The Lumpiness of German Exports and Imports of Goods

Joachim Wagner

Abstract

This paper looks at a hitherto neglected extensive margin of international trade by investigating for the first time the frequency at which German exporters and importers trade a given good with a given country. Imports and exports show a high degree of lumpiness. In a given year about half of all firm-good-country combinations are recorded only once or twice for trade with EU-countries, and this is the case for more than 60 percent of all firm-good-country combinations in trade with non-EU countries. The frequency of recorded transactions tends to decline with an increase in the number of transactions per year. This is in accordance with the presence of per-shipment fixed costs that provide an incentive for trading firms to engage in cross-border transactions infrequently. Empirical models show that for Germany the frequency of transactions at the firm-good-country level tends to decrease with an increase in per-shipment costs when unobserved firm and goods characteristics are controlled for.

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1   Motivation

International trade is costly. While tariff-type trade restrictions tend to play a diminishing role only today, other barriers to trade still matter. Hornok and Koren (2015a) argue that some of these trade costs are not proportional to the value of the transaction. Hence, the assumption of iceberg-type trade costs used in most models of international trade is not appropriate here. There are fixed costs that come with every shipment across borders. These costs include paper work (filling in customs declarations and other forms) and the time and monetary costs related to having the cargo inspected. These fixed costs lead to a trade-off between per-shipment trade costs and shipping frequency. On the one hand, firms engaged in international trade would like to economize on these per-shipment costs by sending fewer and larger shipments. On the other hand, this comes at a cost due to time-lags related to waiting to fill a larger shipment and because of the need to keep costly inventories between shipment arrivals. At the firm level, shipping frequency can be considered as an additional margin of trade besides the intensive margin (the volume of trade) and the extensive margins made of the number of goods traded and the number of countries traded with (see Békés et al. 2011).

That said, per-shipment costs may make it optimal for traders to engage in cross-border transactions infrequently. If this is the case, trade flows at the microeconomic level – imports by one firm of one good from one country of origin, or exports by one firm of one good to one country of destination – are lumpy. Empirical evidence on the lumpiness of international trade has been reported in a small number of studies. Alessandria et al. (2010) use monthly data on the universe of US exports for goods in narrowly defined categories to six destination countries from January 1990 to April 2005 and find that goods are traded infrequently over the course of a year. Exports are lumpy, trade is highly concentrated in a few months. Békés et al. (2015) explore transaction level data for exports from France in 2007 at the firm-product-destination level and approximate the number of shipments by the number of months within a year in which a transaction is recorded for a given firm-product-destination. A large number of firms ship their products only in a few months. The authors report a high degree of lumpiness in exports – almost 45 percent of firms ship a given product to a given destination only once a year to EU markets and more that 60 percent do so to extra-EU markets. Hornok and Koren (2015a) examine disaggregated data on

exports of the United States and Spain in 2009 and look at the lumpiness of trade transactions by documenting how frequently the same good is exported to the same destination country within a year. Trade transactions for a given product to a given destination show strong signs of lumpiness. Kropf and Sauré (2014) look at transaction level data for Swiss exports from 2007, a subset of which contains a firm identifier so that export data are at the firm-product-destination level. Exports are lumpy; the mean value of shipments per year is 3.5.

Hornok and Koren (2015a) investigate how the frequency and the size of shipments vary with the level of per-shipment costs. They estimate a number of gravity-like regressions (that include variables for GDP and GDP per capita of destination countries, and distance to destination countries of exports, among others, as control variables) for exports of the US and Spain at the product-country level and find that the number of shipments decrease ceteris paribus when the time costs or the monetary costs per shipment increase.

Up to now, we have no evidence on the degree of lumpiness of international trade in goods by German firms and its relation to per-shipment costs. Given that Germany is one of the leading actors on the world market for goods (according to the WTO's World Trade Report, it was number three in both exports and imports in 2013; see World Trade Organization (2014, p. 34)), empirical evidence here is interesting in itself. This paper contributes to the literature by providing such evidence based on transaction data for complete German exports and imports at the firm-good-country level for the years 2009 to 2012.

To anticipate the most import results I document that imports and exports show a high degree of lumpiness. In a given year about half of all firm-good-country combinations are recorded only once or twice for trade with EU-countries, and this is the case for more than 60 percent of all firm-good-country combinations in trade with non-EU countries. Empirical models show that the frequency of transactions at the firm-good-country level tends to decrease with an increase in per-shipment costs when unobserved firm and goods characteristics are controlled for.

The rest of the paper is organized as follows. Section 2 introduces the data used and discusses measurement issues. Section 3 reports descriptive results for the lumpiness of German exports and imports of goods. Section 4 presents results from regressions of the number of shipments on per-shipment costs. Section 5 concludes.

2   Data and measurement issues

The empirical investigation uses a tailor-made data set that combines high quality transaction level data on Germany's exports and imports of goods from official statistics with data on per-shipment costs in international trade plus other information for characteristics of the countries traded with.

In Germany information on goods[1] traded across borders and on the countries traded with is available from the statistic on foreign trade (Außenhandelsstatistik). This statistic is based on two sources. One source is the reports by German firms on transactions with firms from countries that are members of the European Union (EU); these reports are used to compile the so-called Intrahandelsstatistik on intra-EU trade. The other source is transaction-level data collected by the customs on trade with countries outside the EU (the so-called Extrahandelsstatistik).[2] The raw data that are used to build the statistic on foreign trade are transaction level data, i.e. they relate to one transaction of a German firm with a firm located outside Germany at a time. Published data from this statistic report exports and imports aggregated at the level of goods traded and by country of origin.

The data used in this paper are based on the raw data at the transaction level. The unit of observation in these raw data is a single transaction between economic agents located in two countries, e.g. the import of X kilogram of good A with a value of Y Euro from China to Germany.[3] For a given year, the sum over all transactions is identical to the figures published by the Federal Statistical Office for total exports or imports of Germany.

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[1] Note that in Germany information on international trade in services is compiled by the German Central Bank (*Deutsche Bundesbank*) to build the balance of services trade (*Dienstleistungsbilanz).*

[2] Note that firms with a value of trade with EU-countries that did not exceed 400,000 Euro in the previous year or in the current year per direction of trade do not have to report to the statistic on intra-EU trade. For trade with firms from non-member countries all transactions that exceed 1,000 Euro (or have a weight that exceeds 1,000 kilogram) are registered. For details see Statistisches Bundesamt, Qualitätsbericht Außenhandel, Januar 2011, Wiesbaden.

[3] Transaction level data of this type have been used in numerous empirical studies on international trade for many countries in recent years; see Wagner (2016) for a survey.

The record of the transaction usually includes a firm identifier (tax registration number) of the trading German firm.[4] Using this identifier information at the transaction level can be aggregated at the level of the trading firm. These data show which firm trades how much of which good with firms from which country in a given month. Products are distinguished according to very detailed classifications. In the data used for this paper, the Harmonized System at 6-digit level (HS6) is used as the product classification system.

For the reporting years 2009 to 2012 the transaction level data at the month-firm-product-country level were used to compute a proxy-variable for the frequency of export or import transactions by one firm for one HS6-good and one country in a year. This proxy-variable is given by the number of months in a year in which transactions of this firm-good-country combination are recorded. Note that within a month all exports or imports of a specific HS6-good to a specific country by a firm are aggregated and reported as one data point only. Therefore, the proxy for trade frequency used here may be biased for high frequency traders which trade the same good with the same country in (nearly) every month several times. For low frequency traders, however, the number of months with recorded transactions is a reliable approximation (see the discussion in Békés et al. 2015).

