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COLECH, Cemafi-International

March 2018

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Christine Carton*, Sadri Slim**

Abstract

This paper aims to explore the extent of trade misinvoicing among OECD countries and to determine trends and patterns over the period 2006-2016. Following the standard approach developed by Morgenstern (1950), four categories of misreported bilateral transactions are estimated to highlight two channels used to shift illicit financial flows. The study is reinforced by an analysis in terms of bilateral intensity indices proposed by Kojima (1964) and modified by Kunimoto (1977) to identify strong bilateral relations for selected OECD countries in terms of misinvoicing practices. Some interesting findings can be pointed out: (i) estimated values of intra-OECD misinvoicing trade indicate that accumulated amounts have reached more than 12 trillion US dollars over the period mostly through illicit financial inflows, although illicit outflows tend to increase during the last years; (ii) significant amounts of illicit financial flows occur between the most advanced countries despite the quality of their statistical recording services; (iii) arguing against explanation based on tax evasion and capital flight, it is shown that countries with high GDP per capita are both senders and recipients of IFFs, while lower GDP per capita countries are also receivers of illicit inflows; (iv) the share of misreported imports in countries´ total imports is larger than for total exports, which seems to indicate that imports are the principal vehicle facilitating bilateral misinvoicing trade; and (v) geographical proximity appears to be an important factor in determining the channel used and the direction of illicit financial flows as well as in describing intense relations relative to bilateral misinvoicing trade.

Keywords: Trade misinvoicing, intra-OECD trade, mirror statistics, bilateral intensity index

JEL classification: C1, F14, F32

Acknowledgments:
The authors would like to express their gratitude to Friedrich Ebert Stiftung for their financial support in the presentation of this paper at the Tax Justice Network Annual Conference 2018 and are also grateful to the participants for their useful comments and suggestions.

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1. Introduction

The significance of trade misinvoicing has gained increasing interest, in recent years, as likely to provide further insights into the scale of illicit financial flows (hereafter IFFs) and its implications in terms of lost revenues, within the scope of the current global agenda on financing for development and domestic resource mobilization. Most empirical studies are thus focused on analysing estimates of illicit outflows of capital, through import over-invoicing and export under-invoicing, from developing countries vis-à-vis their developed-country trade partners and/or the rest of the world, often regarded as broad aggregates.

In doing so, it is noteworthy to highlight that the methodology hitherto followed neglects part of crucial information: (i) by targeting only certain components of trade misinvoicing; (ii) by limiting the analysis to trade between developing and developed countries; (iii) and by proceeding on the basis of *ad hoc* assumptions, including no-misinvoicing behaviour demonstrated by developed countries as supposedly declaring their trade data properly.

In an attempt to address these shortcomings and to adopt a more nuanced approach, this paper aims to determine significant patterns and trends as a result of trade misinvoicing in the specific context of OECD countries, over the period 2006-2016.[1] OECD countries, as a whole, play an important role on the international trade scene and exert a great influence on this matter. In addition, comprising mostly developed countries, it should be expected that one major feature would be minor discrepancies related to trade data as their respective statistical systems are transparent, accurate and homogenized.

The extent of misinvoicing practices relative to imports and exports is estimated through a country-by-country comparison of discrepancies in mirror trade data, sourced from the UN COMTRADE database, carried out annually for each trading partner (i.e. 13,090 bilateral flows). These estimates are used to rank countries' participation in both the total size of export/import misinvoicing, which allow to identify the main leading countries. In particular, two channels are highlighted depending on whether import and export values are understated or overstated. Observed discrepancies in trade data are also analysed by development levels and growth dynamics to identify some major regularities over the studied period.

The methodology developed to measure trade misinvoicing, in the context of intra-OECD trade, is also used to adapt a bilateral intensity index aimed to assess how intense are specific relations between countries in terms of IFFs. In particular, the cases of Germany, Japan, Mexico and the United States are analysed with their more "intense" trading partners.

At an aggregated level, estimated amounts tend to support substantial illicit financial inflows within the OECD in conjunction with a recent trend pointing to an increase in illicit outflows. Expressed in proportion of import and export values as registered by each country, trade misinvoicing estimates appear to be driven by the import side regardless GDP per capita levels. At a country-level, major developed economies are top-ranked relative to amounts of trade misinvoicing, with the exception of Mexico. In addition, bilateral intensity indexes suggest intense relations either from the export or import side, as demonstrating potential geographical

[1] The OECD currently comprises 35 full members which are: Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Republic of Korea, Latvia, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

bias in trade misinvoicing between specific countries, and allow to infer the country of origin and the modus operandi used to transfer IFFs.

This paper contributes to the evolving debate on the issue of trade misinvoicing in several ways: (i) to our knowledge, there are no empirical papers focused on OECD countries; (ii) it involves an analysis of trade misinvoicing between developing countries, developing and developed countries, and between developed countries; (iii) pairwise comparisons are assessed; (iv) the four types of trade misinvoicing are taking into account; (v) developed/advanced countries are also assumed to manipulate trade invoices; and (vi) specific trade indicators are adapted to provide insights in terms of trends, shares, structure and intensities relative to trade misinvoicing.

The remainder of the paper is organized as follows. Section 2 reviews briefly some major findings from the existing literature on data discrepancies and trade misinvoicing. Section 3 presents the methodology followed to measure the extent of trade misinvoicing and the bilateral intensity in trade misinvoicing relationships. In addition, data used for the purpose of this paper are discussed. In Section 4, findings are detailed at an aggregated and country levels. Section 5 is examining specific cases of bilateral intensity related to trade misinvoicing. The final section concludes with additional comments for further developments.

2. Data discrepancies and trade misinvoicing: A brief overview

Trade misinvoicing results from illegal and criminal behaviors aimed to deliberately manipulate trade statistics, i.e. by undervaluing or overvaluing exports and imports. The standard approach used to detect this kind of practices relies on partner-country comparisons through analysis of mirror trade data. In this respect, within a "perfect world", exports (imports) of country *i* to country *j*, as declared by country *i*, are equal to imports from *i* (exports to *i*) as reported by country *j*, after making necessary adjustments since imports are valued on a c.i.f. basis (cost, insurance and freight) and exports in f.o.b (free on board).

Discrepancies between valuations of the same merchandise flow reported by both countries allow the identification of potential trade misinvoicing, although presenting some limitations. As stated by the UN Trade Statistics Branch, they do not reflect the exact reality, and the results of their processing need to be taken with cautious. Nitsch (2012) presents a comprehensive analysis on possible inconsistencies in mirror trade statistics.

Such discrepancies have raised a lot of concerns about the accuracy of trade statistics.[2] Since the seminal work of Morgenstern (1950), likely causes of disparities in reported trade statistics have been extensively acknowledged and can be classified into two broad categories. Although transportation costs tend to appear as the main explanation of such disparities (as unavoidable factors), the magnitude of observed gaps points to other factors in determining the mismatch of reported bilateral data, apart from the sole transportation costs.

The first one is related to structural differences between countries due to the registration of commodities (uniformity in data compilation methodology, non-compliance of statistical coverage, misclassification of goods and destination, geographical definition and indication of trading partners). As noticed by Federico and Tena (1991), these errors could be eliminated by

[2] In this sense, asymmetries in reported bilateral statistics, between a country and its trading partners, might jeopardize the relevance of any results achieved by empirical or econometric analysis, upon which policy-makers will ultimately need to base their decision.

standardization and international cooperation. Following on this idea, Hamanaka (2012) has proposed a multiple mirror data method to identify misclassification.

The second category comprises errors made by national statistical offices and international agencies such as the use of domestic rather than international prices, the choice of an exchange rate other than the one prevailing at the time of payment or the absence of data. Time lag effects due to maritime shipments, especially at the end of the fiscal year, introduce bias between the country and its partners. However, it is important to stress that such bias is marginal when considering annual data.

Following Morgenstern (1950, 1965), the related-literature has largely adopted these sources of discrepancies in trade data. Nevertheless, as defined by Morgenstern (1965, p.141), the last cause combines "inability (or unwillingness) of importers and especially exporters to furnish accurate information". As a result, the unwillingness to report "true" values of imports and exports may thus explain significantly observed gaps in bilateral trade statistics. Interestingly, this last point has possibly induced confusion or misinterpretation in recent studies on trade misinvoicing, by putting at the same level inability and unwillingness.

First, it can be stressed that inability is linked to the statistical structure itself (e.g. lack of related-skills and/or resources) while unwillingness is inherent to criminal behaviours of individuals or firms making a deliberate choice. Consequently, this confusion or misinterpretation tends to assimilate the incentives for deliberate distortions and the motives of bilateral data discrepancies. In doing so, a large strand of the literature on trade misinvoicing has generally assumed fraud as a given fact, instead of analysing criminal behaviours to provide appropriate recommendations on this matter.

Second, given that advanced countries have the ability to record properly their trade data, it leads to assume *de facto* that "no-misinvoicing" can occur in that regard (see Hong and Pak, 2017). With this confusion in mind, statistics provided by developed countries are more reliable than those reported by developing countries.[3] As a result, numerous studies have analysed bilateral trade statistics between developed and developing countries and, based on this "no-misinvoicing" assumption, have interpreted misinvoicing practices as coming from developing countries (see Tandon and Rao, 2017).

Finally, mirror-import flows reported by trading partners are assumed to be more consistent due to an easier identification of merchandise provenance and higher controls since customs services are supposed to register imports with more caution for, inter alia, tariffs and regulatory purposes. According to the FATF (2006, p.2), customs services are monitoring "less than 5% of all cargo shipments entering or leaving their jurisdictions". In addition, export statistics seem to be less reliable due to the willingness to exploit subsidy regime, as recently drawing researchers' attention and leaving aside specific issues on IFFs.[4]

As argued by Linsi and Mügge (2017), although statistical systems have improved during the 20th century, at the age of global data, increasing globalization driven by transnational corporations and the use of offshore financial centres tend to undermine the quality of economic statistics, with serious implications for economic policy and academic research.

[3] Nitsch (2016) is suggesting, among others, that trade statistics of developed countries are more accurate than those of developing countries, due to better quality of national statistics services and smaller incentives for misinvoicing in trade.

[4] See for instance Gupta *et al*. (2012).

Consequently, beyond unintentional errors due to structural and logistical issues, the analysis of mirror trade data can reveal other inconsistencies resulting from deliberate misreporting for fraudulent purposes by under or overstating values of imports and exports.[5]

When reviewing the extensive literature relative to trade misinvoicing, four distinct phases can be distinguished given the specific topic debated to provide further insights into this issue. Originally conceived in the 1960s and 1970s, the first phase has established the theoretical and empirical foundations on this matter, as demonstrated by the successive writings of Bhagwati. The second, drawn up during the 1980s and 1990s, is essentially intended to improve the understanding of interlinkages between trade misinvoicing and illicit capital flights.[6] The third phase, initiated around the 2000s, has focused on practices as regards trade-based money laundering (e.g. de Boyrie *et al.*, 2005a), while the final phase in the last ten years underlines development financing issues related to trade misinvoicing and IFFs, as highlighted by target 16.4 of the Sustainable Development Goals.

The most commonly reason advanced to misreport trade data arises from seeking to evade tariffs and taxes. In this context, Bhagwati (1964) has shown that import taxes may determine practices of under-valued imports for the case of Turkey. Fisman and Wei (2004) have shown a strong correlation between tariffs, smuggling and "missing imports" in the case of China. Furthermore, Buehn and Eichler (2011) have carried out empirical tests into microeconomic determinants of import and export misinvoicing, finding evidence for tariffs and black-market premium. However, they did not find strong results for punishment costs and fines, leading them to conclude, accordingly with their theoretical framework, that an enforcement of penalties should deter trade misinvoicing. On the contrary, Patnaik *et al*. (2012) have evidenced that tariffs and trade barriers are less persuasive in the case of emerging economies.

Nevertheless, in our case, a major part of OECD countries belongs to the European Union or the NAFTA and benefits from preferential trade agreements, invalidating any explanations linked to tariff incentives. However, malpractices are a major source of discrepancies in trade data: smuggling and illegal traded goods represent a substantial share of misinvoicing (Fisman and Wei, 2009); the value added tax fraud in intra-European trade may explain a significant part of data discrepancies in intra-EU trade (Nitsch, 2012).

Numerous studies on trade misinvoicing have focused on the issue of capital flight which have only included undervalued exports and overvalued imports within the four potential components of misinvoicing, thus ignoring the issue of illicit financial inflows (see for instance de Boyrie *et al.*, 2005b).

In addition, it should be noted that trade-based money laundering is one of the most used practice for moving illicit capitals and reintegrating them into the formal economy (FATF, 2006). Although assessments made by de Boyrie *et al*. (2005a, 2005b, 2007) and Zdanowicz (2007) seem to be overestimated, they do provide an interesting view on the magnitude of illegal money moved by commodity transactions. According to Berger and Nitsch (2008), as well as Shaar (2017), high levels of corruption can also explain discrepancies in trade data.

[5] Each category of trade misinvoicing is defined in section 3.

[6] See, for example, J.K. Boyce and L. Zarsky (1988). "Capital flight from the Philippines, 1962-1986.", Journal of Philippine Development, XV (2), p.191-222.

As a result, many studies on trade misinvoicing have focused on trade between developed and developing countries, assuming that developed country reporter´s statistics are accurate while discrepancies are attributed to their less developed partners, as mentioned previously.[7]

To sum up, practices of trade misinvoicing seem to prevail in developing countries while developed countries are supposed to have resolved them through accurate reported data and transparent statistical systems. In addition, import flows are more reliable to detect trade misinvoicing as using the mirror-data technique. The related-literature has mostly focused on trade misinvoicing and IFFs by identifying specific motivations related to duty avoidance, tax evasion, capital flight and money laundering. However, we will see that, in the case of OECD countries, some inferences made *a priori* may not be supported by the estimated outcomes presented hereafter (see sections 4 and 5).

3. Methodology and data

The methodology followed, in this paper, combines two standard approaches related to analysis of bilateral trade relationships. The first one aims to assess intra-OECD trade misinvoicing based on partner-country comparison, using mirror data, in order to determine gaps between values as recorded by the reporter country and its trading partner. This approach was initially proposed by Morgenstern (1950) and developed by Bhagwati (1964) to identify "anomalies" arising from the declaration of a similar merchandise transaction.[8] The second approach provides an adaptation of the geographical trade intensity index proposed by Kojima (1964), among others, and extended by Kunimoto (1977) to detect strong relations between each country with its trading partners in terms of misinvoicing practices.

The mirror data technique

To estimate amounts of trade misinvoicing, exports (imports) of the reporting country are compared to imports (exports) of its partner country, after being corrected for the c.i.f./f.o.b. bias. The standard ratio c.i.f./f.o.b. of 10% is applied here to convert imports into f.o.b. values.[9]

The bilateral trade balance is used to determine four types of trade misinvoicing. It should be noticed that every country in the sample is assumed to be potentially engaged in misinvoicing practices. As a result, misreported values are attributed to both partners since computed estimations are implemented for all bilateral flows.

Consequently, the method to compute values of trade misinvoicing can be expressed as follows:

Export misinvoicing: $\mathrm{MisX}_{ij} = \mathrm{M}_{ji} - \mathrm{X}_{ij}$ (1)

Import misinvoicing: $\mathrm{MisM}_{ij} = \mathrm{M}_{ij} - \mathrm{X}_{ji}$ (2)

with X_{ij} and M_{ij} country *i*'s exports and imports; M_{ji} and X_{ji} country *j*'s imports and exports (or mirror data) respectively.

The first practice (or first channel) will involve an understatement of values for exports and imports, which entails a movement of "hidden" goods during the transaction between country *i* and its partner *j*.

[7] For assessments of trade misinvoicing and IFFs in developing countries, see UNECA (2015), Ndikumana (2016) and Salomon and Spanjers (2017); for developed countries, see Hong and Pak (2017).

[8] In this paper, we are referring to Morgenstern O. (1965), *On the Accuracy of Economic Observations*, Princeton University Press; 2nd Revised Edition (February 21, 1965).

[9] We also computed estimated values of trade misinvoicing with an adjustment ratio of 6%, however, our results did not change significantly.

The latter is given by:

Export under-invoicing (MisXu_{ij}) such as $\mathrm{M}_{ji} > \mathrm{X}_{ij} \xrightarrow{yields} \mathrm{MisX}_{ij} > 0$,

Import under-invoicing: (MisMu_{ij}) such as $\mathrm{M}_{ij} < \mathrm{X}_{ji} \xrightarrow{yields} \mathrm{MisM}_{ij} < 0$.

Note that export under-invoicing attributed to country *i* will be translated into an import over-invoicing for country *j* as $\mathrm{MisXu}_{ij} = \mathrm{MisMo}_{ji}$. Similarly, import under-invoicing for country *i* will correspond to export over-invoicing for country *j* as $\mathrm{MisMu}_{ij} = \mathrm{MisXo}_{ji}$.

The second practice (or second channel) will entail an overstatement of values for exports and imports, or movements of "phantom" goods between both countries, as follows:

Export over-invoicing (MisXo_{ij}) such as $\mathrm{M}_{ji} < \mathrm{X}_{ij} \xrightarrow{yields} \mathrm{MisX}_{ij} < 0$,

Import over-invoicing: (MisMo_{ij}) such as $\mathrm{M}_{ij} > \mathrm{X}_{ji} \xrightarrow{yields} \mathrm{MisM}_{ij} > 0$.

