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ESTIMATING CIF-FOB MARGINS ON INTERNATIONAL MERCHANDISE TRADE FLOWS

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In the context of TiVA, an adequate measurement of (and adjustments for) the CIF-FOB margin (or the costs of transport and insurance of international trade) is important, both to assist in the development of a balanced view of international trade (at FOB), and to improve the quality of estimates of transport and insurance services (and their breakdown between services provided by residents and non-residents). In the absence of official data on CIF-FOB margins by product and partner country, this paper uses a model-based approach to estimate CIF-FOB margins. Although analytical in nature, with an a priori selection of factors that drive CIF margins, the approach developed demonstrates that robust and meaningful estimates of CIF margins are obtainable using econometric techniques.

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1. Introduction

1. The analytical use of international merchandise trade statistics is often hampered by differences in the valuation of exports and imports. Following international guidelines (*e.g*. IMTS2010), exports are generally recorded as Free On Board (FOB), in other words the market value of the goods at the customs frontier of the exporting economy. At the same time, imports are typically valued on a Cost, Insurance and Freight (CIF) basis, that is the value of imported goods reflects the market value of the goods at origin, including all of the associated costs involved in transporting them to the importing country from their origin. This means that for a given trade flow between two countries the recorded value of the imports will, by design, be at least as large as the recorded value of the corresponding exports. The exact magnitude of this CIF-FOB margin typically depends on a number of factors including for example the geographical distance between borders, the mode of transport used, and the type (including value) of product.

2. In the context of TiVA, an adequate measurement of (and adjustments for) the CIF-FOB margin (or the costs of transport and insurance of international trade) is important for two key reasons.

- Underpinning TiVA is a global (inter-country) input-output table, containing by design a balanced view of international trade. Such a balanced view also requires a consistent price basis for exports and imports but also production and exports, which is why the TiVA system is built on a basic price basis (F.O.B equivalent for trade data).
- In addition, a robust measurement of CIF-FOB margins provides the means to improve the quality of estimates of transport and insurance services, and indeed to identify and differentiate between those costs that may already be included in services data, broken down into those are provided by non-residents and those provided by residents.

3. But this is not the only reason why the development of data on CIF-FOB margins is important. The calculation of the margins is an essential component of the OECD's attempts to engineer a coordinated international effort to develop a coherent view of international trade, and to accelerate work on resolving structural asymmetries (see also Fortanier and Sarrazin, 2016).

4. At present, most countries only publish aggregated information on the CIF-FOB ratio (or on the CIF-FOB adjustments in the Supply and Use tables), rather than at a detailed product level; which is what is needed for creating a coherent view of global trade. In the absence of detailed data therefore analytical approaches are required (cf. the work of CEPII, WIOD, and others, reviewed below). Typically, this is done either by generalizing information from one or a few countries (USA is often used as they have very detailed data available), or by using bilateral mirror data from UN COMTRADE (which is less precise but has the advantage of covering more countries).

5. This paper partly follows in these footsteps in that it uses a model-based approach to estimate CIF-FOB margins. However, one of the main improvements compared to earlier studies is the construction and use of a more extensive dataset of bilateral CIF-FOB information as published by national statistical authorities at the 6 digit level. It is the largest dataset to date of CIF-FOB data both in terms of numbers of countries involved (Argentina, Australia, Bolivia, Brazil, Chile, Colombia, the Czech Republic, Ecuador, Iceland, Luxembourg, New Zealand, Paraguay, Peru, Uruguay and the USA) and time period covered (1995-2013)[1]. The dataset forms the basis for an econometric model, which is subsequently validated using a larger – but often considered less reliable – dataset of CIF-FOB values indirectly derived from UN COMTRADE. The estimated CIF-FOB margins are made available for feedback from statistical offices, academics and any other interested parties, and of course for further analytical use.

6. The remainder of this paper is organized as follows. First, section 2 provides provide a brief overview of the recommendations in international standards (IMTS2010, BPM6 and SNA2008) with respect to the valuation of exports and imports and subsequent treatment of the CIF-FOB margin. Subsequently, the existing literature on estimating CIF-FOB margins is reviewed (section 3), while section 4 describes the data and methodology. Section 5 gives a detailed descriptive overview of the most important patterns and trends that can be observed from the explicit CIF-FOB margin data, in order to provide a good overview of the levels of, and variations in, reported CIF-FOB margins across countries and products, and over time. Section 6 presents the results of the regression analysis, while section 7 discusses the findings and concludes.

WPTGS Delegates are kindly requested to comment on the approach and methodology described, and to provide any insights or data regarding their national practices to estimate CIF-FOB margins that may help improve future estimates.

2. The valuation of exports and imports in international statistical standards and in TiVA

7. The various relevant international statistical standards – including those on International Merchandise Trade Statistics (IMTS2010), the 6th Balance of Payments Manual (BPM6), and the System of National Accounts 2008 (SNA2008) – recommend that *exports* should be recorded as Free on Board (FOB) (the closest match to basic prices in the National Accounts). However, the recommendations of the standards vary with respect to the preferred valuation of *imports*.

8. IMTS2010 follows the data-reporting practices for the majority of countries, and recommends that imports should be measured on a CIF basis, although the manual does encourage the compilation of imports on a FOB as supplementary information. In contrast, the 6th edition of the Balance of Payments Manual (BPM6) and the 2008 SNA both recommend that total imports should be measured on an FOB basis.

9. In practice however import data are rarely available on a CIF basis by detailed product and so Supply Use tables for example typically record transactions on a CIF basis with a global CIF-FOB adjustment. The adjustment avoids double-counting CIF services provided by non-residents that may also

[1] The nearest match is Hummels and Skiba (2004), who used bilateral 6-digit product information for 6 countries for 1 year (1994).

be included, in practice, in imported services data, and services provided by residents that should not be included in imports.

3. Literature review: existing work on estimating CIF-FOB margins

10. In the academic literature, several datasets on CIF-FOB margins by product and partner country have already been produced, mostly with the aim of explaining the size, trends, and drivers of trade costs and the importance of trade facilitation (see *e.g.* Limao and Venables (2001), Hummels and Skiba (2004), Hummels and Lugovskyy (2006), Pomfret and Sourdin (2010), and Sourdin and Pomfret (2012) for some of the most prominent examples of this literature). Others have undertaken similar work in the context of developing international trade statistics more generally, such as Gaulier and Zignago (2008, 2010) for CEPII, or more recently Timmer *et al.* (2012) and Streicher and Stehrer (2013) in the context of the creation of international input-output tables (*e.g.* WIOD and GTAP).

11. Overall, the literature can be divided into a group of papers that uses what is often referred to as *explicit* data on transport costs, published by statistical offices (*e.g.* the US), and a group of papers that uses the differences between mirrored flows (imports CIF and exports FOB), generally drawing on UN COMTRADE data, to *implicitly* derive transport costs.

3.1 Studies using explicit data on CIF-FOB margins

12. Although the analysis of CIF-FOB margins, and transportation costs more generally, have been on the academic agenda for a long time (see *e.g.* Moneta (1959) and Geraci and Prewo (1977)) it was only in the mid-to-late nineties that larger and more detailed international datasets became available to facilitate estimation on a large scale. Hummels (1999) and Limão and Venables (2001) were among the first to exploit such sources. Hummels (1999), aiming to measure trade barriers that separate countries, uses bilateral CIF-FOB margins at the product level provided by the US, New Zealand, and five Latin American countries (Argentina, Brazil, Chile, Paraguay and Uruguay) for 1994. He found trade-weighted CIF-FOB rates ranging from 3.8% for the US to around 7-8% for New Zealand, Chile and Argentina and 13.3% for land-locked Paraguay. This dataset was later also used in Hummels and Skiba (2006).

13. Limao and Venables (2001) present two sets of experiments that highlight the importance of geography (distance, landlockedness, island status) and infrastructure (quality of transport and communications infrastructure) for transport costs. The first experiment was based on shipping company data on US container exports to selected destinations (with average transport costs of 6.6%). The second set uses CIF-FOB margins derived from bilateral trade data reported by the IMF (without product detail), using data for 103 countries for the year 1990. While they remove those observations where CIF values are smaller than FOB values, and IMF estimates, the median CIF-FOB rate in this dataset is rather high (28%).

14. Later work by *e.g.* Clark *et al*. (2004) used US import data by partner and detailed product from the Department of Transportation, for the years 1996, 1998 and 2000. This allowed them to identify the effect of *e.g.* mode of transport and port efficiency on the transport costs for imports, while controlling *e.g.* for GDP per capita (correlated with infrastructure), and the unit value of products (correlated with insurance costs). They record average CIF-FOB margins on imports to the US of 5.2%, with important variation across exporting regions (*e.g.*, imports from Oceania and Africa had a CIF-FOB margin of around 12%).

15. Similar US data were used by Wang *et al.* (2007) in their corrections for China-Hong Kong-US trade relationships for GTAP, who found, in contrast to Clark *et al*. (2004), that higher unit value products have lower overall CIF-FOB margins. They apply the US rates (distinguishing between contiguous and non-contiguous countries) to the Chinese and HK trade relationships. Finally, the CHELEM/CEPII database (De Saint Vaulry, 2008)) used an unspecified data source of marine transport costs of 1969 (for 32 geographic zones and 12 product groups), which was indexed over time to obtain a global average CIF-FOB margin of roughly 6%.