The transaction level data at the firm-good-country level were matched to country-specific information that is taken from two sources.

Information on two types of per-shipment trade costs is taken from the World Bank's Doing Business Data Base (see www.doingbusiness.org). Doing Business measures the time and cost (excluding tariffs) necessary to complete every official procedure that is needed for exporting and importing a standardized cargo of goods by ocean transport. Time is recorded in calendar days, costs are in U.S. dollars; for details see appendix.[5]

Note that the time and cost of ocean transport are not included in the cost indicators from the Doing Business data base. The time dimension of transport can

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[4] Note that this identifier is missing for several transactions for various reasons including traders that do not have a (German) tax identification number; further details were not revealed to me.

[5] Data from the World Bank's Doing Business database have been used in the literature on the lumpiness of international trade before; see Alessandria et al. (2010) and Hornok and Koren (2015a, 2015b).

be considered as another per-shipment cost – it takes X days to ship a container from Germany to country Y, irrespective of the amount of goods in this container. Time for transport is closely linked to distance between countries. Therefore, distance is included as another trade cost variable. Data on distance between Germany and the countries of origin of imports, and the countries of destination of exports, are taken from the CEPII's GeoDist database (Mayer and Zignago 2011). The "distw" – measure is used that calculates the distance between two countries based on bilateral distances between the biggest cities of those two countries, those inter-city distances being weighted by the share of the city in the overall country's population (see Mayer and Zignago (2011, p. 11) for details).

The empirical models that link the number of international trade transactions at the firm-good-country level to per-shipment costs of trade include two control variables that are standard in gravity models of trade, namely Gross National Income and per capita Gross National Income (see Hornok and Koren (2015a) for a similar approach). Gross National Income per capita (measured in current US-Dollar) is taken from the Doing Business database directly, Gross National Income is calculated from the per capita values and the size of the population reported in the data base.[6]

In the empirical study two groups of trade partner countries are distinguished, namely countries that are members of the European Union (EU) and Non-EU countries. This controls for the cutoff-point used when imports from and exports to EU-members are recorded. Furthermore, information on per-shipment costs is not relevant for intra-EU trade.

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[6] Note that information whether a country is landlocked or not (that is available from CEPII's GeoDist database described in Mayer and Zignago (2011) and that has been used in the literature on the lumpiness of trade) is not used here because this country characteristic is closely related to the time and monetary costs of exports and imports.

3 The lumpiness of German exports and imports: Descriptive evidence

The degree of lumpiness of trade is measured by the number of import or export transactions at the firm-product-country level. In the German trade data used here trade frequency is measured by the number of months in a year in which transactions of this firm-good-country combination are recorded. Note that within a month all exports or imports of a specific HS6-good to or from a specific country by one single firm are aggregated and reported as one data point only. Therefore, the proxy for trade frequency used here may be biased for high frequency traders which trade the same good with the same country in (nearly) every month several times. For low frequency traders, however, the number of months with recorded transactions is a reliable approximation (see the discussion in Békés et al. 2015).

That said, information on the lumpiness of German trade in goods is reported in Table 1 to Table 8. All data are for the reporting year 2012.[7] Information is provided for trade with EU-countries and non-EU-countries separately.

To begin with imports, Table 1 shows a high degree of lumpiness. About half of all firm-good-country combinations are recorded only once or twice for imports from EU-countries, and this is the case for 70 percent of all firm-good-country combinations in imports from non-EU countries. The frequency of recorded transactions tends to decline with an increase in the number of transactions per year. This is in accordance with the presence of per-shipment fixed costs that provide an incentive for importers in engage in cross-border transactions infrequently. However, there is a remarkable increase in the frequency of the number of transactions when it comes to twelve transactions per year. This might be due to the fact (mentioned above) that within a month all imports of a specific HS6-good from a specific country by one single firm are aggregated and reported as one data point only. Therefore, the proxy for trade frequency used here may be biased for high frequency traders which trade the same good with the same country in (nearly) every month several times.

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[7] The detailed picture is identical for the years 2009 to 2011, so we focus on information for the most recent year 2012.

Table 1: Number of import transactions per year by firm-good-country of origin in 2012

Number of transctions per year	EU countries		Non-EU countries	
	Frequency	Share (percent)	Frequency	Share (percent)
1	475,589	35.46	1,135,184	55.95
2	190,471	14.20	286,341	14.11
3	117,854	8.79	144,043	7.10
4	86,268	6.43	91,788	4.52
5	69,206	5.16	66,050	3.26
6	58,412	4.36	51,017	2.51
7	53,006	3.95	41,885	2.06
8	52,214	3.89	36,207	1.78
9	51,163	3.81	33,181	1.64
10	50,252	3.75	31,752	1.56
11	54,671	4.08	33,863	1.67
12	82,096	6.12	77,578	3.82
Average number of transaction	4.168		2.783	

Note: Number of transactions refers to months with recorded import transactions at the firm-product-country of origin level; goods refer to categories at the HS6 level.

Table 2 and Table 3 report more detailed information by looking at four of the most important countries of origin for German imports of goods, namely the Netherlands and France from the EU, and the US and China from outside the EU. The big picture is highly similar if results for these countries are compared to results reported for the EU as a whole, or for all non-EU countries, in Table 1. Appendix Table 1 reports the average number of import transactions per year by firm-good-country of origin for countries of origin with more than 5,000 recorded import transactions in 2012. The degree of lumpiness varies widely over the countries. Within the EU, the average number of transactions is 3.31 for Luxembourg and 4.63 for the Czech Republic. Outside the EU, imports from the

United Arab Emirates (1.82), Hong Kong (1.98) and Australia (2.04) show a high degree of lumpiness compared to countries like Bangladesh (3.79), Tunisia (3.45) or Vietnam (3.27). The role of EU membership is nicely illustrated by comparing the neighbor countries Austria (4.00) and Switzerland (2.67), or Sweden (3.98) and Norway (2.16).

Table 2: Number of import transactions per year by firm-good-country of origin in 2012 for imports from the Netherlands and France

Number of transctions per year	Netherlands		France	
	Frequency	Share (percent)	Frequency	Share (percent)
1	71,647	34.07	49,291	34.14
2	29,803	14.17	20,223	14.01
3	18,324	8.71	13,018	9.02
4	13,515	6.43	9,408	6.52
5	10,996	5.23	7,475	5.18
6	9,555	4.54	6,474	4.48
7	8,642	4.11	5,776	4.00
8	8,765	4.17	5,700	3.95
9	8,811	4.19	5,591	3.87
10	8,753	4.16	5,735	3.97
11	9,073	4.32	6,031	4.18
12	12,482	5.89	9,659	6.69
Average number of transaction	4.273		4.284	

Note: Number of transactions refers to months with recorded import transactions at the firm-product-country of origin level; goods refer to categories at the HS6 level.