As in the first channel, export over-invoicing relative to country *i* will coincide to import under-invoicing for country *j* as $\mathrm{MisXo}_{ij} = \mathrm{MisMu}_{ji}$. In the same way, import over-invoicing for country *i* will be equal to export under-invoicing for country *j* as $\mathrm{MisMo}_{ij} = \mathrm{MisXu}_{ji}$.

Now turning to totals of export and import misinvoicing for country *i* as estimated for all its trading partners, each category will be expressed in net values given that export over-invoicing and import under-invoicing exhibits negative values. In this sense, each total is obtained in the following manner:

Sum of export misinvoicing: $\mathrm{MisX}_i = \sum \mathrm{MisX}_{ij}\,, i \neq j,$ (3)

Sum of import misinvoicing: $\mathrm{MisM}_i = \sum \mathrm{MisM}_{ij}\,, i \neq j.$ (4)

Finally, in aggregated terms as regrouping 35 OECD-countries, it should be noticed the following results:

- Sum of export over-invoicing for the OECD = Sum of import under-invoicing for the OECD

$$\mathrm{MisXo}_{OECD} = \mathrm{MisMu}_{OECD} \quad (5)$$

- Sum of export under-invoicing for the OECD = Sum of import over-invoicing for the OECD

$$\mathrm{MisXu}_{OECD} = \mathrm{MisMo}_{OECD} \quad (6)$$

- Sum of export misinvoicing for the OECD = Sum of import misinvoicing for the OECD

$$\mathrm{MisX}_{OECD} = \mathrm{MisM}_{OECD} \quad \text{in net values} \quad (7)$$

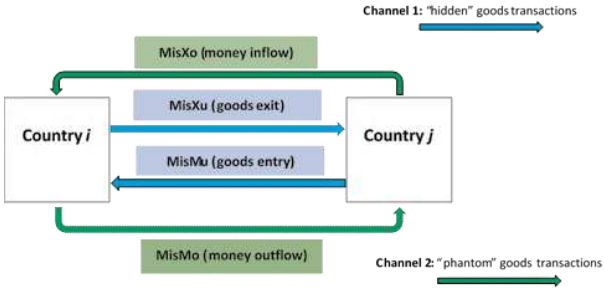
By considering four types of trade misinvoicing (export and import over and under-invoicing), we can identify two types of IFFs according to the nature of the flow: physical movements of "hidden" merchandises (channel 1) or non-physical movements of "phantom" merchandises (channel 2), the latter implying money flows as shown in the following diagram (see Tandon and Rao, 2017).

The first channel is driven by physical movements of merchandises that are "hidden" during the transaction process. It implies an under-invoicing of exports and imports which allows to move in and out illicit flows indirectly, as involving sales and purchases of merchandises.

Undervalued exports mean receiving lesser amount of money (money outflow) as the trader, in the partner country, is supposed to place the remaining funds in a bank account abroad but after

selling the merchandises.[10] Undervalued imports are related to receive larger funds (inflows) but involve selling the merchandises in the home country.[11]

Diagram 1: Illicit financial flows according to merchandise movements



Source: Authors.

Though export or import over-invoicing, exporters or importers are reporting amounts (or values) of physical and non-physical merchandises. In doing so, this practice would be assimilated to "phantom" goods transactions with in counterpart direct money flows. In the case of export over-invoicing, the exporter is receiving a money inflow larger than he would have earn by declaring the true value of exports.[12] As for import over-invoicing, the importer will receive less money flow (money outflow) according to the real goods transactions.[13] The trader localized in the partner country concedes losing benefits on the domestic market but benefits from the money flow received. This second channel allows to generate inward and outward illicit flows in a relatively direct manner (avoiding in this sense actions of selling or buying any physical merchandises).

As a result, for the country *i*, IFFs are defined as follows:

Illicit financial outflows = $(\mathrm{MisXu}_{ij} + \mathrm{MisMo}_{ij})$, (8)

Illicit financial inflows = $(\mathrm{MisXo}_{ij} + \mathrm{MisM}u_{ij})$. (9)

Now, considering all OECD countries, there are two ways to characterize IFFs since "nothing is lost, everything is transformed", as follows:

- from the trade point of view, everything that goes out comes in:

$$\mathrm{IFF}_{OECD} = abs\mathrm{MisXo}_{OECD} + \mathrm{MisXu}_{OECD} = \mathrm{MisMo}_{OECD} + abs\mathrm{MisMu}_{OECD} \quad (10)$$

- from the accounting point of view: every movement of merchandise is cleared by a financial flow:

$$\mathrm{IFF}_{OECD} = abs\mathrm{MisXo}_{OECD} + \mathrm{MisMo}_{OECD} = \mathrm{MisXu}_{OECD} + abs\mathrm{MisMu}_{OECD} \quad (11)$$

with (*abs*) denoting absolute values.

From the trade point of view, IFFs are driven by both channels, and from the accounting point of view, they are generated within one channel.

[10] In this case, it would allow to pay less taxes in exporter's country or take advantage of black market premium.

[11] Undervalued imports are mainly driven by tariff evasion purposes.

[12] According to the literature, this practice may occur when exporters seek to benefit from export subsidies or duty drawbacks (such as carousel mechanisms) or to repatriate illicit capitals.

[13] In this case, overvalued imports allow processes of transfer pricing, profit shifting as evading capital control. Traditionally, they are related to capital flight purposes.

Bilateral intensity index and trade misinvoicing

This last step involves an analysis of trade misinvoicing based on bilateral relationships between OECD members to appraise tendency for each country to mis-trade with particular partners. Computations of bilateral intensity indices provide thus an analytical tool for describing the strength of bilateral links between countries, and for detecting the potential source of IFFs as well as channels used in trade misinvoicing to facilitate transfers of such flows.

Following Kunimoto (1977), the bilateral intensity index is considering each country's total import and export misinvoicing as given. The rationale is based on discerning between factors that may influence the total levels in misinvoicing in the OECD and those that affect their geographical distribution. As a result, bilateral intensity indices aim to measure the current trade misinvoicing compared to "hypothetical" amounts that would occur under the assumption of no distortion in the direction of intra flows of misinvoicing, in geographical terms. In this respect, a country's total share of trade misinvoicing will be allocated among its partners according to their relative shares within the OECD. In doing so, the "size bias" is removed so each economy can be expected to be engaged in misinvoicing practices through exports and imports proportionally to its size.

Since disparities are evidenced between trade data as declared by the reporting country and its partner, the bilateral trade intensity index can be calculated using direct data (recorded by the reporter) and mirror data (recorded by trade partners).

According to direct data as reported by country *i*, the hypothetical export flow from country *i* to country *j* is given by:

$$\mathrm{X}_{ij}^{*} = \mathrm{X}_{i,OECD}\,\frac{\mathrm{M}_{j,OECD}}{\mathrm{M}_{OECD}-\mathrm{M}_{i,OECD}} \qquad (12)$$

where $\mathrm{X}_{i,j}^{*}$ denotes country *i*'s exports to country *j* in the hypothetical OECD; $\mathrm{X}_{i,OECD}$ is the country *i*'s total exports to all OECD countries; $\mathrm{M}_{j,OECD}$ country *j*'s total imports from the OECD; M_{OECD} total OECD imports and $\mathrm{M}_{i,OECD}$ country *i*'s total imports from OECD.

This export flow can also be expressed using mirror data as recorded by country *i*'s trading partner in the following manner:

$$\mathrm{M}_{ji}^{*} = \mathrm{M}_{OECD,i}\,\frac{\mathrm{X}_{OECD,j}}{\mathrm{X}_{OECD}-\mathrm{X}_{OECD,i}} \qquad (13)$$

where M_{ji}^{*} denotes hypothetical imports as reported by country *j* from country *i*; $\mathrm{M}_{OECD,i}$ are imports reported by all trading partners from country *i*, $\mathrm{X}_{OECD,j}$ total OECD exports to country *j*, X_{OECD} total OECD exports and $\mathrm{X}_{OECD,i}$ total exports of OECD countries to country *i*.

The expected value of export misinvoicing (MisX_{ij}^{*}) from country *i* to country *j* would be:

$$\mathrm{MisX}_{ij}^{*} = \mathrm{M}_{ji}^{*}-\mathrm{X}_{ij}^{*} \qquad (14)$$

The export misinvoicing intensity is thus measured by an index defined as the ratio of the estimated (observed) value of export misinvoicing to its hypothetical value:

$$I_{ij}^{\mathrm{MisX}} = \frac{\mathrm{MisX}_{ij}}{\mathrm{MisX}_{ij}^{*}} \text{ with } \mathrm{MisX}_{ij} \text{ the estimated value.} \qquad (15)$$

The similar reasoning applies in order to determine the import misinvoicing intensity as follows:

$$\mathrm{M}_{ij}^{*} = \mathrm{M}_{i,OECD}\,\frac{\mathrm{X}_{j,OECD}}{\mathrm{X}_{OECD}-\mathrm{X}_{i,OECD}} \qquad (16)$$

and its mirror equivalent,

$$X^{*}_{ji} = X_{OECD,i} \frac{M_{OECD,j}}{M_{OECD} - M_{OECD,i}} \quad (17)$$

As a result, the expected value of import misinvoicing is given by:

$$MisM^{*}_{ij} = M^{*}_{ij} - X^{*}_{ji}, \quad (18)$$

and the corresponding intensity index would be,

$$I^{MisM}_{i,j} = \frac{MisM_{ij}}{MisM^{*}_{ij}} \text{ with } MisM_{ij} \text{ the estimated value.} \quad (19)$$

Both bilateral intensity indexes will include two types of key information that should be highlighted. Absolute values suggest whether bilateral relations are stronger (weaker) than expected when greater (less) than 1 on one hand, and associated signs tend to indicate the origin of the IFFs and the modus operandi used (under- or over-reported values of exports and imports), on the other. Consequently, the computation of such bilateral intensity indices can provide useful indications in order to identify potential deviations as regard trade misinvoicing between each OECD country and its partners.[14]

Further observations

The methodology previously exposed is based on the mirror data technique and, in particular, includes adjustments made to import values due to costs incurred in insurance and freight (c.i.f), i.e. applying a ratio of 10%.[15] Although these costs vary across countries and products, when estimates of trade misinvoicing are low, it may be argued that discrepancies reflect the gap between the proxy and the value of c.i.f. (UNCTAD, 2016). Following the OECD recommendations, the IMF and the COMTRADE are now using a ratio of 6% as the new conversion factor (Marini *et al*., 2018).[16] As highlighted by Carlo Ferraris more than 130 years ago, the problem raised by imports valued in c.i.f and exports in f.o.b. has not yet been resolved properly by statistical institutions since only few countries report their import data on f.o.b. (e.g. Australia, Canada, Mexico and Brazil until recently).[17]

Following the admonition of Morgenstern (1950), Kenessey (1997) has highlighted the need of significant improvements in statistical infrastructure at the international level in order to address key issues covering, in particular, accuracy, timeliness and significance of economic statistics. As he mentioned, "recognizing the imperfections in users of data is no excuse to overlook the deficiencies in the producers of statistics in supplying as accurate data as warranted and made possible under the circumstances" (Kenessey, 1997, p.253).

Data: UN Comtrade database

Trade statistics for OECD countries are sourced from the UN COMTRADE database, as being assumed to be gathered as reported by individual countries.[18] When examining bilateral trade

[14] Trade intensity indices for all country pairs were computed over the period of 2006-2016.

[15] Another issue, intrinsic to the mirror data technique, appears when reporter and partner are misreporting the same transaction (over-invoicing in one side and under-invoicing in the other side). In this case, the misdeclaration can cancel each other, leading to underestimate the magnitude of overall misinvoicing trade (see Nitsch, 2012).

[16] See Miao and Fortanier (2016). For further information on the c.i.f./f.o.b. ratio, see Gaulier *et al*. (2008).

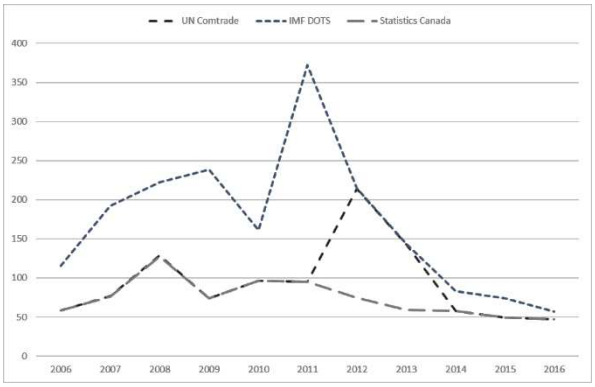
[17] Ferraris, C. (1885): "La Statistica del movimento dei metalli preziosi fra l'Italia e l'estero", cited by Morgenstern (1965, p.139).

[18] Exports are expressed on a f.o.b. basis and imports in c.i.f, except for Australia, Canada, Mexico and Slovak Republic (2006-2008).

at a country level, two commonly cited datasets include the one mentioned previously and that proposed by the IMF in the Direction of Trade Statistics (DOTS).[19] However, information thus collected may be subject to some limits thereby adding caveats in the appraisal of results described hereafter.

Several issues have been identified in our case, the main ones being related to data coherence. A comparison between data compiled by the COMTRADE and the DOTS suggests that statistics were not correctly and accurately recorded for some OECD countries, leading to significant variations in the results obtained (see Figure 1-A in appendix). For instance, the figure below portrays export data from Canada to Hungary, which were retrieved over the selected period, showing high disparities between the DOTS, and to a lesser degree the COMTRADE, compared to the Canadian International Merchandise Trade Database.[20]

Figure 1a. Exports from Canada to Hungary in millions of US$ (2006-2016)



Note: Canadian exports were converted in US dollars according to the exchange rate available at UNCTAD Stat. Sources: UN comtrade, IMF DOTS and Statistics Canada.

Another illustration of inconsistencies is that having concordance between data recorded in both databases but not with those registered by national statistical offices as in the case of Chili (see Figure 1b).[21]

Even though showing some limitations, the UN COMTRADE database was selected for the purpose of this analysis, due to an overall better consistency with national data (as published by reporting countries) and data availability.[22] In addition, as specified by the OECD in its own database on international merchandise trade, data since 2013 about trade in value by partner countries are extracted from the COMTRADE database. The International Trade Centre has thus identified more than thirty reasons for discrepancies in bilateral data. Among them, only few apply to the intra-OECD trade. Nevertheless, taking into account the motives of misreporting

[19] Our estimation of the magnitude of trade misinvoicing in OECD countries were elaborated initially from these two datasets.

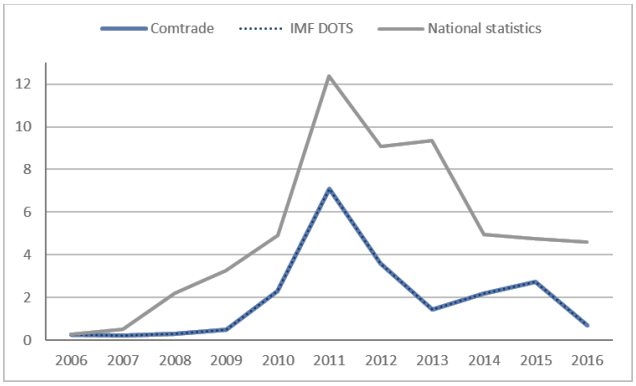
[20] Source : http://www5.statcan.gc.ca.

[21] In the special case of Chile, one should mention that Chilean imports are also available in f.o.b values by trading partner in the National Customs Directorate (*Dirección Nacional de Aduanas*) but are not included in any of these cited databases (see http://www.aduana.cl).

[22] One of the main limitation identified lies in the use of exchange rates that would imply another source of bias. As for data consistency concerning OECD countries, major disparities between national statistics and UN data were adjusted. As for data availability, the DOTS database is less complete such as in the case of Mexico's imports and exports that are not available for Estonia, Iceland, Latvia etc., even though available in the COMTRADE database and published by the Mexican National Statistical Office INEGI (*Secretaría de economía*).

and the limits of the mirror data method, the assessment presented below should be considered as a high valuation of the misinvoicing within the OECD countries.

Figure 1b: Exports from Chile to Luxembourg in millions of US$ (2006-2016)

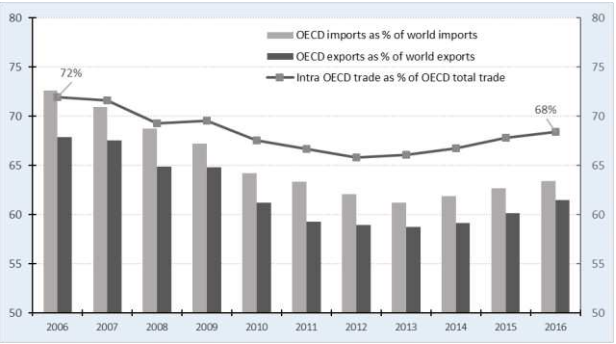


Note: Chilean exports recorded by the *Dirección Nacional de Aduanas* are available in millions of US dollars.
Sources: UN comtrade, IMF DOTS and Dirección Nacional de Aduanas.

4. Estimates of trade misinvoicing for OECD countries

OECD countries exert great influence on the dynamics and patterns of global trade: OECD share in world exports and imports remains high on average, at around 63% and 66% respectively, despite declining trends over the selected period (see Figure 2). One of the main features that can be emphasized is the significant part of merchandise trade occurring within the OECD, with exports reaching the largest percentage (72% of total OECD exports) compared to imports (65% of total OECD imports). Intra-OECD trade is, however, characterized by asymmetric patterns when taking into account, for instance, the distribution across geographical regions (see Figure 2-A in appendix).[23]

Figure 2: OECD share in world trade and intra-OECD trade, in percentage (2006-2016)



Notes: Units are expressed in current US$ and calculations are realized based on direct data as reported by each country and do not consider mirror data. Intra-OECD trade, as % of OECD total trade, is defined as the ratio between the sum of export and import values among the OECD members and the sum of values of their total exports and imports.
Source: Authors' calculations based on data from the Word Integrated Trade Solution (WITS).

