1. Introduction

A striking feature of the world trading system in the half century between 1945 and 1995 was the dramatic decline in formal trade taxes, quantitative restrictions and other non-tariff barriers to international trade. Much of this was carried out under the General Agreement on Tariffs and Trade (GATT), which provided a set of agreed rules governing trade among its signatories, whose number increased from 23 in 1947 to 123 in 1994, when the World Trade Organization (WTO) superseded GATT as an international organization.1 At the same time, substantial reductions in transport costs, such as containerization and improved jet aircraft, and in logistics also contributed to the rapid growth of trade.

Despite these changes, international trade remains more costly than domestic trade, and emphasis has turned to other costs of international trade. The issue was highlighted in the 1990s by research on the border effect, the mystery of missing trade, and puzzles in international economics. John McCallum (1995) showed that, despite the openness of the USA–Canada border, trade between a US state and a Canadian province is substantially lower than between two states or two provinces, other things equal; in 1988, British Columbia’s exports to Ontario were $1400 million and to Texas $155 million, for example, even though Texas and Ontario are equidistant from British Columbia and the Texan economy was 50 per cent larger than that of Ontario. A border effect of this magnitude was striking because the two countries had reduced tariff barriers to very low levels, the USA–Canada border was one of the most open in the world, and cultural differences between the two countries were small.2

1 The WTO, established on 1 January 1995, incorporated the GATT as its umbrella treaty for trade in goods, updated as a result of the Uruguay Round negotiations and supplemented by other agreements such as the General Agreement on Trade in Services (GATS). The WTO provided a formal institutional structure with dispute settlement procedures. In 2011 the WTO had 153 members. Most non-members had observer status and were negotiating accession; the only exceptions are Turkmenistan, North Korea and some micro-states.

2 The differences in bilateral trade flows, depending on whether the international border is crossed or not, are substantial and robust to specifications (John Helliwell, 1998; Howard Wall, 2000). Charles Engel and John Rogers (1996) found large border effects on the basis of price dispersion, claiming that crossing the border is equivalent to adding 75000 miles to the distance between two North American cities, but Yuriy Gorodnichenko and Linda
striking empirical study, Daniel Trefler (1995) found that the level of international trade was far below that predicted by standard trade models. In an influential paper that appeared at the end of the 1990s, Maurice Obstfeld and Kenneth Rogoff (2000) argued that the six major problems in international economics could all be explained by home country bias.

These studies suggested that there are significant obstacles to international trade over and above the costs of domestic trade, and that the added costs are not explained by traditional trade barriers such as tariffs or quotas on imports. The difference between the costs of domestic and international trade, other than those costs related to traditional trade policy instruments such as import duties, came to be referred to as trade costs. Reduction in trade costs, or trade facilitation, began to feature explicitly in international trade negotiations, such as the Doha Development Round, and in regional or bilateral trade agreements.

The studies in the 1990s did not provide any guide to the magnitude of the obstacles or to the reasons why international trade should be more difficult or costly than domestic trade. In an article simply called ‘Trade costs’, James Anderson and Eric van Wincoop (2004) publicized the potentially large costs of trading internationally. They estimated that in the high-income countries trade costs amount on average to a 170 per cent ad valorem barrier to trade, and that tariffs and non-tariff barriers account for less than a fifth of the 44 per cent at-the-border trade costs. Although widely quoted, the headline figure of 170 per cent is based on an extremely broad definition of trade costs: all the costs of getting a good to the final user apart from the marginal cost of producing the good itself. Moreover, the empirical base for their estimates relied on indicative case studies or indirect evidence from gravity models.

An alternative approach, reported in a number of World Bank studies, breaks down trade costs into various components and estimates their impact on trade with a gravity model. John Wilson, Catherine Mann and Tsunehiro Otsuki (2003) use four broad trade facilitation indicators, and find that port efficiency has the largest positive effect on trade flows, regulatory barriers deter trade, and customs environment and e-business

Tesar (2009) show that their results are driven by price heterogeneity among cities within the USA and within Canada. Carolyn Evans (2001) estimated that McCallum’s border effect can be decomposed into the imperfect substitutability of domestic and foreign goods (20 per cent), traditional trade barriers (34 per cent) and other transactions costs of crossing the border (46 per cent).

