create strategic alliances, and the resulting synergies can reduce costs and increase profitability. But there can also be negative effects when such cooperation leads to a monopolistic market structure, with consequent damage to the consumer.

123.   Standards were not considered a particularly important constraint to innovation and standardisation was considered to be an effective way of reducing the economic risk of R&D activities, and of reducing R&D costs. The survey found that safety standards played a role in reducing accident rates, but respondents emphasised that standards were not the only factor behind this trend.

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12.   The DIN (2000) report is just a summary. Further details are in Blind (2004, Chapter 17, Section 17.9).

13.   ON and SNV are (respectively) the national standards institutes of Austria and Switzerland.

World Bank TBT Survey – Wilson and Otsuki (2004)

124.   The surveys listed above were specific to *particular countries*, and the World Bank Technical Barriers to Trade Survey was probably the first attempt to investigate the *global* impacts of technical requirements. The aim of the survey was to ask firms in agriculture, manufacturing and commerce in developing countries about the technical barriers they encounter, and the impact of these on export success. The data covers 689 firms in over twenty industries in 17 developing countries.   The survey sought information about the stringency and importance of technical regulations specific to five major export markets (EU, USA, Japan, Canada, and Australia).

125.   Some 70 percent of exporters encounter mandatory standards and technical regulations and the majority of respondents consider that the obligations to meet these requirements can discourage exporting. Of the five export markets considered, the EU is the one whose technical regulations are considered most important, followed by the USA. A particularly large share of firms in Eastern Europe and LAC (Latin America and Caribbean) consider technical regulations to be important. Product quality standard, performance standards and testing/certification requirements are considered the most important for export success. In some cases, however, it is recognised that technical regulations can reduce production costs and therefore enhance exports.

126.   Firms are usually able to manage compliance to technical regulations using existing resources, but in those cases where firms face additional costs of compliance, this usually involves investment in additional plant or equipment, or alternatively product re-design and additional employment. Conformity assessment is most widely imposed in the EU. Companies tend to find that outsourcing of conformity testing is less expensive than trying to assess conformity in house.

127.   Amongst international standards, ISO is most commonly used in this sample of firms from developing countries. The majority consider international standards are important for success both in domestic and foreign markets. Mutual Recognition Agreements are not common among countries in this survey, but there is some experience of these in Eastern Europe and Latin America and Caribbean. The majority of respondents said that Mutual Recognition Agreements lead to cost savings.

NIST (2004)

128.   This study contains two case studies of technical barriers to trade experienced by the US pharmaceuticals and automobile industries. US pharmaceutical firms have sometimes alleged technical barriers to trade (TBTs) when these are not actually TBTs in law. Nonetheless, NIST finds evidence that some importers use regulations that differentially affect either the ability of US firms to export or the cost of doing so. While the regulations are not written in an explicitly discriminatory way, they are written in such a way that they only impact on innovative pharmaceuticals. This is of particular concern to US pharmaceutical companies as the majority of 'on-patent' products are developed in the USA. The leading industry association does not collect systematic data on such TBTs, but instead focuses its attention on several 'priority markets', which makes it hard to form a definitive assessment. In the auto industry, NIST identified several regulations, standards, and conformity assessment procedures in some of the main US export markets for autos which appear to show the characteristics of technical barriers to trade. Such regulations are most common in the repair and service sector, but may also be found in some 'end of life' regulations.

Michalek et al (2005)

129.   Section 2 of Michalek *et al* compared the opinions of Polish and Israeli companies on technical regulations and standards imposed by the European Union. The survey was carried out before the

accession of Poland to the EU (May 2004). Michalek *et al* carried out a series of personal, telephone and email interviews with firms in three industries (food, chemicals and electricals). Respondents were asked to assess the implications of technical regulations and standards for costs and export success.

130.   In general, firms in all three industries in Poland had a positive (or at worst, neutral) attitude to EU technical regulations. By contrast, Israeli firms reported many more problems in exporting to the EU. In both countries, the greatest problems from technical regulations and standards were in the food sector, while firms in the electrical industry were most successful in exporting to the EU. In general, Polish firms reported that they had less need (than Israeli firms) to redesign products for exporting to the EU market, but when they did such re-design would involve them in greater investments than Israeli firms.

131.   In both countries, harmonization of standards was considered mostly beneficial and ISO standards are popular in both – though ISO 9000 is found to be much more popular in Israel than in Poland. Mutual Recognition Agreements are also viewed favourably. The main issue for Israeli firms in exporting to the EU is the necessity to carry out costly additional tests and certifications. This is a particular issue in the food industry. In general, the survey finds that many of the necessary adjustments were made in Poland before May 2004, while Israeli firms were still in transition and therefore faced greater obstacles in exporting to the EU.

Summary

132.   As indicated at the start of this section, the studies listed below are very heterogeneous, and ask rather different questions in different contexts. For that reason, it is not easy to compare the findings of the different surveys. They do however contribute an interesting miscellany of insights into how standards impact on trade. Table 8 summarises the main features and conclusions of each survey.