Consequently, the OECD tends to be a relevant sample of countries due to their participation in world trade when examining the phenomenon of trade misinvoicing. Estimated values of the total trade misinvoicing are specified at an aggregated level, covering all bilateral flows across the 35-member states over the period 2006-2016.

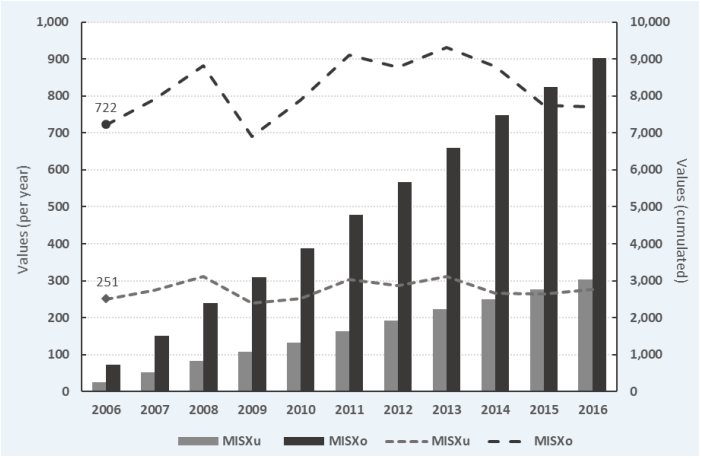
[23] In this respect, it is stressed that the EU occupies a dominant position, since 22 of the 28 Member States are also members of the OECD.

By referring to the OECD, and thus considering a "closed" set of countries, it is important to point out that the total export over-invoicing (or under-invoicing) is equal to the total import under-invoicing (or over-invoicing) as mentioned previously. In this case, the discussion below will only focus on export discrepancies since it is easily replicable from the import perspective. Misdeclared values of exports can result in illicit money inflows (export over-invoicing) and in illicit merchandise exit (export under-invoicing).

The total export misinvoicing generated within the OECD has increased by a factor of 1.8 over the 11 past years.[24] As depicted in Figure 3, export over-invoicing which entails illicit financial inflows constitutes the larger component (on average 75% of the total export misinvoicing), amounting to approximately US$ 9,020 billion, accumulated from 2006 to 2016.

In addition, export under-invoicing accounts, albeit to a lesser extent, for US$ 276 billion on average each year and its share in total misinvoicing has risen by 0.25% during the period and registered an accelerating rate of 6.85% over the last three years, in contrast with the downward trend of the share of export over-invoicing.[25]

Figure 3: Trends of OECD's export misinvoicing in billions of US$ (2006-2016)



Notes: Units are expressed in current US$. MISXo and MISXu stand for export over-invoicing and export under-invoicing, respectively. The bars in the figure represent cumulated sums during the studied period (second vertical axis).
Source: Authors' calculations based on the UN COMTRADE database.

In such context, these figures provide more insight into the size of trade misinvoicing, especially for countries mostly regarded as developed/advanced economies, forging trade relationships essentially with developed/advanced countries.[26] To give an order of magnitude, a simple calculation exercise, based on data provided by the OECD Development Assistance Committee (DAC) gathering 29 OECD countries, suggests that the total development aid granted in 2016 by the DAC members barely reaches 20% of the amount generated by the sole export over-invoicing in the same year (see Table 2-A in appendix).

When turning to each country's participation, the estimated grand total of trade misinvoicing is split into four categories, i.e. over-and under-reporting of exports and imports. Table 1 displays the ranking of the OECD countries according to their average shares in the total amount of each category, expressed in percentage, and according to which channel is used to misreport trade

[24] Export misinvoicing is calculated using absolute values of export over-invoicing due to negative figures.
[25] According to our calculations, estimates show an overall 0.1% decrease over the period, at an even faster diminishing rate of 2.16% between 2014 and 2016.
[26] As defined in either the UN classification or the IMF World Economic Outlook.

values. The major OECD economies appear in the top ranking which tend to reflect their global trade performance and/or the importance of market size as measured by population or relative wealth, but contrary to what would be expected under the assumption of "no-misinvoicing" behaviors from developed countries.

Table 1: Countries' participation in total OECD misinvoicing by category, in percentage (2006-2016)

#	Channel (1): "hidden" goods transactions				Channel (2): "phantom" goods transactions (money flows)				Channel (1)		Channel (2)	
	Export Under-Invoicing (exit)	(%)	Import Under-Invoicing (entry)	(%)	Export Over-Invoicing (inflows)	(%)	Import Over-Invoicing (outflows)	(%)	Total	(%)	Total	(%)
1	**United States**	**23.3**	**France**	**14.7**	**Germany**	**19.5**	**Germany**	**16.3**	**United States**	**15.8**	**Germany**	**18.7**
2	**Japan**	**12.0**	**Germany**	**14.4**	**Belgium**	**14.1**	**Mexico**	**12.0**	**France**	**12.3**	**Belgium**	**12.8**
3	**Ireland**	**7.7**	**United States**	**13.3**	**Netherlands**	**9.9**	**Canada**	**11.4**	**Germany**	**11.3**	**Netherlands**	**7.5**
4	**Mexico**	**6.8**	**Netherlands**	**8.3**	**United Kingdom**	**7.1**	**Belgium**	**8.9**	**Netherlands**	**7.8**	**United Kingdom**	**6.5**
5	**Netherlands**	**6.4**	**United Kingdom**	**6.2**	**Italy**	**5.0**	**Japan**	**6.7**	**United Kingdom**	**5.2**	**Mexico**	**6.3**
6	France	5.1	Spain	5.0	Mexico	4.3	United States	6.4	Spain	3.9	Canada	5.0
7	Korea	4.7	Poland	4.7	France	4.1	France	6.1	Poland	3.6	France	4.6
8	Canada	4.1	Italy	3.9	Czech Republic	3.0	United Kingdom	4.9	Japan	3.6	Italy	4.0
9	Norway	4.0	Switzerland	3.7	Canada	2.9	Australia	2.8	Italy	3.5	United States	3.7
10	Switzerland	2.7	Austria	3.1	Norway	2.8	Spain	2.2	Switzerland	3.5	Japan	3.4
11	Italy	2.4	Czech Republic	2.5	United States	2.8	Sweden	2.1	Ireland	3.2	Czech Republic	2.7
12	Turkey	2.2	Turkey	1.8	Spain	2.8	Austria	1.8	Austria	2.5	Spain	2.6
13	United Kingdom	2.2	Slovak Republic	1.8	Switzerland	2.8	Czech Republic	1.7	Norway	2.2	Norway	2.4
14	Australia	2.2	Ireland	1.7	Poland	2.7	Israel	1.6	Canada	2.0	Switzerland	2.3
15	Germany	2.1	Norway	1.6	Japan	2.3	Korea	1.5	Czech Republic	2.0	Poland	2.3
16	Luxembourg	1.3	Finland	1.4	Austria	2.0	Turkey	1.5	Turkey	1.9	Austria	2.0
17	Israel	1.2	Canada	1.3	Sweden	1.9	Poland	1.3	Korea, Rep.	1.9	Sweden	2.0
18	Finland	1.2	Sweden	1.2	Hungary	1.7	Norway	1.3	Mexico	1.8	Hungary	1.5
19	Denmark	1.0	Belgium	1.1	Slovak Republic	1.6	Ireland	1.2	Slovak Republic	1.4	Slovak Republic	1.4
20	Chile	1.0	Denmark	1.0	Korea	1.2	Switzerland	1.1	Finland	1.4	Korea, Rep.	1.3
21	Sweden	0.9	Korea	0.9	Denmark	1.1	Italy	1.1	Sweden	1.2	Australia	1.2
22	Spain	0.9	Japan	0.8	Portugal	0.8	Slovak Republic	0.9	Denmark	1.0	Denmark	0.9
23	Austria	0.6	Luxembourg	0.7	Australia	0.6	Hungary	0.9	Belgium	0.9	Portugal	0.7
24	Hungary	0.6	Greece	0.7	Israel	0.4	Netherlands	0.7	Luxembourg	0.9	Israel	0.7
25	Portugal	0.6	Hungary	0.7	Turkey	0.4	New Zealand	0.5	Australia	0.8	Turkey	0.7
26	Czech Republic	0.5	Portugal	0.6	Chile	0.4	Chile	0.5	Israel	0.7	Ireland	0.5
27	New Zealand	0.5	Slovenia	0.6	Slovenia	0.3	Denmark	0.5	Hungary	0.7	Chile	0.4
28	Latvia	0.4	Israel	0.5	Finland	0.3	Finland	0.5	Portugal	0.6	Finland	0.4
29	Poland	0.3	Estonia	0.3	Greece	0.3	Portugal	0.4	Greece	0.5	Slovenia	0.3
30	Slovak Republic	0.2	Chile	0.3	Estonia	0.2	Greece	0.4	Chile	0.5	Greece	0.3
31	**Estonia**	**0.2**	**New Zealand**	**0.3**	**Ireland**	**0.2**	**Slovenia**	**0.3**	**Slovenia**	**0.5**	**Estonia**	**0.2**
32	**Belgium**	**0.2**	**Australia**	**0.3**	**Latvia**	**0.2**	**Estonia**	**0.2**	**New Zealand**	**0.3**	**New Zealand**	**0.1**
33	**Slovenia**	**0.2**	**Latvia**	**0.2**	**Iceland**	**0.1**	**Iceland**	**0.2**	**Estonia**	**0.3**	**Latvia**	**0.1**
34	**Iceland**	**0.1**	**Iceland**	**0.1**	**Luxembourg**	**0.1**	**Luxembourg**	**0.1**	**Latvia**	**0.3**	**Iceland**	**0.1**
35	**Greece**	**0.1**	**Mexico**	**0.1**	**New Zealand**	**0.0**	**Latvia**	**0.0**	**Iceland**	**0.1**	**Luxembourg**	**0.1**
		100%		***100%***		***100%***		***100%***		***100%***		***100%***

Trade misinvoicing for OECD (in billions US$):			
Total trade misinvoicing-accumulated	**12,053**	**Total export over- invoicing (import under-invoicing)-accumulated**	**9,020**
Total trade misinvoicing per year (on average)	**1,096**	**Total export under-invoicing (import over-invoicing)- accumulated**	**3,033**
Total export (import) misinvoicing in net values-accumulated	**5,987**		

Notes: Countries are ranked by descending order. Total of channel (1) comprises export and import under-invoicing and total of channel (2) combines export and import over-invoicing.
Source: Authors' calculations based on the UN COMTRADE database.

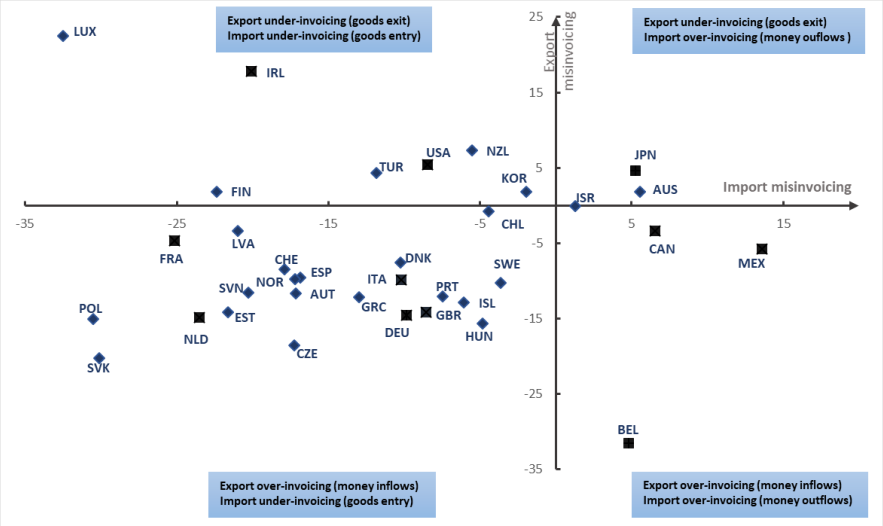
Focusing on the first channel, United States and Netherlands are among the highest ranked of the OECD-35 by under-invoicing both their exports and imports. France, Germany and United Kingdom tend to rely more on an undervaluation of their imports ("hidden" goods to enter) in contrast with Japan, Ireland and Mexico more prone to undervalue their exports ("hidden" goods to exit). As for the second channel, involving money flows as a counterpart of "phantom" goods, Germany, Belgium and Mexico are more likely to overstate in both directions, while Netherlands and Italy seem to facilitate overinvoicing practices from the export side, compared to Canada and Japan from the import side.

As a result, by considering the completeness of each channel, countries' positioning changes slightly indicating which channel is favoured, on average, when misdeclaring merchandise values (columns 5 & 6, Table 1). For instance, related to "hidden" goods movements, Japan, Ireland and Mexico move down to the 8th, 11th and 18th position respectively as using a "mix" between both channels. On the other hand, by focusing only on the second channel, Canada, Italy and Japan also declined few places in the overall classification. Nonetheless, both rankings remain fairly constant for Belgium, Germany, France, Netherlands, United Kingdom and the United States classified among the top 5 according to each criterion.

Finally, it is worth noting the significant position of Japan and Mexico by under-reporting their exports and over-invoicing their imports as well as that of Italy showing a high ratio relative to export over-invoicing given their moderate contribution to the overall trade within the OECD.[27] Likewise, the particular case of Ireland deserves to be mentioned by occupying a high position related to export under-invoicing notwithstanding its size and performance accounting for only 1.6% of OECD total exports on average during the period.

That being said, it is important to bear in mind that the previous ranking is only intended to provide a relative positioning among OECD countries with reference to trade data discrepancies but measured in absolute terms. To offer a different perspective, a first step consists in assessing each misinvoicing category relative to direct trade data in values as declared by each country. Following Morgenstern (1965, p. 169), these percentage differences highlight four distinct cases as illustrated in the figure below.

Figure 4: Ratio of trade misinvoicing estimates to official trade values by country (imports and exports), in percentage (2006-2016)



Notes: Each ratio is calculated as total exports (imports) misinvoicing from the reporter's perspective arising from its bilateral transactions divided by total exports (imports) according to reporter's statistics and averaged over the period. Country codes are included in Table 1-A.
Source: Authors' calculations based on the UN COMTRADE database.

The first case – at the upper left quadrant – indicates the complete channel (1) related to movements of "hidden" goods: countries tend to undervalue their exported and imported goods (or their trading partners tend to overstate their trade statistics in both directions as using the second channel). In this instance, two countries previously mentioned – Ireland and the United States – seem to establish their position although with slight variations: Ireland also appears to adopt an under-invoicing practice as for its imports expressed in proportion of the direct declared value. Furthermore, particular high ratios shown by Luxembourg draw attention as an example of "extreme" under-invoicing relatively to others countries, taking into account its limited participation in intra-OECD trade over the period (see Table 1-A in appendix).

The second – at the lower right quadrant – is the symmetric case of the first one but in terms of money flows, which involves an over-reporting of both imports and exports from the perspective of the country (or an under-reporting in both directions for its trading partners). Comments

[27] For further details, see Table 1-A in appendix.

stated above still apply for Canada, Mexico and Belgium, the latter well ahead given its position in terms of export over-invoicing when referring to direct data.

The third case – at the upper right quadrant – suggests misinvoicing practices related to both channels, export under-invoicing and import over-invoicing, which both point in the same direction in terms of illicit financial outflows, Japan clearly confirming its ranking as noted previously.

The last case – at the lower left quadrant – displays the larger concentration of OECD members, 22 countries out of 35, which underlies the most distinctive feature previously identified about illicit financial inflows. France and Netherlands remain among the first places relative to import misinvoicing and Germany's position is quite similar to that of the United Kingdom. Of particular interest are the cases of Poland and Slovakia for which trade misreporting represents a substantial part of their official merchandise values, as showing high ratios in this respect. In addition, these two economies currently exhibit relatively low GDP per capita, as will be examined infra, and should be characterized by a tendency towards illicit financial outflows according to the dominant findings in the related-literature.

As a second step, it is also relevant to nuance such positioning in conjunction with a cross-country comparison regarding each component of trade misinvoicing and the use of each channel depending on GDP per capita (as a proxy of development level). Figures 5a and 5b indicate that trade misreporting globally shows high ratios associated to direct import data, regardless *a priori* of GDP per capita levels. However, this phenomenon seems to be more widespread among countries with lower GDP per capita, especially concerning import under-invoicing.

On the issue of illicit financial inflows, using both channels, movements of "hidden" goods tend to be the dominant pattern among OECD countries. Some particular cases can be briefly outlined: (i) higher ratios of import under-invoicing are essentially associated with the most advanced economies within the OECD. For example, Ireland and Luxembourg generate about 88% of their illicit financial inflows through this practice, along with Finland and United States at around 82%;[28] (ii) Among countries with lower GDP per capita, import discrepancies derived from their statistical data are rather high, such as the cases of Slovakia accounting for 36% of the reported value and Poland for 34%; (iii) Conversely, Belgium and Mexico, although characterized by different GDP per capita, rely primarily on export over-invoicing and use this channel at 93% and 98% respectively to repatriate illicit financial flows; and (iv) as pointed out before, Germany and Netherlands are among the countries which are using both categories in a balanced fashion in that respect.

