

# Trade Misinvoicing What can we Measure?

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## Trade Misinvoicing: What can we measure?

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### Abstract

The existing studies on trade misinvoicing have focussed on the discrepancy in reported trade statistics between developing and developed countries. The estimates based on such methods rely on the assumption that developed countries report their trade statistics correctly. In this paper, we provide evidence that trade misinvoicing between developed countries is in fact large and any estimate based on such method may not provide an accurate representation of the dimensions of trade misinvoicing in the world. Further, there is need to develop a methodology by which one can attribute the misinvoicing to one or the other trade partner. To address this problem, we offer an alternative methodology. Since the exports of a country are necessarily imports of another country we use domestic factors to predict the export and import misinvoicing for a sample of large misinvoicers for the period 1990 to 2014. Such estimates allow us to establish whether the discrepancy can be attributed to the export or the import side for all countries. We find that the domestic factors better explain the export side, therefore, allowing us to estimate illicit flows through trade misinvoicing using the export misinvoicing by all countries.

**Keywords:** illicit financial flows, misinvoicing, developing countries, corruption, tariffs, capital controls.

**JEL classification codes:** H26: Tax Evasion, H87: International Fiscal Issues; International Public Goods, F: International Economics trade misinvoicing, capital controls, corruption, tariffs.

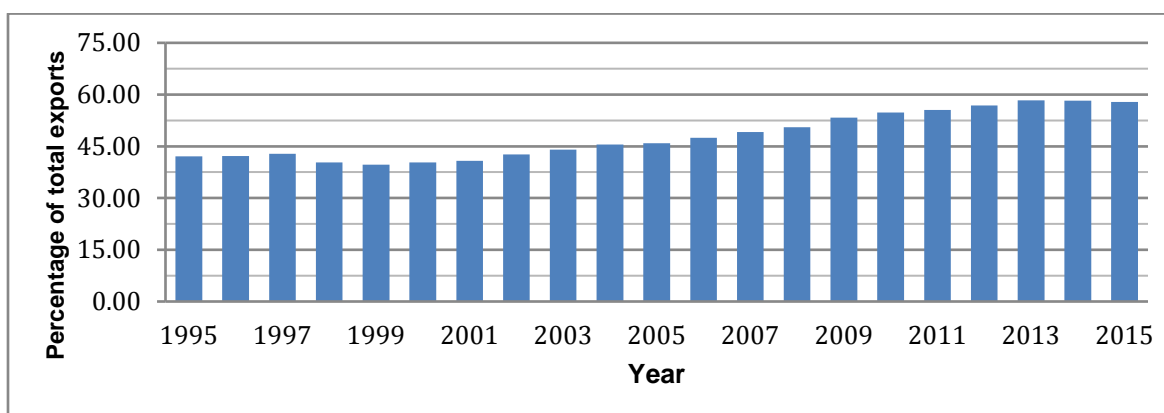
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## 1. Introduction

In the policy sphere, there is a considerable interest in the flow of funds between countries, especially if such flows are illicit. The study reports released by the Global Financial Integrity (GFI), for instance, continue to create headlines like “USD 1 trillion leaving poor nations annually”. A number of such studies have focused on trade between developing countries and developed countries and used *a priori* assumptions to attribute trade misinvoicing to developing countries. (Patnaik et al. 2010; Ndikumana and Boyce, 2008; Kar and Cartwright-Smith, 2010; Kar and Leblanc, 2013; and Kar and Spanjers, 2014).<sup>1</sup> If one seeks to understand misinvoicing in the world, there is a problem with making such assumptions. Misinvoicing is not limited to trade between developing and developed countries. If one examines the share of developing countries in their exports, it can be seen that it has increased over time (Figure 1) and is close to 60 per cent. With the higher share of trade among developing countries only a part of the misinvoicing is captured when estimated vis-à-vis developed countries.

**Figure 1: Share of exports by developing countries**

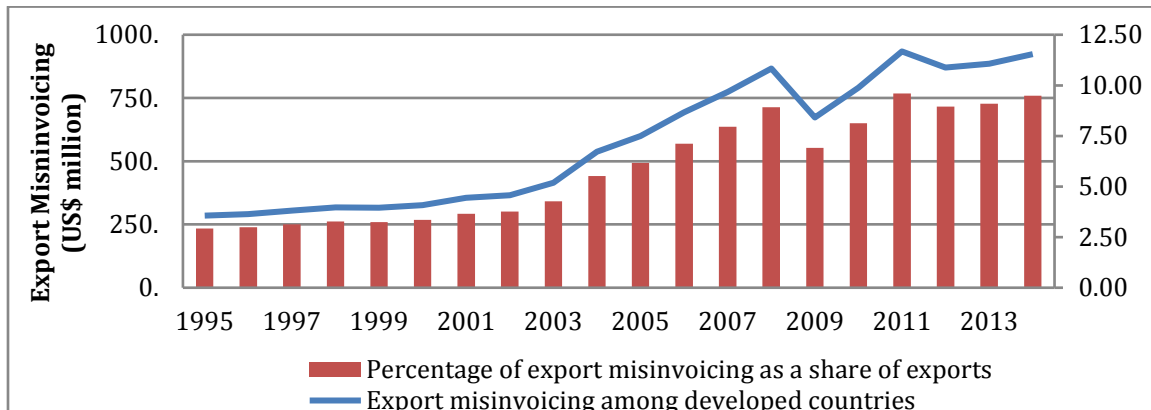


Source: Estimated from UNCTAD.

Further, to assume that developed countries report their trade statistics correctly would mean that any discrepancies in reporting were negligible, if not zero, for trade among developed countries. However, Figure 2 shows that misinvoicing of exports among developed countries has increased over time not just in absolute terms but also in terms of their share in total exports.

Lastly, even if the proportions and value of misinvoicing between developing and developed countries is compared with that of developed countries, it is observed (Table 1) that the latter is greater than the former. That is, developed countries tend to misinvoice trade to a greater extent than do developing countries in their trade with developed countries.

<sup>1</sup> Studies such as Farzanegan (2009), Kar and Freitas (2012), Jha and Nguyen (2014) and Kwaramba et al. (2016) provide country-specific estimates of trade misinvoicing where the discrepancy in trade statistics is assigned to the relevant country.

**Figure 2: Misinvoicing of exports among developed countries**


Source: UNCTAD

**Table 1: Export Misinvoicing by developed and developing countries (2014)**

Export Misinvoicing	Value (US\$ million)	% of total exports
Among developing countries	701	8.27
By developing countries with developed countries	37	0.44
Among developed countries	923	9.49
By developed countries with developing countries	424	4.36

Source: Computed from UNCTAD

Given these dimensions, if one seeks to expand the ambit of discussion to all countries, the axiomatic assignment of misinvoicing as in the above studies cannot be extended forward and hence there would be a need for an alternative method. Exploring such alternative methods is the objective of the present paper.