Table 3: Number of import transactions per year by firm-good-country of origin in 2012 for imports from the United States and China

Number of transctions per year	United States		China	
	Frequency	Share (percent)	Frequency	Share (percent)
1	203,598	57.38	261,148	51.69
2	49,297	13.89	74,316	14.71
3	24,133	6.80	39,135	7.75
4	15,456	4.36	25,794	5.11
5	10,866	3.06	18,754	3.71
6	8,463	2.38	14,459	2.86
7	6,914	1.95	12,008	2.38
8	5,981	1.69	10,362	2.05
9	5,495	1.55	9,770	1.93
10	5,333	1.50	9,086	1.80
11	5,890	1.66	9,578	1.90
12	13,427	3.78	20,765	4.11
Average number of transaction	2.724		2.991	

Table 4 illustrates that the degree of lumpiness of imports differs between goods (classified by section at the HS2 level) when EU membership is controlled for. For example, live animals and animal products (HS2-section 1) have the lowest degree of lumpiness in imports for both EU-members and non-members. This does not come as a surprise – it is obvious that an importer will only rarely trade all the beef he intends to import over the year from Poland or Brazil in one deal. Other figures in the table are more difficult to understand – for example, why is the extra-EU trade with "Pulp, paper, paperboard and articles thereof" (HS2-section 10) so lumpy? Is this due to trade costs related to the countries of origin? This will be investigated empirically in the next section of the paper. But before this, we will look at exports.

Table 4: Average number of import transactions per year by firm-good-country of origin
for HS2-sections of goods in 2012

HS2-sect.	Description	EU countries	Non-EU countries
		Average number of transactions	
1	Live animals; animal products	5.02	3.44
2	Vegetable products	4.39	3.01
3	Animal or vegetable fats and oils etc.	4.50	2.70
4	Prepared foodstuffs; beverages; tobacco	5.00	3.02
5	Mineral products	4.75	2.79
6	Products of chemical or allied industries	4.20	2.99
17	Plastics, rubber and articles thereof	4.31	2.77
8	Leather, furskins and articles thereof	3.83	2.74
9	Wood, cork and articles thereof	4.49	2.71
10	Pulp, paper, paperboard and articles thereof	4.18	2.15
11	Textiles and textile articles	3.63	3.05
12	Footwear, headgear, umbrellas	4.02	3.09
13	Articles of stone, ceramic products, glass	4.06	2.63
14	Pearls, precious stones or metals	3.94	2.72
15	Base metals and articles of base metals	4.16	2.81
16	Machinery, electrical equipment	4.04	2.72
17	Vehicles, aircraft, vessels, transport equipment	4.60	3.14
18	Optical etc. instruments; clocks; musical instruments	3.89	2.74
19	Arms and ammunition	4.37	3.03
20	Miscellaneous manufactures articles	4.42	2.83
21	Works of art, collectors' pieces and antiques	3.84	2.08

Note: Number of transactions refers to months with recorded import transactions at the firm-product-country of origin level. For a detailed description of the HS2 classification by section see the web at: http://unstats.un.org/unsd/tradekb/Knowledgebase/HS-Classification-by-Section.

Table 5 shows that the big picture for exports is very much the same as the one for imports (documented in Table 1) – exports are lumpy, the degree of lumpiness is much larger for trade with non-EU countries than for trade with EU-countries, and there is a remarkable increase in the frequency of the number of transactions when it comes to twelve transactions per year. Compared to imports, exports tend to be less lumpy, but the difference is small.

Table 5: Number of export transactions per year by firm-good-destination country in 2012

	EU countries		Non-EU countries	
	Frequency	Share (percent)	Frequency	Share (percent)
Number of transctions per year				
1	1,241,816	31.45	1,708,600	48.46
2	558,044	14.13	552,527	15.67
3	352,014	8.91	294,976	8.37
4	258,440	6.54	190,405	5.40
5	208,554	5.28	139,314	3.95
6	176,977	4.48	107,841	3.06
7	156,478	3.96	87,384	2.48
8	152,904	3.87	74,160	2.10
9	150,814	3.82	66,545	1.89
10	156,217	3.96	64,440	1.83
11	187,298	4.74	68,936	1.96
12	349,211	8.84	170,687	4.48
Average number of transaction	4.569		3.136	

Note: Number of transactions refers to months with recorded export transactions at the firm-product-destination country level; goods refer to categories at the HS6 level.

Table 6 and Table 7 report more detailed information by looking at four of the most important destination countries for German exports of goods, namely the Netherlands and France from the EU, and the US and China from outside the EU. The big picture is highly similar if results for these countries are compared to results reported for the EU as a whole, or for all non-EU countries, in Table 5. Appendix Table 2 reports the average number of export transactions per year by firm-good-destination country for destination countries with more than 5,000 recorded export transactions in 2012. The degree of lumpiness varies widely over the countries. Within the EU, the average number of transactions is 5.29 for Austria and 2.85 for Malta. Outside the EU, imports from Syria (1.67), Ethiopia (1.71) and Libya (1.78) show a high degree of lumpiness compared to countries

like the United States (3.84) or Switzerland (3.90). Like in the case of imports the role of EU membership is nicely illustrated by comparing the neighbor countries Austria (5.29) and Switzerland (3.90), or Sweden (4.60) and Norway (3.53).

Table 8 illustrates that the degree of lumpiness of exports differs between goods (classified by section at the HS2 level) when EU membership is controlled for. Similar to the case of imports discussed above, some of these differences are easily explained by the characteristics of the goods traded (e.g., the low degree of lumpiness in exports of "Live animals; animal products" – HS2-section 1 – and in exports of "Prepared foodstuffs; beverages; tobacco" – HS2-section 4) while

Table 6: Number of export transactions per year by firm-good-destination country in 2012 for exports to the Netherlands and France

Number of transctions per year	Netherlands		France	
	Frequency	Share (percent)	Frequency	Share (percent)
1	84,931	28.38	86,775	27.31
2	39,141	13.08	40,536	12.76
3	25,461	8.51	26,266	8.27
4	19,297	6.45	19,851	6.25
5	16,116	5.38	16,585	5.22
6	13,717	4.58	14,864	4.68
7	12,367	4.13	13,336	4.20
8	12,742	4.26	13,436	4.23
9	12,939	4.32	13,558	4.27
10	13,433	4.49	15,117	4.76
11	17,006	5.68	18,629	5.86
12	32,144	10,74	38,784	12.21
Average number of transaction	4.984		5.169	

Note: Number of transactions refers to months with recorded export transactions at the firm-product-destination country level; goods refer to categories at the HS6 level.

Table 7: Number of export transactions per year by firm-good-destination country in 2012
for exports to the United States and China

Number of transctions per year	United States		China	
	Frequency	Share (percent)	Frequency	Share (percent)
1	85,713	41.95	68,031	45.23
2	29,365	14.37	22,151	14.73
3	16,934	8.29	12,173	8.09
4	11,363	5.56.	8,173	5.43
5	8,894	4.35	6,283	4.18
6	7,256	3.55	4,977	3.31
7	5,907	2.89	4,377	2.91
8	5,345	2.62	3,628	2.41
9	4,940	2.42	3,406	2.26
10	5,151	2.52	3,359	2.23
11	5,811	2.84	3,738	2.4
12	17,651	8.64	10,113	6.72
Average number of transaction	3.839		3.518	

Note: Number of transactions refers to months with recorded export transactions at the firm-product-destination country level; goods refer to categories at the HS6 level.

others are not (e.g., the high degree of lumpiness in exports of "Footwear, headgear, umbrellas" – HS2-section 12- in trade with non-EU members).