Table 8. Summary of Studies in Section 3

Author(s)	Date	Particular Focus	Standards/ Regulations?	Sectors	Countries	Summary of Results
USITC	1998	Explore standards-related barriers to trade	Both	Computer hardware, software and telecom equipment	USA, Europe, Asia, and Latin America	Duplicative conformity assessment a particular matter for concern. Suppliers often have to go through repeated conformity assessments to sell in different countries, even for similar technical regulations, or slight variations in such regulations. Similar concerns apply to proliferation of quality registration, testing, and certification requirements, and to inconsistent marking and labelling requirements.
OECD	1999	Compliance costs in export markets, and to what extent these impede trade.	Both	Telecoms equipment, dairy products and automotive components	USA, UK, Germany and Japan	For most, differences in mandatory technical requirements are a minor problem. But conformity assessment costs could be substantial (e.g. if products must be tested both prior to export and at the port of entry). Time to approval is an additional factor in conformity costs, especially when product lifecycles are short. The challenge of meeting non-mandatory product standards can be just as difficult as meeting mandatory requirements, if not more so.

Author(s)	Date	Particular Focus	Standards/ Regulations?	Sectors	Countries	Summary of Results
DIN	2000	How do standards influence the way companies interact with the business environment	Standards (mostly)	Sectors where standardisation is especially important	Germany, Austria and Switzerland	International standards can reduce trading costs. European and International Standards can lower trade barriers. Standards have beneficial effects on transaction costs. Standards encourage cooperation between businesses but can be problematic if this leads to a monopolistic market structure. Standards are not a particularly important constraint on innovation.
Wilson & Otsuki (World Bank)	2004	The stringency of technical regulations in five major OECD markets	Regulations (mostly)	20 industries	17 developing countries	Most exporters encounter mandatory standards and technical regulations and find these discourage exports. These are especially relevant in exporting to the EU or USA. Product quality standards, performance standards and testing/certification requirements are considered the most important issues. In some cases, however, it is recognised that technical regulations can reduce production costs.
NIST	2004	Do US products encounter TBT in export markets? What sort?	Both	Pharmaceutical and automobile industries	USA	Some importers use regulations that differentially affect the ability of U.S. firms to export. While not written in an explicitly discriminatory way, they only impact on innovative producers. This is of particular concern to producers of 'on-patent' pharmaceuticals. In the auto industry, several regulations, standards, and conformity assessment procedures show the characteristics of technical barriers to trade.
Michalek *et al*	2005	To assess the implications of EU technical regulations and standards for costs and export success.	Both	Food, chemicals and electricals	Israel, Poland	Polish firms had a more positive attitude to EU technical regulations than did Israeli firms. In both countries, the greatest problems from technical regulations and standards were in the food sector. Firms in the electrical industry were most successful in exporting to the EU. In both countries, harmonization of standards was considered mostly beneficial. Mutual Recognition Agreements are also viewed favourably.

4.   Productivity, Growth and Welfare

133.   In this section, we briefly note a few of the studies that have looked at the broader economic effects of standards. In no way is this a comprehensive review, but rather we give a few examples of some of the approaches that have been taken in the literature and some of the effects that have been found.

134.   The first group of studies use the Perinorm database and data on EU countries, and seek to estimate the effect of standards on productivity, and hence on overall economic growth. The next group use a variety of other approaches to explore the implications of standards for wages, employment and foreign direct investment. One is concerned with household income and poverty in Senegal, another is concerned with standards and FDI in a variety of developed and developing nations, and the last is concerned with standards and wages in Argentina.

Blind, Grupp and Jungmittag(1999); Jungmittag, Blind and Grupp (1999) [14]

135.   These were, as far as we know, the first econometric studies to examine the effects on standards on productivity. Blind and colleagues estimated an augmented production function for German business (excluding agriculture, forestry, fishing and property rentals) using data for the period 1960-1996.   In addition to conventional factors of production, their models also include measures of patents and standards – the latter is computed from the Perinorm database. Their results find that standards have a persistently positive and statistically significant coefficient in their regressions. The effects are economically important also, since over the period of their study, standards account for about one percentage point of the average annual growth rate.

Temple, Spencer & Witt (2005)

136.   This study was published alongside those by Blind and Jungmittag (2005) and Swann (2005) in the DTI report on *The Empirical Economics of Standards*. Temple *et al* seek to estimate the contribution of standardisation to long run productivity growth in the UK. Temple first constructed a long term series counting the number of BSI standards in the catalogue, using data from the BSI 'History Book' and from Perinorm. This is a most valuable contribution in its own right. Then, using data from 1948 to 2002, Temple *et al* estimate an econometric model of growth in labour productivity in which this measure of standards shows a positive and statistically significant correlation with labour productivity. Temple *et al* find that the direction of causation appears to run from standards to labour productivity growth rather than vice-versa, and that the impact of standards on labour productivity is a *long-run* effect. They find that the elasticity of labour productivity with respect to the number of standards is about 0.05.[15] This means that a 10% increase in the standards catalogue is associated with a 0.5% increase in labour productivity, and that implies that over the period 1948-2002, standards contribute about 13% of the observed growth in labour productivity in the UK. However, Temple *et al* stress that standardisation tends to act in conjunction with other factors such as innovation, and the nature of their data did not allow the role of standards to be separated from the role of these other inputs. Finally, Temple *et al* examined whether the progressive internationalisation of the BSI catalogue over the period (and especially in the 1990s) had any evident impact on their regression estimates, but found no significant effect.