When it comes to illicit financial outflows, even though imports still remain as the major vehicle through over-invoicing practice, the scale and distribution of trade misinvoicing across countries is less pronounced, particularly in the case of economies with high GDP per capita. However, it should be noticed that: (i) within the group of upper-middle GDP per capita, Belgium and Germany appear to drive essentially their illicit financial outflows through the second channel, and thus import over-invoicing, at around 98% and 92%; (ii) as mentioned before, the most developed countries depend more on average upon export under-invoicing, except for Sweden using import over-invoicing at 72% to move abroad illicit financial flows; and (iii) among countries with higher rates of export under-invoicing, Luxembourg and Latvia are more prone

[28] These percentages can be easily calculated from Table 1-A in appendix.

to use this channel regarding their illicit financial outflows, showing a ratio at approximately 93%.

Figure 5a: Ratios of illicit financial inflows (both channels) to trade values reported by each country, by GDP per capita, in percentage (2006-2016)

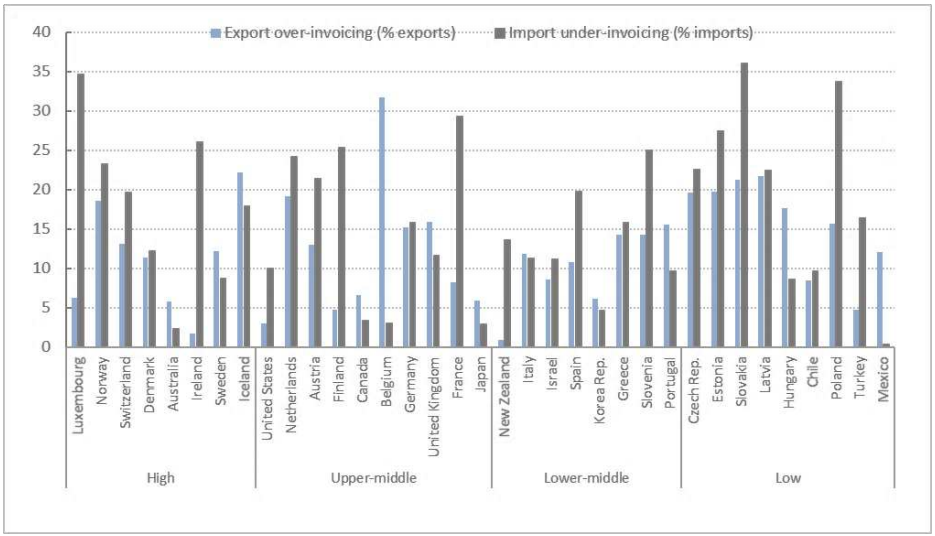
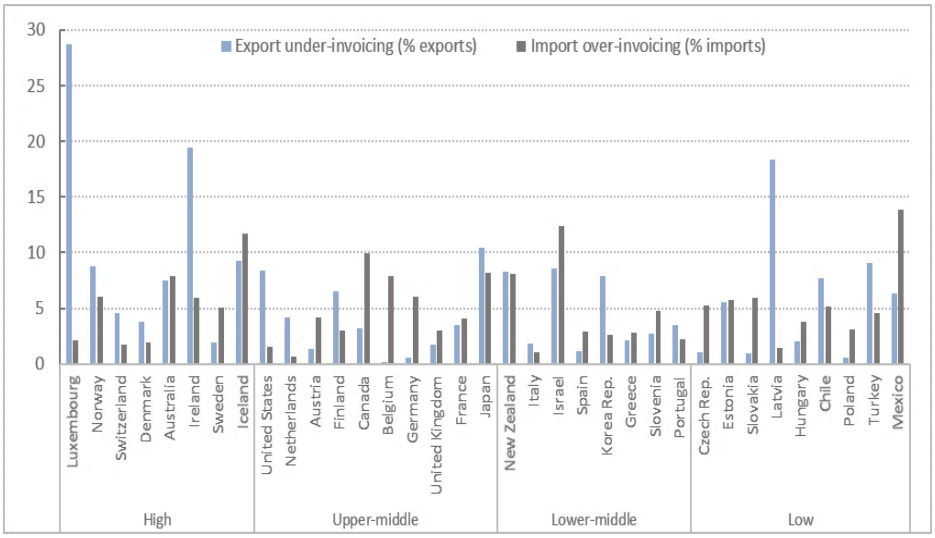


Figure 5b: Ratios of illicit financial outflows (both channels) to trade values reported by each country, by GDP per capita, in percentage (2006-2016)



Notes: Countries are ranked by GDP per capita. The latter is expressed in current dollars and its classification is relative to the OECD grouping. Average GDP per capita observations are sorted according to computed interquartile ranges in the following manner: High (50,571≤ GDP p.c.); Upper-middle (40,157 ≤ GDP p.c. < 50,571); Lower-middle (20,435 ≤ GDP p.c. <40,157); Lower (20,435 <GDP p.c.).
Source: Authors' calculations based on UNCTAD STAT and UN COMTRADE databases.

The final step will consist in examining the overall growth dynamics of each component to identify diminishing and increasing patterns among OECD countries. The data contained in Table 2 tend to underscore different dynamics between individual countries and misinvoicing categories according to growth rates relative to reported statistics on exports and imports.

It should be noticed that none of the OECD countries has registered a diminishing growth rate considering simultaneously the four categories related to trade misreporting. In addition, when official trade values tend to decline (or increase), around 54% of the OECD countries display growth rates evolving in the same direction for export misinvoicing and 46 % for import

misinvoicing, mostly concentrated in the latter group of low GDPs per capita. This positive relation is observed simultaneously for exports and imports only for the cases of Korea, Japan and New Zealand.

Table 2: Growth rates in percentage respective to official trade values and trade misinvoicing for OECD countries (2006-2016)

Reporting country	Export growth (%)	Export misinvoicing growth (%)		Import growth (%)	Import misinvoicing growth (%)	
		Over-invoicing	Under-invoicing		Under-invoicing	Over-invoicing
High GDP per capita						
Luxembourg	-1.99	-1.79	-3.60	-0.63	0.21	15.38
Norway	-2.65	-5.71	-5.61	0.26	4.70	4.19
Switzerland	4.94	8.46	-5.20	5.39	-1.84	30.53
Denmark	-0.57	3.63	5.08	-0.62	0.70	-6.67
Australia	0.27	-2.31	0.63	1.94	12.27	-3.41
Ireland	0.56	-2.51	-4.18	-0.45	-2.73	16.95
Sweden	-1.20	-0.65	3.72	0.16	-0.89	6.65
Iceland	1.06	0.27	9.45	-1.85	1.71	-6.28
Upper- middle GDP per capita						
United States	2.65	-0.88	-1.60	2.42	0.81	13.22
Netherlands	0.60	-1.53	6.06	0.75	0.29	11.04
Austria	0.37	-1.99	16.50	0.58	-0.80	-6.48
Finland	-2.85	-8.84	-1.17	-1.90	-1.85	9.81
Canada	0.37	-2.24	-0.55	1.93	4.59	2.22
Belgium	-0.01	-0.16	18.52	-0.17	-4.30	2.13
Germany	0.86	1.91	-0.12	0.69	1.37	-4.05
United Kingdom	-0.63	-1.65	-7.93	0.23	2.77	-12.82
France	-0.51	2.80	7.36	-0.22	-0.39	1.32
Japan	-1.55	-4.31	-1.74	1.26	0.98	1.88
Lower-middle GDP per capita						
New Zealand	1.52	35.04	0.97	2.23	2.05	6.49
Italy	-0.08	-1.03	12.75	-1.37	-2.08	0.15
Israel	0.94	11.72	23.21	3.21	-3.04	9.77
Spain	1.92	8.24	-7.50	-2.28	-3.88	-2.58
Korea, Rep.	2.99	9.24	-0.13	2.79	4.77	7.40
Greece	2.21	8.64	-9.74	-6.81	-7.80	-7.84
Slovenia	2.49	0.19	19.43	0.33	1.73	-4.20
Portugal	1.72	1.54	-2.01	-1.95	-2.72	-9.65
Low GDP per capita						
Czech Rep.	4.59	5.23	16.17	2.73	5.23	4.77
Estonia	4.82	4.86	3.03	2.24	0.03	-3.97
Slovakia	5.20	7.63	21.21	2.88	9.59	6.03
Latvia	6.04	9.57	-8.61	1.57	5.79	-6.87
Hungary	2.35	3.86	7.77	1.60	5.13	7.88
Chile	-2.01	-7.81	-4.08	4.95	11.63	4.10
Poland	5.47	2.37	23.03	2.11	7.47	1.90
Turkey	3.64	-2.79	4.70	3.52	6.63	-5.25
Mexico	5.01	3.62	6.46	3.91	0.92	-4.46

Notes: Countries are ranked by GDP per capita. The latter is expressed in current dollars and its classification is relative to the OECD grouping. Average GDP per capita observations are sorted according to computed interquartile ranges in the following manner: High (50,571≤ GDP p.c.); Upper-middle (40,157 ≤ GDP p.c. < 50,571); Lower-middle (20,435 ≤ GDP p.c. <40,157); Lower (20,435 <GDP p.c.). Growth rates are computed over the studied period based on the Least-Squares method.
Source: Authors' calculations based on UNCTAD STAT and UN COMTRADE databases.

On average, the category of export under-invoicing displays higher growth rates, thus indicating an increasing use of the first channel ("hidden" goods movements) driven by the steep rise of eight economies among them Israel, Poland and Belgium. As for understated imports, among the first ranked countries are Australia and Chile. Conversely, we can discern the case of Greece registering a declining trend relative to both components while Belgium and United Kingdom show negative growth rates in import and export under-invoicing. Regarding the second channel, through overdeclared values of imports and exports, New Zealand is well ahead related to the export side and five countries, such as Switzerland, Ireland and Luxembourg, demonstrate high growth rates viewed from the import side. The most diminishing trends related to this channel are presented by Finland and Chile (export over-invoicing) and by United Kingdom and Portugal (import over-invoicing).

At this stage of the analysis, four broad regularities can be outlined for the OECD countries over the period 2006-2016:

- As a whole, OECD countries tend to be characterized by gaps in trade statistics pointing towards predominant illicit financial inflows depending on channels used (movements of "hidden" or "phantom" goods). However, above described estimates indicate that illicit financial outflows may be increasing at a steady pace, especially within the last three years;
- The decomposition of trade misinvoicing into four categories enables to identify the main scenario emerging from data discrepancies among OECD countries, which is related to practices concerning export over-invoicing and import under-invoicing. Both practices rely on a different channel to repatriate illicit financial flows from abroad. The distribution of the countries suggests that the underreporting of imports is more widespread as expressed relative to import values declared by each country. This last finding tends to favour the first channel (or movements of "hidden" goods) as regards illicit financial inflows;
- In addition, misdeclared values of imports seem to appear as the main conduit to move illicit financial flows across borders regardless of GDP per capita levels, even though this pattern is less marked in the case of illicit outflows;
- Conversely, in terms of growth dynamics, a positive relationship is likely to appear between trends in exports and imports (according to official data) and growth of trade discrepancies, particularly for the group of low GDPs per capita, demonstrating in this case some evidence of the impact of development levels.

5- Analysis of bilateral trade misinvoicing: selected country cases

This section offers a more in-depth analysis at a country level, based on specific examples that have demonstrated relevant features and significance to illustrate some behaviours related to trade misinvoicing phenomenon within the OECD. In such context, Germany, Japan, Mexico and the United States were selected according to their participation in terms of IFFs and channels used to move "hidden" or "phantom" merchandises. In this respect, bilateral intensity indices modified to include trade misreporting are computed for all country pairs over the period of 2006-2016.[29]

From the previous analysis, these computed indices are used to explore whether these countries have showed a bias towards intense practices of misinvoicing with certain trading partners. In addition, similar indexes will be reported but relative to the trading partners' side to provide a complete picture of the bilateral relation under study.[30]

Bilateral mis-trade intensity between Japan and selected trade partners (Korea and Mexico)

As pointed before, Japan is essentially characterized by using both channels to misreport its trade data, through export under-invoicing and import over-invoicing, in order to move abroad illicit flows. However, this pattern seems to change over the period when taking into account the dynamic dimension of each component of trade misinvoicing.

[29] The bilateral intensity index related to export and import misinvoicing was computed for all 35 OECD countries, each one with their 34 trading partners over 11 years. Nevertheless, results are too numerous to be all mentioned here. Only those showing the strongest and weakest relationships were reported for the selected countries under study.

[30] In terms of trade misinvoicing, the index of geographic export intensity of country *i* is presented in relation to the import intensity index of country *j*, its trade partner (see Kunimoto 1977, p.17).

Indeed, it can be observed that misstated export values tend to follow a decreasing trend, with export over-invoicing registering the largest decline (at around 3%) against a steady growth as for misreported imports (see Figure 3-A in appendix).

When focusing on Japan's main partners relative to trade misinvoicing, it is interesting to note several patterns induced by bilateral relations: for instance, Japan's bilateral relation with Belgium tends to be based on the first channel, or "hidden" goods transactions, to generate reciprocal IFFs (outflows and inflows); with Korea and Netherlands, both channels are used to repatriate illicit flows from abroad; and for the case of the United States, induced illicit inflows and outflows are driven by the same channel, i.e. "phantom" goods movements. It is important to add that, from the import side, misreported values tend to be relatively more concentrated between Japan's trading partners, however, showing a reverse trend towards a more diversified pattern in favour of import over-invoicing as supported by observed trends.[31]

With this in mind, when turning to geographical intensity indexes related to trade misreporting, Japan shows strong relations, from the export side, with New Zealand, Korea, Mexico and the United States. From the import side, intense relationships can be identified with Australia, Mexico, France and Korea (see Table 3-A in appendix). Japan's bilateral relation with Germany denotes a particular case, being highly intense from the export side and among the weakest from the import side. Generally, the pattern observed for Japan tends to indicate that illicit financial inflows are associated with neighbouring partners, bilateral relations being more intense in this direction, compared to illicit outflows, which are more distant.[32] Figure 6 thus displays the most salient aspects derived from bilateral intensity indexes related to trade misinvoicing between Japan and its selected trading partners such as Korea and Mexico.

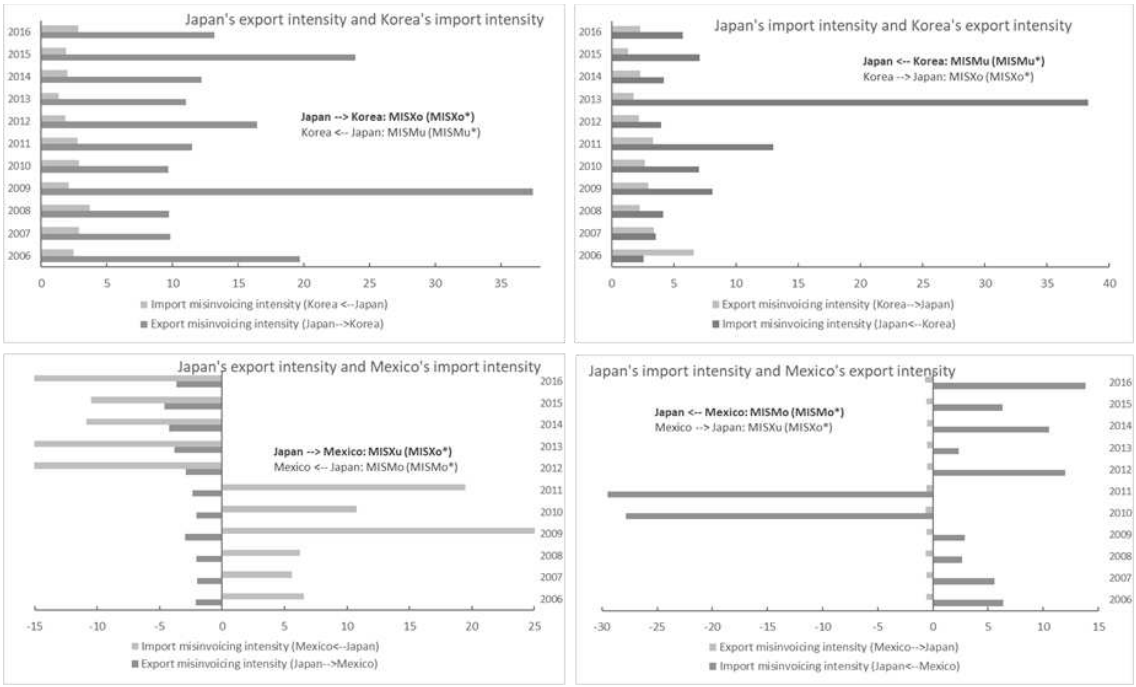
When analysing the bilateral relationship between Japan and Korea, practices of trade misreporting aim at facilitating illicit financial inflows based on both channels (export over-invoicing and import under-invoicing from the Japan's perspective). Interestingly, there are no illicit financial outflows recorded over the studied period for both countries either in terms of understated exports or overstated imports. Korea is ranked as Japan's leading partner as regards import under-invoicing and represents the third largest partner for export over-invoicing, although both categories have registered declining growth rates in the same period at 0.2% and 3%, respectively.

As depicted in Figure 6, Japan's bilateral intensity indexes are higher in absolute values (and greater than one) than those computed for Korea. Illicit financial inflows tend to be corroborated for both trading partners as evidenced by positive signs associated with intensity indices, which are coincident with the hypothetical situation on the export and import side. From this perspective, exporters and importers in both countries are likely to repatriate illicit financial funds from abroad through both channels of trade misinvoicing, even though the relationship seems to be more intense for Japan.