The big picture on the lumpiness of trade reported for Germany is in line with the empirical evidence (summarized in Section 1 above) for exports from the U.S., France, Spain and Switzerland. The role of differences in trade costs between the destination countries of exports or the countries of origin of imports for an explanation of differences in the degree of lumpiness of exports or imports will be investigated in the next section.

Table 8: Average number of export transactions per year by firm-good-destination country for HS2-sections of goods in 2012

HS2-sect.	Description	EU countries	Non-EU countries
		Average number of transactions	
1	Live animals; animal products	5.53	3.49
2	Vegetable products	4.63	3.18
3	Animal or vegetable fats and oils etc.	4.74	3.09
4	Prepared foodstuffs; beverages; tobacco	5.59	3.56
5	Mineral products	4.65	3.38
6	Products of chemical or allied industries	4.88	3.64
7	Plastics, rubber and articles thereof	4.73	3.37
8	Leather, furskins and articles thereof	4.31	2.83
9	Wood, cork and articles thereof	4.54	3.07
10	Pulp, paper, paperboard and articles thereof	4.29	2.71
11	Textiles and textile articles	4.43	3.14
12	Footwear, headgear, umbrellas	4.67	2.88
13	Articles of stone, ceramic products, glass	4.60	3.10
14	Pearls, precious stones or metals	4.39	3.03
15	Base metals and articles of base metals	4.61	3.20
16	Machinery, electrical equipment	4.42	3.09
17	Vehicles, aircraft, vessels, transport equipment	4.26	2.62
18	Optical etc. instruments; clocks; musical instruments	4.43	3.07
19	Arms and ammunition	4.45	2.73
20	Miscellaneous manufactures articles	4.63	2.95
21	Works of art, collectors' pieces and antiques	4.07	2.82

Note: Number of transactions refers to months with recorded export transactions at the firm-product-destination country level. For a detailed description of the HS2 classification by section see the web at: http://unstats.un.org/unsd/tradekb/Knowledgebase/HS-Classification-by-Section

4 Per-shipment costs and the lumpiness of German exports and imports: Econometric results

One empirical fact documented in Section 3 is the large difference in the degree of lumpiness of imports and of exports in trade with EU-members on the one hand and with non-EU countries on the other hand. This might be due to the much lower

per-shipment costs in trade with EU-countries, because there are no costs related to customs' procedures in intra-EU trade. However, this might be due to different concepts used to record the trade with EU-countries and non-EU countries (see Footnote 2), too. Given that information on per-shipment costs (detailed below) is relevant for extra-EU trade only we will focus on trade with countries outside the EU for the rest of this section.

4.1   Empirical strategy

Information on two indicators of per-shipment trade costs is taken from the World Bank's Doing Business Data Base (see www.doingbusiness.org). Doing Business measures the time and cost (excluding tariffs) necessary to complete every official procedure that is needed for exporting and importing a standardized cargo of goods by ocean transport. Time is recorded in calendar days, costs are in U.S. dollars. The data used here (that are discussed in detail in the appendix) are taken from the report for 2013 and refer to June 2012.[8]

Note that the time and cost of ocean transport are not included in the cost indicators from the Doing Business data base. The time dimension of transport can be considered as another per-shipment cost – it takes X days to ship a container from Germany to country Y, irrespective of the amount of goods in this container. Time for transport is closely linked to distance between countries. Therefore, distance is included as another trade cost variable (for details, see Section 2 above).

The value of an indicator of per-shipment costs varies widely between countries. The figures for the 151 non-EU countries included in the econometric investigation are reported in Appendix Table 3. The time necessary to complete every official procedure that is needed for exporting and importing a standardized cargo of goods by ocean transport is between 5 days (Hong Kong) and 81 days

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[8] This information on trade costs is available for a number of years, including the years 2009 to 2012 for which the transaction level data for German exports and imports of goods are available. A look at these cost data reveals a high degree of stability over time – the coefficient of correlation for the value of a cost measure between two years usually is much larger than +0.9. Given this lack of variance in trade costs measures over time we focus data for 2012, the year used in the descriptive analysis in Section 3.

(Kazakhstan) for exports, and between 4 days (Singapore) and 101 days (Chad) for imports. Cost (excluding tariffs) necessary for this is between 435 US-Dollar (Malaysia) and 8,450 US-Dollar (Tajikistan) for exports, and between 420 US-Dollar (Malaysia) and 9,800 US-Dollar (Tajikistan) for imports. Distance between Germany and the country of origin of imports or the destination country of exports varies between 543 kilometers (Switzerland) and 18,220 kilometers (New Zealand).

To see how these per-shipment costs are related to the degree of lumpiness of imports and exports in German trade with goods with non-EU countries in 2012, empirical models are estimated with the number of transactions for firm-HS6good-country combinations as the endogenous variable and trade-cost variables measured at the level of the country of origin (for imports) or destination country (for exports) plus data on other characteristics of the country. Some of the empirical models include fixed effects for the firms engaged in international trade and the goods traded (discussed in detail below).

In the econometric investigation six variants of empirical models are estimated that include different sets of exogenous variables. Model 1, Model 3 and Model 5 include the time to export (for imports to Germany) or the time to import (for exports from Germany), Model 2, Model 4 and Model 6 include the costs of exports (for imports to Germany) or the costs of imports (for exports from Germany). Note that both indicators of per-shipment costs of trade are highly positively correlated with a correlation coefficient of +0.79 for export costs and +0.77 for import costs; therefore, the two indicators are included in the empirical models alternatively.

All models include the distance to the country of origin (for imports to Germany) or the distance to the destination country (for exports from Germany). Distance is closely related to the time necessary to transport a good from the country of origin or to the country of destination, and to the costs of transport. For the countries included in the empirical investigation distance is negatively correlated with the time and cost indicators, but the correlation is small (–0.17 for time to export and –0.18 for time to import; –0.24 for cost to export or import).

Furthermore, all models include two standard variables from gravity models of trade, Gross National Income and per capital Gross National Income, as control variables.[9]

The indicators for trade costs and the control variables are included in Model 1 and Model 2 (where Model 1 includes the time to trade, and Model 2 includes the costs of trade from the Doing Business Database detailed above). All these variables are constant for a given country of destination (for exports) or origin (for imports). Descriptive evidence reported in Table 3 and Table 7 (for import and export transactions with the United States and China) demonstrates that the number of transactions per year by firm-good-country is not constant. For a given country of destination or origin with given values for trade costs (and control variables) the number of transactions varies widely between one and twelve.

This illustrates that for some firms trading some goods with a specific country the same measured trade costs lead to a high degree of lumpiness in trade, and for others they lead to a low degree of lumpiness. This might be caused by differences between firms with respect to productivity, size, or other characteristics. Unfortunately, the data available have no information on the trading German firm (besides the firm identifier). To control for unobserved firm characteristics in the link between trade costs and lumpiness of trade Model 3 and Model 4 include firm fixed effects. Identification of the role of trade costs for the number of transactions per year by firm-good-country here comes from the within-firm variation over goods and countries.