Blind and Jungmittag (2005) [16]

137.   This study, also published as part of the DTI report on *The Empirical Economics of Standards*, examines the impact of standards on productivity in four EU countries (France, Germany, Italy and UK). Blind and Jungmittag used data on 12 manufacturing sectors, and constructed measures of the catalogue of standards in each sector using the Perinorm database and the International Standards Classification (ICS). With this rich data set, it was possible to estimate a range of models, and to examine the separate impact of standards and patents on productivity growth. Blind and Jungmittag were also able to study the different effects of 'national' and 'international' standards – where the latter are counted as those standards in the national catalogue (AFNOR, DIN, UNI and BSI respectively) which are equivalent either to EU standards (CEN, CENELEC, and ETSI) or to international standards (ISO, IEC, ITU, etc).

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14.   The results from the papers are conveniently summarised in Blind (2004, Chapter 18).

15.   Standards Australia (2007) replicated this model for Australia, but did not find the same results. Using a different formulation, however, they demonstrated that growth in standards (when combined with growth in the R&D stock) was correlated with productivity growth.

16.   A revised version of this was recently published as Blind and Jungmittag (2008).

138. Blind and Jungmittag's results are encouragingly similar to those of Temple *et al* described above. In most cases, the elasticity of output with respect to standards is positive and statistically significant, and this is the case whether or not patents are also included in the regression model. Their cross-industry comparisons find an interesting result: in mature (and less R&D intensive) industries, the impact of standards is important, but in the more R&D intensive industries, patents are more important than standards. Finally, their attempt to distinguish between the impact of national and international standards finds an unexpected result. While the estimated effects of the former are positive and significant, the estimated effects of the latter are minimal and statistically insignificant. However, the authors argue that this last result needs to be treated with caution because the estimates cover a period of transition.

Maertens and Swinnen (2006)

139. Maertens and Swinnen examine how tightening food standards have impacted on fruit and vegetable exports from Senegal, and the implications of this for welfare and poverty. They used three sources of data: (a) statistics on horticulture production and exports from existing data sources; (b) interviews with nine of the 20 horticulture exporting companies in the Dakar region of Senegal; (c) a large survey of smallholder farm-households.

140. Maertens and Swinnen make several important findings. First, food and vegetable exports from Senegal to the EU have increased sharply, despite stricter EU food standards. Second, increased exports have had a positive impact on incomes of poor households. Third, stricter food standards have led to structural changes in the supply chain. In particular, they describe a shift from smallholder farming to large-scale estate production. But fourth, despite this last change, the welfare effects of export growth for rural households are still positive. Structural change in the supply chain means that local households now benefit through labour markets rather than through product markets, and indeed the gains within rural communities have been equitable.

Clougherty and Grajek (2008)

141. We have discussed this study already in sub-Section 2.2. But in addition to its findings on the implications of ISO 9000 diffusion for trade patterns, they also examine the implications of ISO 9000 for FDI flows. Clougherty and Grajek argue that the ability of ISO 9000 to act as a quality signal, a common language, and a device for conflict settling will reduce the transaction costs involved in cross-border investment, just as in trade. For that reason, they posit that ISO 9000 diffusion should have a similar effect on FDI as it has on trade. Their empirical work, based on FDI data of OECD countries find that: (a) ISO 9000 diffusion in developed countries does not increase FDI; but (b) ISO 9000 diffusion in developing countries increases inward FDI (from developed countries into developing countries).

Sanchez et al (2008)

142. The study by Sánchez *et al* was noted above (sub-Section 2.5). In addition to estimating the effects of stricter standards on exports from Argentina to OECD countries, Sánchez *et al* also examine the consequent implications for labour markets. Once again, using a difference in difference estimator, they find that more stringent standards led to a marked reduction in export shares, and an associated increase in the level of skills required by exporting firms. The overall effect on average wages in exporting firms is negative. They interpret this as follows. Stricter standards raise compliance costs and that reduces the net prices received by producers. These reductions are passed on to workers in the form of lower wages.

Summary

143. This section is relatively easy to summarise as most of results seem to point in a similar direction. For that reason, we do not attempt to copy the summary tables as used in Sections 2 and 3 (Tables 3-8).