[31] Herfindahl-Hirschman indexes (HHI) and their respective growth rates were calculated for all OECD countries according to the two broad categories of misinvoicing. In the case of Japan, computed HHIs for import partners are relatively high but declining at a rate of 5.8% over the period.

[32] In this case, illicit financial outflows seem to be directed particularly towards European countries.

Figure 6: Japan's bilateral intensity indexes (export and import misinvoicing) by selected partners (2006-2016)



Notes: MISXu and MISXo denote export under-invoicing and over-invoicing respectively, and MISMu and MISMo stand for import under-invoicing and over-invoicing. (*) stands for the hypothetical misinvoicing. Import and export intensities refer to import misinvoicing and export misinvoicing.
Source: Authors' calculations based on the UN COMTRADE database.

As for the bilateral relationship between Japan and Mexico, the situation is characterized by illicit financial outflows, Mexico being among the top five trade partners relative to import over-invoicing and export under-invoicing, each category increasing over the period at rapid rates of 4% and 2.6%, respectively.[33]

Unlike the previous case, some distinction has to be made based on which modus operandi is used for reported values of exports and imports. When focusing on the export intensity of Japan (and import intensity of Mexico), bilateral intensity indexes display large absolute values, although higher for Mexico and with positive signs as predicted by the hypothetical scenario until 2011. Negative signs associated with the export intensity indexes for Japan allow to infer that these movements of illicit outflows could be attributed to Mexico through overstated imports from 2006 to 2011.

Turning to the import intensity of Japan, bilateral indexes show high absolute values, with consistent signs except for two years, compared to negative values of export intensity for Mexico, lower than the unity. This situation may suggest that such illicit financial outflows are induced by importers in Japan through over-invoicing practices, or "phantom" goods transactions.

Bilateral mis-trade intensity between Mexico and selected trade partners (Canada and The United States)

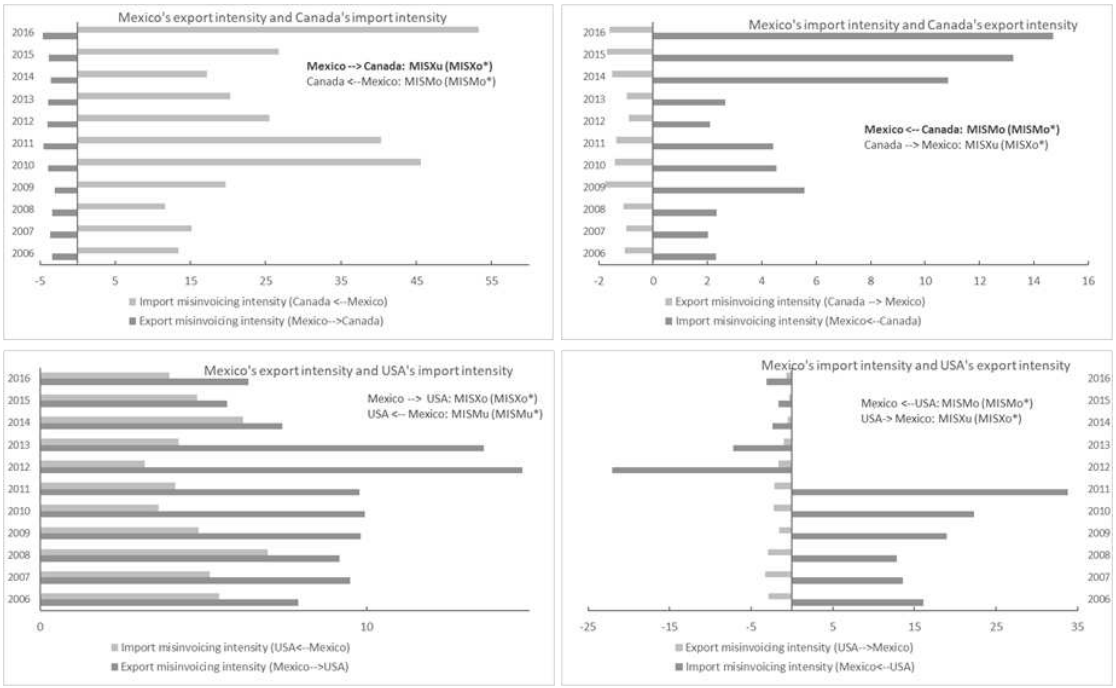
Alike the previous case, the Mexican situation tend to suggest opposite patterns according to some assumptions included in the main literature on trade misinvoicing: Japan is among the

[33] There are no illicit financial inflows recorded over this period associated to the bilateral trade between Japan and Mexico.

more advanced economies and still shows evidence of illicit financial outflows; Mexico is among the lowest GDPs per capita relative to the OECD average and yet tends to be characterized by illicit inflows.

Mexico's position relative to its official trade amounts indicates a particular case of over-invoicing in both directions, exemplified by its bilateral relation with the United States (see Figure 3-A in appendix). In addition, overvalued exports and undervalued imports seem to be concentrated within few trading partners. Trends relative to each component of trade misinvoicing indicate however that the first channel, through understated exports, follows a gradually rising trend, as illustrated by the bilateral trade relation with Canada. The figure below highlights some specific bilateral relations between Mexico and its premier partners, regardless of goods flows, which are the United States and Canada.

Figure 7: Mexico's bilateral intensity index (export and import misinvoicing) by selected partners (2006-2016)



Notes: MISXu and MISXo denote export under-invoicing and over-invoicing respectively, and MISMu and MISMo stand for import under-invoicing and over-invoicing. (*) stands for the hypothetical misinvoicing. Import or export intensity refers to import misinvoicing or export misinvoicing.
Source: Authors' calculations based on the UN COMTRADE database.

In the case of Canada, the key characteristic identified relates to illicit outflows driven by both channels. This situation of illicit outflows can be differentiated on the basis of absolute values and signs of bilateral intensity indexes as depicted in Figure 7. In the first case, illicit outflows tend to be driven from Canada by means of overstated imports: absolute values indicate strong intense relation with Mexico from the import side with positive signs according to the hypothetical situation. It can be noticed that these particular illicit outflows are recording a high growth rate at 7% during the period. In the second case, illicit outflows could be considered as originated in Mexico through import over-invoicing. Bilateral indexes related to import intensity are indeed displaying high positive values in line with the expected situation in contrast with values associated to the export intensity for Canada. Illicit financial outflows between Mexico and Canada are facilitating by the same channel in both countries based on import over-invoicing or movements of "phantom" goods.

The bilateral relation between Mexico and the United States is mostly characterized by an inflows-outflows situation. As shown in Figure 7, in the first case, both bilateral intensity indexes exhibit high positive values for Mexico and the United States. In that respect, IFFs are driven by export over-invoicing for Mexico and import under-invoicing for the United States, pointing at illicit inflows towards both countries. In the second case, alike the case of Japan with Mexico, illicit financial outflows tend to be corroborated for Mexico through import over-invoicing at least until 2011, as evidenced by high positive values of import intensity indexes. It should be noticed that this specific year has marked a changing pattern towards a declining trend in import over-invoicing for Mexico at a rate of 18.6%.

Bilateral mis-trade intensity between the United States and selected trade partners (Germany and United Kingdom)

For the United States, it should be noticed that IFFs are predominantly based on the use of the "hidden" goods technique: illicit inflows are mainly facilitated by undervalued imports, reaching an accumulated amount of 1.2 trillion US$, and illicit outflows rely on undervalued exports, accounting for 0.7 trillion US$, over the period.[34] Import over-invoicing tends however to increase strongly compared to others components of trade misinvoicing, at a rate of about 13%. From this perspective, misinvoicing practices destined to understate trade values is highly diversified among the United States' trade partners as opposed to the over-invoicing practice more concentrated.

Focusing on the United States' bilateral intensity, strong relations have been established with Chile, New Zealand, the United Kingdom and Japan from the export side, and with Mexico, the United Kingdom, Estonia, Germany and Canada on the import side (see Table 5-A in appendix). As for the selected trading partners, it is important to underline that Germany and the United Kingdom are among the first ranked countries in the United States' bilateral misinvoicing according to the first channel (under-invoiced values). However, during the entire period, neither Germany nor the United Kingdom appear as partner country according to the second channel (overstated values of exports or imports).

IFFs' patterns indicate that the United States has developed intense bilateral relations with Germany and the United Kingdom resulting in an inflow-outflow situation (see Figure 8).

The bilateral relation between the United States and Germany related to trade misinvoicing can be characterized by movements of illicit outflows from the United States to Germany, through export under-invoicing, as shown by high positive values of export intensity indexes for the United States.[35] As for illicit financial inflows, the same conclusion could be drawn as values of bilateral indexes for the export intensity in the case of Germany are less than the unity even though exhibiting the expected signs. To sum up, illicit financial outflows and inflows are likely to be driven by exporters and importers in the United States using under-reported practices or "hidden" goods movements.

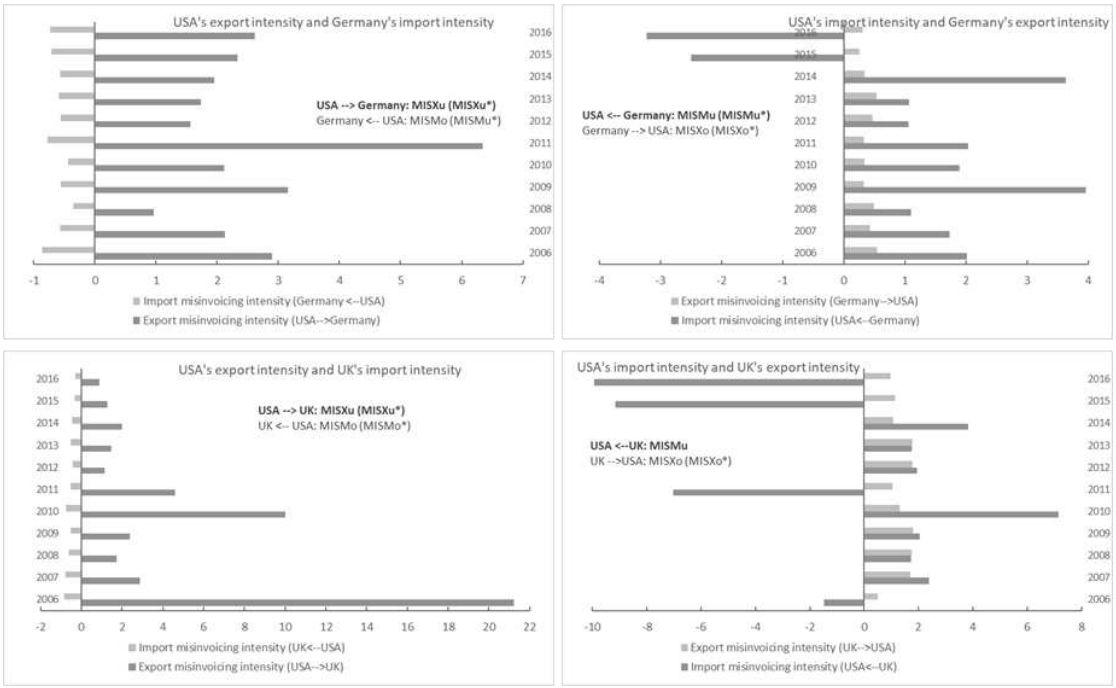
In the case of the United Kingdom, illicit financial outflows relying on the first channel tend to corroborate the hypothetical scenario for the United States through export under-invoicing

[34] In fact, total illicit outflows are reaching sizeable amounts over the period when including the second channel (0.9 trillion US$). As displayed in Figure 3-A (in appendix), all four categories of trade misinvoicing were impacted by the 2008 financial crisis, as depending on trade volumes, but showed a quick recovery in 2009.

[35] For the United States, under-invoiced exports are showing an increasing trend over the studied period at a rate of 4.3% against a steady trend related to under-invoiced imports at 0.1%.

while, for the United Kingdom, the observed pattern is differing from the expected one and bilateral intensity indexes from the import side exhibit low values.[36] As for illicit financial inflows, values and associated signs of indexes – import intensity for the United States and export intensity for the United Kingdom – are indicating an overall correspondence with the expected scenario leading to deduce that importers and exporters are likely to be involved in misinvoicing practices, through import under-invoicing in the United States with the exception of certain years and export over-invoicing in the United Kingdom.

Figure 8: The United States' bilateral intensity index (export and import misinvoicing) by selected partners (2006-2016)



Notes: MISXu and MISXo denote export under-invoicing and over-invoicing respectively, and MISMu and MISMo stand for import under-invoicing and over-invoicing. (*) stands for the hypothetical misinvoicing. Import or export intensity refers to import misinvoicing or export misinvoicing.
Source: Authors' calculations based on the UN COMTRADE database.

Bilateral mis-trade intensity between Germany and selected trade partners (France and Netherlands)

The case of Germany is situated in the most widespread configuration applying to the OECD countries, as using both channels to misreport trade values in direction of illicit inflows. Although this case tends to be described in terms of illicit financial inflows, it has to be acknowledged that consistent values derived from data discrepancies with Germany's partners are also resulting in illicit outflows by means of import over-invoicing.

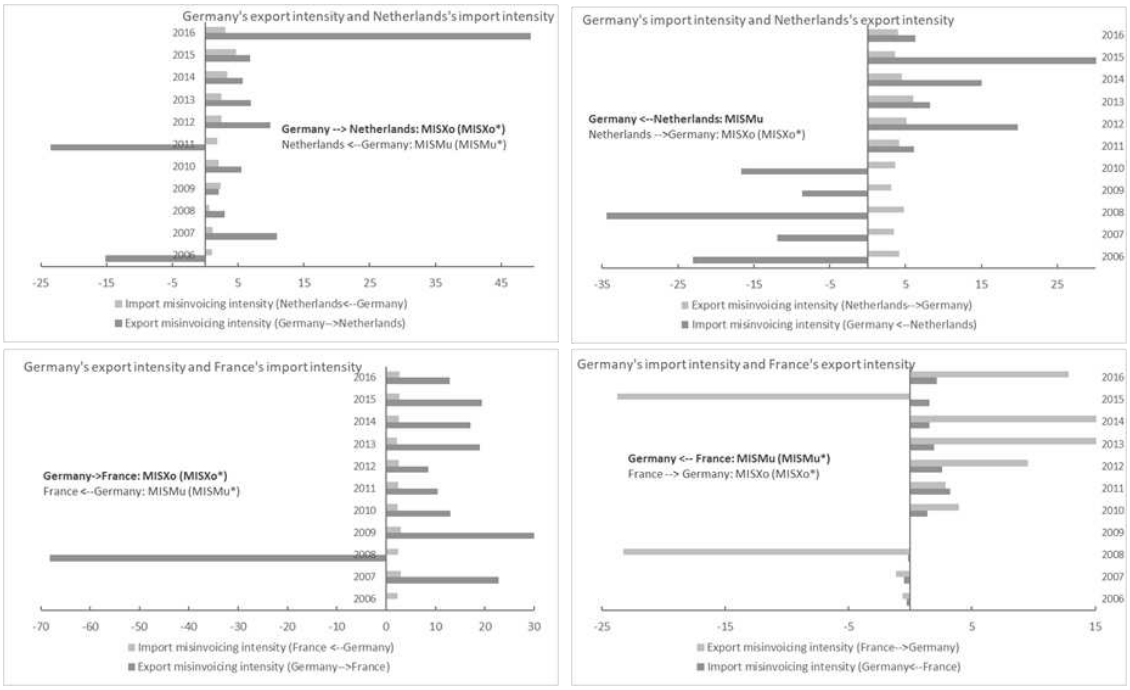
This predominant use of "phantom goods" method is pointing to large amounts of export over-invoicing – exceeding 1.7 trillion US$ accumulated over the studied period, with a peak in 2014 of 182 billion US$ – compared to amounts of import over-invoicing when added up are reaching around 0.5 trillion in the same period. In addition, it should be noticed that illicit inflows are likely to be distributed among a large number of countries while illicit outflows tend to be highly

[36] Estimated values of export under-invoicing seem to follow a decreasing trend at a rate of 5.1% over the period.

concentrated, as export under-invoicing being restricted for instance to a relatively small number of 13 countries (Canada, Mexico, Belgium, New Zealand and Japan at the top five).

Regarding bilateral trade intensity, Germany presents strong relations in export misinvoicing with France, Poland and Netherlands for instance, and concerning import misinvoicing with Hungary, Czech Republic and Netherlands, Canada and Mexico being ranked among the weakest relations independently from the kind of misreporting practice (see Table 6-A in appendix). As mentioned for Japan, illicit inflows have involved geographically close partners to Germany, while illicit outflows are linked to more distant countries. Within Germany's main partners, bilateral relations are especially developed through both channels of misinvoicing with Netherlands and France leading to an inflow-inflow situation, as detailed hereafter (see Figure 9).

Figure 9: Germany's bilateral intensity index (export and import misinvoicing) by selected partners (2006-2016)



Notes: MISXu and MISXo denote export under-invoicing and over-invoicing respectively, and MISMu and MISMo stand for import under-invoicing and over-invoicing. (*) stands for the hypothetical misinvoicing. Import and export intensities refer to import misinvoicing and export misinvoicing.
Source: Authors' calculations based on the UN COMTRADE database.