3.2 Studies using implicit data on CIF-FOB margins

16. A second strand of literature on analysing the differences between imports (CIF) and the mirror export data (reported FOB) to obtain estimates of the CIF-FOB margin. Data are often sourced from the UN COMTRADE or the IMF Direction of Trade Statistics databases. While substantially increasing sample size, the downside of this approach is that the estimates are often considered much less reliable, indeed Hummels and Lugovskyy (2006) concluded that such data are "error-ridden in levels and contain no useful information for time-series or cross-commodity variation". It should be noted however that the data they examined were rather old (*e.g.* 1974-1983 for UN COMTRADE) and that sources, quality and coverage have improved significantly in the past 30 years. In addition, the most recent contributions also carefully edit the data to only consider (or to give more weight to) those observations that can be seen as most reliable.

17. Ghelhar (1996) was among the first to produce reconciled data based on UN COMTRADE information, for GTAP. He estimated CIF-FOB margins at the SITC level, by estimating it, first, for all transactions, by comparing exports FOB and imports CIF, and, subsequently, using only the data for the most reliable reporters. GTAP currently records an average 4% trade-weighted average CIF-FOB margin. Streicher (2012) and Timmer *et al.* (2012) similarly use UN COMTRADE data to make CIF-FOB estimations for WIOD, using the ratio of import unit values over export unit values as a dependent variable, and standard gravity variables (distance, landlockedness, part of same continent) as independents. They only consider flows with Kilogram as a quantity unit, whose mirror flows deviate less than 5% (in quantity), and where the CIF value is larger than the FOB value. They establish CIF-FOB margins in the range of 5-7%.

18. CEPII presents two very similar reports on estimating CIF-FOB margins, one for the purposes of their balanced trade dataset (Gaulier and Zignago, 2010), and a second for the explicit purpose of an estimated CIF-FOB margins database (Gaulier et al., 2008). Like others, both studies use a gravity approach using CIF-FOB margins derived from mirror flows from UN COMTRADE, with explanatory variables including distance, distance squared, contiguity, landlockedness (reporter and partner) and the median Unit Value of each product (to account for higher costs of trading heavier commodities). Gaulier *et al.* (2008) also added GDP and GDP-per-capita to account for economies of scale and for infrastructure quality, respectively. They also aim to control for methodological differences in recording trade statistics across countries by including a set of dummy variables *e.g.* the use of customs data as a main source and the use of exchange rates.

19. Gaulier and Zignago (2010), using UN Comtrade, measure the CIF-FOB margin by using the ratio in unit value between imports and exports, assuming that recorded unit value ratios are typically less

prone to problems caused by asymmetries, and give greater weight to observations with similar quantities. They estimated the average world CIF-FOB margin to be around 3%. Gaulier *et al.* (2008) found a similar overall average percentage (2%). Both seem surprisingly low given the values reported by the studies using explicit CIF-FOB rates. This is very likely due to the fact that neither of the two studies excluded incorrect observations (most notably negative CIF-FOB margins). For example, the 10th percentile of the sample used in Gaulier et al. (2008) had a CIF-FOB margin, -7%.

4. Data and methodology

20. The approach used here, and that forms the basis of the OECD's coordinated approach to developing coherent international trade statistics, replicates some of the characteristics of the above approaches. In summary the method uses a gravity type approach, described in detail below, whose parameters are determined using, in a first step, information from the 16 countries that currently publish or have published detailed bilateral product-level information on the CIF-FOB margin on their imports. This sample is the largest and most detailed cross-country sample of official national statistics on explicit CIF-FOB margins to date used in these kinds of analyses, and will be extended if and when more countries develop similar data; which this initiative hopes to provide momentum to. It thereby gives important insights into the levels and developments of real CIF-FOB margins across countries, partners, products, and over time and provides a solid platform for model development. In a second step implicit unit value CIF-FOB margins are derived from the UN COMTRADE database (for those cases where the data is of good quality) to test the robustness of the model across a broader set of countries.

21. The following sections provide an overview of the data sources used in both steps, including the 'cleaning and screening' process, followed by a description of the model.

4.1 Data collection and harmonization: explicit CIF-FOB margins reported by NSOs

22. A variety of official national sources were combined in order to construct a dataset of explicit CIF-FOB margins, described in more detail in Appendix 1. Data in imports CIF and FOB for the following countries and years were available in the OECD's International Trade by Commodity Statistics (ITCS) database, (fully synchronized with the UN COMTRADE database), by partner and detailed product: Data were obtained this way for Luxembourg (2008-2011), Chile (2003-2013), Iceland (2001-2011, and 2013), the Czech Republic (2011 and 2013), the Slovak republic (2012-2013), the US (2002-2012), New Zealand (2000-2012) and Australia (1995-2006). In addition, the OECD Maritime Transport Costs database, containing explicit CIF-FOB margins, was used for the following countries and years (see also Karine, 2011): Argentina (1995-2007), Bolivia (1995-2000), Brazil (1997-2007), Colombia (1995-2007), Ecuador (2000-2007), Paraguay (1995), Peru (1995-2007), Uruguay (1995-2007), US (1995-2001), Chile (1995-2002), New Zealand (1995-1999) and Australia (2007).

Dealing with different vintages of HS classifications

23. A key issue when combining these data sources is that they cover a variety of HS product classifications, ranging from HS1988 (all the data in the Maritime Transport Cost database) to the most recent HS2012, reflecting the continued updating of classifications. Table 1 gives an overview of the data availability across countries, years and HS classification.

Table 1. Overview of data availability by HS classification, importing country and over time

	ARG	AUS	BOL	BRA	CHL	COL	CZE	ECU	ISL	LUX	NZL	PER	PRY	SVK	URY	USA
1995	HS88	HS88	HS88	-	HS88	HS88	-	-	-	-	HS88	HS88	HS88	-	HS88	HS88
1996	HS88	HS96	HS88	-	HS88	HS88	-	-	-	-	HS88	HS88	-	-	HS88	HS88
1997	HS88	HS96	HS88	HS88	HS88	HS88	-	-	-	-	HS88	HS88	-	-	HS88	HS88
1998	HS88	HS96	HS88	HS88	HS88	HS88	-	-	-	-	HS88	HS88	-	-	HS88	HS88
1999	HS88	HS96	HS88	HS88	HS88	HS88	-	-	-	-	HS88	HS88	-	-	HS88	HS88
2000	HS88	HS96	HS88	HS88	HS88	HS88	-	HS88	-	-	HS96	HS88	-	-	HS88	HS88
2001	HS88	HS96	-	HS88	HS88	HS88	-	HS88	HS96	-	HS96	HS88	-	-	HS88	HS88
2002	HS88	HS02	-	HS88	HS88	HS88	-	HS88	HS02	-	HS02	HS88	-	-	HS88	HS02
2003	HS88	HS02	-	HS88	HS02	HS88	-	HS88	HS02	-	HS02	HS88	-	-	HS88	HS02
2004	HS88	HS02	-	HS88	HS02	HS88	-	HS88	HS02	-	HS02	HS88	-	-	HS88	HS02
2005	HS88	HS02	-	HS88	HS02	HS88	-	HS88	HS02	-	HS02	HS88	-	-	HS88	HS02
2006	HS88	HS02	-	HS88	HS02	HS88	-	HS88	HS02	-	HS02	HS88	-	-	HS88	HS02
2007	HS88	HS88	-	HS88	HS07	HS88	-	HS88	HS07	-	HS07	HS88	-	-	HS88	HS07
2008	-	-	-	-	HS07	-	-	-	HS07	HS07	HS07	-	-	-	-	HS07
2009	-	-	-	-	HS07	-	-	-	HS07	HS07	HS07	-	-	-	-	HS07
2010	-	-	-	-	HS07	-	-	-	HS07	HS07	HS07	-	-	-	-	HS07
2011	-	-	-	-	HS07	-	HS07	-	HS07	HS07	HS07	-	-	-	-	HS07
2012	-	-	-	-	HS12	-	-	-	-	-	HS12	-	-	HS12	-	HS12
2013	-	-	-	-	HS12	-	HS12	-	HS12	-	HS12	-	-	HS12	-	HS12

24. Rather than converting all data to a common HS classification, which may introduce errors, the problem of different classifications is resolved using 'auxiliary' codes, which flag the consistance across all classifications and combined with information for HS vintage. This means that the panel nature of the product codes is maintained as much as possible across HS classifications, and that the model can be used to simultaneously produce estimates for all HS vintages.

25. Table 2 gives examples of this procedure for HS product 6401. It shows that data, for example, for product code HS88 code 640110 (waterproof footwear with protective metal toe-cap), whose definition has remained constant across time, can be used across all HS classifications, with dummy entries of 1 for each HS classification. However, HS88 code 640191 (waterproof footwear product covering the knee), which was consistent in HS88, HS96, and HS02 was merged with product 641099 in HS07 onwards (and hence ceased to exist). In parallel, while product 640199 existed throughout HS classifications, the change in definition means that the product code cannot be used consistently over time, hence the creation of a new auxiliary code HS code 640199a in HS07 and HS12, and dummy entries of 1 for these classifications only.