The first three studies of standards and productivity all find a positive relationship between the two in some EU countries (Germany, UK, France, Italy). The fourth study finds that international standards have lead to increased exports and household incomes in Senegal. The fifth study found that ISO 9000 diffusion in developing countries increases FDI (from developed countries into developing countries). Only the last study finds a negative result: more stringent standards in OECD countries leads to a decline in average wages in Argentina's exporting firms.
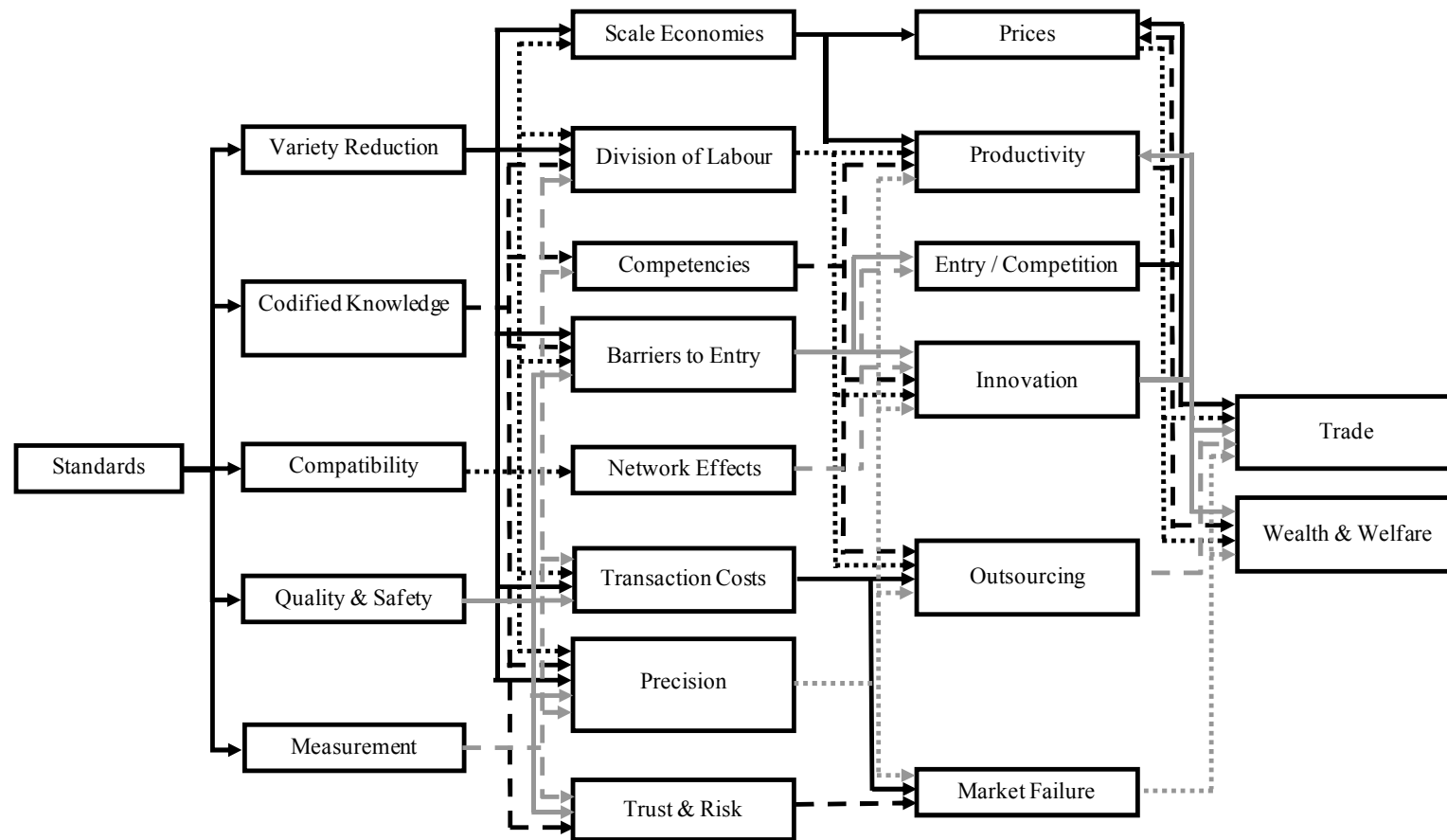
5.   Inside the 'Black Box'

144.   It was readily apparent from Tables 1 and 2 in Section 2 that there is no single answer to the question, "how do standards impact on trade?" If we take all those results at face value, then we need to explore why the results differ from case to case. Part of the reason is that the different studies referred to different countries, different industries and different measures of standards. But more generally, we shall see below that the relationship between standards and trade is by no means a simple one and that the econometric models surveyed in Section 2 represent, at best, very simple 'black boxes' that disguise a complex of relationships.