As for Netherlands, the intense relation established by Germany relies primary on export over-invoicing and import under-invoicing, the former registering an increasing trend at a rapid rate of 14.5% from 2006 to 2016. The values and signs displayed by bilateral intensity ratios show a consistent pattern either from the export side for Germany or the import side for Netherlands but relatively more intense for Germany. As a result, this situation of bilateral illicit inflows between both countries tends to broadly support the predicted scenario. When analysing bilateral intensity indexes from the import side for Germany and the export side for Netherlands, it can be observed a changing pattern in the German case.

Although Netherlands displays a consistent picture leading to infer potential illicit inflows through export over-invoicing, the same inference can be drawn for Germany through import under-invoicing but only from 2011.

As for the case of France, it is clearly apparent that observed and hypothetical situations are fully aligned since 2009, according to illicit inflows driven by complementary channels. From the export side, it is noteworthy to mention that this bilateral relation is more intense for Germany given France's positioning in the ranking of export over-invoicing and import under-invoicing (at the first and third place respectively). To emphasize this pattern, it should be noticed that no export under-invoicing was recorded with France during the studied period. When analysing the import misinvoicing side, Germany shows less intense values in its bilateral intensity indexes with France. In this context, Germany's bilateral relation with France tends to be easier to interpret since 2009, as both situations, observed and expected, seem to coincide according to values and signs of respective intensity indexes. As a result, such bilateral misinvoicing relation is essentially described in terms of illicit inflows using complementary channels for both countries.

5. Concluding remarks

The extensive use of the mirror data technique has prompted debate on possible reasons for explaining mismatches between trade flows reported by one country and identical flows reported by its trading partner. Major explanations advanced include transportation costs, structural and logistical issues relative to distinct statistical registration systems across countries. However, global efforts to deter illicit financial flows have put forward a growing interest in such technique to appraise the magnitude of trade misinvoicing identified as a significant channel used inter alia to evade tariffs and taxes, to transfer illegitimate capitals across borders, and to facilitate money laundering. As a result, discrepancies in bilateral trade data can reveal deliberate misreporting by under-invoicing or over-invoicing exports and imports.

However, it must be acknowledged that the burgeoning literature addressing this issue has mainly focused its attention on attributing misinvoicing practices to developing countries through analysis on illicit financial outflows to developed countries, which can lead to recognize only one facet of the reality thereby failing to give the whole picture, as highlighted by some recent studies (Rao and Tandon, 2017; Hong and Pak, 2017).

In an attempt to propose a wider perspective on this matter, this preliminary study has allowed to bridge some extant gaps in particular by both quantifying and examining all components of trade misinvoicing in the case of OECD-35 countries. In such context, the methodology followed to determine relevant empirical regularities has combined two approaches for assessing the scale of intra-OECD trade misinvoicing and the strength of certain bilateral intensive relationships, based on the mirror data technique. In an effort to provide insights in the extent and trends of these illegal practices, even in cases of developed countries largely engaged in global trade, 1,190 bilateral flows were analysed over an eleven-year span, based on UN COMTRADE data, to estimate amounts in each category of trade misinvoicing and to compute corresponding bilateral intensity indexes for all possible country pairs.

As a result, the size, direction and intensity of bilateral trade misinvoicing were emphasized to provide interesting findings on trends and patterns in intra-OECD mis-trade: (i) illicit financial flows exhibit substantial figures at an aggregate level associated, in most cases, to some advanced countries – Germany, Japan, Ireland, the Netherlands, the United-Kingdom, the United-States; (ii) OECD's trade misinvoicing is predominantly characterized by illicit financial inflows showing, however, a reverse trend in favour of illicit outflows in recent years; (iii) results

obtained yield some regularities contrary to key assumptions included in the related-literature. For instance, countries with relatively low GDP per capita, such as Poland, Mexico and Turkey, are recipients of illicit inflows and countries with high GDP per capita – such as Ireland, the Netherlands and the United States – are shifting abroad illicit funds; (iv) bilateral intensity indexes relative to selected advanced countries indicate strong relations between them regarding trade misinvoicing and allow to infer the country of origin and the modus operandi used to facilitate IFFs; and (v) trends over the period tend to demonstrate a consistent growth pattern, for all categories of misinvoicing, notwithstanding the reduction of tariffs and the OECD's increasing initiatives to curtail IFFs (OECD, 2014).

In a nutshell, our findings can serve as a baseline for further improvements in current understanding of trade misinvoicing through more detailed analysis at a commodity level and discussions on trade statistics consistent with those provided by national statistical offices. Furthermore, given that trade misinvoicing relies increasingly on the service sector, refinements can be explored in this direction depending on available statistics.

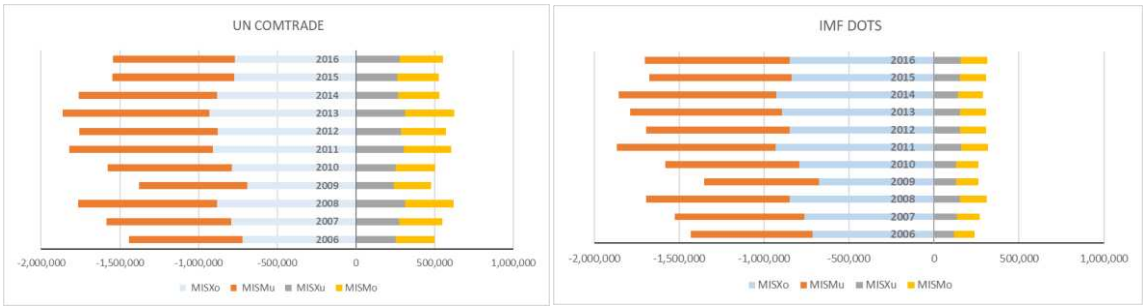
Appendix

Table 1-A: Synthetic data for OECD countries on average (2006-2016)

Country	Country Codes	Export share in OECD trade (%)	Import share in OECD trade (%)	Export misinvoicing		Import misinvoicing		Export misinvoicing		Import misinvoicing		Trade misinv.
				Over (US$ bn. p.a)	Under (US$ bn. p.a)	Under (US$ bn. p.a)	Over (US$ bn. p.a)	in total misinv. (%)	in total exports (%)	in total misinv. (%)	in total imports (%)	in GDP (%)
Australia	AUS	1.30	1.62	4.9	6.1	2.4	7.6	51.2	13.3	48.8	10.2	1.8
Austria	AUT	1.92	1.98	16.5	1.7	25.6	5.1	37.7	14.3	62.3	25.6	12.1
Belgium	BEL	5.51	5.10	115.7	0.6	9.1	25.0	77.6	31.8	22.4	10.9	30.8
Canada	CAN	5.36	5.16	24.4	11.4	10.7	31.3	44.8	9.9	55.2	13.3	4.8
Chile	CHL	0.54	0.44	3.1	2.8	2.5	1.4	60.0	16.2	40.0	14.7	4.6
Czech Rep.	CZE	1.90	1.47	24.9	1.4	20.2	4.7	51.2	20.7	48.8	27.8	25.3
Denmark	DNK	1.17	1.13	8.8	2.9	8.3	1.3	54.4	15.1	45.6	14.1	6.5
Estonia	EST	0.15	0.16	2.0	0.5	2.6	0.5	44.1	25.2	55.9	33.2	25.6
Finland	FIN	0.79	0.74	2.5	3.4	11.4	1.3	31.9	11.2	68.1	28.3	7.3
France	FRA	6.14	6.77	33.6	14.2	119.8	16.9	25.8	11.8	74.2	33.3	6.9
Germany	DEU	15.93	12.31	159.5	5.8	118.5	44.5	50.4	15.7	49.6	21.8	9.3
Greece	GRC	0.24	0.59	2.3	0.3	5.6	1.0	29.8	16.4	70.2	18.5	3.4
Hungary	HUN	1.18	1.06	13.9	1.6	5.6	2.4	66.0	19.7	34.0	12.4	17.6
Iceland	ISL	0.06	0.06	0.9	0.4	0.7	0.5	54.1	31.4	45.9	29.6	15.1
Ireland	IRL	1.65	0.89	1.9	21.1	14.0	3.3	56.9	21.2	43.1	32.0	15.9
Israel	ISR	0.60	0.59	3.4	3.4	3.9	4.5	42.5	17.2	57.5	23.5	6.1
Italy	ITA	5.25	4.66	41.2	6.5	31.7	3.0	58.0	13.7	42.0	12.3	3.9
Japan	JPN	4.80	3.74	18.8	32.9	6.5	18.6	67.3	16.4	32.7	11.1	1.5
Korea, Rep.	KOR	2.51	2.65	10.3	13.0	7.4	4.3	66.6	14.0	33.4	7.2	3.0
Latvia	LVA	0.09	0.13	1.4	1.1	1.9	0.1	55.5	40.0	44.5	23.8	15.7
Luxembourg	LUX	0.19	0.29	0.8	3.7	6.0	0.4	41.6	35.0	58.4	36.7	19.6
Mexico	MEX	4.45	4.00	35.7	18.8	0.7	32.9	61.5	18.4	38.5	14.2	8.0
Netherlands	NLD	6.35	4.67	80.7	18.1	68.4	1.9	58.2	23.3	41.8	24.8	20.2
New Zealand	NZL	0.26	0.29	0.2	1.4	2.4	1.4	28.9	9.2	71.1	21.7	3.4
Norway	NOR	1.87	0.95	23.5	10.8	13.4	3.5	65.9	27.3	34.1	29.3	11.7
Poland	POL	2.12	1.90	21.8	0.9	39.0	3.6	35.1	16.3	64.9	36.8	13.6
Portugal	PRT	0.67	0.91	6.8	1.5	5.2	1.2	57.0	19.1	43.0	11.8	6.5
Slovakia	SVK	0.92	0.68	13.3	0.6	15.2	2.5	44.2	22.3	55.8	42.0	34.2
Slovenia	SVN	0.29	0.32	2.8	0.5	4.8	0.9	37.0	17.0	63.0	29.7	18.9
Spain	ESP	3.17	3.39	22.8	2.4	40.4	6.0	35.3	11.9	64.7	22.6	5.2
Sweden	SWE	1.95	1.91	15.6	2.6	10.0	5.9	53.5	14.2	46.5	13.7	6.7
Switzerland	CHE	2.56	2.68	22.7	7.4	30.6	3.2	48.6	17.7	51.4	21.4	10.5
Turkey	TUR	1.00	1.50	3.1	6.0	15.2	4.0	32.3	13.8	67.7	20.9	3.6
United Kingdom	GBR	5.43	7.24	57.6	6.0	50.9	13.2	49.4	17.6	50.6	14.6	4.7
United States	USA	11.67	18.01	22.7	64.2	109.6	17.7	40.8	11.3	59.2	11.6	1.4

Source: Authors' calculations

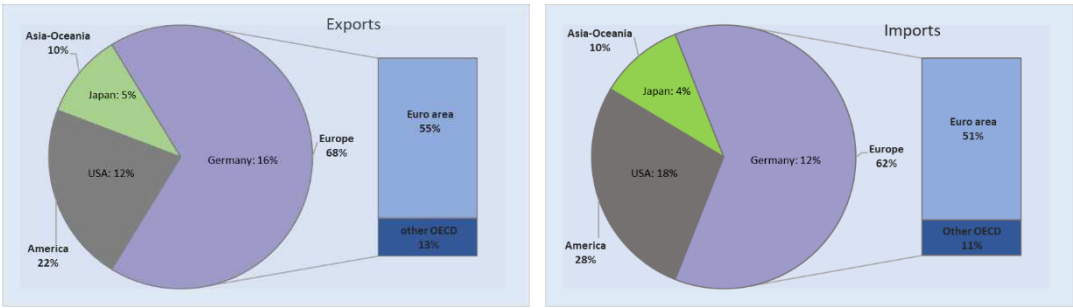
Figure 1-A: Comparison of estimated values of trade misinvoicing for overall OECD in millions of US$ (2006-2016)



Notes: MISXo and MISXu denote export over- and under-invoicing; MISMo and MISMu refer to import over- and under-invoicing.

Source: Authors' calculations based on UN COMTRADE and IMF DOTS databases.

Figure 2-A: Trade in goods by region in % of total OECD trade, on average (2006-2016).



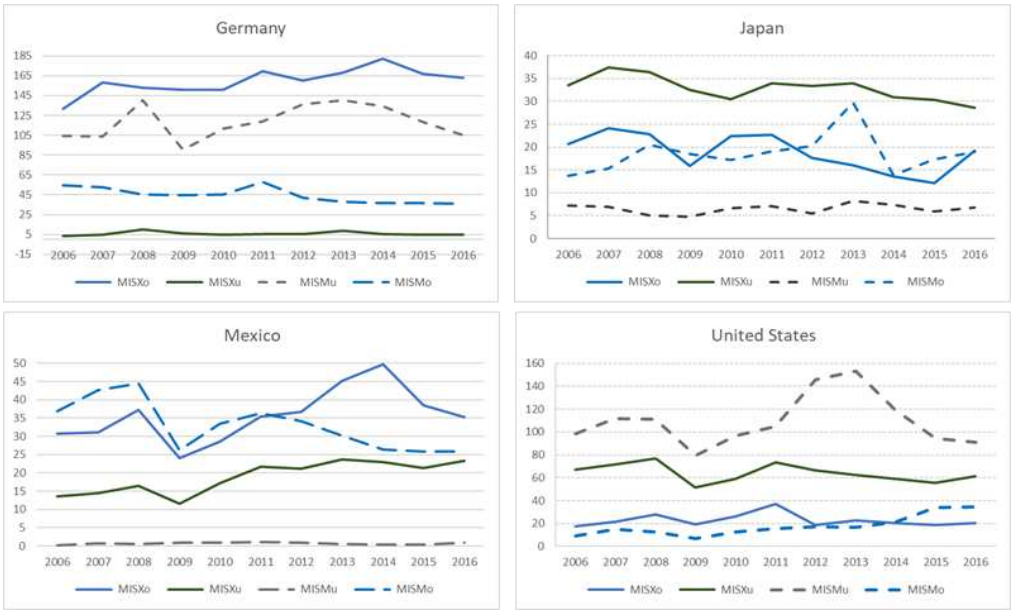
Notes: Geographical regions are defined according to the UNCTAD STAT classification as follows: America (Canada, Chile, Mexico, USA); Asia-Oceania (Australia, Israel, Japan, Korea Rep., Turkey, New Zealand); Euro area (Austria, Belgium, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia, Spain, UK); Other-OECD (Czech Rep., Denmark, Hungary, Iceland, Norway, Poland, Sweden, Switzerland).
Source: Authors' calculations based on trade statistics from the WITS database.

Table 2-A: Official Development Assistance and export overinvoicing in Gross National Income (per cent) for 2016

DAC Members	ODA	MISXo	ODA/GNI	MISXo/GNI
	(current US$ bn)	(current US$ bn)	(%)	(%)
Australia	3.28	4.69	0.28	0.40
Austria	1.64	18.68	0.42	4.78
Belgium	2.30	102.93	0.50	22.25
Canada	3.93	10.06	0.26	0.67
Czech Republic	0.26	27.50	0.14	15.12
Denmark	2.37	10.07	0.75	3.20
Finland	1.06	1.15	0.44	0.48
France	9.62	36.34	0.38	1.45
Germany	24.74	162.76	0.70	4.60
Greece	0.37	2.57	0.19	1.32
Hungary	0.20	14.01	0.17	11.73
Iceland	0.06	1.02	0.29	5.00
Ireland	0.80	2.70	0.33	1.11
Italy	5.09	37.16	0.27	1.99
Japan	10.42	19.27	0.20	0.38
Korea	2.25	9.81	0.16	0.69
Luxembourg	0.39	0.74	0.98	1.85
Netherlands	4.97	55.05	0.65	7.17
New Zealand	0.44	0.29	0.25	0.16
Norway	4.38	12.40	1.12	3.17
Poland	0.66	19.48	0.15	4.30
Portugal	0.34	7.95	0.17	3.97
Slovak Republic	0.11	14.35	0.12	16.41
Slovenia	0.08	4.25	0.19	9.82
Spain	4.28	27.93	0.35	2.26
Sweden	4.89	16.19	0.94	3.11
Switzerland	3.58	31.74	0.54	4.75
United Kingdom	18.05	51.40	0.70	1.99
United States	34.41	20.23	0.18	0.11
Total	*144.96*	*722.73*		

Notes: Gross National Income (GNI) data were sourced from the World Development Indicators (World Bank) and export over-invoicing (MISXo) were estimated from the representative sample of OECD countries (including only 29 members).
Source: Authors' calculations based on development financial data from the OECD-DAC and the UN COMTRADE database.

Figure 3-A: Trends in trade misinvoicing for selected countries, in billion US$(2006-2016)



Notes: MISXo and MISXu stand for export over-invoicing and under-invoicing respectively and MISMo and MISMu for import over-invoicing and under-invoicing.
Source: Authors' calculations.