Descriptive evidence reported in Table 4 (for imports) and Table 8 (for exports) shows that the average number of transactions per year by firm-good-country differs between different groups of goods. This variation is expected to be related to the differences in the fixed costs of trade with the different countries of destination or origin of these goods, but it might as well be related to the characteristics of the goods itself (irrespective of the countries traded with). To control for these unobserved characteristics of goods in the link between trade costs and

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[9] Gross National Income per capita (measured in current US-Dollar) is taken from the Doing Business database directly, Gross National Income is calculated from the per capita values and the size of the population reported in the data base. Information for 2012 used here is taken from the 2014 edition.

lumpiness of trade, and to take care of the role of unobserved firm characteristics discussed above, Model 5 and Model 6 include fixed effects at the firm-good level. Identification of the role of trade costs for the number of transactions per year by firm-good-country here comes from the within-firm within-good variation over countries.

Following the literature on the lumpiness of trade all variables are included in logs. The regression coefficients, therefore, are estimates for the elasticity of the number of trade transactions per year by firm-good-country with respect to an indicator of trade costs (or a control variable).[10]

If higher per-shipment costs make it optimal for traders to engage in cross-border transactions more infrequently and if the degree of lumpiness is positively related to fixed costs of trade this means that the number of transactions per year at the firm-good-country level decreases with an increase in trade costs. In the empirical models this implies a negative sign of the estimated elasticity of the number of transactions with respect to a variable that measures trade costs.

4.2   Imports

Results for the empirical models for the lumpiness of imports are reported in Table 9.[11] Here Model 5 and Model 6 are the preferred models because the unobserved characteristics of both firms and goods are controlled for by including fixed effects at the firm-good level.

From Model 6 we see that the costs of exports in the country of origin and the distance between Germany and the country of origin are negatively related to the number of transaction per year at the firm-good-country level. Both variables can be regarded as indicators of per-shipment trade costs (see the discussion in Section 4.1). These results, therefore, are in line with the expectations regarding the link between per-shipment costs and the degree of the lumpiness of trade, because fixed costs lead to a trade-off between per-shipment trade costs and shipping

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[10] The big picture is identical when all variables enter the empirical models in levels; details are available on request.

[11] Note that all p-values are based on estimated standard errors that are clustered at the level of the firm.

frequency. On the one hand, firms engaged in international trade would like to economize on these per-shipment costs by sending fewer and larger shipments. On the other hand, this comes at a cost due to time-lags related to waiting to fill a larger shipment and because of the need to keep costly inventories between shipment arrivals.

A negative impact of costs of exports in the countries of origin and of distance to Germany is found in all other models listed in Table 9 (including models without fixed effects,[12] and with firm fixed-effects only), too. The exception is the time to export in the country of origin. The estimated regression coefficient of this indicator of per-shipment costs is statistically insignificant at a conventional level in the preferred Model 5 (and positive and significant in Model 1 and Model 3).[13]

Regarding the estimated size of the elasticities of the number of transactions with respect to trade costs, from Model 6 we see that a one hundred percent increase in the cost of export in the country of origin leads to a reduction in the number of import transactions by 15.3 percent. Doubling the distance between Germany and the country of origin reduces the number of transactions by 11 percent according to Model 5 and by 14.5 percent according to Model 6. As is documented in Appendix Table 3 trade costs vary considerably between the countries of origin; therefore, the estimated elasticities can be considered to be significant from an economic point of view (and not only from a statistical point of view), too.

It was pointed out in Section 3 that within a month all imports of a specific HS6-good from a specific country by one single firm are aggregated and reported as one data point only. Therefore, the proxy for trade frequency used here may be biased for high frequency traders which trade the same good with the same country in (nearly) every month several times. The large increase in the frequency of the

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[12] As suggested by a referee, the models without fixed effects were estimated using the sample that is used to identify the estimated coefficients in the models with firm-HS6 fixed effects, too, i.e. after dropping 1,100,883 singletons in firm-good groups from the estimation sample. Results did not change qualitatively; details are available on request.

[13] Note that both GNI and GNI per capita in the country of origin are included as control variables in the empirical models only. Therefore, we do not discuss the results for the estimated coefficients of these variables here and in the next section.

number of import transactions per year from 11 to 12 reported in Table 1 to Table 3 illustrates this. As a robustness check, therefore, all empirical models were estimated using a restricted sample that excludes cases with a calculated number of 12 transactions (see the discussion in Békés et al. 2015). The big picture from this robustness check is identical to the one reported in Table 9; details are available on request.

4.3   Exports

Results for the empirical models for the lumpiness of exports are reported in Table 10. From Model 5 and 6, which are again the preferred models because the unobserved characteristics of both firms and goods are controlled for, we see that all three indicators of trade costs are negatively related to the number of transaction per year at the firm-good-country level. As in the case of imports these results are in line with the expectations regarding the link between per-shipment costs and the degree of the lumpiness of trade, and this holds for results reported for the other models (without fixed effects,[14] and with firm fixed-effects only), too.

Regarding the estimated size of the elasticities of the number of transactions with respect to trade costs, from Model 5 we see that a one hundred percent increase in the time to import in the country of destination leads to a reduction in the number of import transactions by 6.7 percent. According to Model 6, doubling the costs of imports in the destination country reduces the number of export transactions by 2.4 percent. This estimated elasticity is considerable smaller than the value for import transactions. Doubling the distance between Germany and the destination country reduces the number of transactions by ca. 18 percent according to Model 5 and Model 6. As is documented in Appendix Table 3 trade costs vary considerably between the countries of destination; therefore, the estimated elasticities can be considered to be significant from an economic point of view (and not only from a statistical point of view), too.

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[14] As suggested by a referee, the models without fixed effects were estimated using the sample that is used to identify the estimated coefficients in the models with firm-HS6 fixed effects, too, i.e. after dropping 750,615 singletons in firm-good groups from the estimation sample. Results did not change qualitatively; details are available on request.

Table 9: Determinants of lumpiness of German imports of goods from non-EU countries 2012

Endogenous variables		Endogenous variable: Log of (number of transactions for firm-HS6good-country of origin combination)					
	Model	1	2	3	4	5	6
Log (time to export) (days)	ß	0.045		0.028		0.053	
	p	0.000		0.002		0.133	
Log (costs of export) (US-Dollar)	ß		–0.036		–0.057		–0.153
	p		0.000		0.000		0.000
Log (distance to country of origin (kilometer)	ß	–0.014	–0.027	–0.044	–0.058	–0.109	–0.145
	p	0.000	0.000	0.000	0.000	0.000	0.000
Log (Gross National Income of country of origin)	ß	0.019	0.021	0.045	0.047	0.135	0.141
	p	0.000	0.00	0.000	0.000	0.000	0.000
Log (per capita Gross National Income of country of origin)	ß	–0.026	–0.042	–0.014	–0.022	–0.0062	–0.020
	p	0.000	0.000	0.000	0.000	0.616	0.000
Constant	ß	0.610	1.189	0.407	1.022	–0.473	1.052
	p	0.000	0.000	0.000	0.000	0.002	0.000
Firm fixed effects (N = 121,581)		no	no	yes	yes	no	no
Firm-HS6 fixed effects (N = 1,397,566)		no	no	no	no	yes	yes
R-squared		0.0044	0.0044	0.213	0.213	0.726	0.727
Number of observations		2,016,846	2,016,846	2,016,846	2,016,846	2,016,846	2,016,846

Note: For a definition of exogenous variables see text. ß is the estimated regression coefficient, p is the prob-value of this estimate (based on estimated standard errors that are clustered at the level of the firm).