Table 2. Examples of evolving HS classifications

HS code	HS vintage (when code first appeared)	Dummy coding				
		HS88	HS96	HS02	HS07	HS12
640110	HS1988	1	1	1	1	1
640191	HS1988	1	1	1	0	0
640199	HS1988	1	1	1	0	0
640199a	HS2007	0	0	0	1	1

Harmonizing quantity units

26. Quantity units are recorded and coded differently across countries and have to be harmonized to the international common standards (as used in UN COMTRADE) to facilitate the calculation and comparability of unit values (as independent variables in the model). To do this, concordances were developed between national quantity units and the international standards. For example, energy reported in gigajoules was converted to thousands of kilowatt-hours, and weights in tonne to kilograms.[2] The primary reported quantity unit was used as the main source for information, and only supplemented with the secondary quantity unit (often in "weight in kilograms") when the first was not available. Data from the Maritime Transport Costs database are all reported as "*weight in kilograms"*. The results of this harmonization exercise are displayed in table 3, highlighting that "weight in kilograms", and "number of items", are the two most frequently used quantity units, representing 85% of the total observations. The number of the observations without quantity information is limited to 455 thousand (including those observations where quantity units did not align with international standards, footnote 3). The exact concordance tables will be made available on-line with the release of the first version of harmonised trade statistics.

Outliers

27. Not surprisingly nationally reported CIF-FOB margins contained significantly fewer extreme values (outliers) compared to those seen when implicitly derived (using UN Comtrade data, see below). To avoid introducing distortionary effects in estimating the parameters in the model excessively high values (2% of all observations) were removed from the analysis.

[2] Some country and product specific quantity unit classifications have been converted to their closest possible match after carefully examining the nature of the products. For example, New Zealand reports a few observations in "hanks", which have been changed to "*Number of items*". The US "*doses*" and "*squares*" are changed into "*Number of items*" and "*Area in square meters*". Some units used by the US, such as Gross Lines, Jewel, Megabecquerels and Ozone Depletion Equivalent, turned out to be difficult to match with any standard quantity unit. Given that these quantity units only applied to very few transactions, these observations were removed from the analysis ("*No quantity*").

Table 3. Harmonized quantity units and data distribution

Quantity unit	Number of observations
Area in square meters	216,777
Dozens of items	146,015
Electrical energy in thousands of kilowatt-hours	105
Length in meters	18,569
Number of items	1,178,265
Number of packages	1,189
Number of pairs	62,034
Thousands of items	10,274
Volume in cubic meters	23,037
Volume in litres	63,292
Weight in carats	3,383
Weight in kilograms	4,338,076
No quantity	455,260
Total	**6,516,276**

4.2 Data collection and harmonization: implicit CIF-FOB margins derived from UN Comtrade

28. To test the robustness of the analysis, and results, based on the explicitly reported CIF-FOB margins, an additional analysis is conducted using implicit CIF-FOB margins derived from UN COMTRADE. For this analysis, only data reported in the HS2007 classification were used (to avoid introducing possible errors related to conversion of data across classifications). Countries that report imports to UN Comtrade (only) at FOB (Australia, Brazil, Canada, Mexico and South Africa) were excluded from the sample.

29. The ratio between the reported import unit values and the mirror export unit values was used as a proxy for the CIF-FOB margin, calculated at the HS 6 digit level. After matching import flows with their mirror exports, and following the approaches used in earlier studies, observations were retained only in the following cases:

a) the reported quantity units were the same,
b) the differences in reported quantities was less than 5%, and
c) the ratio between import unit values and export unit values was between 1 and 2

30. As Annex 2 shows, this substantially reduces the number of observations: from 48 million to just over 900,000.

4.3 Model specification

31. The aim of this study is to estimate or predict CIF-FOB rates for those reporters, partners and products where information is not currently available.

32. The approach uses a gravity model with a list of independent variables identified as relevant in earlier studies (see Table 4 below), including the geographical distance between trading partners the infrastructure quality of importing and exporting country (measured using GDP per Capita), the median unit value of each 6-digit product, dummies for partner contiguity and for partners being on the same

continent, the oil price, a set of dummies related to the HS vintage within which an HS code can be interpreted, as well as a set of product and year dummies.

Table 4. Overview of independent variables

Code	Description
dist	Natural log of the weighted geographical distance between the country pair
$dist^2$	Square of the natural log weighted geographical distance between the country pair
$gdppc_i$	Natural log of GDP per capita of the importing country *i*
$gdppc_j$	Natural log of GDP per capita of the exporting country *j*
$infstr_i$	Infrastructure index of the importing country *i*
$infstr_j$	Infrastructure index of the exporting country *j*
Uvmdn	Natural log of median product unit value
contig	Dummy = 1 if importing and exporting country are contiguous
conti	Dummy = 1 if importing and exporting country are on the same continent
poil	Nature log of average crude oil price, annual data
H0	Dummy = 1 if the 6-digit HS code can be interpreted within HS1988
H1	Dummy = 1 if the 6-digit HS code can be interpreted within HS1996
H2	Dummy = 1 if the 6-digit HS code can be interpreted within HS2002
H3	Dummy = 1 if the 6-digit HS code can be interpreted within HS2007
H4	Dummy = 1 if the 6-digit HS code can be interpreted within HS2012

33. The data on geographical distance, contiguity and continent are taken from the CEPII database. Geographical distance is expected to increase CIF-FOB margins (although the effect may be non-linear), while contiguity is expected to lower the trade and insurance costs (note that theoretically, the CIF-FOB margin between two contiguous countries should be zero, but in practice this is not the case, reflecting a number of factors including the mode of transport, (see also Table 7). If both countries are on the same continent, land transport is more likely to be used as compared to sea transport, resulting in a relatively higher CIF-FOB margin.

34. Infrastructure quality of both exporting and importing partner is expected to reduce the CIF-FOB margin. Two measures of infrastructure quality are tested. First, a measure is constructed that mimics the Infrastructure Quality Index of Limao and Venables (2001), an average of four normalized variables including kilometres of rail lines, number of fixed telephone subscriptions, the quality of port infrastructure, and the logistics performance index (all from the World Bank Development Indicators). Secondly, to ensure wider country coverage, GDP per capita data (also from World Bank) is used, which has been found to be highly correlated with infrastructure quality (see Clark et al., 2004).

35. The worldwide median unit value for each 6-digit product *by each quantity unit* (value/quantity) is included to capture the relation between unit values and transportation costs – reflecting the a priori expectation (supported by the literature) that higher unit values imply higher insurance costs. The median unit value is based on import CIF prices to facilitate out-of-sample prediction.

36. Finally, the model accounts for the average annual oil price, and includes product dummies at the HS 4-digit group, time dummies, and dummies by partner country. It is specified as follows:

$$Y_{ijkt} = \alpha + \beta_1 dist_{ij} + \beta_2 dist_{ij}^2 + \beta_3 uvmdn_{ktu} + \beta_4 contiguity_{ij} + \beta_5 poil_t + + \beta_6 conti_{ij} + \beta_7 gdppc_{it} + \beta_8 gdppc_{jt} + \beta_9 infstr_{it} + \beta_{10} infstr_{jt} + \delta_t + \delta_{k4} + \delta_j + \varepsilon_{ijkt}$$

where Y_{ijkt} represents the natural log of the CIF-FOB margin of a specific product *k* imported by country *i* from country *j* at a given year *t*; $dist_{ij}$ is the natural log of the geographical distance between countries *i* and *j*; $uvmdn_{ktu}$ represents the natural log of median unit value of each HS 6-digit product *k* with the same unit quantity code *u* in year *t*; $contiguity_{ij,}$ and $conti_{ij}$ indicate the geographical situation of country *i* relative to country *j* as explained above; $gdppc_{it}$ and $gdppc_{it}$ represent the natural log of GDP per capita of countries *i* and *j*; $infstr_{it}$ and $infstr_{jt}$ reflect the infrastructure indices; $poil_t$ represents the natural log of the average annual price of crude oil (in USD per barrel); δ_t reflects time dummies, δ_j partner country dummies, and δ_{k4} the product dummies at HS 4-digt section level.

37. The model does not include landlocknesss of importers and exporters, even if this has regularly been included by others, for two reasons. First, the number of observations for landlocked importing countries in the explicit dataset is small and strongly biased towards European countries (see also below in section 5). Secondly, the inclusion of partner fixed effects ensures that effects of partner landlockedness are captured.

5. Descriptive statistics: the development of CIF-FOB margins over time

5.1 CIF-FOB margins across importing countries

38. Table 5 below summarizes the annual trade weighted CIF-FOB margins for those countries where explicit data are available. It shows substantial cross-country variation but a declining trend overall. Of note is the observation of relatively high (albeit declining) CIF costs in Latin American countries compared to imports by Europe and the United States; which may be at least partly explained by the relatively low degree of regional integration in Latin America, unlike the EU and NAFTA. Australia, New Zealand and Iceland also report high CIF-FOB margins, reflecting in part their geographical location. Slovakia, the Czech Republic and Luxembourg - in the middle of the Europe – show very low CIF-FOB margins of 3 percent or lower.

39. Another interesting observation apparent from Table 5 is that 5 out of 16 countries (Paraguay, Slovakia, Luxembourg, Czech Republic, and Bolivia) in the data set are landlocked. Of note, are the relatively low margins for the Czech Republic, Slovak Republic and Luxembourg, contradicting the general expectation that landlockedness increases transportation costs; although, certainly for the Czech Republic and Slovakia, this may also reflect a relatively high degree of integration within European value chains, and correspondingly high degrees of intermediate imports for further processing. Also noteworthy are the relatively high values for Argentina in 2007, Bolivia during 1998-2000, Paraguay in 1995, and Peru in 1995, which mainly reflects only a limited number of product observations for these countries and years (see the table in Annex 1).