Table 3-A: Bilateral intensity indexes of trade misinvoicing for Japan with selected trading partners (2006-2016)

		Exporter										
Trading partners		Japan										
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Strong Relations												
New Zealand	Mis Xij	93	151	25	217	110	69	289	110	207	61	147
	Mis Xij*	22	7	-4	-8	22	48	4	-8	-3	17	-21
	Intensity Index	*4.2*	*22.7*	*-6.2*	*-26.2*	*5.0*	*1.4*	*67.1*	*-13.7*	*-68.6*	*3.6*	*-7.0*
Korea Rep.	Mis Xij	-3,064	-3,197	-4,078	-2,339	-3,910	-4,065	-3,016	-1,941	-2,633	-2,334	-3,084
	Mis Xij*	-156	-325	-420	-63	-404	-354	-184	-176	-215	-98	-234
	Intensity Index	*19.7*	*9.8*	*9.7*	*37.4*	*9.7*	*11.5*	*16.4*	*11.0*	*12.2*	*23.9*	*13.2*
Mexico	Mis Xij	6,019	6,092	6,334	4,573	5,440	6,264	7,083	7,385	6,910	6,893	7,088
	Mis Xij*	-2,878	-3,019	-3,067	-1,552	-2,644	-2,647	-2,453	-1,939	-1,638	-1,486	-1,929
	Intensity Index	*-2.1*	*-2.0*	*-2.1*	*-2.9*	*-2.1*	*-2.4*	*-2.9*	*-3.8*	*-4.2*	*-4.6*	*-3.7*
United States	Mis Xij	-8,794	-9,785	-8,385	-5,847	-7,827	-7,167	-8,965	-8,563	-5,770	-3,638	-7,752
	Mis Xij*	2,251	2,516	2,176	2,527	685	965	3,709	4,158	2,345	1,505	-372
	Intensity Index	*-3.9*	*-3.9*	*-3.9*	*-2.3*	*-11.4*	*-7.4*	*-2.4*	*-2.1*	*-2.5*	*-2.4*	*20.9*
Germany	Mis Xij	7,002	7,360	6,695	6,287	6,285	8,136	6,442	6,034	5,042	4,925	5,407
	Mis Xij*	979	806	2,805	1,384	774	403	2,927	3,266	3,017	3,057	1,451
	Intensity Index	*7.2*	*9.1*	*2.4*	*4.5*	*8.1*	*20.2*	*2.2*	*1.8*	*1.7*	*1.6*	*3.7*
Weak relations												
Poland	Mis Xij	832	1,237	2,002	1,299	836	855	846	975	1,128	722	913
	Mis Xij*	1,007	1,265	1,079	1,180	1,332	1,612	1,802	1,592	1,878	1,925	1,952
	Intensity Index	*0.8*	*1.0*	*1.9*	*1.1*	*0.6*	*0.5*	*0.5*	*0.6*	*0.6*	*0.4*	*0.5*
Denmark	Mis Xij	-187	-119	-138	-16	-61	-21	-30	-21	-68	-73	-42
	Mis Xij*	251	55	117	242	184	137	167	180	255	257	199
	Intensity Index	*-0.7*	*-2.2*	*-1.2*	*-0.1*	*-0.3*	*-0.2*	*-0.2*	*-0.1*	*-0.3*	*-0.3*	*-0.2*
Italy	Mis Xij	-218	-61	-107	136	-427	1	68	-177	-251	-478	-1,160
	Mis Xij*	899	1,082	1,384	965	208	195	700	852	782	854	667
	Intensity Index	*-0.2*	*-0.1*	*-0.1*	*0.1*	*-2.1*	*0.0*	*0.1*	*-0.2*	*-0.3*	*-0.6*	*-1.7*
Luxembourg	Mis Xij	-72	-90	128	182	114	154	70	130	81	-190	95
	Mis Xij*	321	172	218	269	323	283	240	267	226	203	189
	Intensity Index	*-0.2*	*-0.5*	*0.6*	*0.7*	*0.4*	*0.5*	*0.3*	*0.5*	*0.4*	*-0.9*	*0.5*
Latvia	Mis Xij	-34	-43	-28	-11	-31	-29	-45	-37	-33	-32	-32
	Mis Xij*	52	78	49	40	45	54	68	107	96	90	70
	Intensity Index	*-0.7*	*-0.6*	*-0.6*	*-0.3*	*-0.7*	*-0.5*	*-0.7*	*-0.3*	*-0.3*	*-0.4*	*-0.5*
		Importer										
Trading partners		Japan										
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Strong Relations												
Australia	Mis Mij	942	1,610	479	1,578	909	-553	1,638	15,135	608	1,802	1,321
	Mis Mij*	-168	-154	-62	-96	-64	-52	-137	-653	-220	-155	-41
	Intensity Index	*-5.6*	*-10.5*	*-7.7*	*-16.4*	*-14.1*	*10.7*	*-12.0*	*-23.2*	*-2.8*	*-11.6*	*-32.6*
Mexico	Mis Mij	974	958	1,420	944	1,240	1,365	1,393	1,626	1,281	1,303	1,449
	Mis Mij*	152	172	533	324	-45	-46	116	699	122	207	105
	Intensity Index	*6.4*	*5.6*	*2.7*	*2.9*	*-27.9*	*-29.5*	*12.0*	*2.3*	*10.5*	*6.3*	*13.8*
France	Mis Mij	1,015	1,221	1,421	1,679	1,571	1,695	2,165	1,583	1,371	1,646	2,374
	Mis Mij*	-103	-112	272	211	69	483	529	704	-339	-74	206
	Intensity Index	*-9.8*	*-10.9*	*5.2*	*8.0*	*22.6*	*3.5*	*4.1*	*2.2*	*-4.0*	*-22.2*	*11.5*
Korea	Mis Mij	-1,690	-1,546	-1,456	-1,786	-2,176	-3,487	-1,949	-2,096	-1,898	-1,206	-1,609
	Mis Mij*	-667	-434	-351	-220	-309	-268	-487	-55	-454	-170	-282
	Intensity Index	*2.5*	*3.6*	*4.2*	*8.1*	*7.0*	*13.0*	*4.0*	*38.3*	*4.2*	*7.1*	*5.7*
Iceland	Mis Mij	47	-83	-105	40	19	27	48	54	52	46	46
	Mis Mij*	2	26	42	17	15	15	-3	29	-4	2	18
	Intensity Index	*25.4*	*-3.2*	*-2.5*	*2.4*	*1.3*	*1.8*	*-17.7*	*1.9*	*-14.0*	*22.8*	*2.5*
Weak relations												
Austria	Mis Mij	17	-89	-55	154	11	-84	35	-117	-44	25	185
	Mis Mij*	419	385	678	399	309	319	296	432	143	254	467
	Intensity Index	*0.04*	*-0.23*	*-0.08*	*0.38*	*0.04*	*-0.26*	*0.12*	*-0.27*	*-0.31*	*0.10*	*0.40*
Slovakia	Mis Mij	41	55	59	78	61	86	61	64	69	53	93
	Mis Mij*	187	236	389	325	282	407	556	605	464	430	400
	Intensity Index	*0.22*	*0.23*	*0.15*	*0.24*	*0.21*	*0.21*	*0.11*	*0.11*	*0.15*	*0.12*	*0.23*
Czech Rep.	Mis Mij	-23	-62	-70	-39	-43	-5	-39	-145	-318	-233	-234
	Mis Mij*	444	491	804	533	583	842	953	872	702	794	758
	Intensity Index	*-0.05*	*-0.13*	*-0.09*	*-0.07*	*-0.07*	*-0.01*	*-0.04*	*-0.17*	*-0.45*	*-0.29*	*-0.31*
Germany	Mis Mij	-646	-251	1,014	166	164	-208	231	-1,209	-849	-502	-670
	Mis Mij*	2,843	3,599	4,199	4,688	3,939	4,496	4,799	5,569	3,808	4,518	4,614
	Intensity Index	*-0.23*	*-0.07*	*0.24*	*0.04*	*0.04*	*-0.05*	*0.05*	*-0.22*	*-0.22*	*-0.11*	*-0.15*
Luxembourg	Mis Mij	-1	-3	-9	-9	-7	-2	-22	-14	-3	-4	-2
	Mis Mij*	-153	-139	-188	-111	-101	-121	-131	-110	-136	-111	-83
	Intensity Index	*0.01*	*0.02*	*0.05*	*0.08*	*0.07*	*0.02*	*0.17*	*0.12*	*0.02*	*0.03*	*0.02*

Notes: MisXij and MisMij indicate export and import misinvoicing in values (in millions of US dollars), *i* being the country under study and *j* the partner. (*) denotes the hypothetical share.
Source: Authors' calculations.

Table 4-A: Bilateral intensity indexes of trade misinvoicing for Mexico with selected trading partners (2006-2016)

		Exporter										
Trading partners		Mexico										
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Strong Relations												
United States	Mis Xij	-29,859	-29,862	-35,552	-23,338	-27,721	-33,708	-35,827	-44,451	-48,812	-37,230	-33,158
	Mis Xij*	-3,783	-3,145	-3,876	-2,377	-2,786	-3,447	-2,427	-3,269	-6,583	-6,495	-5,195
	Intensity Index	*7.9*	*9.5*	*9.2*	*9.8*	*9.9*	*9.8*	*14.8*	*13.6*	*7.4*	*5.7*	*6.4*
Turkey	Mis Xij	202	277	282	238	314	448	430	552	530	566	508
	Mis Xij*	-284	-345	-353	-148	-49	-145	-133	-121	-178	-33	28
	Intensity Index	*-0.7*	*-0.8*	*-0.8*	*-1.6*	*-6.4*	*-3.1*	*-3.2*	*-4.6*	*-3.0*	*-17.1*	*18.0*
Canada	Mis Xij	8,955	9,572	9,774	6,295	10,801	14,120	14,609	15,505	15,357	13,873	14,648
	Mis Xij*	-2,680	-2,624	-2,913	-2,068	-2,746	-3,126	-3,643	-3,952	-4,271	-3,630	-3,181
	Intensity Index	*-3.3*	*-3.6*	*-3.4*	*-3.0*	*-3.9*	*-4.5*	*-4.0*	*-3.9*	*-3.6*	*-3.8*	*-4.6*
Austria	Mis Xij	144	173	230	153	218	250	217	198	215	324	76
	Mis Xij*	-112	-91	-262	77	229	38	260	89	43	313	-204
	Intensity Index	*-1.3*	*-1.9*	*-0.9*	*2.0*	*1.0*	*6.5*	*0.8*	*2.2*	*5.0*	*1.0*	*-0.4*
Weak relations												
Belgium	Mis Xij	239	462	774	491	452	565	566	788	555	1,293	1,626
	Mis Xij*	-2,059	-2,190	-3,025	-2,139	-2,267	-3,191	-3,485	-5,285	-3,812	-2,287	-2,416
	Intensity Index	*-0.12*	*-0.21*	*-0.26*	*-0.23*	*-0.20*	*-0.18*	*-0.16*	*-0.15*	*-0.15*	*-0.57*	*-0.67*
Israel	Mis Xij	-61	-77	-116	21	73	47	20	16	2	-46	-45
	Mis Xij*	-102	-121	-203	-218	-219	-308	-353	-367	-488	-361	-488
	Intensity Index	*0.59*	*0.63*	*0.57*	*-0.10*	*-0.34*	*-0.15*	*-0.06*	*-0.04*	*0.00*	*0.13*	*0.09*
Hungary	Mis Xij	-2	2	-62	44	-42	-288	-147	-51	-24	-31	-70
	Mis Xij*	-251	-239	-387	-306	-304	-362	-398	-349	-415	-308	-233
	Intensity Index	*0.01*	*-0.01*	*0.16*	*-0.14*	*0.14*	*0.79*	*0.37*	*0.15*	*0.06*	*0.10*	*0.30*
Portugal	Mis Xij	16	5	24	34	29	-7	40	10	15	-17	-8
	Mis Xij*	-212	-275	-385	-232	-210	-22	-73	-219	-323	-241	-197
	Intensity Index	*-0.07*	*-0.02*	*-0.06*	*-0.15*	*-0.14*	*0.32*	*-0.55*	*-0.04*	*-0.05*	*0.07*	*0.04*
Sweden	Mis Xij	3	-7	-5	1	16	12	-22	-23	-59	-59	-25
	Mis Xij*	-400	-514	-689	-445	-558	-763	-931	-858	-859	-672	-596
	Intensity Index	*-0.01*	*0.01*	*0.01*	*0.00*	*-0.03*	*-0.02*	*0.02*	*0.03*	*0.07*	*0.09*	*0.04*
		Importer										
Trading partners		Mexico										
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Strong Relations												
Korea Rep.	Mis Mij	4,337	5,132	4,437	3,813	3,885	3,935	4,299	3,766	2,922	3,727	3,891
	Mis Mij*	240	480	444	168	373	457	111	151	75	154	-34
	Intensity Index	*18.0*	*10.7*	*10.0*	*22.7*	*10.4*	*8.6*	*38.7*	*24.9*	*38.9*	*24.3*	*-113.2*
Japan	Mis Mij	6,019	6,092	6,334	4,573	5,440	6,264	7,083	7,385	6,910	6,893	7,088
	Mis Mij*	918	1,091	1,015	55	506	321	-74	-440	-635	-655	-200
	Intensity Index	*6.6*	*5.6*	*6.2*	*82.4*	*10.8*	*19.5*	*-95.3*	*-16.8*	*-10.9*	*-10.5*	*-35.5*
United States	Mis Mij	16,287	20,570	20,253	7,071	13,633	14,932	10,851	6,125	3,243	1,995	3,808
	Mis Mij*	1,012	1,517	1,574	373	611	442	-493	-850	-1,360	-1,186	-1,227
	Intensity Index	*16.1*	*13.6*	*12.9*	*19.0*	*22.3*	*33.8*	*-22.0*	*-7.2*	*-2.4*	*-1.7*	*-3.1*
New Zealand	Mis Mij	67	71	110	93	116	107	108	127	113	92	46
	Mis Mij*	12	33	28	-10	-6	4	-5	-16	-48	-50	-46
	Intensity Index	*5.8*	*2.1*	*4.0*	*-9.2*	*-18.5*	*26.0*	*-21.5*	*-8.2*	*-2.4*	*-1.8*	*-1.0*
Canada	Mis Mij	3,830	3,946	4,579	3,932	4,427	4,923	4,499	4,569	5,215	4,992	4,153
	Mis Mij*	1,647	1,946	1,965	706	973	1,112	2,137	1,727	481	377	283
	Intensity Index	*2.3*	*2.0*	*2.3*	*5.6*	*4.6*	*4.4*	*2.1*	*2.6*	*10.9*	*13.3*	*14.7*
Weak relations												
Poland	Mis Mij	90	103	38	89	71	97	111	238	394	477	261
	Mis Mij*	818	1,017	1,299	934	1,045	1,141	950	1,097	1,075	1,024	883
	Intensity Index	*0.11*	*0.10*	*0.03*	*0.10*	*0.07*	*0.08*	*0.12*	*0.22*	*0.37*	*0.47*	*0.30*
Norway	Mis Mij	193	174	120	55	141	47	37	60	33	76	46
	Mis Mij*	758	1,054	1,512	348	561	773	855	837	592	331	317
	Intensity Index	*0.25*	*0.17*	*0.08*	*0.16*	*0.25*	*0.06*	*0.04*	*0.07*	*0.06*	*0.23*	*0.15*
Netherlands	Mis Mij	-20	452	801	79	-11	43	-209	681	143	587	-82
	Mis Mij*	3,159	3,824	4,549	2,969	3,669	2,239	3,447	2,782	2,920	2,813	1,862
	Intensity Index	*-0.01*	*0.12*	*0.18*	*0.03*	*0.00*	*0.02*	*-0.06*	*0.24*	*0.05*	*0.21*	*-0.04*
Slovakia	Mis Mij	20	-4	-42	9	24	29	47	89	91	62	127
	Mis Mij*	375	497	614	413	470	608	733	737	731	677	615
	Intensity Index	*0.05*	*-0.01*	*-0.07*	*0.02*	*0.05*	*0.05*	*0.06*	*0.12*	*0.12*	*0.09*	*0.21*
Belgium	Mis Mij	-86	-261	-368	-373	-375	-483	-494	-548	-342	-160	-309
	Mis Mij*	4,435	5,108	5,515	4,090	4,711	5,183	5,045	6,251	4,781	4,619	4,633
	Intensity Index	*-0.02*	*-0.05*	*-0.07*	*-0.09*	*-0.08*	*-0.09*	*-0.10*	*-0.09*	*-0.07*	*-0.03*	*-0.07*

Notes: MisXij and MisMij indicate export and import misinvoicing in values (in millions of US dollars), *i* being the country under study and *j* the partner. (*) denotes the hypothetical share.
Source: Authors' calculations.