Table 10: Determinants of lumpiness of German exports of goods to non-EU countries 2012

Endogenous variables		Model 1	2	3	4	5	6
		Endogenous variable: Log of (number of transactions for firm-HS6good-country of origin combination)					
Log (time to import) (days)	ß	–0.051		–0.039		–0.067	
	p	0.000		0.000		0.000	
Log (costs of import) (US-Dollar)	ß		–0.027		–0.011		–0.024
	p		0.000		0.002		0.001
0.Log (distance to country of destination (kilometer)	ß	–0.059	–0.056	–0.107	–0.103	–0.181	–0.176
	p	0.000	0.000	0.000	0.000	0.000	0.000
Log (Gross National Income of country of destination)	ß	0.054	0.053	0.084	0.083	0.155	0.154
	p	0.000	0.000	0.000	0.000	0.000	0.000
Log (per capita Gross National Income of country of destination)	ß	0.010	0.028	0.018	0.032	0.028	0.051
	p	0.000	0.000	0.000	0.000	0.000	0.000
Constant	ß	0.567	0.441	0.458	0.284	0.144	–0.134
	p	0.000	0.000	0.000	0.000	0.053	0.025
Firm fixed effects (N = 106,550)		no	no	yes	yes	no	no
Firm-HS6 fixed effects (N = 1,168,442)		no	no	no	no	yes	yes
R-squared		0.024	0.023	0.218	0.218	0.564	0.563
Number of observations		3,388,205	3,388,205	3,388,205	3,388,205	3,388,205	3,388,205

Note: For a definition of exogenous variables see text. ß is the estimated regression coefficient, p is the prob-value of this estimate (based on estimated standard errors that are clustered at the level of the firm).

Like in the case of import transactions, as a robustness check all empirical models were estimated using a restricted sample that excludes cases with a calculated number of 12 transactions. Again, the big picture from this robustness check is identical to the one reported in Table 10; details are available on request.

5   Concluding remarks

This paper looks at a hitherto neglected extensive margin of international trade by investigating for the first time the frequency at which German exporters and importers trade a given good with a given country over a year. Imports and exports show a high degree of lumpiness. In a given year about half of all firm-good-country combinations are recorded only once or twice for trade with EU-countries, and this is the case for more than 60 percent of all firm-good-country combinations in trade with non-EU countries.

The frequency of recorded transactions tends to decline with an increase in the number of transactions per year. This is in accordance with the presence of per-shipment fixed costs that provide an incentive for trading firms to engage in cross-border transactions infrequently. Empirical models show that for Germany the frequency of transactions at the firm-good-country level tends to decrease with an increase in per-shipment costs when unobserved firm and goods characteristics are controlled for.

To put the findings for Germany reported in this paper into perspective we compare them to results reported in empirical studies on the lumpiness of trade for other countries. This, however, is not an easy task because these studies differ in details in the empirical approach used and as regards the type of data that are analyzed. That said, a high degree of lumpiness in exports is reported for the US (in trade with six destination countries) by Alessandria et al. (2010), for France by Békés et al. (2015), for the US and Spain by Hornok and Koren (2015a), and by Kropf and Sauré (2014) for Switzerland. The findings for the lumpiness of German exports, therefore, are in line with the big picture from empirical studies for exports from the US, France, Spain and Switzerland. Note that none of the studies on the lumpiness of trade for other countries looks at the degree of lumpiness of imports.

The finding that for Germany the frequency of export transactions at the firm-good-country level tends to decrease with an increase in per-shipment costs when unobserved firm and goods characteristics are controlled for is in line with results reported by Hornok and Koren (2015a) for exports of the US and Spain at the product-country level (without control for the exporting firms). Again, comparable results for imports are not available for other countries.

The bottom line, then, is that according to the empirical results presented in this paper for Germany and with a view on the results for other countries summarized above a reduction of per-shipment costs can be expected to lead to a decrease in the degree of lumpiness of trade and to a reduction of costly inventories. This will foster international trade by pushing a hitherto neglected extensive margin of international trade of firms – the number of transactions at the firm-good-country level.

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Appendix Table 1: Average number of import transactions per year by firm-good-country of origin for selected countries of origin in 2012

Country	Average number of import transactions	Number of total import transactions
Argentina	2.42	5,110
Australia	2.04	14,614
Austria	4.00	154,996
Bangladesh	3.79	8,281
Belgium	4.26	93,742
Bosnia Herzegovina	4.15	5,106
Brazil	2.82	17,969
Bulgaria	3.71	8,416
Canada	2.30	31,891
China	2.99	505,175
Croatia	2.68	9,105
Czech Republic	4.63	55,445
Denmark	4.03	55,234
Egypt Arab Republic	2.43	6,176
Finland	3.75	14,193
France	4.28	144,381
Greece	3.59	8,388
Hong Kong	1.98	47,839
Hungary	4.43	26,325
India	2.84	69,065
Indonesia	2.85	20,388
Ireland	4.09	11,447
Israel	2.40	21,616
Italy	4.21	207,884
Japan	3.20	99,257
Korea Republic	2.67	43,730
Lithuania	3.58	5,036
Luxembourg	3.31	12,017
Malaysia	2.88	24,893
Mexico	2.79	23,214
Morocco	3.14	5,920
Netherlands	4.27	210,266
Norway	2.16	20,595
Pakistan	2.80	14,106
Philippines	2.93	10,177
Poland	4.53	63,449
Portugal	3.88	16,446
Romania	4.15	15,077

Appendix Table 1 continued

Appendix Table 1 continued

Country	Average number of import transactions	Number of total import transactions
Russian Federation	2.38	14,031
Singapore	2.38	18,496
Slovak Republic	4.42	15,956
Slovenia	4.25	13,567
South Africa	2.52	13,950
Spain	3.94	62,551
Sweden	3.98	36,236
Switzerland	2.67	279,411
Taiwan China	2.83	90,017
Thailand	2.95	32,147
Tunisia	3.45	5,691
Turkey	2.70	97,903
Ukraine	2.96	7,141
Unit Arab Emirates	1.82	8,790
United Kingdom	3.94	102,918
United States	2.72	354,853
Vietnam	3.27	18,344

Note: Number of transactions refers to months with recorded import transactions at the firm-product-country of origin level. Countries of origin with more than 5,000 recorded import transactions are included in the table.