145.   Figure 4 shows an (incomplete) representation of what is to be found inside the 'black box'. This is based on the author's knowledge of the theoretical, empirical and anecdotal evidence on how standards impact on the economy. We say 'incomplete', because surely there will be other linkages that are not made explicit here. But those shown in Figure 4 are probably some of the most important. The first thing to note is that there are immediately five different routes by which a standard may *start* to impact on the economy. And there are many possibilities after that. The simple standards stocks used in the various studies surveyed here do not (and indeed cannot) distinguish between which of these five initial routes and which of the subsequent routes an additional standard may take. As we said before, this sort of 'count' variable is very much a 'mixed bag', and will presumably contain a mix of standards that follow quite different routes through Figure 4. From this, it is readily apparent that according to the mix of standards counted in any particular stock, we can expect to obtain a different average result. While perhaps the majority of effects in our diagram are positive, some of those effects are negative. When we look at the results in Section 2 (Tables 1 and 2) from this perspective, the diversity of results is not necessarily surprising.

146.   For this reason, we believe that a priority for future research must be to open up the 'black box' and to gather empirical evidence on all the linkages within Figure 4. In what follows, we provide a preliminary sketch of *some* of the available empirical evidence on *some* of the links, in no particular order. A full elaboration of all the relevant evidence would be a long report in its own right. Some of the items below refer to one link only while others may refer to several linkages together.[17]

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17.   Swann (2000) lists some other evidence relating to some of the other linkages, but obviously this does not cover material published since 2000.

Figure 4. Inside the Standards–Trade 'Black Box'

Standards	
Variety Reduction	Scale Economies → Prices
Codified Knowledge	Division of Labour → Productivity
Compatibility	Competencies → Entry / Competition
Quality & Safety	Barriers to Entry → Innovation → Trade
Measurement	Network Effects
	Transaction Costs → Outsourcing → Wealth & Welfare
	Precision
	Trust & Risk → Market Failure

*   'competencies' encompass institutions, innovation- and productivity-relevant knowledge, and vision
**   'barriers to entry' include compliance costs
***   'precision' includes uniformity and consistency

a) Standards and Variety

147.   In the usual typologies of standards, one is the 'variety reduction' standard. This may be a slightly misleading label in that variety reduction is not necessarily an explicit objective of the standards, but rather the net effect of the standard.   Nonetheless, this outcome is highly relevant in this context. Standards sometimes seek to reduce variety in order to exploit economies of scale. Bongers (1982) gives a striking example of this in the context of concrete posts.   That reduction in variety may in some circumstances lead to a reduction in trade.

148.   On the other hand, the reduction in variety may also lead to a reduction in transaction costs. A good example of that is given by Raballand and Aldaz-Carroll (2005). They note that the *multiplicity* of different standards in pallet sizes increases the transaction costs of would-be exporters. When there is such a multiplicity, the exporter must unload the traded items from one size of pallet onto another which is compatible with the destination country standard. Raballand and Aldaz-Carroll show that traders must therefore carry a stock of pallets of different sizes, and that poses a particular problem for the least developed countries (LDCs), when there is neither a rental market, nor an exchange market for pallets. Moreover, exports from the LDCs tend to have a low value per tonne or per unit volume, which means that LDC exporters are more sensitive to the cost of pallets.

149.   An interesting counterpoint to this is the standardisation of container sizes, which has dramatically reduced transaction costs and the shipper's transport costs, and has radically changed the worldwide transport infrastructure (Butter *et al*, 2007).   In the container case, moreover, network externalities play a major role in the use of standards.

b) Standards, the Division of Labour and Outsourcing

150.   A commonplace in economic theory is that if standards can reduce transaction costs, then they will support the division of labour and the outsourcing (and in some cases, *off-shoring*) of various activities. Steinmueller (2005) discusses the role of standards in co-ordinating the division of labour in industries that produce complex systems (such as civil engineering projects). Grimaldi and Torrisi (2001) describe the same process at work in the software industry. They also describe the relationship between standards and codified knowledge – a theme that will recur below.

151.   Butter (2007) shows that the fragmentation of production into ever more complex supply chains is one of the key features of globalisation, and the steady reduction of transaction costs is an important element in that. Swann (2009, p. 179) illustrates this with particular reference to the globalisation of personal computer manufacture. Butter and Pattipeilohy (2007) estimate a production function for the Netherlands covering the period 1972-2001, and find that off-shoring has a clearly positive effect on total factor productivity (TFP) – indeed this effect is larger than the effect of R&D on productivity.

c) Standards, Codified Knowledge and Institutions

152.   Several of the econometric papers described in Sections 2 and 4 suggested that standards can play an important role as the carrier of codified knowledge. Cowan *et al* (2000) pay particular attention to the role of standards in the codification of knowledge. Bénézech *et al* (2001) look at similar issues, but this time in the specific context of the ISO 9000 registration process.   The ISO 9000 standards provide a common language, which can be used within firms to help their process of knowledge codification. Bénézech *et al* break the standards implementation process into three steps: (1) the starting point of the implementation; (2) the substance and behavioural characteristics of the production process; and (3) the impact of ISO 9000 implementation on the firm's capacity to accumulate knowledge. When standards are not consistent and implementation is incomplete, knowledge about products and production does not travel

easily. Velkar's (2007) case study of wire standards in the nineteenth-century British iron and steel industry shows how inconsistent standards inhibited the transport and communication of facts about wire products.

d) Institutions and Trade

153.   A popular theme in recent trade studies has been the role of institutions in breaking down barriers to trade. In Section 2.2, we referred to the work of Kim and Reinert (2009) who found that two aspects of institutional capacity (informational capacity and conformity capacity) have strong and significant effects on developing country exports, and that developing countries cope better with stringent standards in food products when they have stronger institutional capacity. They measured a country's conformity capacity by the extent of diffusion in certification to the ISO 9000 standards.