3 Some trade-facilitating measures had been part of the original GATT, or featured in the work of other institutions such as the World Customs Organization, or appeared in regional trade agreements such as the European Single Market, but trade facilitation became identified more explicitly as a component of trade policy negotiations after the turn of the century.
usage are statistically significant but less important. Simulating a scenario in which Asia-Pacific countries with below-average port efficiency improve to half the Asia-Pacific Economic Cooperation (APEC) average, they estimate that intra-APEC trade would increase by $254 billion a year. This result suggests that the impact of trade facilitation on international trade flows could be large, but it does not provide any guide to the magnitude of trade costs.

Since these pioneering quantitative studies, much work has been done on conceptualizing trade costs. An important part of the agenda is to design agreed measures of trade costs that can be used, among other things, to assess implementation of trade facilitation measures. It is also desirable to have agreement on the nature of trade costs in order to understand why trade costs exist and why they are high. Finally, measurement and understanding can contribute to the policymaking process by highlighting where the greatest reductions in trade costs are possible and likely.

DEFINITIONS

We define trade facilitation as a reduction in trade costs. Trade costs refer to the difference between the costs of domestic and international trade other than those costs related to traditional trade policy instruments such as import duties. Trade costs include transport costs and the costs of clearing borders, but there is a grey area concerning which behind-the-border costs should be included in a measurement of trade costs.

The narrowest definitions restrict trade facilitation to customs and other border operations, in practice to at-the-border measures. The World Customs Organization (WCO) definition of trade facilitation is associated with its mission, which is ‘to enhance the efficiency and effectiveness of Customs administration by harmonizing and simplifying Customs procedures’. The WCO, established in 1952 and now with 176 members, is

4 A parallel can be drawn with international negotiations on agricultural trade, which was a notorious exception to the pre-1995 trade liberalization within GATT. Agreeing on appropriate aggregate measures of barriers to trade in agricultural goods, such as the producer subsidy equivalents developed by the Organisation for Economic Co-operation and Development, facilitated negotiations compared to when trade negotiators had to deal with a heterogeneous bundle of country-specific restrictions on agricultural trade. On its own, agreement on measurement was not enough to produce rapid liberalization of agricultural trade, but it did eliminate many fruitless arguments about which practices and policies were the biggest obstacles to trade.

5 The online definition (at http://www.wcoomd.org/home_pfoverviewboxes_pfoverview.htm) goes on to say, in a circular fashion, ‘In order to further trade facilitation, the WCO has developed and maintained Conventions, standards and programmes and provided technical assistance and support for capacity building. Through these instruments and
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the intergovernmental organization most clearly focused on facilitation of international trade. Its work includes the development of global standards, simplification and harmonization of customs procedures, trade supply chain security, enhancement of customs enforcement and compliance activities, anti-counterfeiting and piracy initiatives, integrity promotion, and sustainable global customs capacity building programmes. The WCO also maintains the international Harmonized System of goods nomenclature, and administers the technical aspects of the WTO Agreements on Customs Valuation and Rules of Origin. Even the WCO, with its focus on customs operations would, however, recognize the need for coordination at the border between customs, quarantine and other agencies (integrated border management) and the desirability of coordination between the border countries’ exit and entry posts (one-stop).

The definitions used by Asia-Pacific Economic Cooperation (APEC) and the International Chamber of Commerce (ICC) also focus on at-the-border processes and procedures, related to preparation of customs and trade documents, customs clearance procedures, border control and release.

The APEC Second Trade Facilitation Action Plan in 2008 defined trade facilitation as:

The simplification and rationalization of customs and other administrative procedures that hinder, delay or increase the cost of moving goods across international borders.

A 2007 paper prepared by the ICC Commission on Customs and Trade Regulation advocating an International Trade Facilitation Agreement as an outcome of the Doha Development Round included the statement:

ICC has long advocated a trade facilitation agreement with mutually-agreed rules for trade procedures that will improve the efficiency of managing the movement of goods across national borders.

although the ICC does also address a wide range of behind-the-border issues under other headings.

The definitions used by the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) and the OECD reflect a broader activities, its Member Customs administrations have been able to offer their governments and other stakeholders enhanced trade facilitation combined with effective Customs control.

approach to trade facilitation, covering international trade procedures and associated information flows and payment along the entire supply chain. These definitions include some behind-the-border measures such as standards and conformity assessment measures, business facilitation, e-commerce, trade finance and logistics services.7

The scope of the UN/CEFACT definition derives from the UN/CEFACT Buy–Ship–Pay Model, which identifies three processes involved in international trade. ‘Buy’ groups the activities of identifying a potential trading partner, establishing a business agreement and placing an order. ‘Ship’ is broken down into five activities, from preparing for export, export, transport, to preparing for import and import itself. ‘Pay’ represents the payment activity from buyer to seller. The Buy–Ship–Pay Model suggests the application of a total transaction approach to trade facilitation encompassing both at-the-border and other processes involved in international trade.