Table 5. Reported CIF-FOB margin (%)

Country Name	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13
Argentina	8.2	7.6	6.6	5.9	5.6	5.7	6.0	6.3	5.1	5.2	4.7	4.3	7.8						
Australia	7.2	7.1	7.1	7.1	6.3	6.4	6.4	5.5	5.6	6.1	6.0	5.6	7.4						
Bolivia	15.1	13.5	12.7	25.2	26.3	27.6													
Brazil			5.9	6.0	5.6	5.3	5.4	4.9	4.8	5.2	4.8	4.2	4.4						
Chile	8.5	8.0	7.8	8.2	8.5	10.3	10.4	9.0	7.7	8.1	7.4	7.0	7.1	7.4	6.7	6.9	6.1	6.2	6.2
Colombia	8.4	7.8	7.4	7.6	7.4	7.4	7.8	7.8	7.0	7.8	7.5	6.6	6.7						
Czech Rep.																	3.0		3.0
Ecuador						9.3	8.7	7.8	7.2	7.9	7.3	6.9	7.3						
Iceland							8.8	8.6	8.5	8.4	8.6	7.9	8.1	8.7	8.7	8.3	7.4		7.9
Luxembourg														1.7	0.9	2.4	1.2		
New Zealand	8.3	7.9	7.7	8.0	6.8	6.5	7.0	6.6	6.6	6.7	6.9	6.7	6.2	6.3	5.6	5.9	5.3	5.3	
Peru	2.6	8.4	8.4	8.4	8.4	7.8	8.5	7.7	6.9	8.0	8.3	7.9	7.3						
Paraguay	16.0																		
Slovakia																		2.4	2.3
Uruguay	8.0	8.3	8.2	8.6	7.0	5.5	6.2	5.4	4.6	4.8	4.9	4.6	5.6						
United states	4.2	3.8	3.8	4.2	4.5	4.6	4.6	3.3	3.6	3.8	3.7	3.5	3.3	3.1	2.9	2.9	2.6	3.1	

NB: grey-shaded cells are derived from the MTC database

40. For Australia, Chile, New Zealand and the United States, some care is needed when looking at the observations over time as the source data (Maritime Transport Costs database and Customs data) varies by year. The number of observations in the Maritime Transport Costs is much less than the Customs source in each respective country (see the table in Annex 1), since only sea freight is captured.

5.2 CIF-FOB margins across HS chapters

41. There are also significant differences in the CIF-FOB margin across products. Table 6 provides an overview of the average trade-weighted CIF-FOB margin by HS chapter (pooling data across all countries, partners and 6 digit product categories). For Chapter 25 (salt, sulphur, earth & stone, lime & cement), an average CIF-FOB margin of 28% is established, with values varying from 0.1% to as high as 47.6% depending on the detailed 6 digit product and importing and exporting country involved. On the other side of the spectrum, Chapter 30 (pharmaceutical products), shows a CIF-FOB margin of only 3 percent, with relatively little variation.

Table 6. CIF-FOB margins by HS chapter

HS chapters with highest average CIF-FOB margins			HS chapters with lowest average CIF-FOB margins		
HS Chapter	Mean CIF-FOB %	Stddev	HS2	Mean CIF-FOB %	Stddev
25	28.0	9.2	37	3.3	1.7
26	17.2	12.8	74	3.2	2.3
46	16.7	5.3	30	3.0	2.4
06	14.9	7.1	71	2.9	2.5
07	14.7	5.5	75	2.7	2.4

5.3 CIF-FOB margins across trading partners

42. Naturally CIF-FOB margins vary not only by importing country but also by trading partner, reflecting *e.g.* geographical distance. Figures 1, 2 and 3 illustrate this for the US, Australia and Chile. For the US, the CIF-FOB margin on imports from Canada and Mexico is much lower compared to margins on imports from European markets. Imports from the Middle East and Asian trade partners show the highest

CIF-FOB margins. For Australia, however, although the overall CIF-FOB margin on imports is much higher than that of the US, there seems to be much less of a correlation between distance and transport and insurance costs: for example, the CIF-FOB margin on imports from Germany and the UK is lower than that on flows from Japan, partly reflecting compositional effects. Finally, for Chile, CIF-FOB margins on imports from Peru, Brazil and Mexico are relatively low, while those on imports from Colombia and Argentina (separated by the Andes) are much higher.

Figure 1. US trade-weighted CIF-FOB margin for its top 10 trading partners, 1995-2012

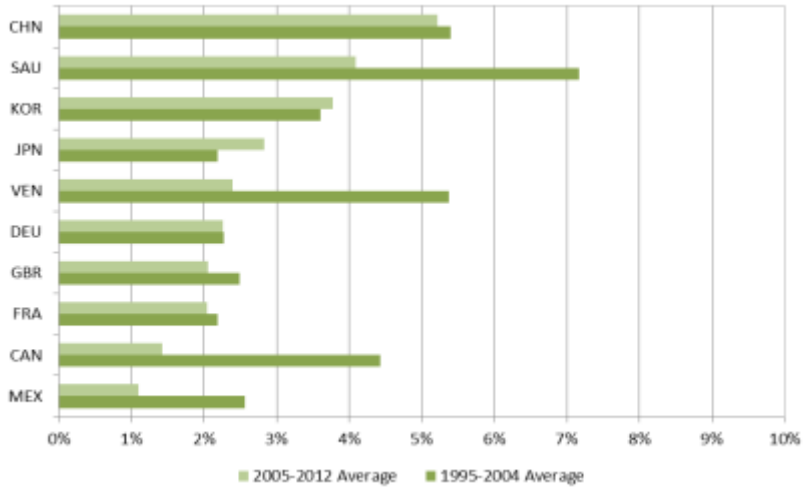


Figure 2. Australia's trade-weighted CIF-FOB margin for its top 10 trading partners, 1995-2007

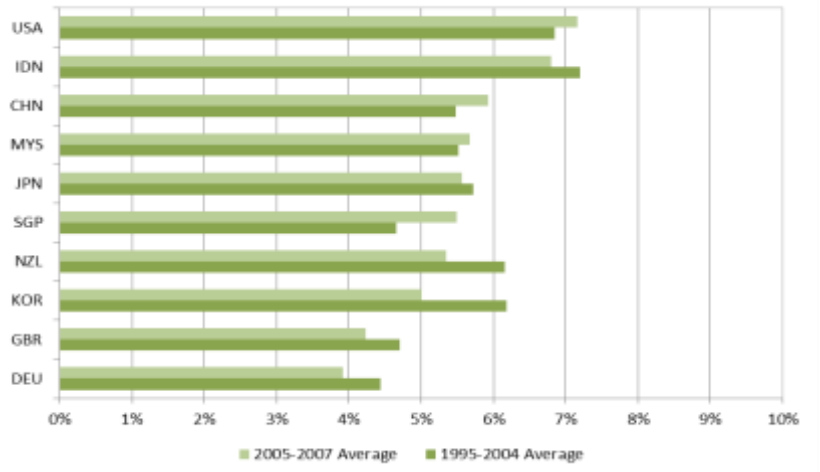
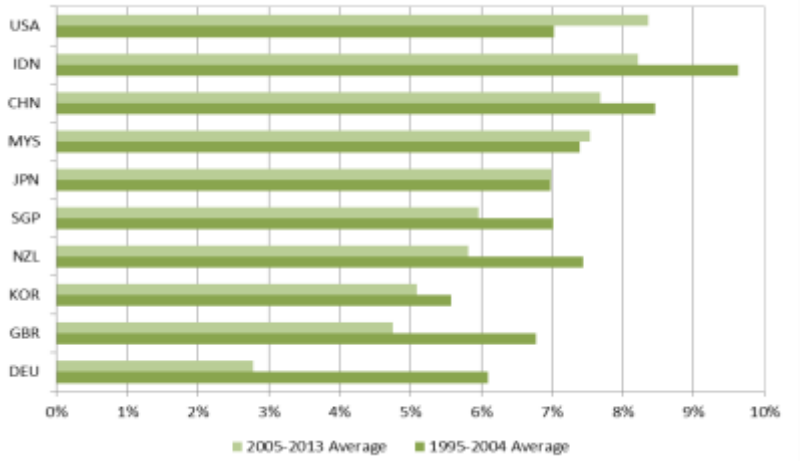


Figure 3. Chile's trade-weighted CIF-FOB margin for its top 10 trading partners, 1995-2013



5.4 CIF-FOB margins with neighbouring countries

43. As mentioned before, if the exporting and importing countries are contiguous, the CIF-FOB margin should theoretically be equivalent to zero. In reality this is not always the case, as the transport charges and insurance cost may be recorded in practice *e.g.* in the case of air transport, or indeed where trade passes through other contiguous countries. The Czech Republic is the only country in the sample that reports zero CIF-FOB margins for trade with neighbouring countries. Table 7 compares countries' overall CIF-FOB margin on imports with those on imports from neighbouring (contiguous) partners. It shows that while the overall CIF-FOB margin on trade with neighbouring countries is lower than the overall CIF-FOB margin, it is not zero, and may even be higher in certain cases.