154.   Two other recent studies have also examined the role of institutions in promoting trade. Berkowitz *et al* (2006) show how good institutions in the exporter country enhance international trade. They argue, from a theoretical point of view, that this is of special relevance in the case of trade in complex products, where it is hard to write a complete contract covering all relevant characteristics of the product. They find strong empirical evidence for their arguments: countries with good institutions (by their measures) tend to export more complex products and import more simple products. Islam and Reshef (2006) also show that good institutional quality can help to promote international trade by reducing transaction costs. Using a gravity model of bilateral trade, they find that the trade-promoting effects of good institutions outweigh any trade-reducing effects that arise from differences in legal systems.

e) Standards, Network Effects and Innovation

155.   It is well known that in industries such as the information and communication technologies, standards play an essential role in ensuring compatibility. Such standards can serve to increase network effects and that in turn supports innovation. Swann (1990) provides a striking example of this in the context of the PC software industry. Following the emergence of Lotus 1-2-3 as the industry standard spreadsheet software package during the MS-DOS era (i.e. up to early 1990s), and the decision by Lotus to open up some of its code to third party software developers, there was a rapid growth in innovative add-ons for 1-2-3, produced by third party software houses which took advantage of the large network of 1-2-3 users. Langlois and Robertson (1992) find a similar phenomenon in personal computers and stereo systems.

156.   However, this is not the only route by which standards can support innovation. The Community Innovation Survey for the UK has repeatedly found that standards are an important course of (codified) knowledge for the innovator. But equally, standards that reduce variety or raise quality standards can act as a constraint on innovation. Surprisingly, perhaps, Swann (2005) found that the informative role of standards and the constraining role of standards and regulations are positively correlated. This means that those innovators who find standards an important source of information for innovation are more likely than not to find standards and regulations a constraint on innovation. Swann also calculated an *optimum age* profile for the standards stock which would maximize the information content of the standards while minimising the constraining influence of those standards.

f) Measurement and Innovation

157.   In addition, those standards that support accurate measurement can also support innovation. Swann (1999) conjectured that the innovator's incentives to produce products with particular characteristics hinged on the ability of the innovator and the customer to measure (and verify) those characteristics. King *et al* (2006) tested this hypothesis using data from the Community Innovation survey

and data on the use of the National Measurement System (NMS) by different industrial sectors. They found that NMS activity has a clear positive and statistically significant influence on product innovation, but the effects on process innovation are less clear.

g) Standards, Quality and Compliance Costs

158.   Jones and Hudson (1996) and Hudson and Jones (2001, 2003) provided important explanations for some of the econometric results in Section 2 – especially those that find the effects of national standards on trade exceed the effects of international standards. They show how standards can serve as an important quality signal in trade and thus help to promote the competitiveness of those that meet stringent standards.   Leland (1979) showed that stringent standards can help to overcome the 'lemons' problem, where incomplete and asymmetric information on the quality of products leads to a market failure and a reduction in average product quality.

159.   That is the good side of having stringent standards. The bad side is that they can raise barriers to entry by increasing compliance costs. The World Bank TBT Survey, discussed in Section 3 has already shed some light on this, and the econometric study by Maskus et al (2005) estimates the costs of complying with standards. Such compliance costs will influence whether some exporters find it profitable to start trading or whether instead they find the barriers to trade are too great. The Maskus *et al* study uses firm-level data from 16 developing countries in the World Bank Technical Barriers to Trade (TBT) Survey Database. They find that standards do increase short-run production costs, and that a 10 percent increase in investment required to meet compliance costs will raise the variable costs of production by around 1 percent. They also find that the fixed costs of compliance are by no means trivial.

h) Trust and Trade

160.   Standards are a mark of trust. Hudson and Jones (2003) use data from the NOP National Random Omnibus Survey of September 1995 which asked a sample of about 1000 adults in the UK: "How would you reassure yourself that the household products you buy are safe enough for your purposes?" Consumers were allowed to cite one or more reassuring factors, and the four most important were: producer's name (30%), self-assessment (26%), the Kite Mark ® symbol of quality (24%) and the fact that a product conforms with a British Standard (18%). Conformity with other standards was only mentioned by a small proportion of the sample, leading Jones and Hudson to conclude that UK citizens tended (at that time) to put more weight on UK standards than international standards.