In developing the alternative method, one faces two problems: first, on what basis can one assign misinvoicing to a country and second, how to interpret the direction of flow of funds. These two issues are discussed in section 1 and then a possible methodology is developed and applied to illustrate the use. In section 2, the interpretation of direction of fund flow is presented while in section 3, the two alternative methodologies are developed based on the discussion in section 2. One of these methodologies is implemented taking a sample of countries and the results are presented in section 4. A discussion on the implication of and interpretation of the proposed methodology is in section 5.

## 2. Types of Misinvoicing

In simple terms, the statistical discrepancy between mirror trade statistics, adjusted for costs of transportation and insurance, is called misinvoicing in trade. For every country the export and imports can be misinvoiced and this can be measured as follows-

$$\text{export misinvoicing}_i = X_{ij} - (1 - c)M_{ji} \text{---(i)}$$

$$\text{import misinvoicing}_j = M_{ji}(1 - c) - X_{ij} \text{---(ii)}$$

Where  $X_{ij}$  is the export of goods by country i to country j and  $M_{ji}$  is the import of goods by country j from country i. 'c' refers to the costs<sup>2</sup> associated with freight, insurance and transportation.

From the above equations, it is possible to see that for exports as well as imports the discrepancy can either be positive or negative. That is, exports and imports can either be over or under invoiced. Therefore, there are four possible types of discrepancies that can be observed for an economy in any year. These are export over invoicing, export under invoicing, import over invoicing and import under invoicing. Each of these discrepancies is associated with either an inflow or an outflow. For example, when exports are over invoiced, it suggests that the country got more than its due flow of foreign exchange, in other words, it is an inflow into the country. On the other hand, if exports are under invoiced, it suggests that the due value for the export transaction was not remitted to the exporting country, i.e., resources that should have come to the country were being held elsewhere amounting to an outflow from the country in the form of goods/services. On the import side, import over-invoicing is when value of imports is higher than the value of the exports reported by the partner. This would mean an outflow of resources from the country beyond that required to procure the goods. On the other hand, if imports are under-invoiced, it would suggest that less than due amount was paid for the imports. If the transaction is financed by diverting flows from some other location or through some other channel, it would suggest that the country received an inflow of funds embodied in the goods received. Viewed from the perspective of a single country, this would appear to indicate clear direction of flows. From the discussion it is also clear that each of the discrepancy can for a country represent a flow on account of goods or a flow of funds. Table 2 summarises the implication of each of the discrepancies in terms of flows. This brings in another important issue relating to the interpretation of direction of fund flows as a result of trade misinvoicing. Taking any one pair of countries, the trade misinvoicing can be estimated for each of the countries, as represented in eq.s (i) and (ii).

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<sup>2</sup> The costs adjusted for here are normally taken to be 10 percent of the c.i.f values. The adjustment factor was reconfirmed by comparing c.i.f and f.o.b values across countries that report both these numbers for imports. While the trade numbers can be adjusted for such costs it is important to acknowledge that the discrepancy can be attributed to other factors such differences in timing and/or high sea sales and it is not possible to adjust for these factors since no information is available.

**Table 2: Direction of Flows through trade misinvoicing**

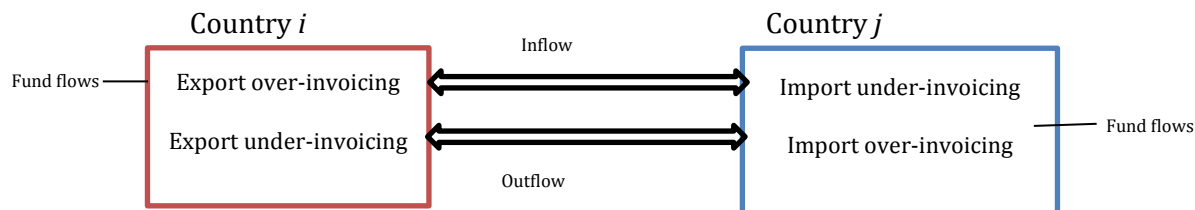
Type of Misinvoicing	Implication for fund flows
Export over-invoicing (EOI)	Inflows of funds
Export under-invoicing (EUI)	Outflows embodied in “goods”
Import over-invoicing (IOI)	Outflows of funds
Import under-invoicing (IUI)	Inflows embodied in “goods”

In the bilateral transaction represented in Table 2, since the export of country *j* is import of country *i* and likewise import of country *j* are exports by country *i*, the discrepancy measured using this method will give numbers for misinvoiced export for *i* and that of imports for *j*. Take for example, in case  $export\ misinvoicing_i > 0$ , i.e., there is export over-invoicing by *i*, then the discrepancy will be interpreted as an inflow to country *i* from country *j*.  $export\ misinvoicing_i > 0$ . This works on the assumption that country *j* reported correctly. On the other hand, if country *i* is assumed to report correctly, then for country *j*, the same discrepancy will amount to  $import\ misinvoicing_j < 0$ . Import under-invoicing as argued earlier means an inflow into country “*j*”. In this case too, therefore, the interpretation is an inflow into *j*. Now if we have to compute mis-invoicing for both these countries separately, we would interpret the results as suggesting inflows into both country “*i*” and country “*j*”.

Similarly, consider the case where export of country “*i*” is under-invoiced. It could also be interpreted as over-invoicing of imports of country “*j*”. In both these cases, the interpretation of flows would be an outflow from these countries. In the case of “*i*”, the outflow would be embodied in goods while in the case of country “*j*”, the outflow is of funds. If both these countries are subject to analysis of trade misinvoicing, as in the earlier example, it would appear that there is an outflow from both. Further, if one cumulates the flows across countries, there would be a gross over-estimation of the flows if both trade partners are part of the group being analysed.

A pictorial representation of the transaction in Figure 3 helps illustrate the aforementioned point more clearly.

**Figure 3: Implications of estimating trade misinvoicing for a pair of trading partners**



The exports by country  $i$  to  $j$  necessarily represent the imports by country  $j$  from  $i$ . Therefore, when the mirror statistics are compared for  $i$  and  $j$ , these can be used to measure discrepancy from either side i.e. for any of the two countries. As is shown in Figure 3, what is said to be export over-invoicing for country  $i$  also represents import under-invoicing for country  $j$ . The anomaly that this pair of transaction presents is that while for country  $i$  this represents an inflow of funds, for  $j$  it represents an inflow of goods (as was described in Table 2).

Therefore, for the analysis of global numbers of misinvoicing, it is essential to find a methodology by which to identify the side of the trade transaction to which the misinvoicing can be attributed to.

### 3. Exploring alternative methodologies

One can think of two alternative ways of analysing trade misinvoicing. First, since exports and imports are mirrors of each other, it is possible to argue that one or the other alone should be considered for analysing trade misinvoicing. This approach would avoid the problem of classifying both export over-invoicing and import under-invoicing as inflows.<sup>3</sup> Alternatively, from Table 2, it can be seen that certain forms of misinvoicing result in financial fund flows while the mirror transaction would result in a fund flow embedded in a commodity flow. For example, if a transaction is classified as export over-invoiced, it would mean that more funds in the form of cash flows entered the economy. On the other hand, if there is import under-invoicing, then there would be an inflow too but this would be in the form of goods, the value of which has been under-reported. This difference could be used to construct an alternative approach where only fund flows are cumulated to determine dimensions of trade misinvoicing.<sup>4</sup>

Both these methods should in principle provide similar estimates of the dimensions of trade misinvoicing across countries. Let us consider, for example, the estimates of fund flows measured through export misinvoicing.<sup>5</sup> Export misinvoicing can either be over-invoicing or under-invoicing, EUI and EOI, respectively. Since EOI represents an inflow and EUI represents an outflow, to get the total quantum of fund flows, one needs to consider the absolute value of the flows, or in other words.

$$\text{Exportmisinvoicing} = \sum_i \sum_j (EOI_{ij} + \text{abs}(EUI_{ij}))$$

$$\text{MisinvoicingthroughFundflows} = \sum_i \sum_j EOI_{ij} + \sum_i \sum_j (IOI_{ji})$$

<sup>3</sup> If both sides of the transaction are analysed and both trade partners are being analysed, this could result in double counting of flows.

<sup>4</sup> This approach is different from the GFI approach for instance, since it is not focusing on “outflows” but on “fund flows” which would include both inflows and outflows.

<sup>5</sup> Estimates for misinvoicing can be constructed through export misinvoicing or import misinvoicing. Here we consider export misinvoicing as an illustration.

$$Butabs(EUI_{ij}) = IOI_{ji}$$

$$\therefore \text{Exportmisinvoicing} = \sum_i \sum_j EOI_{ij} + \sum_i \sum_j (IOI_{ji})$$

$$\therefore \text{Exportmisinvoicing} = \text{MisinvoicingthroughFundflows}$$

Thus, to obtain the total value of fund flows, either of these approaches can be adopted. However, in identifying the quantum of fund flows into or out of individual countries, the two approaches would result in different attributions. If one considers export misinvoicing as shown in the example above, then the outflows corresponding to export under invoicing would be attributed to the exporting country. On the other hand, if one considers the fund flow approach, then the outflows are attributed to the importing country. Similarly, if one constructs the misinvoicing estimates using import misinvoicing, then for IUI which is a flow embedded in goods would be replaced by EOI, a financial flow. The attribution here would change from inflows into the importing country to inflows into the exporting country.

Since the second approach requires an artificial truncation of data at “0” by taking only export over-invoicing and import over-invoicing, it does not permit an analysis of individual countries. For instance, in a sample of 30 countries,<sup>6</sup> we identified for this study, if one uses the second approach, some countries appear to have fund flows in only a part of the sample period 1990-2014 (Table 3). Further, such an analysis also does not throw light on the variables that might induce a country to over invoice or under invoice. In this paper, therefore, with the objective of explaining the observed behaviour of misinvoicing, we adopt the first approach. At this point, we need to find out the side of the trade transaction that one should focus on.

**Table 3: Number of years for which country remains in the sample**

Number of years	Countries
25	Australia, Bahrain, Canada, Hong Kong, Denmark, France, Germany, Italy, Korea, Netherlands, Norway, Singapore, Spain, UAE, UK
20-24	Mexico, USA, Czech Republic
15-19	Russia, Belgium
10-14	India, Ireland, Indonesia, South Africa, China
1-4	Malaysia, Poland, Panama, Philippines, Switzerland

Trade misinvoicing could be induced by economic factors of either the exporting country or the importing country. For example, if say, the interest rate in the exporting country is higher than

<sup>6</sup> For a discussion on the selection of sample of countries please see section 4.



that in the rest of the world, trade misinvoicing could support an inflow into this country. The variables of the importing countries would be less relevant to explain this movement. Similarly, if the tariffs in a country are “too high”, then the imports into this country would be under-invoiced suggesting an illicit inflow into the country. Here, the variables of the exporting country would be less important in explaining the inflow. Using this argument, one can take domestic variables for countries being analysed and attempt to explain behaviour of both export misinvoicing and import misinvoicing for these countries. If the misinvoicing is being induced by the variables in the exporting country, then it means that the importing country would be reporting its trade statistics correctly and the exporting country would be mis-reporting and the result should be read as export misinvoicing. On the other hand, if misinvoicing is the result of variables in the importing country, then the exporting country would be reporting information correctly while the importing country would be misreporting and the result would be import misinvoicing.

Based on the above argument, one can attempt to explain both export misinvoicing and import misinvoicing separately, using the set of variables that are expected to affect misinvoicing. To the extent the variables are better at explaining one kind of misinvoicing, this could be one method for identifying the leg of transaction to be used for understanding misinvoicing.

Here it may be noted that while these methods attribute the misinvoicing to one or the other country, this is not the same as attributing misinvoicing to the agents in the country. To give an example, if one considers the interest rate example presented above, the higher interest rate could encourage agents outside the economy to bring money into the economy. These agents could be citizens and residents of the concerned economy or from any other economy. In other words, agents anywhere in the world could be responding to the opportunities arising out of the trends observed in the variables in any one economy. Thus, even after interpreting the transaction as export or import misinvoiced based on the proposed analysis, one should be cautious about assigning the ownership rights on such resources to the country concerned.

In what follows, we use estimates of trade misinvoicing on both exports and imports and attempt to explain the observed trends in terms of factors relevant to the country being analysed to see if the data throws up additional information on which part of the transaction to analyse.

#### **4. Explaining misinvoicing**

To address the problem of which side of an international trade transaction to study, we take the export as well as import misinvoicing by each of the countries and use country-specific factors to explain the variations in these estimates. It is proposed that if the country-specific factors are useful to explain one side better than the other side, this could be treated as evidence regarding which leg of the transaction is more closely influenced by domestic factors. The identification of the side of transaction that is better explained by domestic factor allows us to attribute that discrepancy to an economy which then can be used to estimate the overall size of flows by aggregating this side for all countries. However, it is important to note that the mere recognition of domestic factors does not suggest that the flows can be attributed to domestic agents. The decision to misinvoice for movement

of funds into or out of the economy can be that of domestic agents as well as foreign agents. Therefore, this exercise looks at finding domestic factors that predict export and import misinvoicing and the explanatory power of models facilitate the identification of the leg of transaction that can be better explained and should be focused on for policy discussions.

#### 4.1 Factors that influence trade misinvoicing

Trade misinvoicing has been associated with concepts of capital flight and illicit financial flows. Therefore, there are factors that affect each of these kinds of flows through the trade misinvoicing channel. Capital flight is a phenomenon that can result in official outflow of capital in response to adverse change in political and economic environment. Therefore, for capital to choose trade misinvoicing to move money out, the capital controls in place would have to be sufficiently high. Studies have shown that when loose capital controls exist for an economy, the flight of capital can take place through official channels (Hung, 2008). However, with sufficiently stringent controls capital may choose to move through the route of misinvoiced trade. For this reason for capital flight has been explored extensively in the literature and it is expected that this factor would affect fund flows through illicit channel as well (Cuddington, 1986; Kar and Freitas, 2012). To capture this dimension, capital controls were introduced to the equation for export and import misinvoicing. Capital controls can be imposed on inflows and outflows that in turn can be combined to get an overall index of control. These measures are used as explanatory variables to explain misinvoicing. It may be pertinent to mention that the controls on inflows and outflows have moved together over time and either can be used to capture the flight of capital associated with such controls.<sup>7</sup>

Funds flowing through trade misinvoicing could be influenced by factors such as real interest rate that represents the expected return from capital being deployed in the economy, as well as by corporate tax rates.

Interest rate differentials that indicate higher returns abroad are associated with capital flight from an economy. That is, for higher interest rates in an economy the capital flight from the economy will be lower, since better returns are available to capital. Fofack and Ndikumana (2014) estimate the relationship between interest rates and capital flight for African countries. However, they find that the former has no significant impact on the latter. On the other hand, studies such as Patnaik et al. (2010) show that real interest rate differential has a significant impact on export misinvoicing by industrialised countries. In this paper, we check if the returns to capital, represented by the real interest rate, compel money to flow into or out of the economy.

A firm may misreport trade transactions to avoid payment of taxes or to avail generous incentives offered to exporters. These two effects work in the opposite directions. A higher corporate tax rate can either lead to inflated reported value of imports that are expenses in which case the value added or exports reported by the firm would also have to be commensurate with such imports. Following such argument, at higher rates of tax both exports and imports would be over-stated. On the other hand, a higher tax rate may lead to lower reported value of output and as a result lower value of input will have to be reported, so as to avoid raising suspicion. Therefore, two kinds of effects can

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<sup>7</sup> Check appendix for Figure A.1.

play out across countries. In order to explore this dimension, statutory corporate tax rate is selected as an explanatory variable.

Among the more traditional explanations of misinvoicing is the avoidance of customs tariff. For higher rates of tariff, a firm or an individual will have to pay higher customs for import of goods. Therefore, an increase in customs tariff is expected to result in under-reporting of imports. The simple mean of customs tariff on all products was taken as an explanatory variable in the import equation. In the context of imports, crude oil is the most significant item of import for most countries in the world. The volatility in crude oil prices adversely affects the trade balance of most countries. With a rise in crude oil prices there is a pressure from governments to cut down the import for fear of inflation and unmanageable current account deficits. While this is true, there exists a strong and growing lobby of refiners who cannot stop production in spite of such rise in prices. Therefore, imports could be affected in times of rising oil prices – one could witness imports being under invoiced. To incorporate such effects, world price of crude oil (brent) is taken as an explanatory variable.

The illicit component of trade misinvoicing is often associated with illegal activities which include bribes. Bribe money can flow through this channel in two alternative ways. . . It can either be money that is brought into the economy for greasing the palms of the officials that facilitate the procurement and execution of projects in that country or alternatively, payments received in the form of bribes can leave the economy for fear of confiscation. While corruption perception index is often used to capture this dimension, another way to proxy rent seeking is to look at the share of rent from natural resources in the GDP.<sup>8</sup> With higher shares of rents, the businesses that are engaged in exploration and production of natural resources may illegally extract more than what it is permitted and may as a result have to pay bribes. The illegal extraction will be undertaken in collusion with the state machinery. Therefore, the profits from such unaccounted production may be moved out through under-declared exports as may proceeds from bribe money. Therefore, the share of natural rents in GDP is included among the explanatory variables.

Some studies show that liberalisation of trade tends to reduce the level of corruption (Ades and Di Tella, 1999; Sung and Chu, 2003). However, the evidence of such a relation is shown to be weak (Pitt, 1981). While its link with corruption is one dimensional, the movement of goods and services across borders is a significant component of the external account. With the higher trade to GDP, which signals more trade transactions, the possibility of using the trade route to move money is larger, especially when the controls on capital are higher. To explore whether openness of trade can influence misinvoicing, the share of exports in GDP, imports in GDP as well as share of exports and imports of goods and services are taken as explanatory variables.

## 4.2 Data

In order to ascertain which side of the transaction is better explained by the factors discussed above two set of countries are selected. The first set of countries is selected on the basis of the size of

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<sup>8</sup> The analysis did introduce corruption perception index as an explanatory variable but it was not significant in any of the specifications.

misinvoicing undertaken by these countries. That is, the absolute values of export and import misinvoicing or gross flows were added for all countries for the year 2014 and of these top 30 were selected.<sup>9</sup> This group would be referred to as Top 30. To establish that the result is generalizable a different group of countries was selected on the basis of nominal GDP (in US \$ million) in 2014. In this group, all countries with GDP above US\$ 500 million were selected for the analysis. This group will be referred to as Large Economies. The equation for export and import misinvoicing are estimated for these two samples separately. It may be mentioned here that there is some overlap in the two samples (Figure 3).

Keeping in mind, the fact that there are differences in size of the economies, i.e., some countries though smaller in size have a higher value for misinvoicing, variables were normalised to make them comparable. For example, South Africa is relatively small country when considering GDP, however, it ranks 3<sup>rd</sup> in terms of size of export underinvoicing. Export and import misinvoicing are taken as a proportion of GDP for the purpose of estimating. The numbers for misinvoicing are estimated for the period 1990-2014 by comparing mirror trade statistics reported in Direction of Trade Statistics (DoTS) by the IMF<sup>10</sup>.

From the discussion in section 5.1 we identified some of the important factors that are expected to drive export and import misinvoicing. First, the index of capital controls, on inflows, outflows and overall were taken from the dataset prepared by Klein, Rebucci, Schindler and Uribe (2015).<sup>11</sup> The authors construct this data from IMF's Annual Report on Exchange Rate Arrangements and Restrictions (AREAER). The share of rent from natural resources in GDP is taken from World Bank's World Development Indicators. The variable captures the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. The data for corporate tax rate represents the top statutory rate and has been taken from the Centre for Business Taxation's tax database and updated for some countries where information was not available using IBFD's tax news service and KPMG's corporate tax rate data. Customs tariff represents the simple average of rates on all products as reported in the World Development Indicators released by the World Bank. As for real interest rate, it is the lending interest rate adjusted for inflation as measured by the GDP deflator. The variable crude price represents the annual average of spot crude oil (brent) price taken from the Global Economic Monitor (GEM) Commodities database of the World Bank. Lastly, keeping with the common practice,<sup>12</sup> the indicator for trade openness has been constructed using the ratio of exports and imports of goods and services to GDP. Alternatively, export of goods and services and import of goods and services as a percentage of GDP were introduced as measures of openness in the equations for export and import misinvoicing. These too have been taken from World Bank's world development indicators.

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<sup>9</sup> Australia, Bahrain, Canada, Hong Kong, Denmark, France, Germany, Italy, Korea, Netherlands, Norway, Singapore, Spain, UAE, UK, Mexico, USA, Czech Republic, Russia, Belgium, India, Ireland, Indonesia, South Africa, China, Malaysia, Poland, Panama, Philippines, Switzerland.

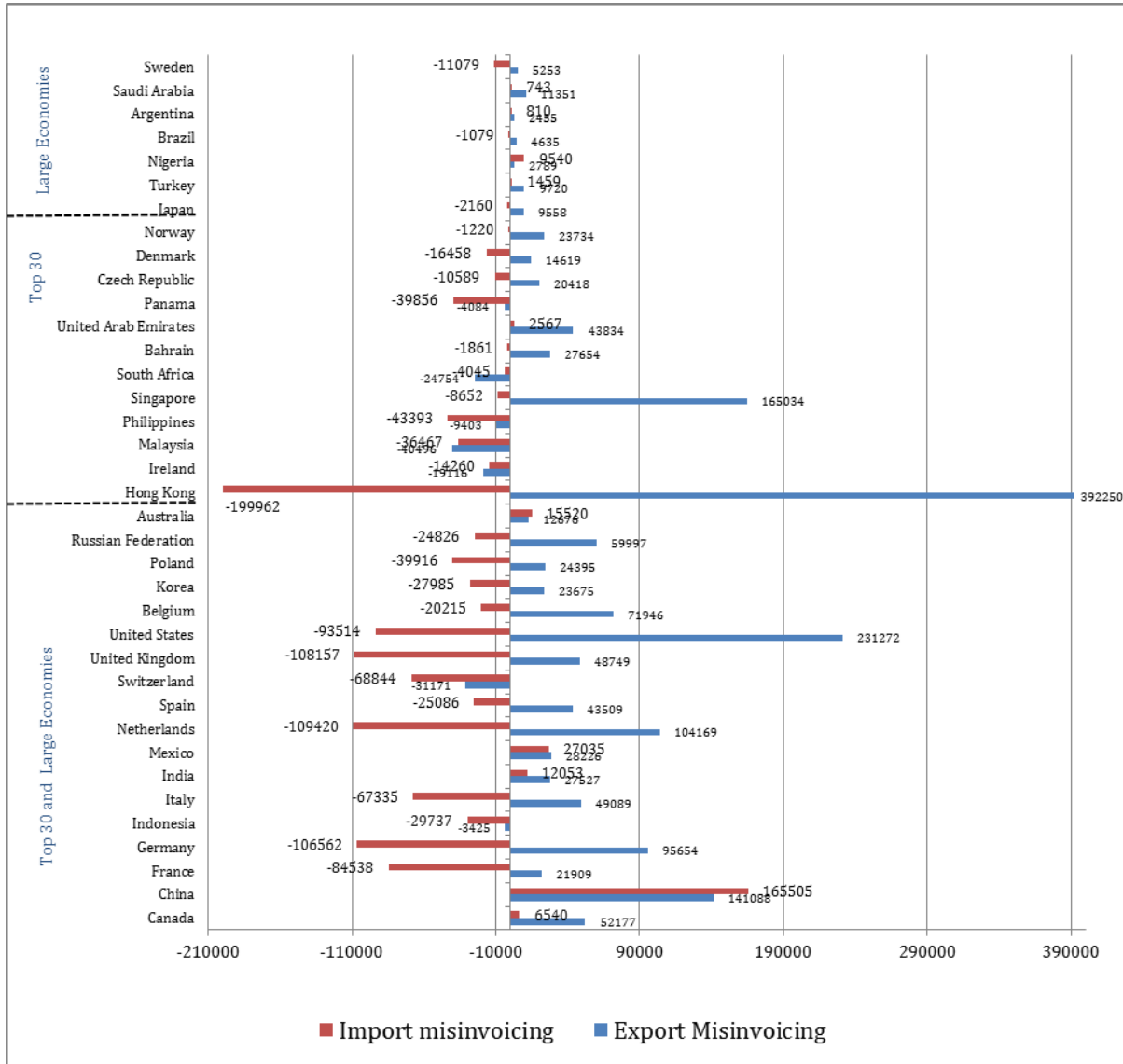
<sup>10</sup> Data last accessed in August 2015

<sup>11</sup> Klein, Rebucci, Schindler and Uribe (2015) "Capital Control Measures: A New Dataset"

<sup>12</sup> WITS uses this as the measure for openness.

To begin with, to give an overall sense of the dimensions of trade misinvoicing by the selected countries, in Figure 3, we present export and import misinvoicing in 2014 for all the selected countries.

**Figure 3: Export and Import Misinvoicing in 2014 by selected countries**



Source: Estimated from DoTS, IMF

As can be seen from the figure above, the value of misinvoicing varies largely across countries and though for a country the numbers may be small in comparison to other countries it may account for large proportion of the GDP. Further, the flows through misinvoicing could be in either direction, therefore, under and over-invoicing are taken for estimation.

### 4.3 Results

Using the variables discussed, the equations for export and import misinvoicing are estimated using panel random effects model, for the period 1990-2014. Based on tests, it was found that there is heteroskedasticity and autocorrelation (see Appendix Table A.1). The necessary correction for the two has been made in the estimations. The following equations (base scenario) have been estimated for export and imports:<sup>13</sup>

$$\frac{\text{export misinvoicing}}{\text{GDP}_{it}} = \alpha + \beta_1 \text{capital controlsoninflows}_{it} + \beta_2 \text{shareofrentfromnaturalresources}_{it} + \beta_3 \text{Tradeopeness}_{it} + \beta_4 \text{Realinterestraterate}_{it} + \beta_5 \text{corporatetaxrate}_{it} + u_{it}$$

$$\frac{\text{import misinvoicing}}{\text{GDP}_{it}} = \alpha + \beta_1 \text{capital controlsoninflows}_{it} + \beta_2 \text{shareofrentfromnaturalresources}_{it} + \beta_3 \text{Tradeopeness}_{it} + \beta_4 \text{Realinterestraterate}_{it} + \beta_5 \text{corporatetaxrate}_{it} + \beta_6 \text{worldpriceofbrentcrude} + \beta_7 \text{customstariff}_{it} + u_{it}$$

The results from different specifications are reported in Tables 4 to 7.

**Table 4: Estimated Equation for Export Misinvoicing for Top 30 economies**

	1	2	3	4	5	6
Corporate Tax Rate	-57.87			-54.88		
Capital controls on inflows	132.2	127.96		141.18	135.64	
Trade openness	2.12***	2.13***	1.98**			
Export by GDP				4.51	4.53	4.31
Real interest rate	-1.099	-0.95	-0.73	-0.88	-0.7	-0.33
Rent from natural resources	-2.54**	-2.24*	-2.25**	-3.61***	-3.27**	-2.99**
constant	-120.83	-138.31** *	-95.48	-140.76*	-156.57** *	-117.08
R squares	0.512	0.495	0.508	0.514	0.502	0.516

Notes: \* implies significant at 10%, \*\* at 5% and \*\*\* at 1%

<sup>13</sup> The specification is modified by selecting different combinations of variables as is shown in Table 4.

**Table 5: Estimated Equation for Export Misinvoicing for large economies**

Variable	1	2	3	4	5	6	7
export of goods and services as % of GDP	1.34*	1.11*	1.39**	1.17**			
trade openness					0.77*	0.63**	0.75***
Rent from natural resources	-0.93*	-0.63	-0.82**	-0.73**	-0.63	-0.37	-0.82**
Capital control on inflows	-12.29	-10.72			-15.49	-13.27	
corporate tax rate	68.2	49.4	30.44		100.9	66.26	30.44
real interest rate	0.02				0.02		
Constant	-30.1	-20.4	-27.7	-12.17	-44.86	-29.5	-26.7
R square	0.37	0.38	0.32	0.28	0.421	0.424	0.324

Notes: \* implies significant at 10%, \*\* at 5% and \*\*\* at 1%

**Table 6: Estimated Equation for Import Misinvoicing for Top 30 economies**

	1	2	3	4	5	6
Corporate Tax Rate	-357.9***	-292.4***	-164.27*	-283.6	-199.86	-8.36
Capital controls on inflows	1.48	15.33		24.36	35.46	
Trade openness	-1.64**	-1.57**	-1.26**			
Import by GDP				-0.96	-1.06	-0.7
Real interest rate	0.085			0.065		
Rent from natural resources	2.42	1.83	1.34	2.22	1.64	1.56
Tariff	-1.61	-1.78	-0.39	-1.3	-1.47	-0.123
crude price	-0.44*	-0.35**	-0.19*	-0.58	-0.45	-0.34
constant	198.34*	169.99	96.79	53.59	29.07	-17.22
R squares	0.097	0.097	0.095	0.015	0.01	0.02

Notes: \* implies significant at 10%, \*\* at 5% and \*\*\* at 1%

The primary purpose of estimation, as was mentioned at the end of the previous section, was to identify whether the export side or the import side is explained better by domestic factors. While the R squares cannot be compared across specifications the explanatory power of the model can be ascertained from the number of domestic factors that explain export and import misinvoicing. From the estimated models it can be seen that the domestic factors that explain export misinvoicing are consistent across specifications whereas that for imports varies across samples and specifications. Further, the R square for import misinvoicing is very poor in order to say that the misinvoicing is explained by domestic factors.

**Table 7: Estimated Equation for Import Misinvoicing for large economies**

Variables	1	2	3	4	5
Import/GDP	-1.42***	-1.16***			
Trade openness			-0.76***	-0.85***	-0.71***
Rent from natural resources	0.15		0.34	-0.17	
Capital control on inflows	-1.51		-3.4	2.4	
Corporate tax rate	30	5.55	18.77		
Real interest rate	-0.20	-0.2	-0.25*	-0.3**	-0.35**
Tariff	-0.40	-0.33	-0.46*	-0.5*	-0.45**
Crude price	-0.07	-0.08	-0.09	-0.7	-0.06
Constant	24.46	24.4	33.9*	44***	35.3***
R square	0.09	0.09	0.105	0.097	0.103

Notes: \* implies significant at 10%, \*\* at 5% and \*\*\* at 1%

One way to interpret this is that domestic factors play a greater role in driving misinvoicing through exports. The mirror image of this is the import misinvoicing and the discrepancy observed for imports is the result of the incentives driving misinvoicing of exports. Since imports are an accommodating entry in this sense, it would be affected by policy changes in partner countries. From this asymmetry in explaining export versus import misinvoicing, it follows that the measurement of flows through the export channel may be preferable since the causes contributing to this are identifiable. The results from Kellenberg and Levinson (2016) supports such an interpretation. Kellenberg and Levinson (2016) incorporate variables related to both exporting country and importing country in the analysis and shows that apart from import tariffs, in terms of regulatory variables, the effect of exporting country variables tend to have a significant effect of trade misinvoicing more often than those of the importing country.<sup>14</sup>

The second interesting result is that factors such as the customs tariff do not offer a consistent explanation for the extent of import misinvoicing. This result is expected since the average tariffs have declined over the period 1990-2014 across countries whereas the misinvoicing has not shown a similar trend. The other traditional explanation for misinvoicing is the need to circumvent capital controls. These too are found to be insignificant. Note that the controls on inflows and outflows have a similar impact and irrespective of what measure is used for estimation, it is found that the measure has no impact on export misinvoicing. Therefore, both these results allow one to question whether

<sup>14</sup> The study undertakes a pair-wise analysis of differences between exports and imports reported by trading partners including all countries. This analysis ignores the possibility of “high seas sales” distorting the picture on reported imports and exports.



traditional explanations for misinvoicing are relevant anymore.<sup>15</sup> Trade openness is found to have an impact on export and import misinvoicing. That is, higher degree of openness of the trade account leads to higher inflows.

There is support for the argument that there could be deliberate misreporting for the purpose of taking out money obtained from illegal sources, including bribe. Across specifications for export misinvoicing, the share of rent from natural resources in GDP is found to be significant and negative, suggesting that for higher rents earned in the economy will have higher outflows through trade misinvoicing.

Lastly, other than trade openness, corporate tax rate is the other variable that is found to be negative and significant in some specifications for import misinvoicing. That is for higher rates, imports are under-invoiced to a greater extent. Similarly, world crude oil price are found to be significant and has a negative coefficient across a few specifications implying that for higher crude prices the imports tend to be under-invoiced. While these variables are found to have an impact on import misinvoicing, it is clear that none of these are consistent.

## 5. Conclusions

The existing literature on trade misinvoicing has largely focussed on measuring misinvoicing of trade between developing and developed countries. However, since trade between developing countries as well as that between developed countries and misinvoicing therein are substantial components of global trade misinvoicing, the existing methodology is inadequate. This paper makes a compelling case to revisit the methodology and provides solutions that would allow one to generate a global number for the dimension of flows through this channel.

The existing literature implicitly works on an assumption of who reports their statistics correctly. Instead of making an assumption, this paper offers an alternative solution of taking one side or leg of the transaction. Further, the paper follows the lead from data, in which side of the transaction should be selected.

In order to be able to attribute misinvoicing to a country, the paper presents estimates of export and import misinvoicing. The estimated equations provide a consistent result which suggests that the export side is explained by domestic factors reasonably well while on the import side, the identified factors explain very little of the observed variation. Using this information, it appears reasonable to use export misinvoicing to measure global misinvoicing and to attribute it to different countries.

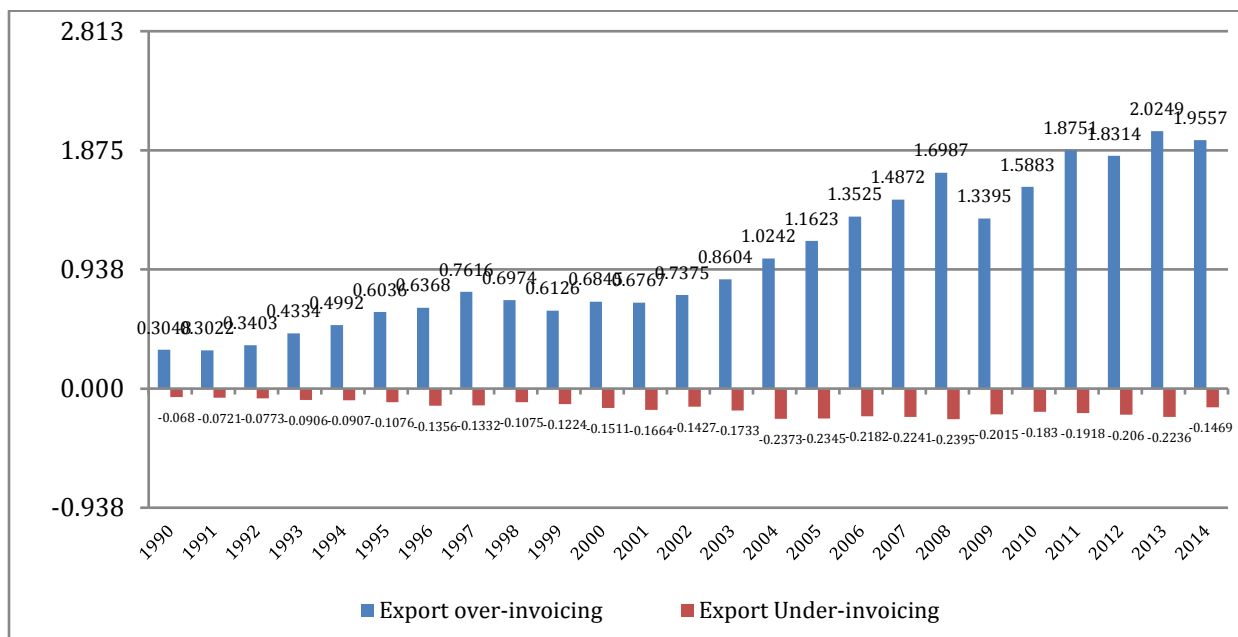
Going forward from here, it is important to understand how to interpret the numbers of trade misinvoicing. Export over-invoicing represents an inflow into the exporting country while export under-invoicing represents an outflow from the exporting country. Figure 5 shows the changes in the

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<sup>15</sup> This result is different from that in Kellenberg and Levinson (2016) where they used disaggregated data at the country level.

trends of export over and under invoicing across all countries. Interestingly, the figure shows that export over-invoicing is substantially higher in magnitude than export under invoicing, i.e., inflows are substantially higher than outflows. Further, to estimate global numbers the two, export over and under-invoicing, can be added across countries. This estimate gives the size of net flows through export misinvoicing. Since the over-invoicing dominates across years, there is an inflow throughout the period. However, if a measure of total flows through this channel are to be estimated the two should not be netted. Therefore, gross flows through export misinvoicing are estimated by adding the absolute values of outflows and inflows. The sum of absolute numbers for all countries gives us a global estimate. The gross flows for the year 2014 are estimated to be \$2.1 trillion. The estimates of gross and net flows are presented in Figure 6.

**Figure 5: Estimates of export misinvoicing 1990-2014 (US\$ trillion)**



Source: Estimated from DoTS, IMF.

In the discussion on trade misinvoicing there has been considerable focus on the outflows from developing countries, resulting in these countries becoming impoverished. Given the interest this dimension of the discussion evokes, it is important to ask if one can split the flows into those related to developing and to developed countries. Taking the UN classification of countries<sup>16</sup> into developed and developing, the flows were classified into export misinvoicing by developed countries and export misinvoicing by developing countries. To understand the gross flows from and to a country or a group of countries, we present gross flows on account of export misinvoicing. Figure 7 shows the gross flows for developed, developing and a subgroup of developing countries, i.e., BRICS countries. The

<sup>16</sup> UN country classification, 2014. Available at [http://www.un.org/en/development/desa/policy/wesp/wesp\\_current/2014wesp\\_country\\_classification.pdf](http://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf).

figure shows that the dimensions of fund flows with respect to developing countries are similar to those from developing countries.

**Figure 6: Estimates of gross and net flows through export misinvoicing 1990-2014 (US\$ trillion)**



Source: Estimated from DoTS, IMF.

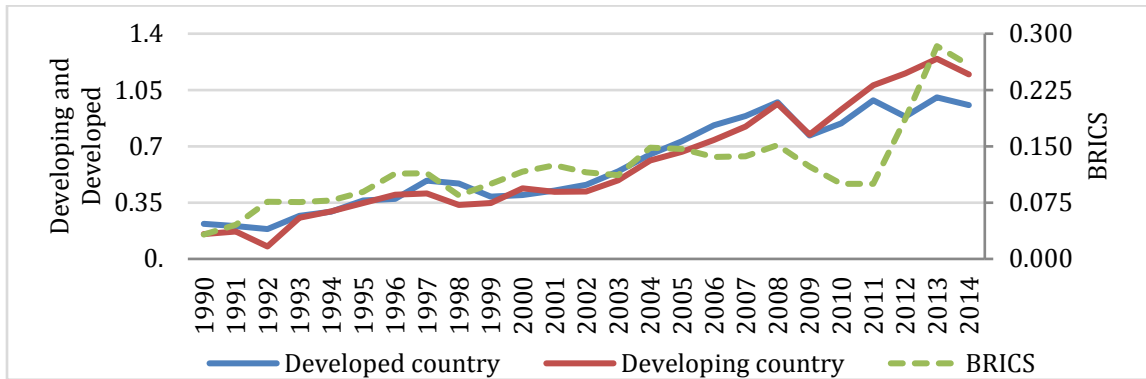
In the discussion on trade misinvoicing there has been considerable focus on the outflows from developing countries, resulting in these countries becoming impoverished. Given the interest this dimension of the discussion evokes, it is important to ask if one can split the flows into those related to developing and to developed countries. Taking the UN classification of countries<sup>17</sup> into developed and developing, the flows were classified into export misinvoicing by developed countries and export misinvoicing by developing countries. To understand the gross flows from and to a country or a group of countries, we present gross flows on account of export misinvoicing. Figure 7 shows the gross flows for developed, developing and a subgroup of developing countries, i.e., BRICS countries. The figure shows that the dimensions of fund flows with respect to developing countries are similar to those from developing countries.

In order to judge the dimension of flows to or from a country or a group of countries, we should consider the net flows, i.e., inflows net of outflows. Figure 8 presents the numbers for net flows. The figure shows that there are significant inflows into developing as well as developed countries. Further, the flows into developed countries dominate the picture till the financial crisis in 2007. In the subsequent period, there is a sharp increase in the flows to developing countries and they record

<sup>17</sup> UN country classification, 2014. Available at [http://www.un.org/en/development/desa/policy/wesp/wesp\\_current/2014wesp\\_country\\_classification.pdf](http://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf).

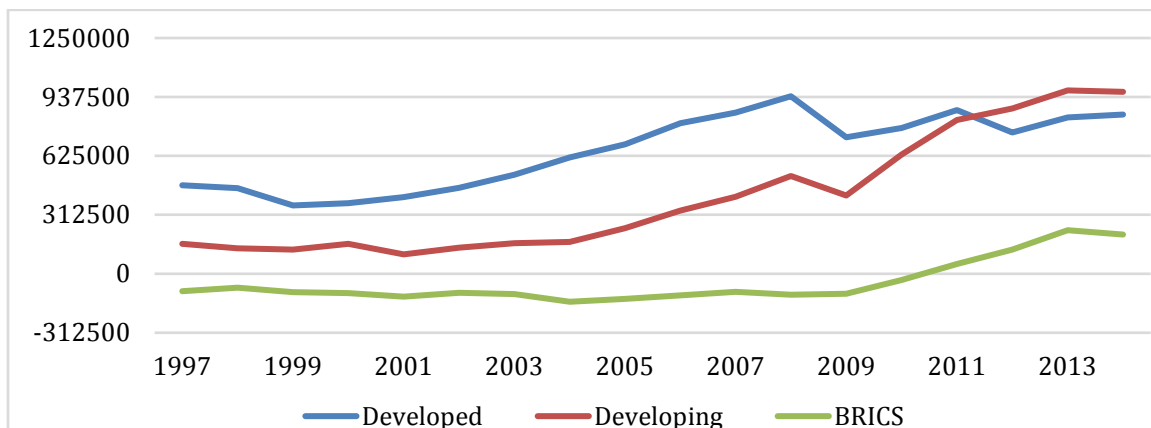
numbers higher than those for developed countries from 2011 onwards. More interestingly, the BRICS group records net outflows, i.e. negative net flows till 2010 after which they report net inflows!

**Figure 7: Gross Flows: Developed versus Developing Countries**



Source: Estimated from DoTS, IMF

**Figure 8: Net Flows: Developed versus Developing Countries**

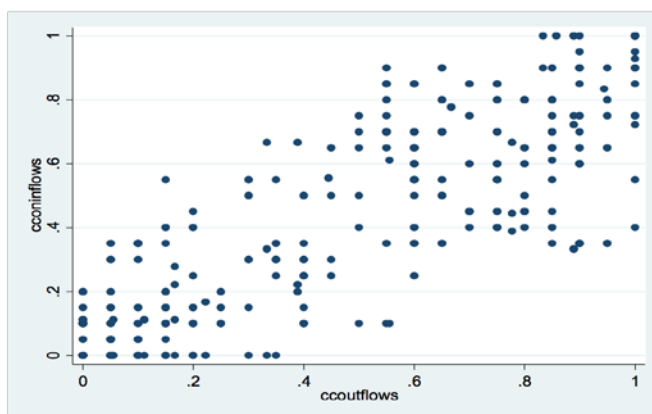


Source: Estimated from DoTS, IMF.

It should be mentioned once more that while these numbers suggest inflows into or outflows from countries, these numbers cannot be construed to suggest that the inflows or outflows belong to the residents of the country. Money moves in and out of the country through the illicit channels at the behest of agents that operate within and outside the economy.

**Appendix**

## A.1 Scatter plot for capital control on inflows and outflows (all countries 1995-2014)



## Tests for Heteroskedasticity, Autocorrelation and VIF for equation with all variables

Test for	Export misinvoicing by GDP			Import misinvoicing by GDP		
	all countries	top twenty	top GDP	all countries	top twenty	top GDP
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	chi2(1)=485.22	chi2(1)=460.82	chi2(1)=584.55	chi2(1)=1251.98	F( 1, 20) = 21.663	chi2(1)=24.26
Wooldridge test for autocorrelation in panel data	F( 1, 30) = 76.169	F(1, 20) = 21.663	F( 1, 22) = 500.518	F(1,28) = 19.646	F( 1, 20) = 7.076	F( 1, 20) = 18109.091
Mean VIF	1.13	1.54	1.2	1.3	1.99	1.44

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