Table 5-A: Bilateral intensity indexes of trade misinvoicing for the United States with selected trading partners (2006-2016)

		Exporter										
Trading partners		**United States**										
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Strong Relations												
Chile	Mis Xij	-606	-460	-504	-1,419	-837	-853	-292	-1,457	-2,190	-3,344	-2,266
	Mis Xij*	67	-22	-114	103	-86	-24	3	-154	30	331	208
	Intensity Index	*-9.1*	*21.1*	*4.4*	*-13.8*	*9.7*	*35.6*	*-96.8*	*9.5*	*-72.6*	*-10.1*	*-10.9*
New Zealand	Mis Xij	10	65	531	461	173	42	307	436	508	523	480
	Mis Xij*	147	107	68	-36	117	173	69	-24	-53	-13	-19
	Intensity Index	*0.1*	*0.6*	*7.8*	*-13.0*	*1.5*	*0.2*	*4.4*	*-18.5*	*-9.5*	*-40.4*	*-25.1*
United Kingdom	Mis Xij	7,293	9,698	8,992	5,502	7,688	6,231	7,375	8,309	6,919	4,299	4,392
	Mis Xij*	344	3,395	5,194	2,305	768	1,356	6,484	5,593	3,480	3,374	4,977
	Intensity Index	*21.2*	*2.9*	*1.7*	*2.4*	*10.0*	*4.6*	*1.1*	*1.5*	*2.0*	*1.3*	*0.9*
Switzerland	Mis Xij	-3,663	-6,527	-10,529	-7,160	-9,361	-11,892	1,031	554	3,203	1,437	4,591
	Mis Xij*	2,505	3,179	4,102	3,618	5,130	9,408	47	1,610	1,288	1,999	1,434
	Intensity Index	*-1.5*	*-2.1*	*-2.6*	*-2.0*	*-1.8*	*-1.3*	*22.1*	*0.3*	*2.5*	*0.7*	*3.2*
Japan	Mis Xij	7,482	7,732	10,330	8,008	7,173	8,307	6,593	5,667	5,108	5,127	5,789
	Mis Xij*	-1,266	-1,559	-2,884	-2,843	-3,056	-3,594	-3,643	-4,843	-2,905	-3,570	-3,227
	Intensity Index	*-5.9*	*-5.0*	*-3.6*	*-2.8*	*-2.3*	*-2.3*	*-1.8*	*-1.2*	*-1.8*	*-1.4*	*-1.8*
Weak relations												
Sweden	Mis Xij	120	239	82	60	-47	-5	-60	60	-220	-84	-39
	Mis Xij*	1,063	765	384	76	-177	-567	-674	-295	-167	-299	-179
	Intensity Index	*0.11*	*0.31*	*0.21*	*0.78*	*0.26*	*0.01*	*0.09*	*-0.20*	*1.32*	*0.28*	*0.22*
Luxemboug	Mis Xij	53	-195	-340	-507	-421	-90	15	-4	75	355	-141
	Mis Xij*	873	519	645	730	919	837	782	865	748	659	666
	Intensity Index	*0.06*	*-0.38*	*-0.53*	*-0.69*	*-0.46*	*-0.11*	*0.02*	*0.00*	*0.10*	*0.54*	*-0.21*
Estonia	Mis Xij	18	83	103	29	68	4	23	63	71	54	86
	Mis Xij*	365	311	323	99	135	210	317	260	267	300	319
	Intensity Index	*0.05*	*0.27*	*0.32*	*0.29*	*0.51*	*0.02*	*0.07*	*0.24*	*0.27*	*0.18*	*0.27*
Poland	Mis Xij	644	137	198	948	1,248	1,352	1,365	1,465	1,489	1,285	1,731
	Mis Xij*	2,935	3,668	3,365	3,165	3,953	4,800	5,789	5,152	6,256	6,352	6,771
	Intensity Index	*0.22*	*0.04*	*0.06*	*0.30*	*0.32*	*0.28*	*0.24*	*0.28*	*0.24*	*0.20*	*0.26*
Slovakia	Mis Xij	75	-52	350	391	310	388	340	408	438	415	450
	Mis Xij*	685	1,028	838	1,340	1,861	2,359	2,250	1,809	1,995	1,960	2,434
	Intensity Index	*0.11*	*-0.05*	*0.42*	*0.29*	*0.17*	*0.16*	*0.15*	*0.23*	*0.22*	*0.21*	*0.18*
		Importer										
Trading partners		**United States**										
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Strong Relations												
Mexico	Mis Mij	-29,859	-29,862	-35,552	-23,338	-27,721	-33,708	-35,827	-44,451	-48,812	-37,230	-33,158
	Mis Mij*	-5,455	-5,751	-5,107	-4,811	-7,656	-8,144	-11,234	-10,511	-7,857	-7,752	-8,402
	Intensity Index	*5.5*	*5.2*	*7.0*	*4.9*	*3.6*	*4.1*	*3.2*	*4.2*	*6.2*	*4.8*	*3.9*
United Kingdom	Mis Mij	-9,823	-12,468	-10,859	-8,891	-12,582	-15,492	-12,168	-13,469	-11,652	-15,847	-11,429
	Mis Mij*	6,648	-5,222	-6,311	-4,358	-1,756	2,208	-6,254	-7,687	-3,035	1,729	1,150
	Intensity Index	*-1.5*	*2.4*	*1.7*	*2.0*	*7.2*	*-7.0*	*1.9*	*1.8*	*3.8*	*-9.2*	*-9.9*
Estonia	Mis Mij	-146	-214	-403	-362	112	-297	-720	-249	-311	-206	471
	Mis Mij*	-288	-76	93	47	-33	-168	79	-38	-228	65	-139
	Intensity Index	*0.5*	*2.8*	*-4.3*	*-7.7*	*-3.4*	*1.8*	*-9.1*	*6.6*	*1.4*	*-3.2*	*-3.4*
Germany	Mis Mij	-15,088	-12,714	-12,621	-8,988	-10,366	-11,552	-12,981	-14,920	-13,650	-10,956	-12,908
	Mis Mij*	-7,508	-7,350	-11,471	-2,267	-5,473	-5,684	-12,307	-13,898	-3,757	4,398	3,999
	Intensity Index	*2.0*	*1.7*	*1.1*	*4.0*	*1.9*	*2.0*	*1.1*	*1.1*	*3.6*	*-2.5*	*-3.2*
Canada	Mis Mij	-16,935	-21,860	-24,598	-12,910	-15,484	-19,634	-44,600	-45,111	-18,190	-11,246	-8,836
	Mis Mij*	-11,726	-10,647	-11,164	-8,487	-10,998	-11,274	-9,393	-10,512	-13,528	-10,427	-10,018
	Intensity Index	*1.4*	*2.1*	*2.2*	*1.5*	*1.4*	*1.7*	*4.7*	*4.3*	*1.3*	*1.1*	*0.9*
Weak relations												
Spain	Mis Mij	2	-140	-613	-518	-570	-590	-890	-921	-583	677	157
	Mis Mij*	-5,056	-4,545	-5,123	-3,026	-4,263	-1,858	-4,221	-4,117	-2,663	-1,336	-860
	Intensity Index	*0.00*	*0.03*	*0.12*	*0.17*	*0.13*	*0.32*	*0.21*	*0.22*	*0.22*	*-0.51*	*-0.18*
Turkey	Mis Mij	188	274	183	256	256	381	115	421	716	1,198	1,109
	Mis Mij*	-2,688	-2,856	-2,656	-1,944	-2,503	-3,214	-3,649	-4,193	-4,077	-3,701	-3,905
	Intensity Index	*-0.07*	*-0.10*	*-0.07*	*-0.13*	*-0.10*	*-0.12*	*-0.03*	*-0.10*	*-0.18*	*-0.32*	*-0.28*
New Zealand	Mis Mij	161	75	55	97	86	7	-177	-54	-22	146	253
	Mis Mij*	-907	-875	-925	-758	-911	-921	-1,060	-1,020	-1,055	-906	-848
	Intensity Index	*-0.18*	*-0.09*	*-0.06*	*-0.13*	*-0.09*	*-0.01*	*0.17*	*0.05*	*0.02*	*-0.16*	*-0.30*
Luxemboug	Mis Mij	51	106	80	-2	55	-83	102	113	245	160	64
	Mis Mij*	-1,320	-1,270	-1,567	-969	-890	-992	-1,144	-1,227	-1,163	-1,072	-870
	Intensity Index	*-0.04*	*-0.08*	*-0.05*	*0.00*	*-0.06*	*0.08*	*-0.09*	*-0.09*	*-0.21*	*-0.15*	*-0.07*
Australia	Mis Mij	181	-275	-252	6	-435	-423	-1,008	488	-157	-9	-72
	Mis Mij*	-2,891	-3,004	-3,435	-2,811	-2,941	-3,264	-4,683	-7,545	-3,577	-2,982	-2,194
	Intensity Index	*-0.06*	*0.09*	*0.07*	*0.00*	*0.15*	*0.13*	*0.22*	*-0.06*	*0.04*	*0.00*	*0.03*

Notes: MisXij and MisMij indicate export and import misinvoicing in values (in millions of US dollars), *i* being the country under study and *j* the partner. (*) denotes the hypothetical share.
Source: Authors' calculations.

Table 6-A: Bilateral intensity indexes of trade misinvoicing for Germany with selected trading partners (2006-2016)

		Exporter										
Trading partners		Germany										
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Strong Relations												
France	Mis Xij	-28,392	-36,202	-36,617	-34,074	-26,138	-30,712	-26,562	-27,124	-30,841	-26,540	-24,717
	Mis Xij*	222	-1,582	537	-1,134	-2,007	-2,922	-3,120	-1,424	-1,798	-1,365	-1,914
	Intensity Index	*-127.9*	*22.9*	*-68.2*	*30.1*	*13.0*	*10.5*	*8.5*	*19.1*	*17.2*	*19.4*	*12.9*
Poland	Mis Xij	-9,083	-13,737	-14,005	-13,758	-16,071	-18,278	-17,323	-16,187	-20,583	-18,859	-19,599
	Mis Xij*	-225	-278	-851	-596	198	544	1,373	702	1,436	1,714	2,230
	Intensity Index	*40.3*	*49.3*	*16.5*	*23.1*	*-81.3*	*-33.6*	*-12.6*	*-23.0*	*-14.3*	*-11.0*	*-8.8*
Luxembourg	Mis Xij	-947	-780	-596	-2,229	-2,870	-2,994	-2,195	-2,028	-1,874	-1,657	-1,731
	Mis Xij*	268	-174	61	213	395	183	55	191	52	66	90
	Intensity Index	*-3.5*	*4.5*	*-9.8*	*-10.5*	*-7.3*	*-16.3*	*-40.0*	*-10.6*	*-35.8*	*-25.0*	*-19.3*
Netherlands	Mis Xij	-7,611	-8,660	-4,703	-8,747	-12,776	-20,242	-18,061	-17,910	-20,838	-21,392	-20,810
	Mis Xij*	501	-797	-1,617	-4,269	-2,330	860	-1,835	-2,577	-3,645	-3,114	-421
	Intensity Index	*-15.2*	*10.9*	*2.9*	*2.0*	*5.5*	*-23.5*	*9.8*	*6.9*	*5.7*	*6.9*	*49.5*
Finland	Mis Xij	-2,854	-3,752	-2,672	-1,783	-2,132	-1,360	-2,050	-2,174	-2,398	-1,786	-2,301
	Mis Xij*	82	-246	-91	-540	-281	-1,216	-88	-330	-551	-359	-309
	Intensity Index	*-34.7*	*15.2*	*29.4*	*3.3*	*7.6*	*1.1*	*23.4*	*6.6*	*4.4*	*5.0*	*7.4*
Weak relations												
Canada	Mis Xij	1,747	2,064	2,935	2,255	2,432	2,618	2,725	3,088	2,812	2,475	2,423
	Mis Xij*	-14,325	-16,199	-15,724	-14,032	-15,923	-17,880	-17,660	-18,128	-19,112	-16,975	-16,272
	Intensity Index	*-0.12*	*-0.13*	*-0.19*	*-0.16*	*-0.15*	*-0.15*	*-0.15*	*-0.17*	*-0.15*	*-0.15*	*-0.15*
Korea	Mis Xij	-330	331	902	145	-589	-880	-1,063	-1,512	-1,475	-832	-2,120
	Mis Xij*	-4,548	-5,938	-5,902	-5,686	-6,510	-7,372	-6,631	-6,843	-7,783	-6,870	-6,206
	Intensity Index	*0.07*	*-0.06*	*-0.15*	*-0.03*	*0.09*	*0.12*	*0.16*	*0.22*	*0.19*	*0.12*	*0.34*
Mexico	Mis Xij	1,396	1,673	2,611	2,764	1,882	2,273	2,062	1,513	1,663	1,645	1,333
	Mis Xij*	-13,797	-16,106	-16,106	-12,356	-14,625	-16,618	-16,079	-15,913	-16,564	-15,857	-15,368
	Intensity Index	*-0.10*	*-0.10*	*-0.16*	*-0.22*	*-0.13*	*-0.14*	*-0.13*	*-0.10*	*-0.10*	*-0.10*	*-0.09*
Australia	Mis Xij	171	542	478	-163	-399	-645	-449	-504	311	-104	-38
	Mis Xij*	-4,267	-5,442	-5,408	-4,545	-5,388	-5,049	-5,654	-4,545	-5,335	-4,660	-4,981
	Intensity Index	*-0.04*	*-0.10*	*-0.09*	*0.04*	*0.07*	*0.13*	*0.08*	*0.11*	*-0.06*	*0.02*	*0.01*
Japan	Mis Xij	-646	-251	1,014	166	164	-208	231	-1,209	-849	-502	-670
	Mis Xij*	-8,985	-10,301	-11,636	-11,069	-11,326	-13,406	-13,269	-13,607	-11,739	-10,905	-10,914
	Intensity Index	*0.07*	*0.02*	*-0.09*	*-0.01*	*-0.01*	*0.02*	*-0.02*	*0.09*	*0.07*	*0.05*	*0.06*
		Importer										
Trading partners		Germany										
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Strong Relations												
Hungary	Mis Mij	-3,887	-4,256	-5,211	-3,189	-3,691	-4,524	-4,140	-4,247	-4,297	-3,379	-3,239
	Mis Mij*	-53	39	-186	382	69	725	183	-83	-123	-302	-96
	Intensity Index	*72.9*	*-110.4*	*27.9*	*-8.4*	*-53.1*	*-6.2*	*-22.7*	*50.9*	*34.9*	*11.2*	*33.6*
Czech Rep.	Mis Mij	-5,387	-4,479	-8,111	-4,841	-6,534	-10,495	-11,169	-10,715	-11,323	-11,043	-9,691
	Mis Mij*	774	858	540	588	400	1,286	642	-93	432	733	703
	Intensity Index	*-7.0*	*-5.2*	*-15.0*	*-8.2*	*-16.3*	*-8.2*	*-17.4*	*114.8*	*-26.2*	*-15.1*	*-13.8*
Austria	Mis Mij	-8,067	-6,358	-8,097	-4,069	-4,618	-5,153	-5,438	-4,741	-5,899	-5,412	-5,664
	Mis Mij*	319	82	-330	-166	-781	-724	-1,605	-1,832	-1,697	-1,233	-236
	Intensity Index	*-25.3*	*-77.7*	*24.5*	*24.5*	*5.9*	*7.1*	*3.4*	*2.6*	*3.5*	*4.4*	*24.0*
Netherlands	Mis Mij	-29,779	-32,185	-46,062	-31,354	-36,873	-22,939	-36,258	-34,228	-32,232	-21,419	-15,216
	Mis Mij*	1,293	2,712	1,340	3,646	2,218	-3,750	-1,835	-4,161	-2,140	-692	-2,408
	Intensity Index	*-23.0*	*-11.9*	*-34.4*	*-8.6*	*-16.6*	*6.1*	*19.8*	*8.2*	*15.1*	*30.9*	*6.3*
Poland	Mis Mij	-5,447	-5,791	-8,175	-6,792	-6,666	-7,890	-6,143	-7,466	-7,681	-7,176	-6,232
	Mis Mij*	327	565	208	1,183	193	337	-1,081	-853	-758	-762	-899
	Intensity Index	*-16.7*	*-10.2*	*-39.3*	*-5.7*	*-34.5*	*-23.4*	*5.7*	*8.7*	*10.1*	*9.4*	*6.9*
Weak relations												
Turkey	Mis Mij	852	123	-127	675	454	934	989	1,162	1,097	1,214	1,460
	Mis Mij*	-1,438	-1,605	-2,040	-1,180	-1,678	-2,101	-2,272	-2,723	-2,818	-2,553	-2,589
	Intensity Index	*-0.59*	*-0.08*	*0.06*	*-0.57*	*-0.27*	*-0.44*	*-0.44*	*-0.43*	*-0.39*	*-0.48*	*-0.56*
New Zealand	Mis Mij	247	270	225	169	194	297	158	136	252	226	247
	Mis Mij*	-507	-511	-713	-511	-626	-600	-662	-659	-729	-618	-561
	Intensity Index	*-0.49*	*-0.53*	*-0.32*	*-0.33*	*-0.31*	*-0.49*	*-0.24*	*-0.21*	*-0.35*	*-0.37*	*-0.44*
Israel	Mis Mij	-74	127	21	245	349	417	327	214	247	308	222
	Mis Mij*	-497	-631	-938	-723	-930	-971	-1,445	-1,412	-1,075	-1,147	-796
	Intensity Index	*0.15*	*-0.20*	*-0.02*	*-0.34*	*-0.38*	*-0.43*	*-0.23*	*-0.15*	*-0.23*	*-0.27*	*-0.28*
Canada	Mis Mij	1,430	1,129	1,050	1,033	1,494	2,889	1,601	1,772	1,990	1,413	1,428
	Mis Mij*	-5,642	-5,041	-8,524	-4,915	-7,129	-6,672	-5,152	-6,199	-9,416	-7,581	-6,786
	Intensity Index	*-0.25*	*-0.22*	*-0.12*	*-0.21*	*-0.21*	*-0.43*	*-0.31*	*-0.29*	*-0.21*	*-0.19*	*-0.21*
Mexico	Mis Mij	472	544	620	853	876	1,187	622	1,058	943	1,073	1,307
	Mis Mij*	-2,202	-2,339	-3,860	-2,335	-4,813	-4,608	-6,624	-6,382	-5,530	-5,968	-5,791
	Intensity Index	*-0.21*	*-0.23*	*-0.16*	*-0.37*	*-0.18*	*-0.26*	*-0.09*	*-0.17*	*-0.17*	*-0.18*	*-0.23*

Notes: MisXij and MisMij indicate export and import misinvoicing in values (in millions of US dollars), *i* being the country under study and *j* the partner. (*) denotes the hypothetical share.
Source: Authors' calculations.

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