Table 7. Reported CIF-FOB margins for trade with neighbouring (contiguous) partners, selected reporters (%)

Reporting country	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13
Chile – all partners	8.5	8.0	7.8	8.2	8.5	10.3	10.4	9.0	7.7	8.1	7.4	7.0	7.1	7.4	6.7	6.9	6.1	6.2	6.2
Chile – neighbours	7.7	7.4	7.9	9.0	10.1	9.7	10.1	8.0	8.3	8.0	7.2	7.3	7.3	7.1	7.5	6.6	6.0	6.6	6.6
Peru – all partners	2.6	8.4	8.4	8.4	8.4	7.8	8.5	7.7	6.9	8.0	8.3	7.9	7.3						
Peru – neighbours		6.0	5.5	6.2	5.2	5.0	6.1	5.8	4.9	6.1	5.8	5.3	4.4						
Uruguay– all partners	8.0	8.3	8.2	8.6	7.0	5.5	6.2	5.4	4.6	4.8	4.9	4.6	5.6						
Uruguay – neighbours	5.4	5.0	4.9	5.3	5.0	5.1	4.7	4.8	4.0	4.5	4.5	4.4	3.6						
United States – all partners	4.2	3.8	3.8	4.2	4.5	4.6	4.6	3.3	3.6	3.8	3.7	3.5	3.3	3.1	2.9	2.9	2.6	3.1	
United States – neighbours	5.1	3.9	4.2	4.7	4.0	2.8	2.8	1.4	1.4	1.4	1.4	1.3	1.2	1.1	1.3	1.2	1.1	1.6	

6. Regression results

6.1 Using Explicit CIF-FOB margins

44. In building the model to estimate CIF-FOB margins by country, partner and product, a variety of specifications were tested. The results are displayed in Table 8. In the first model (1), all independent variables described in section 4.3 are included, with GDP per capita proxying infrastructure quality.

45. The model was subsequently extended (2) to include the interaction effects between distance and countries being on the same continent, to examine to what extent the effect of distance on CIF-FOB

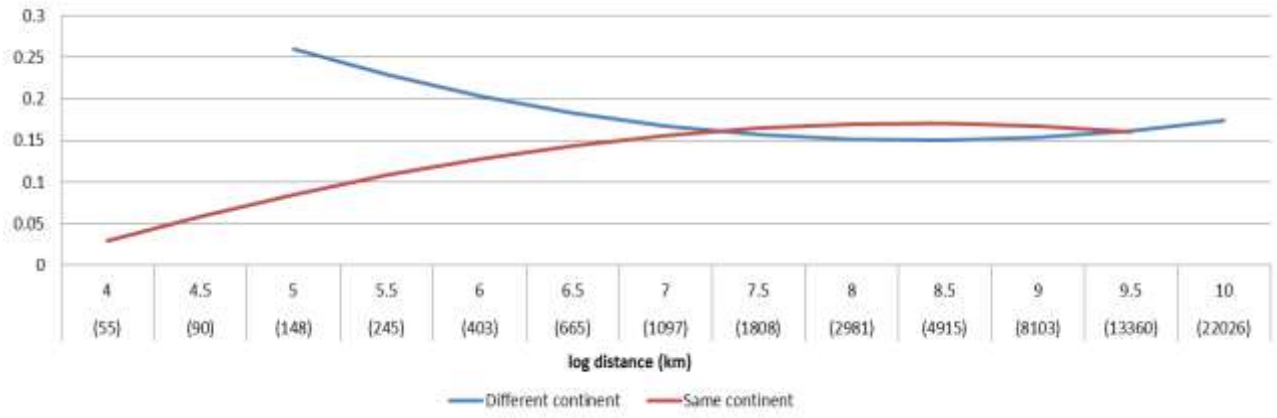
margins could vary depending on the (implicit) mode of transport. The final model (3) also includes fixed effects by trading partner. This final model was subsequently run on the five (overlapping) subsets of data representing all HS codes applicable to HS1998 to HS2012 (see section 4.1).

46. The coefficients for the independent variables remain stable across all model specifications and generally have the signs that would have been expected a priori. Infrastructure quality (GDP per capita) is negatively correlated with CIF-FOB margins, while the price of crude oil per barrel has a positive correlation. The time dummies (not explicitly reported in table 8) indicate that the CIF-FOB rate declines over time. Higher median unit values of a product are generally associated with lower CIF-FOB margins, and CIF-FOB margins are lower between contiguous countries.

47. The assumption that if the trading countries are on the same continent, transportation costs (after controlling for distance) would be higher, as it is more likely that land transport would be used, is supported by model 1. Model 1 also confirms that geographical distance is positively related to the CIF-FOB margin, with a convex nature that suggests diminishing marginal costs to additional distance.

48. While the interaction effect introduced in model 2 between distance (including squared distance) and countries being on the same continent appears to change the signs of the relationship between distance and CIF-FOB margins, figure 4 shows that when considering interactions of all variables, the overall relationship between distance and CIF-FOB margins does not change substantially, although the introduction of the interaction effect does control allow for the higher transportation costs on trade between a very specific subset of countries that are geographically very close but on different continents. [3]

Figure 4. Model predicted CIF margin as a function of distance, based on explicit input data



[3] This mostly involves trade among Lebanon, Israel, Malta, Tunisia, Jordan, Egypt and Turkey.

Table 8. Estimated parameters, explicit data

	(1)	(2)	(3)	(3_HS1988)	(3_HS1996)	(3_HS2002)	(3_HS2007)	(3_HS2012)
Intercept	-0.2023 ***	0.5163 ***	0.5956 ***	0.6918 ***	0.6670 ***	0.6565 ***	0.5912 ***	0.5700 ***
	(-93.79)	*(29.72)*	*(32.39)*	*(33.68)*	*(33.47)*	*(33.38)*	*(30.65)*	*(29.11)*
Gdppci	-0.0018 ***	-0.0016 ***	-0.0017 ***	-0.0018 ***	-0.0018 ***	-0.0018 ***	-0.0019 ***	-0.0016 ***
	(-50.38)	*(-44.41)*	*(-45.03)*	*(-44.96)*	*(-44.83)*	*(-45.25)*	*(-45.58)*	*(-38.24)*
Gdppcj	-0.0030 ***	-0.0030 ***	-0.0142 ***	-0.0139 ***	-0.0142 ***	-0.0143 ***	-0.0145 ***	-0.0146 ***
	(-128.13)	*(-129.1)*	*(-95.44)*	*(-86.34)*	*(-89.3)*	*(-89.98)*	*(-89.93)*	*(-88.98)*
dist	0.0453 ***	-0.1155 ***	-0.1120 ***	-0.1274 ***	-0.1216 ***	-0.1196 ***	-0.1060 ***	-0.1022 ***
	(119.64)	*(-30.86)*	*(-28.41)*	*(-28.93)*	*(-28.46)*	*(-28.37)*	*(-25.63)*	*(-24.35)*
$dist^2$	-0.0020 ***	0.0070 ***	0.0068 ***	0.0077 ***	0.0073 ***	0.0072 ***	0.0065 ***	0.0063 ***
	(-81.98)	*(34.63)*	*(32.19)*	*(32.25)*	*(31.86)*	*(31.81)*	*(29.27)*	*(28.02)*
Poil	0.0090 ***	0.0091 ***	0.0126 ***	0.0126 ***	0.0125 ***	0.0128 ***	0.0127 ***	0.0126 ***
	(60.33)	*(61.17)*	*(81.44)*	*(74.98)*	*(75.77)*	*(77.85)*	*(76.2)*	*(73.73)*
uvmdn_m2	-0.0017 ***	-0.0016 ***	-0.0013 ***	-0.0011 ***	-0.0015 ***	-0.0016 ***	-0.0015 ***	-0.0015 ***
	(-16.44)	*(-15.02)*	*(-12.84)*	*(-9.2)*	*(-13.47)*	*(-14.74)*	*(-13.87)*	*(-13.61)*
uvmdn_i12	-0.0001 ***	0.0002 ***	0.0002 ***	0.0001 **	0.0003 ***	0.0003 ***	0.0004 ***	0.0004 ***
	(-2.69)	*(4.33)*	*(4.4)*	*(1.66)*	*(5.33)*	*(5.66)*	*(7.16)*	*(7.96)*
uvmdn_kwt	-0.0029 ***	-0.0030 ***	-0.0027 ***	-0.0027 ***	-0.0027 ***	-0.0027 ***	-0.0026 ***	-0.0026 ***
	(-6.02)	*(-6.25)*	*(-5.75)*	*(-5.83)*	*(-5.81)*	*(-5.74)*	*(-5.58)*	*(-5.56)*
uvmdn_m	-0.0018 ***	-0.0020 ***	-0.0021 ***	-0.0021 ***	-0.0019 ***	-0.0035 ***	-0.0034 ***	-0.0033 ***
	(-5.43)	*(-6.27)*	*(-6.62)*	*(-4.37)*	*(-5.08)*	*(-10.39)*	*(-9.83)*	*(-9.75)*
uvmdn_i	-0.0021 ***	-0.0021 ***	-0.0021 ***	-0.0022 ***	-0.0022 ***	-0.0022 ***	-0.0021 ***	-0.0021 ***
	(-83.73)	*(-81.92)*	*(-83.37)*	*(-81.9)*	*(-81.78)*	*(-82.72)*	*(-77.72)*	*(-76.34)*
uvmdn_pkg	-0.0053 ***	-0.0052 ***	-0.0052 ***	-0.0054 ***	-0.0051 ***	-0.0052 ***	-0.0052 ***	-0.0053 ***
	(-5.79)	*(-5.7)*	*(-5.73)*	*(-5.86)*	*(-5.55)*	*(-5.65)*	*(-5.64)*	*(-5.77)*
uvmdn_p	-0.0021 ***	-0.0020 ***	-0.0016 ***	-0.0013 ***	-0.0024 ***	-0.0023 ***	-0.0034 ***	-0.0036 ***
	(-12.59)	*(-11.89)*	*(-9.75)*	*(-6.67)*	*(-13.51)*	*(-12.53)*	*(-18.3)*	*(-18.96)*
uvmdn_i1000	-0.0005 ***	-0.0005 ***	-0.0006 ***	-0.0007 ***	-0.0005 ***	-0.0006 ***	-0.0006 ***	-0.0006 ***
	(-4.71)	*(-4.77)*	*(-5.01)*	*(-6.01)*	*(-4.56)*	*(-4.99)*	*(-4.99)*	*(-4.9)*
uvmdn_m3	-0.0016 ***	-0.0016 ***	-0.0015 ***	-0.0012 ***	-0.0012 ***	-0.0012 ***	-0.0014 ***	-0.0014 ***
	(-19.22)	*(-18.78)*	*(-18.12)*	*(-11.81)*	*(-11.96)*	*(-12.47)*	*(-14.06)*	*(-14.08)*
uvmdn_l	-0.0061 ***	-0.0064 ***	-0.0063 ***	-0.0073 ***	-0.0066 ***	-0.0065 ***	-0.0062 ***	-0.0065 ***
	(-21.85)	*(-22.72)*	*(-22.7)*	*(-23.14)*	*(-22.04)*	*(-22.01)*	*(-21.14)*	*(-21.62)*
uvmdn_c	-0.0045 ***	-0.0045 ***	-0.0042 ***	-0.0046 ***	-0.0043 ***	-0.0042 ***	-0.0040 ***	-0.0040 ***
	(-11.31)	*(-11.22)*	*(-10.72)*	*(-11.6)*	*(-10.85)*	*(-10.64)*	*(-10.18)*	*(-10.12)*
uvmdn_k	-0.0007 ***	-0.0009 ***	-0.0008 ***	-0.0014 ***	-0.0009 ***	-0.0008 ***	-0.0005 ***	-0.0004 ***
	(-21.28)	*(-24.56)*	*(-21.88)*	*(-35.3)*	*(-24.05)*	*(-21.09)*	*(-12.77)*	*(-11.46)*
Contig	-0.0347 ***	-0.0379 ***	-0.0392 ***	-0.0392 ***	-0.0403 ***	-0.0409 ***	-0.0390 ***	-0.0383 ***
	(-235.83)	*(-251.53)*	*(-220.86)*	*(-203.26)*	*(-211.73)*	*(-215.92)*	*(-204.58)*	*(-198.1)*
Conti	0.0198 ***	-0.8433 ***	-0.9273 ***	-1.0262 ***	-0.9881 ***	-0.9743 ***	-0.8820 ***	-0.8614 ***
	(171.46)	*(-48.37)*	*(-50.35)*	*(-49.88)*	*(-49.52)*	*(-49.49)*	*(-45.7)*	*(-43.97)*
Yrsq	-0.0002 ***	-0.0003 ***	-0.0001 ***	-0.0001 ***	-0.0001 ***	-0.0001 ***	0.0000 ***	0.0000 ***
	(-12.88)	*(-16.45)*	*(-4.03)*	*(-4.22)*	*(-3.19)*	*(-4.72)*	*(-2.39)*	*(-2.04)*
dist_conti		0.2036 ***	0.2279 ***	0.2516 ***	0.2426 ***	0.2391 ***	0.216 ***	0.2115 ***
		(53.83)	*(57.01)*	*(56.37)*	*(56.03)*	*(55.97)*	*(51.53)*	*(49.71)*
$dist^2$_conti		-0.012 ***	-0.0137 ***	-0.0152 ***	-0.0146 ***	-0.0144 ***	-0.013 ***	-0.0127 ***
		(-58.53)	*(-63.24)*	*(-62.61)*	*(-62.21)*	*(-62.07)*	*(-56.82)*	*(-54.92)*
Product FE	YES	YES	YES	YES	YES	YES	YES	YES
Partner FE	NO	NO	YES	YES	YES	YES	YES	YES
N	6,280,989	6,280,989	6,280,989	5,302,589	5,525,890	5,650,064	5445679	5259975
R-Square	0.1223	0.124	0.1358	0.1395	0.1377	0.1373	0.1352	0.1343
Root MSE	0.074	0.074	0.073	0.073	0.073	0.073	0.0734	0.073
F Value	678.84	688.51	665.81	590.84	605.65	616.82	594.15	568.13