161.   The Kitemark® symbol is perhaps the oldest and best known symbol of trust, integrity and quality. Kitemark® schemes have been running since 1902 and cover a wide variety of products and services, including electrical contractors, double glazed windows, printed circuit boards and cattle tags. Recent research for Kitemark® (2006) found that about 82 percent of customers recognise the Kitemark® symbol, and of these, 93 percent believe the product is safer as a result of carrying this symbol, and 88 percent consider it is a sign of trust and integrity.

162.   Butter and Mosch (2003) have studied the hypothesis that trust helps to reduce transaction costs and therefore supports trade. They estimate a gravity model of bilateral trade for 25 countries and find that different measures of trust (taken from the Eurobarometer Survey) have a positive role to play in promoting trade. They find, moreover, that the causal relationship runs primarily from trust to trade.

6.   Conclusions

163.   The main purpose of this review has been to ask whether international standards help or hinder trade. While it might be convenient if there were a unanimous answer to this question, in reality it is not that simple. However, Tables 1-2 (in Section 2) provided a useful summary of the econometric studies that

have sought to estimate that relationship. These are repeated here as Tables 9 and 10, and we try to draw out as strong a group of conclusions as we can from these tables.

International Standards and Exports

164.   Table 9 (Part i) indicates that in most studies, when exporting countries use international standards, this has in most cases a positive (or at least neutral) effect on their export performance. There are only two exceptions: **M2** (Moenius, 2006a) and **BJ3** (Blind and Jungmittag, 2002). The first of these exceptions refers to trade in agricultural products, and this is one of the sectors in which it is quite often found that standards restrict trade. Moreover, while the overall effect across *all* agricultural products is negative, Moenius also shows that the estimated effects differ substantially between individual products. The second of these exceptions is a study of bilateral trade between Germany and France, which finds that German use of international standards has a negative effect on exports to France. This exception is harder to explain unless one argues, as some do, that DIN standards are often superior to typical international standards, and hence a switch from DIN to international standards in Germany does not help German exports. But despite these exceptions, the weight of evidence here is very much towards a positive effect.

Table 9. Effects of Standards and Regulations* on Exports

(i) Effects of **International** Standards* in Country X on **Exports** from X				
(a) Negative and Significant	(b) Negative	(c) Negligible	(d) Positive	(e) Positive and Significant
M2	BJ3	CG2, CG3	BJ1, ST1	BL1, CG1, G1, G2, KR, M1, M3 BA1 HV, VW

(ii) Effects of **National** Standards* in Country X on **Exports** from X				
(a) Negative and Significant	(b) Negative	(c) Negligible	(d) Positive	(e) Positive and Significant
VB, WS	BJ1	BJ3		BL1, M1, M2, M3, ST1

Table 10. Effects of Standards and Regulations* on Imports

(i) Effects of **International** Standards* in Country X on **Imports** into X				
(a) Negative and Significant	(b) Negative	(c) Negligible	(d) Positive	(e) Positive and Significant
G1, M2 CM3, MH2		CG1, CG2, CZ, ST2, T BA3	CG3	BL2, BJ2, BJ4, G2, M1, M3 BA1, BA2, CM1, CM2, MH1 HV, VW

(ii) Effects of **National** Standards* in Country X on **Imports** into X				
(a) Negative and Significant	(b) Negative	(c) Negligible	(d) Positive	(e) Positive and Significant
CZ, M2 CW1, CW2, SA VB, D2, F2	BJ2, T	BJ4 D1, F1	BL2 F3	M1, M3, ST2

* Studies marked in light grey refer to standards
Studies marked in dark grey refer to standards *and* regulations
Studies not marked refer to regulations

National Standards and Exports

165.   Table 9 (Part ii) also indicates that when an exporter from country X uses national standards (i.e. standards specific to country X) that may lead to superior export performance by X. This time there are just three exceptions: **VB** (van Beers and van den Bergh, 1997), **WS** (Wilson et al, 2002), and **BJ1** (Blind and Jungmittag, 2001). The first two exceptions are relatively easy to explain. These are both studies on the effects of environmental regulations in country X on exports from X. The reason for the negative effect here is not that these regulations make the products of country X less attractive in export markets, but that the regulations make it harder for producers in X to remain competitive while also observing strict environmental regulations. So these two exceptions really are rather different from all the other estimates in Table 9 Part ii. The third exception is harder to explain – being equivalent to the exception **BJ3** in Table 9 Part i. But despite this last, we can once again claim that the weight of evidence here is once again towards a positive effect.

International Standards and Imports

166.   Turning to Table 10, Part i, when the importing countries also adopt international standards, the most common effect is also to increase imports. But this time, there are four exceptions: **M2** (Moenius, 2006a), **G1** (Grajek, 2004), **CM3** (Chen and Matoo, 2004), **MH2** (Michalek et al, 2005). The first of these (**M2**) has already arisen as an exception above, and the same comments also apply here.