World Trade Organization trade facilitation negotiations focus on rules to define permissible and non-permissible trade-related procedures. Accordingly, the WTO’s definition of the scope of trade facilitation refers to administrative processes at the border which are the focus of trade negotiations in the WTO (Philippa Dee, Christopher Findlay and Richard Pomfret, 2008). However, the WTO also deals with aspects of trade facilitation covered by other Agreements, such as Technical Barriers to Trade (TBT) or Sanitary and Phytosanitary (SPS) measures, and some behind-the-border trade-related services are covered by the General Agreement on Trade in Services (GATS).

According to the World Bank, trade facilitation has both narrow and broad definitions. In a narrow sense, trade facilitation simply addresses the transportation logistics and customs administration associated with cross-border trade. In a broad sense, it covers the environment in which trade transactions take place, which includes the transparency of trade policy and regulation, as well as product standards, infrastructure to support trade, and technology as it applies to lowering trade costs.

Irrespective of how one defines trade facilitation, its ultimate objective is to ease the movement of goods between buyer and seller across international borders. A broad definition is more economically meaningful because it holistically captures all costs involved in the international trade transaction. The Anderson and van Wincoop approach of including all the costs of getting a good to the final user apart from the marginal cost of

7 An example of a broad approach by the OECD is the statement that ‘Trade facilitation covers all the steps that can be taken to smooth and facilitate the flow of trade’ (Michael Engman, 2005).
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producing the good itself is, however, far too broad in so far as it fails to distinguish between the costs of international and domestic trade. A more satisfactory approach, and one in keeping with understanding among policymakers, is to include the costs of international trade as opposed to domestic trade (excluding trade policy), but measurement runs up against methodological and data limitations.

Rather than adopting piecemeal or indirect approaches to measuring trade costs, some researchers have looked for a single measure. The most common operational measure has been the gap between the free on board (fob) value of exports at the port of departure and the cost insurance freight (cif) value of the same item on arrival in the importing country. Conceptually, the fob value can be thought of as equivalent to the cost of a domestic producer getting a good to a domestic destination, while the cif value can be thought of as similar to the cost of obtaining a good from the premises of a domestic supplier; the difference between the two is the difference between the costs associated with domestic and international trade.8 David Hummels (2007) has been the leading advocate of this approach, although he cautions against the data problems associated with obtaining relevant data.9 To sidestep the problems of direct measurement, several methods of deriving indices of trade costs have been proposed, and will be examined in the next section.

THEORY

Trade, whether domestic or international, is in response to differences in price, and reducing the wedge between the two prices yields net welfare gains. Many economic historians highlight the reduction in transaction costs and ensuing increase in beneficial exchange as a driving force behind

8 James Harrigan pioneered the use of the cif–fob gap, which he called transport costs, in an analysis of trade among ten OECD countries in 28 manufacturing industries in 1983. He addressed the large discrepancies between the fob values reported by the exporter and cif values reported by the importer by taking the geometric average of all cif–fob values for a country pair and product category, but was clearly unhappy with the ‘very large standard deviation in the average estimated freight factors’ (Harrigan, 1993, p. 100). Another early use of the cif–fob gap as a measure of trade costs was in the pioneering study of the geographical determinants of trade and development by Steven Radelet and Jeffrey Sachs (1998).

9 David Hummels and Volodymyr Lugovskyy (2006) show that data collected by the exporting and importing country (so-called mirror statistics) often suffer from inconsistency. This problem for researchers is becoming less serious as an increasing number of national statistical offices report consistent cif and fob data for their countries’ imports. A large OECD project assembling these data is described in Jane Korinek and Patricia Sourdin (2008).
eras of economic prosperity. In international trade theory, the two-triangles partial equilibrium diagram (Figure 1.1) is the most common way to illustrate the costs of trade barriers, as well as some of the distributional consequences: a tariff yields revenue to the government and increased producer surplus, but together these amount to less than the loss of consumer surplus unless there is a change in world prices. Trade costs can be presented in a similar way, but with the important difference that the distributional effects are smaller and there is more pure efficiency gain. Figure 1.2 illustrates trade costs for an imported good with no domestic production; reducing the shaded triangle represents a net gain from trade which will be shared between importer and exporter in proportions depending on the elasticities of demand and supply.