Note: t-values in parentheses below the coefficients. *** p<0.05; ** p<0.10

Robustness check

49. To test the robustness of the model, the sample was split into two groups, comparing trade in primary products with trade in non-primary products, as CIF-FOB margins on these two sets are likely to behave quite differently. Primary products are defined using the BEC classification and cover primary products of food and beverages (11), primary products for industrial supplies (21), and primary products of fuels and lubricants (31). All other products (including confidential codes) are considered non-primary products. The results are displayed in Annex 3. Overall, the model shows a better fit.

Estimating CIF-FOB margins

50. The final model (model 3 by HS vintage in table 8) was used to predict CIF-FOB margins for all imports of all reporters by all partners at the 6-digit level. Estimates of CIF-FOB margins below zero or above 20 percent (2% of all estimates) were removed, and the 6-digit margins were subsequently aggregated to the HS 4-digit product level (trade weighted). Overall, the estimated CIF-FOB average margin is 6.2% for all countries across whole period from 1995 to 2013. Annex 4 provides the estimated CIF-FOB margins in detail.

6.2 Implicit CIF-FOB margins derived from UN Comtrade

51. The use of UN Comtrade to implicitly derive CIF-FOB margins is widespread, notwithstanding reservations often raised in this context (see section 3.2). Therefore, as an additional test of both the model in section 6.1, and of the UN Comtrade data, similar regressions were run using a dataset of implicit CIF-FOB margins derived from UN Comtrade.

52. The results are displayed in table 9, using two variants. The first by taking the full sample of data of implicit CIF-FOB margins, described in 4.2. The second using only those implicit results for reporters, partners and products those were also included in the explicit dataset.

53. Particularly for the full implicit dataset, the results have less explanatory power as compared to the models run on the explicit data. While overall, the results for the independent variables are consistent with those generated with explicit data (albeit less significant), several counter-intuitive results also arise. For example, the results suggest that oil prices are negatively correlated with CIF-FOB margins, and in the matched sample, high GDP per capita (infrastructure quality) is associated with higher CIF-FOB margins.

54. In summary, the model developed using the explicit datasets seems to perform better and more consistently and certainly more in line with a priori expectations. Further the results indicate the previously mentioned care needed in using Comtrade data to generate margins (even with a restrictive sub-sample) is warranted.

7. Conclusions

55. The availability of detailed data on CIF-FOB margins by product is an essential pre-requisite for a balanced view of international trade, and, so, a key component in the OECD's work, with partners, to develop a transparent and structured approach to balancing trade data and TiVA estimates. To date, as this study demonstrates, few countries systematically produce estimates of imports by detailed product on both a FOB and a CIF basis.

Table 9. Regression results using the implicit CIF-FOB margin data

	Full set of implicit data			Implicit data matched to explicit sample		
	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	0.3416 ***	-0.3384 ***	-0.0704 **	0.5294 ***	0.151	-1.1043 ***
	(12.16)	(-8.47)	(-1.7)	(6.88)	(0.96)	(-4.75)
Gdppci	-0.0026 ***	-0.0026 ***	-0.0033 ***	0.0021 ***	0.002 ***	-0.0004
	(-19.61)	(-19.49)	(-23.53)	(5.6)	(5.34)	(-0.99)
Gdppcj	0.0002	0.0001	-0.0113 ***	-0.0024 ***	-0.0027 ***	-0.0039
	(1.35)	(0.38)	(-7.86)	(-6.34)	(-6.89)	(-1.38)
dist1	-0.0407 ***	0.1211 ***	0.09 ***	-0.1023 ***	-0.017	0.2995 ***
	(-21.7)	(17.29)	(12.58)	(-21.18)	(-0.55)	(6.84)
dist2	0.0039 ***	-0.0057 ***	-0.0045 ***	0.0074 ***	0.0027	-0.0152 ***
	(31.55)	(-13.69)	(-10.6)	(23.46)	(1.57)	(-6.39)
poil	-0.0028 ***	-0.0026 ***	0.0002	-0.0074 ***	-0.0074 ***	-0.006 ***
	(-2.59)	(-2.41)	(0.19)	(-3.34)	(-3.31)	(-2.57)
uvmdn_m2	0	0	0	0	0	0.0001
	(-0.36)	(-0.34)	(-0.37)	(0.07)	(0.06)	(0.17)
uvmdn_kwt	0.0008	0.0008	0.001	-0.0057	-0.0057	-0.0051
	(0.52)	(0.52)	(0.68)	(-1.14)	(-1.14)	(-1.02)
uvmdn_m	-0.0004	-0.0004	-0.0004	-0.0002	-0.0002	-0.0004
	(-1.38)	(-1.38)	(-1.37)	(-0.24)	(-0.24)	(-0.4)
uvmdn_i	0	0	0	0 **	0 **	0
	(-0.59)	(-0.61)	(-1.12)	(1.67)	(1.66)	(1.24)
uvmdn_pkg	0.0005	0.0005	0.0003	0.0032	0.0032	0.0034
	(0.35)	(0.35)	(0.25)	(1.16)	(1.15)	(1.23)
uvmdn_p	0.0001	0.0001	0.0002	0.0005	0.0005	0.0006
	(0.6)	(0.63)	(1.29)	(1.1)	(1.11)	(1.48)
uvmdn_i1000	0.1682	0.1668	0.2284 ***	0.4219	0.4249	0.3601
	(1.5)	(1.49)	(2.06)	(1.4)	(1.41)	(1.21)
uvmdn_m3	-0.0001	-0.0001	-0.0001	0	0	-0.0001
	(-1.01)	(-1.03)	(-1.51)	(-0.27)	(-0.28)	(-0.68)
uvmdn_l	-0.0068 ***	-0.0068 ***	-0.0066 ***	-0.0105 ***	-0.0106 ***	-0.0089 ***
	(-4.22)	(-4.24)	(-4.12)	(-2.73)	(-2.75)	(-2.33)
uvmdn_c	0 ***	0 ***	0 ***	0	0	0
	(2.36)	(2.35)	(2.4)	(-0.77)	(-0.78)	(-1.07)
uvmdn_k	0 ***	0 ***	0 ***	0	0	0
	(-3.84)	(-3.85)	(-4.1)	(-0.85)	(-0.85)	(-0.47)
contig	-0.0274 ***	-0.0274 ***	-0.0243 ***	-0.0445 ***	-0.0443 ***	-0.0393 ***
	(-65.2)	(-64.85)	(-49.85)	(-50.34)	(-49.07)	(-32.13)
conti	-0.0072 ***	0.7527 ***	0.6853 ***	0.002	0.4241 ***	1.7623 ***
	(-15.81)	(24.13)	(21.26)	(1.46)	(2.96)	(8.64)
yrsq	-0.0026 ***	-0.0026 ***	-0.0025 ***	-0.0017 ***	-0.0017 ***	-0.0017 ***
	(-28.31)	(-28.05)	(-25.66)	(-9.16)	(-9.09)	(-7.58)
dist1_conti		-0.1838 ***	-0.1756 ***		-0.0963 ***	-0.3887 ***
		(-24.15)	(-22.38)		(-3.01)	(-8.71)
dist2_conti		0.011 ***	0.011 ***		0.0055 ***	0.0215 ***
		(23.76)	(22.97)		(3.07)	(8.78)
Product FE	YES	YES	YES	YES	YES	YES
Partner FE	NO	NO	YES	NO	NO	YES
N	919,209	919,209	919,209	177,601	177,601	177,601
R-Square	0.0956	0.0962	0.117	0.1426	0.1427	0.1625
Root MSE	0.1393	0.1392	0.1376	0.1285	0.1285	0.127
F Value	78.41	78.81	87.84	23.76	23.73	25.01