167.   The second exception (**G1**) has already been discussed in Section 2.2 In regressions using data on all countries, the diffusion of ISO 9000 in country X promotes exports from X but reduces imports into X, while in regressions using data on just the OECD countries (**G2**), the diffusion of ISO 9000 in country X promotes *both* exports from X *and* imports into X. Grajek argues that asymmetry between **G1** and **G2** can be explained by a substitution effect: ISO 9000 certified firms are more likely to trade with each other

more than with other firms, and for that reason the positive impact of ISO 9000 on trade is more pronounced among the OECD countries (which make heavy use of ISO 9000).

168.   The third exception (**CM3**) was, once again, explained in Section 2.3. Harmonization increases exports from excluded developed countries but reduces exports from excluded developing countries. Chen and Mattoo argue that harmonised standards in a region are likely to be quite strict compared to what developing countries are used to, and as a result any benefits of harmonisation in the form of economies of scale are outweighed by the increased costs of meeting a stricter standard. By contrast, in developed countries that are already familiar with strict standards, the benefits of harmonisation outweigh the costs. The fourth exception (**MH2**) was discussed in Section 2.5: Michalek *et al* (2005) offer an explanation for what seems a rather anomalous result.

169.   Despite these exceptions, which can in part be explained, once again we can claim that the weight of evidence here is very much towards a positive effect.

National Standards and Imports

170.   When we turn to Table 10 Part ii, however, the results are much more diffuse.   If an importer uses national standards, that may either facilitate imports or constrain imports: it depends on the study in question. Focussing on the studies that relate exclusively to standards, the effects are distributed pretty evenly across Table 10, part ii: four positive effects, four negative, and one negligible. But when we turn to the studies concerned with regulations (or regulations and standards) the weight of evidence is definitely towards a *negative* effect on national standards on imports.

171.   Rather than discuss exceptions, it seems more sensible to discuss why the studies involving regulations find negative effects here. The **VB** result refers to environmental regulation, as has been discussed already. The **CZ** result Czubala *et al* (2007) finds that EU standards that are not harmonised to ISO standards tend to constrain imports of clothing and textiles from Africa – which is not really surprising.   The **CW1** and **CW2** findings (Chen et al, 2006) use standards measures based on survey results: the variables measure the companies who find that standards and regulations in their export markets constrain their ability to trade. It is perhaps not surprising that the estimated coefficients from a regression of imports on these variables should be negative. The **SA** results (Sánchez et al, 2008) are based on a difference in difference estimator, and while the results are plausible enough, it is also possible that the strong negative effect results in part from the way such an estimator will pick up all the factors that have reduced exports from Argentina. The **D2** and **F2** results (respectively, Disdier et al, 2007; Fontagné *et al*, 2005) relate to the effects of TBT and SPS notifications on imports of agricultural and food products, and here it is not surprising to find negative effects.

172.   In short, whereas the weight of evidence in the three previous categories (international standards and exports, national standards and exports, international standards and imports) was that the relationships were positive, here we can't make such a claim. Instead, it seems best to conclude that:

- the effects on national standards on imports are uncertain: they can be positive or negative;

- the effects of national regulations on imports are generally negative.

Other Evidence in our Survey

173.   While the main focus of the survey has been on econometric studies of the relationship between standards and trade, we have also summarised (Section 3) a few surveys of technical barriers to trade. For the most part, these tend to be preoccupied with standards and regulations as barriers to trade and with the

costs that a multiplicity of standards or stringent standards can impose on would-be exporters. Only the DIN (2000) study focuses mainly on the benefits from standardisation. While this miscellany of results is important and interesting, it is probably fair to say that these findings reflect the specific focus of each survey.

174.　We have also summarised (in Section 4) a few of the studies that look at the impact of a country's standards stock (whether national or international) on its own growth and productivity, on household incomes and on inward FDI, and these tend to find a positive effect.

175.　If the effect of standards on trade is context specific, as it seems to be, then it seems essential to open up the 'black box' connecting standards to trade performance if we are to understand the complexities of this relationship. We do this in Section 5 of the report. This shows a complex of linkages and helps to explain why there can be no simple answer in the econometric studies described above. We provide a brief sketch of some of the evidence on a few of the linkages inside the 'black box', but a full survey of that evidence would be an invaluable contribution in future research.

Final Remarks

176.　It is arguable that to form a balanced opinion of the empirical relationship between standards and trade, the trade economist must consult with development economists and agricultural economists, on the one hand, and industrial economists and innovation economists[18] on the other. As a broad generalisation, development and agricultural economists are better placed to see the bad side of standards. They can see the barriers to trade created, in the main, by rich countries that restrict imports from poor countries – whether by accident or design. By contrast, industrial economists and innovation economists are better placed to see the good side of standards. They can see how such standards can open up opportunities for firms in poor countries to export to the richest countries.[19] There is a good side and a bad side to the effects of standards on trade, and we need to understand when we expect to see the good side, and when by contrast we expect to see the bad.

18.　The present author is best described by this last category: innovation economist.

19.　For example, the globalisation of standards in the personal computer industry has allowed firms in the Philippines to provide some of the components for personal computers sold in Europe.

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