Appendix Table 2: Average number of export transactions per year by firm-good-destination country for selected destination countries in 2012

Country	Average number of export transactions	Number of total export transactions
Afghanistan	2.10	6,068
Albania	2.27	9,557
Algeria	2.07	13,204
Angola	1.84	5,571
Argentina	3.14	23,330
Armenia	2.05	9,766
Australia	3.44	75,705
Austria	5.29	408,875
Azerbaijan	2.09	20,000
Bahrein	2.19	12,200
Bangladesh	2.30	6,645
Belarus	2.77	41,084
Belgium	4.73	234,168
Bolivia	1.97	5,852
Bosnia Herzegovina	3.04	30,790
Brazil	3.55	65,121
Bulgaria	3.58	68,289
Cameroon	2.17	5,640
Canada	3.18	58,022
Chile	2.92	34,272
China	3.52	150,409
Colombia	3.00	21,893
Costa Rica	2.53	8,034
Cote D'Ivoire	2.06	5,415
Croatia	3.47	71,531
Cyprus	2.76	27,312
Czech Republic	4.73	217,071
Denmark	4.47	154,696
Dominican Republic	2.51	6,438
Ecuador	2.42	11,495
Egypt Arab Republic	2.44	41,162
Estonia	3.63	55,689
Ethiopia	1.71	5,463
Finland	4.15	113,999
France	5.17	317,737
Georgia	2.28	18,147
Ghana	2.06	12,132
Greece	3.70	87,598
Guatemala	2.54	7,170
Hong Kong	3.06	55,894
Hungary	4.41	154,500

Appendix Table 2 continued

Appendix Table 2 continued

Country	Average number of import transactions	Number of total import transactions
Iceland	2.88	24,740
India	3.25	80,580
Indonesia	2.87	28,163
Iran Islamic Republic	1.95	26,741
Iraq	1.86	13,057
Ireland	3.72	61,386
Israel	3.09	54,268
Italy	4.77	250,195
Japan	3.51	81,998
Jordan	2.17	19,624
Kazakhstan	2.49	43,487
Kenya	2.23	10,250
Korea Republic	3.23	64,477
Kuwait	2.33	20,621
Kyrgyz Republic	1.81	5,453
Latvia	3.52	57,823
Lebanon	2.27	25,643
Libya	1.78	12,123
Liechtenstein	2.59	10,514
Lithuania	3.65	66,230
Luxembourg	4.22	125,158
Macedonia FYR	3.15	21,626
Malaysia	2.95	39,291
Malta	2.85	22,221
Mauritius	2.28	7,024
Mexico	3.42	51,643
Moldova	2.42	18,757
Mongolia	1.89	8,355
Montenegro	2.48	6,265
Morocco	2.63	25,425
Netherlands	4.98	299,294
New Zealand	2.99	25,005
Nigeria	2.31	22,909
Norway	3.53	105,112
Oman	2.37	13,822
Pakistan	2.48	15,487
Panama	2.36	7,971
Paraguay	2.25	6,509
Peru	2.79	18,350
Philippines	2.53	18,910
Poland	4.58	247,609
Portugal	3.90	90,222

Appendix Table 2 continued

Appendix Table 2 continued

Country	Average number of import transactions	Number of total import transactions
Qatar	2.37	19,826
Romania	4.00	120,169
Russian Federation	3.41	218,922
Saudi Arabia	2.77	52,843
Singapore	3.29	64,283
Slovak Republic	4.19	105,368
Slovenia	4.08	101,438
South Africa	3.41	68,383
Spain	4.66	198,416
Sri Lanka	2.31	8,914
Sweden	4.60	151,848
Switzerland	3.90	463,713
Syrian Arab Republic	1.67	6,632
Taiwan China	2.97	44,556
Tanzania	2.04	5,397
Thailand	3.09	44,929
Tunisia	2.99	28,350
Turkey	3.33	118,634
Turkmenistan	1.89	5,131
Ukraine	3.17	84,334
Unit Arab Emirates	2.81	73,974
United Kingdom	4.80	211,467
United States	3.84	204,330
Uruguay	2.48	9,756
Uzbekistan	1.83	6,994
Venezuela	2.28	13,380
Vietnam	2.52	20,899

Note: Number of transactions refers to months with recorded export transactions at the firm-product-country of origin level. Destination countries with more than 5,000 recorded export transactions are included in the table.

Appendix Table 3: Trade cost data for 2012

Country	Time to export (Days)	Cost of export (US-$)	Time to import (Days)	Cost of import (US-$)	Dist.to Germany (km)
Afghanistan	74	3545	77	3830	4946
Albania	19	745	18	730	1384
Angola	48	1850	45	2690	6826
Antigua Barbados	16	1440	23	1870	7278
Argentina	13	1650	30	2260	11646
Armenia	13	1815	18	2195	2934
Australia	9	1100	8	1120	15935
Azerbaijan	38	3430	38	3490	3218
Bahamas	19	930	13	1405	7666
Bahrein	11	955	15	995	4423
Bangladesh	25	1025	34	1430	7348
Belarus	15	1510	30	2315	1262
Belize	19	1355	20	1600	9065
Benin	29	1079	30	1549	4912
Bhutan	38	2230	38	2330	7014
Bolivia	19	1425	23	1747	10576
Bosnia Herzegovina	15	1240	13	1200	1020
Botswana	27	2945	37	3445	8473
Brazil	13	2215	17	2275	9396
Brunei Daressalam	19	680	15	745	10614
Burkina Faso	41	2412	47	4030	4503
Burundi	32	2965	46	5005	6374
Cambodia	22	755	26	900	9311
Cameroon	23	1379	25	2167	5072
Canada	7	1610	11	1660	6542
Capa Verde	19	1200	18	1000	4979
Central Africa	54	5491	62	5554	5231
Chad	75	5902	101	8525	4511
Chile	15	980	12	965	12267
China	21	580	24	615	8032
Colombia	14	2255	13	2830	9137
Comoros	31	1295	26	1295	7765
Congo Dem Rep	44	3155	63	3435	6393
Congo Republic	50	3818	62	7709	6192
Costa Rica	13	1030	14	1020	9425
Cote D'Ivoire	25	1999	34	2710	5223
Croatia	20	1300	16	1180	853
Djibouti	18	836	18	911	5357
Dominica	13	1340	14	1350	7388

Appendix Table 3 continued

Appendix Table 3 continued

Country	Time to export (Days)	Cost of export (US-$)	Time to import (Days)	Cost of import (US-$)	Dist.to Germany (km)
Dominican Rep	8	1040	10	1150	7710
Ecuador	20	1535	25	1530	10096
Egypt Arab Repub	12	625	13	755	2957
El Salvador	14	980	10	980	9440
Equatorial Guinea	29	1390	44	1600	5422
Eritrea	50	1460	59	1600	4826
Ethiopia	42	2160	44	2660	5379
Fiji	22	655	23	635	16158
Gabon	20	1945	22	1955	5731
Gambia	23	1180	21	885	4839
Georgia	9	1355	10	1595	2771
Ghana	19	815	34	1315	5105
Grenada	9	1300	9	2235	7687
Guatemala	17	1307	17	1425	9459
Guinea Bissau	23	1448	22	2006	4960
Guyana	19	730	22	745	7928
Haiti	33	1185	31	1545	7873
Honduras	12	1342	16	1510	9221
Hong Kong	5	575	5	565	9026
Iceland	19	1465	14	1620	2317
India	16	1120	20	1200	6566
Indonesia	17	644	23	660	1030
Iran Islamic Rep	25	1470	32	2100	3811
Iraq	80	3550	82	3650	3449
Israel	10	620	10	565	2972
Jamaica	20	1500	17	1560	8244
Japan	10	880	11	970	9086
Jordan	13	825	15	1335	3037
Kazakhstan	81	4685	69	4665	4333
Kenya	26	2255	26	2350	6410
Kiribati	21	1120	21	1120	3979
Korea Republic	7	665	7	695	8505
Kuwait	15	1775	15	1810	3999
Kyrgyz Republic	63	4160	75	4700	4849
Lao PDR	26	2140	26	2120	8725
Lebanon	22	1080	30	1365	2849
Liberia	15	1220	28	1320	5355
Macedonia FYR	12	1376	11	1380	1404
Madagascar	21	1197	24	1555	8666