Note: t-values in parentheses below the coefficients. *** p<0.05; ** p<0.10

56. Although all countries provide total imports on a CIF basis, the difference between total imports CIF and total imports FOB (as *e.g.* reported in supply and use tables) cannot automatically be used as a

measure of the CIF-FOB margin, as it depends greatly on whether the equivalent trade in services statistics on transportation and insurance include the CIF margin services provided by non-residents as well as those provided by residents. In many countries the difference between total imports CIF and total imports FOB only reflects this latter component; and so cannot be used as a benchmark for total CIF margins.

57. To shed light on how countries actually record these transactions, the OECD recently launched a new questionnaire on Supply-Use tables. This will also help accelerate, or at least help to motivate, the development of official detailed estimates of imports by product on a FOB basis, which is requested in the questionnaire.

58. Notwithstanding these developments however, and in particular, the greater push on a number of fronts for more detailed trade data to assist in GVC analysis, it will remain necessary for some time to generate estimates of CIF margins in many (probably most) countries.

59. Although analytical in nature, with an a priori selection of factors that drive CIF margins, the approach developed here demonstrates that robust and meaningful estimates of CIF margins are obtainable using econometric techniques. And it is hoped that as more countries provide the necessary information the quality of the model will itself improve. Indeed, it is hoped that as countries make greater concerted efforts to resolve trade asymmetries this will in and of itself reveal new insights and new estimates of CIF margins.

60. In addition, it is already clear that the dataset itself opens up a new strand of potential GVC analysis. For example whilst TiVA has helped to transform our understanding of GVCs, in its construction, and through necessity, it breaks the link between the transportation costs of a product and the provision of the product itself, meaning that an important part of the GVC chain is hidden from view. A database of CIF margins can recreate that view and directly inform policy-making. For example, the data reinforces the view that geography matters, despite the significant reductions in transportation costs seen in recent decades, and that inadequate infrastructure, such as poor quality roads, and natural barriers, such as the Andes, can also be a barrier to efficient trade; witnessed by the relatively large margins for intra-Latin American trade.

61. To facilitate these strands of analysis the database will therefore be made available, with the following tables, on the OECD website:

- Level 1: Annual CIF-FOB margins by Country
- Level 2: Annual CIF-FOB margins by Country and by Partner
- Level 3: Annual CIF-FOB margins by Country, by Partner and HS 2-digit product
- Level 4: Annual CIF-FOB margins by Country, by Partner and HS 4-digit product

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ANNEX I. DATA SOURCES FOR EXPLICIT CIF-FOB STATISTICS

OECD International Trade by Commodity Statistics

Imports valued at CIF and at FOB for Australia, New Zealand, the United States, Luxembourg, Chile, Iceland, Czech Republic and Slovakia were obtained from the OECD International Trade by Commodity Statistics data collection.

Country	Description	Quantity information
The United States	The US Census Bureau makes data available at the HS 10 digit level by mode of transport, valued at both FOB (customs value) and CIF (including cost, insurance and freight) prices. The import charges represent the aggregate cost of all freight, insurance and other charges (excluding import duties) incurred in bringing the merchandise from alongside the carrier at the port of exportation and placing it alongside the carrier at the first port of entry in the United States. Coverage of year 2012 may be partial.	The US reports 40 different quantity unit types. The primary quantity unit and quantity information is selected by default. Quantity units such as Megabecquerels, Gigabecquerels, Gross Lines, Jewel, Ozone Depletion Equivalent that did not align with COMTRADE, were recoded to “No quantity”
New Zealand	Statistics New Zealand and New Zealand Customs Services make data available at the HS 10 digit level, valued at CIF (i.e., including insurance and freight to New Zealand) and VFD (value for duty, i.e., the value of imports before insurance and freight costs are added) prices.	New Zealand has 23 different quantity unit types convertible to international standards. Quantity and weight in kilograms are both recorded, the former is used if the quantity unit is missing, in which case the “weight in kilograms” is selected
Australia	The Australian Bureau of Statistics has made data available at the HS 6-digit level for all goods transported via sea freight (no data are available for other modes of transport, i.e. air or land), valued at FOB customs value and CIF.	The Australian quantity unit types are fully convertible to international standards.
Chile	The Central Bank of Chile produces monthly customs data at HS 8 digit level including both CIF and FOB values.	The Chilean quality unit types are fully convertible to international standards.
Iceland	Icelandic data are available at HS 8 digit level including both CIF and FOB values.	Iceland has limited quantity information available. Quantity units are missing up to 2013, after which they can be convertible to international standards. When the first quantity type is not available, the second quantity type, weight in kilograms is used.
Czech Republic	Data are available at HS 6-digit level by mode of transport. Both Country of Origin and Country of Consignment are available.	Two separate units of quantity information are provided. When the first quantity type is not available, the second quantity type, weight in kilograms is used.
Luxembourg	Data are available at HS 6 digit level by mode of transport.	Two separate units of quantity information are provided. When the first quantity type is not available, the second quantity type, weight in kilograms is used.
Slovakia	Monthly data are available at HS 8 digit level by mode of transport. Both Country of Origin and Country of Consignment are available.	Two separate units of quantity information are provided. When the first quantity type is not available, the second quantity type, weight in kilograms is used.

Maritime Transport Costs Data

Transports costs data for Australia in 2007, New Zealand from 1995 to 1999 and United States from 1995 to 2001 sourced from the OECD Maritime Transport Costs database (sea freight only), are used to supplement the data series received from Customs offices.

Data for Chile (1995 to 2002), and Bolivia, Colombia, Ecuador, Uruguay, Peru and Paraguay for all years shown below are originally sourced from the Latin-American Integration Association (ALADI). Argentina and Brazil data were originally obtained through national statistics offices.

Table A1. Total number of observations, *in thousands*, at HS 6 digit

	ARG	AUS	BOL	BRA	CHL	COL	CZE	ECU	ISL	LUX	NZL	PER	PRY	SVK	URU	USA
1995	18.1	59.5	5.6		16.6	12.9					21.9	0.0	0.2		7.9	39.4
1996	18.6	51.9	5.1		17.5	12.9					22.9	14.0			9.0	39.9
1997	19.9	63.6	5.1	24.1	17.7	14.2					23.5	11.0			9.5	41.5
1998	19.3	62.1	0.1	23.5	17.1	14.6					23.5	3.5			10.1	42.9
1999	18.5	60.7	0.1	20.8	13.4	14.3					24.6	18.6			9.4	44.3
2000	17.7	60.7	0.2	21.4	9.5	14.9		13.6			61.3	19.1			9.0	46.8
2001	16.7	60.4		21.7	8.9	16.6		16.3	41.8		63.1	19.5			9.0	47.6
2002	11.2	63.8		21.3	11.7	16.2		17.8	41.8		66.9	20.5			7.3	135.5
2003	13.2	66.5		21.0	53.7	16.8		19.4	43.6		69.3	20.6			7.2	137.6
2004	15.5	67.5		22.3	55.3	17.9		20.5	46.6		71.6	21.7			8.3	140.1
2005	17.1	68.5		23.5	56.7	19.2		21.0	49.0		73.8	16.5			9.0	142.8
2006	17.8	63.3		24.5	58.6	20.4		20.5	50.3		74.5	9.2			9.7	144.5
2007	4.2	13.1		25.6	58.6	21.9		20.8	50.8		76.1	23.1			10.4	143.2
2008					59.1				48.5	44.2	76.1					140.0
2009					57.8				45.3	44.5	73.9					134.7
2010					62.5				47.3	45.6	75.6					138.4
2011					67.7		99.6		46.4	46.7	70.5					141.4
2012					69.5						79.5			68.6		92.1