There are, of course, likely to be some losers from trade facilitation. Import-competing producers will lose domestic market share if trade costs fall. Border officials may lose their jobs, prestige or opportunities for bribe-taking.
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The iceberg assumption – that a fraction of a good’s value melts between leaving the exporting country and arriving at the importing country (Paul Samuelson, 1952) – was the standard treatment of trade costs by economists in the second half of the twentieth century, although trade theorists commonly ignored trade costs altogether as immaterial to the analysis. The main exception was the contribution to the new trade theory by Paul Krugman and Anthony Venables (1990) and Paul Krugman (1991), whose model showed that the interaction of country size and transport costs might affect the pattern of trade in a non-linear fashion. Since the turn of the century, many trade theorists have incorporated trade costs

Figure 1.2  Trade costs on an imported good with no domestic production. The gains from reducing trade costs will be shared between importers and exporters in proportions depending on the elasticities of demand and supply. In this figure, with trade costs of 5 pesos, importers pay 9 pesos and exporters receive 4 pesos for the traded good. With zero trade costs the equilibrium price is 6 pesos, and the shaded area represents the potential net gain from eliminating trade costs; the shaded area above a price of 6 pesos indicates the potential gain to importers from paying a lower price than 9 pesos, and the shaded area below a price of 6 pesos indicates the potential gain to exporters from receiving a higher price than 4 pesos.
into their analysis.\textsuperscript{11} Indeed, trade costs increasingly characterize models of international trade.\textsuperscript{12} The theoretical literature has generated a variety of assumptions about the nature of trade costs, with many of the heterogeneous firms’ trade models assuming that large fixed costs inhibit entry into foreign markets, in contrast to the variable trade costs of the iceberg assumption. Empirical testing of such models requires parameterization of the magnitude of trade costs, and to better understand the degree to which trade costs are fixed or variable costs we require estimates of their determinants.

The workhorse empirical approach to explaining bilateral trade flows is the gravity model, and it has an important place in the empirical literature on trade costs. The model was first developed by Dutch economic planners as a component of multi-equation macroeconometric models of the economy (Tinbergen, 1962), and was useful because of its high explanatory power. The basic gravity equation for trade between two countries \((i\) and \(j)\) takes the form of:

\[ F_{ij} = \frac{GM_i M_j}{D_{ij}} \]

where \(F_{ij}\) is the trade flow, \(M\) is the economic mass of each country, \(D_{ij}\) is the distance between the two countries and \(G\) is a constant. The gravity model played little role, however, in the work of international trade economists during the 1960s and 1970s because of its lack of theoretical underpinnings. James Anderson (1979) was the first to provide a theoretical grounding, using the ‘Armington assumption’ of product differentiation by country of origin to explain the presence of income variables in the gravity model.\textsuperscript{13} Nevertheless, the gravity model only really became popular after studies like that of John McCallum (1995) illustrated how powerful conclusions could be drawn about deviations from the gravity constant, \(G\).

James Anderson and Eric van Wincoop (2003) addressed the issue


\textsuperscript{12} Trade costs are also increasingly being incorporated into macroeconomic models of exchange rate determination, e.g. Mario Crucini, Chris Telmer and Marios Zachariadis (2005), Kanda Naknoi (2008) and Mario Crucini and Hakan Yilmazkuday (2009).

\textsuperscript{13} Paul Armington (1969) pioneered the assumption that products are differentiated by country of origin, and this can be represented in trade models by an elasticity of substitution between goods from country \(i\) and country \(j\) which is usually assumed to be constant. Jeffrey Bergstrand (1985) refined the supply-side modelling to highlight the insight that prices in the form of GDP deflators might be an important additional variable to include in the gravity equation.
of the gravity unconstant by including multilateral resistance terms to account for trade barriers, defined broadly to include anything that leads to deviations in domestic prices:

$$F_{ij} = \left[ (y_i/y_w) \cdot \frac{t_{ij}}{\prod_i \cdot P_j} \right]^{1 - \sigma}$$

where $y_w$ is global output and $y_i$ and $y_j$ are national outputs, $t_{ij}$ is the bilateral trade cost factor (one plus tariff equivalent), $\prod_i$ and $P_j$ are outward and inward multilateral resistance terms for the two countries, and $\sigma$ is the Armington elasticity of substitution. For econometricians multilateral resistance can be captured by using a first order log-linearization (Scott Baier and Jeffrey Bergstrand, 2009), or more commonly by including some combination of exporter–country–year and importer–country–year dummy variables. Such fixed effects models have become the standard form for hundreds of studies using gravity equations.¹⁴

The multilateral resistance term has several counterparts in the literature on trade costs. James Anderson and Eric van Wincoop (2004) define trade costs as all costs from factory gate to consumer, and try to establish a dollar or *ad valorem* counterpart. David Greenaway, Danny McGowan and Chris Milner (2009) treat the country-specific multilateral resistance term, derived from cross-country gravity estimates, as a direct measure of trade costs, although this is hard to conceptualize as it is not a monetary value and the magnitude varies depending on whether other control variables are included in the estimating equation. Most fundamentally, this approach treats trade costs as a residual, i.e. an index of bilateral trade that is not explained by country size, distance and other selected controls, and it has little connection to usual definitions of trade costs or policy debates about trade facilitation.¹⁵

The approach pioneered by John Wilson, Catherine Mann and Tsunehiro Otsuki (2003) is to get inside the black box of multilateral resistance to trade by including in a gravity equation variables for specific elements of trade costs, i.e. port efficiency, regulatory barriers, customs environment and e-business usage. Many studies have used a similar formulation to identify the impact of other sources of trade costs, such as

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¹⁴ For more discussion of the gravity model see Chapter 4, and especially the technical appendix to that chapter.

¹⁵ In some of the literature spawned by McCallum (1995) the ‘border effect’ is equated with ‘trade costs’, both being deviations from the gravity constant, $G$. This is semantically dubious in so far as a large border effect may be observed with small trade costs but a high elasticity of substitution between domestic and imported goods. Rocco Huang (2007), following an idea of Gene Grossman (1998), provides evidence that the size of the unconstant is related to unfamiliarity and differences in uncertainty aversion – traits which are not usually considered part of ‘trade costs’.
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internet connectivity, the condition of domestic roads and so forth. The common feature is that they are not estimating trade costs, but the impact on bilateral trade flows of an element of trade costs. These estimates are sensitive to the specification of the gravity equation and to which control variables are included.\footnote{João Santos Silva and Silvana Tenreyro (2006), for example, argue that estimating the log-linearized equation by ordinary least squares can lead to biases, and they suggest estimating the model in its multiplicative form using a Poisson pseudo-maximum likelihood estimator. When controlling for sharing a common language, they find that having past colonial ties does not increase bilateral trade, which is in contrast to what OLS estimates usually indicate.}

David Jacks, Chris Meissner and Denis Novy (2008; 2010) back out the trade cost wedge that is implied by the gravity equation with multilateral resistance term. They do this by comparing the gravity model of bilateral trade with a counterpart for domestic trade, which by definition does not include multilateral resistance variables for either country. The geometric average of domestic trade flows in country $i$ and in country $j$ divided by the product of their bilateral trade flows is defined as the trade cost wedge, $\tau_{ij}$:

$$
\tau_{ij} = \left\{ \frac{F_{ii} \cdot F_{jj}}{F_{ij} F_{ji}} \right\}^{1/(2(\sigma-1))} - 1
$$

In autarchy, where $F_{ij} = F_{ji} = 0$, $\tau_{ij}$ approaches infinity. Higher bilateral trade flows indicate lower trade costs down to the hypothetical benchmark of frictionless trade where $\tau_{ij} = 0$.

An advantage of this approach is that it is easy to obtain data and calculate the relative magnitudes of domestic and international trade. The disadvantage is that, like the Greenaway et al. approach, it essentially incorporates all the residual into a catch-all term called ‘trade costs’. Estimated trade costs are orders of magnitude higher than bottom-up measures based on transport costs, customs clearance costs etc. Moreover, Jacks/Meissner/Novy-type estimates can be volatile, as any reduction in international trade flows that is not matched by similar decline in domestic trade will generate large increases in estimated trade costs.

POLICY

Trade facilitation (TF) has long been the subject of government policy and trade agreements. Several of the original GATT Articles deal with TF issues, especially Articles V (transit), VII (customs valuation), VIII (fees and formalities), IX (marking requirements) and X (prompt publication...
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of all rules affecting trade).\(^{17}\) TF has also featured in regional trade agreements. The characteristic of these approaches was to set rules, proscribe certain procedures, advocate best practices and so forth.

There was little attempt to quantify progress in TF, and this lacuna has begun to be viewed as an obstacle to future agreements.\(^{18}\) Once the most obvious sources of border delays or arbitrary charges have been addressed, the complexity of trade costs makes agreement difficult. The significance of different countries’ TF commitments is hard to compare, because TF consists of many small steps whose impact may not be obvious, especially when behind-the-border costs are included. In 2001, for example, APEC members agreed to reduce trade costs by 5 per cent over five years, allowing each member to determine which particular trade costs it would tackle; in 2006 this was declared a success and a further 5 per cent reduction targeted for 2006–10, even though it is difficult to make sense of such a target in the absence of an agreed measure of trade costs, and such TF commitments have little meaning without consensus on how trade costs are measured.

An alternative approach by national or regional policymakers is to create a setting in which international trade enjoys characteristics, such as lower transactions costs, of domestic trade. China, for example, after opening up the economy in 1978–79, created a variety of special economic zones aimed at providing a low-trade-cost location for export-processing activities while insulating the domestic economy from international forces (Richard Pomfret, 1991). Zones may cross national borders as in the Sijori region (Singapore, Johor state in Malaysia and Riau province of Indonesia), where largely private sector initiatives to utilize the differing factor endowments have been supported by TF measures specific to the sub-regional zone. Notable examples of such an approach at a supranational regional level are the EU’s single market programme and the establishment of the Schengen area with borderless trade among 25 European countries.\(^{19}\)

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\(^{17}\) The General Agreement on Trade in Services, which resulted from the Uruguay Round and is a pillar of the WTO, is also relevant in that liberalization of services such as transportation, insurance, finance and so forth will reduce trade costs, a point forcibly made by Alan Deardorff (2001). So far, however, GATS has been more about statements of principle than actual liberalization, and it will not be covered in this book.

\(^{18}\) An exception was the 1988 Cecchini Report to the Commission of the European Communities on the costs of non-Europe, but this was more concerned with estimating the benefits of an integrated European market than in measuring trade costs or the benefits of TF; see Michael Emerson et al. (1988).

\(^{19}\) The Schengen Agreement was signed by five countries in 1984 and incorporated into the EU’s 1997 Amsterdam Treaty. In 2011 the Schengen area included 22 EU members plus Iceland, Norway and Switzerland. Bulgaria, Romania, Liechtenstein and Cyprus are committed to joining the Schengen area. Microstates such as Monaco, San Marino and the
Trade facilitation has become an important component of development aid. While there is now fairly universal agreement about the potential of trade to enhance growth and reduce poverty, there is less consensus as to why many poor countries fail to realize this potential. Supply-side constraints, including high trade costs, are key reasons why some developing countries fail to benefit from the reduction of trade barriers and from integration into the global economy. At the 2005 Hong Kong Ministerial Meeting in the Doha Development Round of WTO trade negotiations, aid donors committed to incorporate explicit trade objectives into their aid programmes (Michael Finger and John Wilson, 2006). Empirical studies have predicted large potential benefits from Aid for Trade. However, the credibility of such estimates depends crucially on whether the aid hits the right target, which in turn requires better understanding of the incidence and impact of trade costs on a country-specific basis.

SUPPLY CHAINS AND TRADE FACILITATION

The composition of international trade has evolved over time. Historically, most international trade consisted of the exchange or sale of goods. Yet in the 1960s economists observed subcontracting of tasks, most obviously in the electronics industry, where semiconductors were designed and components made in high-income countries and sent to low-wage countries for assembly, before being re-imported into the high-income country for testing and final sale. Such practices were reflected in trade policies that exempted from import duties any components originally coming from the importing country.

Fragmentation of production processes and increasingly complex supply chains took a variety of forms. Transnational corporations sought least-cost locations for different parts of the production process, while buying houses and rich-country retailers scoured the world for lower-cost locations from which to source store-brand goods, such as clothing or travel goods or toys. A high-profile example of fragmentation was Barbie, a doll marketed by Mattel of California, assembled in China from components produced in a variety of countries. Barbie’s body was formed from vinyl plastic pellets made in Taiwan from ethylene produced from Saudi Arabian oil, while her nylon hair came from Japan and other items.

Vatican City are de facto members. The United Kingdom and Ireland appear to have no intention of joining.

Massimiliano Calì, Mohammad Razzaque and Dirk Willem te Velde (2011) estimate that a US$1 million increase in aid for trade to small vulnerable states is associated with a 2.5 to 5.4 per cent decrease in the cost of handling and loading a twenty-foot container.
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of clothing and accessories came from Korea, Thailand and elsewhere in Asia. Sourcing from least-cost locations kept down costs and increased Mattel’s profit margin in the $9.99 selling price, of which only around $2 per doll went to the Asian producers.\(^{21}\) Such fragmentation was only feasible if barriers to international trade were low.

Traders and investors may be concerned about time rather than financial costs. Based on a survey of 7302 companies in eight developing countries (including Brazil, China and India), David Dollar, Mary Hallward-Driemeier and Taye Mengistae (2004) concluded that ‘customs clearance times are key determinants of foreign investment’ and of export status.\(^{22}\) Using proprietary data from a major US department store chain, Carolyn Evans and James Harrigan (2005) found that the retailer’s demand for timely deliveries influenced its choice of source countries. On a more aggregative level, David Hummels (2001) estimated that the cost of a day’s delay in transport adds on average 0.8 per cent to the value of a manufactured good, while Simeon Djankov, Caroline Freund, and Cong Pham (2006) estimated that each extra day of expected delay prior to shipment reduces trade flows by just over 1 per cent.\(^{23}\) This is related to the growing literature on global supply chains, the importance of trade in intermediate goods, and the costs of having to keep larger inventories if trade is slow or unreliable. Countries with high trade costs are likely to be excluded from international supply chains and hence miss out on one of the most dynamic areas of growth in trade and incomes.

Global supply chains are an increasingly common feature of the global economy in the early twenty-first century. Their relation to trade costs is two-way. While low trade costs are a precondition for such supply chains to flourish, participants in supply chains will seek to reduce trade costs further. They can do this by private sector initiatives, such as the emergence of supply chain coordinators (e.g. the Hong Kong firm Li and Fung, which manages production of a large share of the world’s jeans to the specifications of the more famous companies which handle design and

\(^{21}\) The numbers are taken from Rone Tempest (1996).

\(^{22}\) Michael Engman (2005, p. 25) reports that a critical condition for Philips Electronics investing in Hungary in the early 1990s was the reduction of customs clearance time; working with Hungarian authorities, the company’s specialized service unit dealing with movement of goods across borders succeeded in cutting the time from an average of 4–5 days to 1–2 days by the early 2000s. Of the specialized unit’s professional staff of 150, some 40 deal solely with China, facilitating trade at the local and provincial level as well as at the national border.

\(^{23}\) Some delays appear to be more destructive of trade than others. Caroline Freund and Nadia Rocha (2010) highlight the cost of transit delays in Africa, and estimate that a one-day reduction in inland travel times would increase exports by 7 per cent. Hildegunn Nordas, Enrico Pinali and Massimo Gelato Grosso (2006) find that time delays reduce the probability that firms will enter export markets for time-sensitive products.
marketing) or development of better logistics (e.g. real-time tracking facilities). They can also lobby for policy reform, from deregulation of communications services to simplified customs or other bureaucratic procedures. In sum, trade facilitation leads to institutional changes which beget further trade facilitation measures.

The existence of global supply chains is shifting the balance between fixed and variable components of trade costs. Several theoretical papers in the late 1980s highlighted the possibility of hysteresis in exports at the firm level due to the sunk costs of entering a market. However, analysis of disaggregated trade flows revealed substantial volatility; e.g. at the 7-digit level of the US Tariff Schedule, Tibor Besedeš and Thomas Prusa (2006a) found that only two-thirds of flows survived the first year and the median survival rate was two years; similarly short-lived trade relationships have been found for Germany (Volker Nitsch, 2009), for the EU15 (Wolfgang Hess and Maria Persson, 2010), for Latin American (Tibor Besedeš and Juan Blyde, 2010) and for a larger sample of developing countries (Paul Brenton, Christian Saborowski and Erik von Uexkull, 2010). Duration of relationships varies across commodity types, with longer relations among traders in differentiated goods than in homogeneous goods, where arm’s-length relations focused on price competition are the norm (Besedeš and Prusa, 2006b). In East Asia, where global supply chains have blossomed fastest, Ayako Obashi (2010) has found evidence of greater relational longevity in the case of machinery trade, which she relates to the existence of global supply chains, concluding that: ‘the network-forming firms would put priority not only on lowering production costs but on the stability of trade relationships’ (Obashi, 2010, p. 64), although the extent of stability may be related to the centrality of the specific bilateral link in the entire chain.

The increasing importance of global supply chains highlights the divide between low-trade-cost countries, which participate in supply chains, and high-trade-cost countries, which will be left on the sidelines of the

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25 The March 2011 earthquake, tsunami and nuclear crisis in the Tohoku region of Japan highlighted the dangers of being too reliant on stable partnerships. The region had become a preferred location for parts and components suppliers to the Japanese auto industry due to its relatively low wage costs, and external economies of scale added agglomeration benefits, but after the disasters non-delivery of components led to a dramatic decline in Japanese car production. Compared to the same months in 2010, production was down 57 per cent in March and 60 per cent in April 2011, and the fall in car exports led in April to Japan’s first trade deficit in 31 years, while foreign affiliates of Japanese car companies also experienced a 19 per cent decline in output in April 2011 compared to April 2010 (Shujiro Urata, 2011).
global economy.\textsuperscript{26} In a pioneering and influential study, Nuno Limao and Anthony Venables (2001) showed how the cost of shipping a standard container from Baltimore varied greatly depending on the country of destination, and the variations were only weakly related to distance.\textsuperscript{27} They ascribed the variance to ‘port costs’, which is consistent with the findings of John Wilson and his colleagues based on a gravity model. This does not provide a deep explanation of why trade costs vary across countries, but it does imply that trade costs include much more than basic transport costs, which are likely to be determined mainly by the commodity composition of trade and by distance. Identifying why trade costs in money and time are higher in some countries than others may shed light on cross-country differences in economic performance.

CONCLUSIONS

The size of trade costs matters for trade negotiations and for empirical research on international trade. Trade facilitation, i.e. reduction in trade costs, is on the Doha Development Round agenda, and is an increasingly important component of bilateral and regional trade agreements. Predictions of the impact of such agreements using computable general equilibrium models often assume that trade facilitation measures reduce trade costs by a certain percentage of the total value of trade, e.g. 1.5 per cent in the analysis of the Doha Round by Joseph Francois, Hans van Meijl and Frank van Tongeren (2005).\textsuperscript{28} Such numbers are guesses based on flimsy foundations, and yet the results (in the case of Francois et al. that

\textsuperscript{26}One consequence of eastern European countries joining the EU in 2004 was to improve their attractiveness as supply chain participants. Leticia Blázquez, Carmen Díaz-Mora and Rosario Gandoy (2011) document the spatial extension to the east of production networks in the EU automotive industry, while emphasizing that other factors matter beside EU membership (i.e. good quality infrastructure and other unobserved country characteristics) and that this was an extension of networks rather than replacement of existing locations.

\textsuperscript{27}Limao and Venables used World Bank data on the costs of shipping containers to the countries in which the World Bank had a presence. This is a nice natural experiment in so far as the World Bank is ubiquitous and the containers’ contents are fairly similar, irrespective of destination.

\textsuperscript{28}The tariff equivalents of trade costs are often backed out of gravity models, in which case they are sensitive to specification. In their CGE analysis of the welfare gains from agricultural reforms, Thomas Hertel and Roman Keeney (2006) use results from Wilson, Mann and Otsuki (2003) as the measure of the impact of trade facilitation on trade. More firmly based are the estimated cost reductions from customs automation and increased e-commerce penetration as a result of the Japan–Singapore trade agreement used in the CGE analysis by Thomas Hertel, Terrie Walmsley and Ken Itakura (2001), but they still involve some strong assumptions.
Trade facilitation will be a source of substantial gains if Doha is completed) influence policymakers’ perceptions. The empirical studies of trade costs by John Wilson and his colleagues are often, uncritically, cited in defence of aid priorities by the World Bank and other donors.

Trade costs have become an important component of modern trade theories, but the applicability of theoretical models is limited by lack of knowledge of the trade costs parameters. Models make different assumptions about whether trade costs are variable or have a market-specific fixed component, and about commodity-specific differences in trade costs. We would have a better idea of the appropriateness of different models’ assumptions if we had more information about actual trade costs.

Trade facilitation will continue to increase in importance as more and more commodities are produced in international supply chains, and as the slicing up of the value chain becomes ever finer. Pressure to reduce trade costs will come from participants in supply chains, especially if they are in an environment where they have good reasons not to want to relocate an activity, but competitors are shaving their costs by sourcing in more attractive locations. National governments will also recognize the benefits of trade facilitation if they want their producers to participate in value chains and reap gains from trade. Globalization does, of course, have its opponents, but countries and firms opting out will prosper less than those who embrace opportunities for participating in global value chains.