Appendix Table 3 continued

Country	Time to export (Days)	Cost of export (US-$)	Time to import (Days)	Cost of import (US-$)	Dist.to Germany (km)
Malawi	34	2175	43	2870	7701
Malaysia	11	435	8	420	9987
Maldives	21	1550	22	1526	7886
Mali	26	2202	31	3067	4526
Marshall Islands	21	945	25	970	13191
Mauretania	34	1520	38	1523	4293
Mauritius	10	660	10	695	9224
Mexico	12	1450	12	1780	9476
Micrones Fed	30	1295	30	1295	12591
Moldova	32	1545	35	1870	1463
Mongolia	49	2555	50	2710	6409
Morocco	11	577	16	950	2405
Mozambique	23	1100	28	1545	8426
Namibia	25	1800	20	1905	8196
Nepal	41	1975	38	2095	6636
New Zealand	10	870	9	825	18220
Nicaragua	21	1140	20	1245	9364
Niger	59	3676	64	3711	4182
Nigeria	24	1380	39	1540	4847
Norway	7	1125	7	1100	1039
Oman	10	745	9	680	5139
Pakistan	21	660	18	705	5551
Palau	29	970	33	930	11639
Panama	9	615	9	965	9247
Papua New Guinea	23	949	32	1130	13779
Paraguay	33	1440	33	1750	10734
Peru	12	890	17	880	10747
Philippines	15	585	14	660	10309
Puerto Rico	15	1300	15	1350	7477
Qatar	17	885	17	1033	4554
Russian Federation	21	2820	36	2920	2655
Rwanda	29	3245	31	4990	6238
Samoa	25	690	28	775	15845
Sao Tome Principe	26	690	28	577	5689
Senegal	11	1098	14	1740	4746
Seychelles	16	876	17	876	7589
Sierra Leone	24	1385	27	1780	5205
Singapore	5	456	4	439	10181
Solomon Islands	24	1070	20	1037	4596
South Africa	16	1620	23	1940	9111
Sri Lanka	20	720	19	775	8004

Appendix Table 3 continued

Appendix Table 3 continued

Country	Time to export (Days)	Cost of export (US-$)	Time to import (Days)	Cost of import (US-$)	Dist.to Germany (km)
St Kitts Nevis	11	805	12	2635	7274
St Lucia	14	1375	17	2675	7480
St Vinct Grenadines	12	935	13	1575	7566
Sudan	32	2050	46	2900	4552
Suriname	23	1000	21	1165	7793
Swaziland	18	1880	27	2085	8916
Switzerland	8	1435	9	1440	543
Syrian Arab Rep	15	1190	21	1625	2843
Taiwan China	10	655	10	720	9275
Tajikistan	71	8450	72	9800	4724
Tanzania	18	1040	31	1565	6900
Thailand	14	585	13	750	8878
Timor-Leste	25	750	26	755	12548
Togo	24	940	28	1109	4983
Tonga	22	755	26	740	16597
Trinidad Tobago	11	843	14	1260	7813
Tunisia	13	773	17	858	1729
Turkey	13	990	14	1235	2168
Uganda	33	3050	33	3215	6039
Ukraine	30	1865	33	2155	1696
Unit Arab Emirates	7	630	7	590	4824
United States	6	1090	5	1315	7595
Uruguay	16	1125	18	1440	11496
Uzbekistan	80	4585	99	4750	4539
Vanuatu	21	1690	20	1690	5745
Venezuela	49	2590	71	2868	8290
Vietnam	21	610	21	600	9259
Yemen	29	995	25	1490	5136
Zambia	44	2765	56	3560	7517
Zimbabwe	53	3280	73	5200	8044
N	151	151	151	151	151
mean	23.93	1565	27.04	1876	7072
sd	15.79	1134	18.49	1449	3530
min	5	435	4	420	543
max	81	8450	101	9800	18220
p1	5	456	5	439	853
p50	20	1240	22	1510	7014
p99	80	5902	99	8525	16597

Note: For description and source of data, see text.

Appendix: The measurement of trade costs in the *Doing Business* reports

(from *Doing Business 2012* available at *http://www.doingbusiness.org/reports/global-reports/doing-business-2012*, p. 55-56)

Doing Business measures the time and cost (excluding tariff s) associated with exporting and importing a standardized cargo of goods by ocean transport. The time and cost necessary to complete every official procedure for exporting and importing the goods—from the contractual agreement between the 2 parties to the delivery of goods—are recorded. All documents needed by the trader to export or import the goods across the border are also recorded. For exporting goods, procedures range from packing the goods into the container at the warehouse to their departure from the port of exit. For importing goods, procedures range from the vessel's arrival at the port of entry to the cargo's delivery at the warehouse. The time and cost for ocean transport are not included. Payment is made by letter of credit, and the time, cost and documents required for the issuance or advising of a letter of credit are taken into account. Local freight forwarders, shipping lines, customs brokers, port officials and banks provide information on required documents and cost as well as the time to complete each procedure. To make the data comparable across economies, several assumptions about the business and the traded goods are used.

Assumptions about the business

The business:

- Has at least 60 employees.
- Is located in the economy's largest business city.
- Is a private, limited liability company. It does not operate in an export processing zone or an industrial estate with special export or import privileges.
- Is domestically owned with no foreign ownership.
- Exports more than 10% of its sales.

Assumptions about the traded goods

The traded product travels in a dry-cargo, 20-foot, full container load. It weighs 10 tons and is valued at $20,000. The product:

- Is not hazardous nor does it include military items.
- Does not require refrigeration or any other special environment.
- Does not require any special phytosanitary or environmental safety standards other than accepted international standards.
- Is one of the economy's leading export or import products.

Documents

All documents required per shipment to export and import the goods are recorded.

It is assumed that the contract has already been agreed upon and signed by both parties. Documents required for clearance by government ministries, customs authorities, port and container terminal authorities, health and technical control agencies, and banks are taken into account. Since payment is by letter of credit, all documents required by banks for the issuance or securing of a letter of credit are also taken into account. Documents that are renewed annually and that do not require renewal per shipment (for example, an annual tax clearance certificate) are not included.

Time

The time for exporting and importing is recorded in calendar days. The time calculation for a procedure starts from the moment it is initiated and runs until it is completed. If a procedure can be accelerated for an additional cost and is available to all trading companies, the fastest legal procedure is chosen. Fast-track procedures applying to firms located in an export processing zone are not taken into account because they are not available to all trading companies. Ocean transport time is not included. It is assumed that neither the exporter nor the importer wastes time and that each commits to completing each remaining procedure without delay. Procedures that can be completed in parallel are measured as simultaneous. The waiting time between procedures—for example, during unloading of the cargo—is included in the measure.

Cost

Cost measures the fees levied on a 20-foot container in U.S. dollars. All the fees associated with completing the procedures to export or import the goods are included. These include costs for documents, administrative fees for customs clearance and technical control, customs broker fees, terminal handling charges

and inland transport. The cost does not include customs tariff s and duties or costs related to ocean transport. Only official costs are recorded.

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The Editor