ANNEX II. DATA AVAILABILITY FOR IMPLICIT CIF-FOB MARGINS

Descriptive statistics for CIF-FOB unit value ratio estimated by using mirrored flows, by reporting country (top 40 countries with highest trade transitions)

Ctry	N Total	N with mirror data of right quantity	N with CIF-FOB in selected range [1,2]	Selected n as % total	Median CIF FOB unit value ratio
DEU	985678	31510	15288	1.6	1.013
FRA	968093	29133	14503	1.5	1.016
CAN	942112	17479	6230	0.7	0.979
USA	903703	36305	18167	2.0	1.005
GBR	867130	28486	15336	1.8	1.032
ITA	864928	50396	27198	3.1	1.015
BEL	862701	22411	11550	1.3	1.017
ESP	858243	30083	16601	1.9	1.028
AUT	790779	19670	9676	1.2	1.016
POL	767510	28095	16232	2.1	1.022
CHN	755203	21573	12396	1.6	1.054
NOR	754126	21069	12844	1.7	1.049
CHE	737962	44728	26869	3.6	1.025
CZE	706437	24369	13395	1.9	1.025
RUS	701085	37266	19783	2.8	1.019
NLD	686729	15852	6835	1.0	1.001
ZAF	666046	18839	9012	1.4	1.009
DNK	647027	20825	11403	1.8	1.015
SWE	646968	20608	11435	1.8	1.023
TUR	639302	27719	20076	3.1	1.084
KOR	616797	19469	12883	2.1	1.053
FIN	614482	20832	12421	2.0	1.028
SVN	592951	22684	12314	2.1	1.021
THA	583578	16889	10695	1.8	1.050
MEX	563762	16706	11323	2.0	1.065
AUS	553967	11826	4295	0.8	0.971
SGP	553003	14255	8295	1.5	1.041
ROM	541089	36187	21135	3.9	1.028
NZL	525762	9297	5445	1.0	1.095
GRC	508194	23433	13425	2.6	1.028
JPN	497857	21718	15198	3.1	1.059
IND	497244	9068	4595	0.9	1.042
SVK	496147	13378	6808	1.4	1.013
BRA	491925	29215	13807	2.8	1.000
PRT	490636	17457	10113	2.1	1.028
EST	473653	16667	10331	2.2	1.031
HRV	463752	25545	15972	3.4	1.033
HUN	460689	22190	10967	2.4	1.010
CHL	455033	19307	14274	3.1	1.086
IRL	430464	7369	3510	0.8	1.023

ANNEX III. ROBUSTNESS CHECK PRIMARY PRODUCTS

Robustness checks regression results, by product type, explicit data

	Primary products		Non primary products	
	(1)	*(3)*	*(1)*	*(3)*
Intercept	-0.1520 ***	-0.3788 ***	-0.1878 ***	0.7025 ***
	(-12.42)	*(-4.05)*	*(-86.23)*	*(37.46)*
gdppci	-0.0056 ***	-0.0052 ***	-0.0017 ***	-0.0016 ***
	(-26.42)	*(-23.18)*	*(-46.56)*	*(-42.09)*
gdppcj	-0.0035 ***	-0.0221 ***	-0.0029 ***	-0.0135 ***
	(-28.55)	*(-27.83)*	*(-123.96)*	*(-90.18)*
dist1	0.0567 ***	0.1238 ***	0.0420 ***	-0.1342 ***
	(32.44)	*(6.12)*	*(107.93)*	*(-33.41)*
dist2	-0.0021 ***	-0.0055 ***	-0.0018 ***	0.0080 ***
	(-18.6)	*(-5.02)*	*(-73.05)*	*(37.05)*
poil	0.0167 ***	0.0213 ***	0.0085 ***	0.0121 ***
	(20.07)	*(24.92)*	*(56.64)*	*(76.95)*
uvmdn_m2	0.0216 ***	0.0219 ***	-0.0019 ***	-0.0015 ***
	(3.81)	*(3.92)*	*(-18.08)*	*(-14.21)*
uvmdn_i12	-0.0079 ***	-0.0099 ***	-0.0001 ***	0.0002 ***
	(-2.8)	*(-3.55)*	*(-2.75)*	*(5)*
uvmdn_kwt	-0.0016 ***	-0.0015 ***	-0.0025 ***	-0.0020 ***
	(-2.32)	*(-2.13)*	*(-2.93)*	*(-2.36)*
uvmdn_m	0.0062	0.0068 **	-0.0017 ***	-0.0021 ***
	(1.62)	*(1.79)*	*(-5.3)*	*(-6.55)*
uvmdn_i	-0.0025 ***	-0.0025 ***	-0.0021 ***	-0.0021 ***
	(-5.78)	*(-5.82)*	*(-83.97)*	*(-83.24)*
uvmdn_pkg			-0.0053 ***	-0.0052 ***
			(-5.85)	*(-5.76)*
uvmdn_p	-0.0082	-0.0072	-0.0022 ***	-0.0017 ***
	(-0.54)	*(-0.48)*	*(-13.35)*	*(-10.39)*
uvmdn_i1000	-0.0082 ***	-0.0081 ***	-0.0005 ***	-0.0005 ***
	(-3.24)	*(-3.23)*	*(-4.49)*	*(-4.73)*
uvmdn_m3	-0.0012 ***	-0.0011 ***	-0.0016 ***	-0.0015 ***
	(-3.11)	*(-2.87)*	*(-18.1)*	*(-17.03)*
uvmdn_l	-0.0052 ***	-0.0057 ***	-0.0063 ***	-0.0065 ***
	(-2.78)	*(-3.04)*	*(-22.39)*	*(-23.08)*
uvmdn_c	0.0018	0.0023 **	-0.0039 ***	-0.0037 ***
	(1.51)	*(1.96)*	*(-8.36)*	*(-7.84)*
uvmdn_k	-0.0054 ***	-0.0050 ***	-0.0006 ***	-0.0006 ***
	(-22.54)	*(-21.21)*	*(-16.03)*	*(-17.32)*
contig	-0.0436 ***	-0.0320 ***	-0.0337 ***	-0.0387 ***
	(-62.28)	*(-34.53)*	*(-224.34)*	*(-214.59)*
conti	0.034 ***	-0.0228	0.0188 ***	-1.0191 ***
	(57.07)	*(-0.24)*	*(160.31)*	*(-54.28)*
yrsq	-0.0031 ***	-0.0025 ***	-0.0001 ***	0.0001 ***
	(-31.12)	*(-23.92)*	*(-3.35)*	*(3.68)*
dist1_conti		0.0321		0.2478 ***
		(1.55)		*(60.84)*
dist2_conti		-0.0031 ***		-0.0148 ***
		(-2.69)		*(-67)*
Product FE	YES	YES	YES	YES
Partner FE	NO	YES	NO	YES
N	299453	299453	5981536	5981536
R-Square	0.2268	0.2476	0.1099	0.1238
Root MSE	0.0895	0.0883	0.0727	0.0721
F Value	370.26	228.8	662.06	645.95

Note: t-values in parentheses below the coefficients. *** p<0.05; ** p<0.10

ANNEX IV. ESTIMATED CIF-FOB MARGINS BY COUNTRY

ISO code	Country Name	CIF-FOB margin	ISO code	Country Name	CIF-FOB margin
AUS	Australia	6.8%	TUR	Turkey	7.4%
AUT	Austria	4.4%	GBR	United Kingdom	6.2%
BEL	Belgium	5.2%	USA	United States	5.7%
CAN	Canada	5.1%	ARG	Argentina	6.8%
CHL	Chile	7.8%	BRA	Brazil	7.6%
CZE	Czech Republic	5.3%	CHN	China	7.4%
DNK	Denmark	6.1%	TWN	Taiwan	7.1%
EST	Estonia	6.4%	IND	India	7.0%
FIN	Finland	6.1%	IDN	Indonesia	8.0%
FRA	France	5.1%	RUS	Russian Federation	6.3%
DEU	Germany	5.3%	SGP	Singapore	6.3%
GRC	Greece	7.0%	ZAF	South Africa	7.2%
HUN	Hungary	6.1%	HKG	Hong Kong	4.5%
ISL	Iceland	7.8%	MYS	Malaysia	6.4%
IRL	Ireland	5.3%	PHL	Philippines	7.3%
ISR	Israel	6.4%	THA	Thailand	7.0%
ITA	Italy	6.0%	ROM	Romania	7.0%
JPN	Japan	7.7%	VNM	Viet Nam	7.4%
KOR	Korea	7.3%	SAU	Saudi Arabia	7.4%
LUX	Luxembourg	3.7%	BRN	Brunei Darussalam	7.1%
MEX	Mexico	5.7%	BGR	Bulgaria	6.8%
NLD	Netherlands	5.9%	CYP	Cyprus[4]	8.0%
NZL	New Zealand	7.2%	LVA	Latvia	6.4%
NOR	Norway	6.2%	LTU	Lithuania	5.6%
POL	Poland	5.8%	MLT	Malta	6.5%
PRT	Portugal	6.6%	KHM	Cambodia	7.8%
SVK	Slovakia	6.2%	COL	Colombia	7.7%
SVN	Slovenia	5.0%	CRI	Costa Rica	8.1%
ESP	Spain	6.3%	HRV	Croatia	6.2%
SWE	Sweden	6.1%	TUN	Tunisia	7.6%
CHE	Switzerland	4.0%			

[4] Footnote by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognizes the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the "Cyprus" issue.

Footnote by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognized by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus