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AVOIDING AND ESCAPING THE 'COMMODITY TRAP' IN DEVELOPMENT

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Avoiding and escaping the 'commodity trap' in development

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Abstract

Based on the 'Prebisch–Singer' hypothesis, a strand of literature has emerged that focuses on the phenomenon of *commoditization* and '*commodity traps*' in development. Following Kaplinsky (2006), we revisit the hypothesis on a country's terms of trade in manufacturing exports and imports. Offering high quality products and targeting 'niche' markets in high-income countries are beneficial strategies for developing countries to improve their terms of trade and escaping a potential '*commodity trap*'. Barriers to entry via standards in the importing countries might even support such strategies. Non-tariff measures (NTM) such as technical barriers to trade (TBT) and sanitary and phytosanitary measures (SPS) are usually implemented to increase the quality of products, production procedure or environmental and animal health in the importing countries. Based on a gravity framework controlling for multilateral resistance over the period 1998-2014, it is shown that compliance with these measures reduces the negative impact of commoditization on their terms of trade.

Keywords: Terms of trade, product quality, commodity trap, commoditization, non-tariff measure, technical barrier to trade, sanitary and phytosanitary measures

JEL codes: F14, F13, C23

1 Introduction

In the post-World War II reconstruction era, it has commonly been argued that the surging demand for raw materials, primary commodities and food stimulates exports and growth in developing countries. This argument was quickly challenged by the seminal conceptual frameworks introduced by Prebisch (1950) and Singer (1950), which became known as the Prebisch–Singer hypothesis. Accordingly, the ratio of export prices to import prices (terms of trade) of underdeveloped countries tends to deteriorate for various reasons.

More recently, the development of terms of trade again received some attention (e.g. Kaplinsky, 2006), and recent contributions in the literature on 'commoditization'[1] have put the risk of falling into a '*commodity trap*' at the centre of attention. d'Aveni (2010) explicitly addresses commoditization as a worrisome phenomenon in which producers need to undertake continuous endeavours to cope with the declining price pressures to stay in the market. Such a strategy can either be a quality upgrading strategy, which enables domestic producers to compete with other international producers' low prices, or a quality downgrading strategy to which increases the upward pressure on the costs of inputs production firms have to shoulder against their competitors to survive.

The aim of this paper is to explore the determinants of terms of trade and of existing or potentially arising '*commodity trap*s' by focusing on bilateral intra-industry trade relations. These bilateral intra-industry terms of trade are calculated based on the unit values of each country's exports and imports vis-à-vis their trading partners at the HS 6-digit level, which are then aggregated to the ISIC[2] industry level. Drawing on recent developments in gravity modelling (Anderson and Wincoop, 2003; Head and Mayer, 2014) and combining this with the literature examining the determinants of terms of trade (e.g. Debaere and Lee, 2003; Razmi and Blecker, 2008), we empirically address the commoditization process in a gravity framework.

In this study, we contribute several aspects to the literature. First, we extend the Prebisch-Singer hypothesis on terms of trade, which was revisited by Kaplinsky (2006), and focus on bilateral intra-industry terms of trade. Second, we analyse potential factors that favour commoditization and the possibility of a country to actually fall into a '*commodity trap*', as well as remedies against such trends. Third, we conduct our analysis at the bilateral industry level and examine the impact of barriers to entry and quality NTMs directed at the 6-digit level of traded products.

[1] In this study, we borrow the term 'commoditization' from the business literature. Specifically, this term is used in d'Aveni (2010).
[2] International Standard Industrial Classification.

Fourth, we argue that technical barriers to trade (TBT) or sanitary and phytosanitary measures (SPS) tend to reduce the risk of commoditization and might be conducive to avoiding the '*commodity trap*'. An important policy-relevant conclusion from this paper points to the importance of diversification and geographical specialization in trade to avoid the risk of falling into a '*commodity trap*'.

The rest of the paper is organised as follows. Section 2 provides a brief literature review and the position of this contribution within the related literature. Section 3 describes the data and the methodology. Section 4 provides the results of the econometrics analysis. Finally, Section 5 concludes with a short summary of the key findings.

2 Literature review

According to the Prebisch-Singer hypothesis, a developing country's terms of trade—i.e. the ratio of exports to imports prices—tend to deteriorate. The main reason for this trend is that the products these countries export, e.g. primary commodities, are characterized by lower rates of technological progress. Second, technology-intensive products are characterized by higher income elasticities of demand than primary commodities (according to Engel's Law). Thus, demand for raw materials, primary commodities and food, which are exported by underdeveloped countries, remains unchanged relative to the growth of world income. Third, the price elasticities of demand for such commodities are usually lower than those of complex products, which implies that even large decreases in prices of exports from low-income countries lead to only minor increases in demand. Moreover, uniform commodities from developing countries facing low trade barriers are easily substitutable across various sources, pushing down prices and again leading to a deterioration of the terms of trade of underdeveloped countries. Specialization in such products might therefore harm developing countries compared to more developed ones specializing in manufacturing activities characterized by higher rates of technological progress, higher income elasticities, lower price elasticities and higher barriers to trade.

The strand of literature was revisited by Singer (1971) who focused on the innovation process, which yields additional Schumpeterian rents in technology-intensive manufacturing. This prime determinant of income growth that was and continues to remain prevalent in manufacturing, was (and still is) missing in the developing world which invests less than 5 per cent of global R&D expenditure (Singer et al., 1972). This again is seen as a factor underlying developing countries' poor terms of trade even further, while industrialized economies gain from innovative manufacturing activities (Sarkar and Singer, 1991).

It can furthermore be argued that the export and trade-oriented industries in underdeveloped economies were majority owned by foreign investors from the developed world, which might limit the contribution to the host economies' domestic development. All of these factors result in a lack of inventiveness and technological development, as well as in the level of education and skills development in the long run.

Empirical results testing the Prebisch-Singer hypothesis have been rather mixed (Iregui and Otero, 2013; and Baffes and Etienne, 2016). This triggered further research into disaggregated manufacturing trade. For instance, excluding non-processed non-ferrous products, Athukorala (1993) found no deterioration in the net barter terms of trade, challenging the results of Sarkar and Singer (1991). By contrast, Maizels et al. (1998) and Meizels (2000) provide evidence for the level of technology in manufacturing products as a key factor for the deterioration of developing countries' terms of trade compared to industrialized countries'.

The majority of studies analysing terms of trade focus on the aggregate level or on unilateral trade (Sapsford, 1990; Razmi and Blecker, 2008; Wacker, 2016). Some studies focus primarily on one destination market and the terms of trade of the exporter vis-à-vis a single importer (Maizels et al., 1998; and Meizels, 2000). However, more recently, by analysing price changes at the 8-digit level of products, Kaplinsky (2006, 2013) argues that over the period 1988-2001, China and low-income countries have had the largest share of products with a negative trend in the prices of exports to the European Union. This suggests that the lower a country's income or the lower its level of development is, the more likely it is that its export unit prices are decreasing, leading to the commoditization phenomenon. Kaplinsky (2006) focuses on the following three arguments: 1) barriers to entry into high-income markets through standards and 'niche-based' demand, even for commodities such as food products, are essentially beneficial for developing countries to improve their terms of trade by offering better products with special quality; 2) large retail industries in advanced economies are major buyers of food, garments, furniture and other standardized manufactures with a considerable bargaining power. Thus, Kaplinksy argues that the growing concentration in global buying constitutes an important factor that pushes down the price of raw materials and standardized products exported from developing countries; 3) the rapid growth of China and its exports of manufactured products with lower complexity could be accounted as another factor influencing the declining trend of these commodity prices in the global market. However, China's increasing demand for raw materials, capital and inputs of production might lead to higher prices of primary commodities exported by underdeveloped countries. Hence, the net effects of these trends on the

development of terms of trade emphasize the need for an empirical analysis of terms of trade developments (Kaplinsky, 2006).

In a political economy framework, Zysman et al. (2014) argue that the widespread availability of conventional technologies enables firms from various countries to enter different markets that lack standards or other barriers to entry, putting pressure on wages and profit, margins alike. In their view, when all countries can produce a certain good or service, with the resulting intense competition leading to stronger price pressures. Consequently, a developing country lacking the technology to produce and export sophisticated products with higher quality might have to reduce its export prices to remain in the market. Technological progress in advanced economies would ultimately, however, force underdeveloped exporters to exit the market in the medium to longer run. This '*commodity trap*' concept implies that the countries specialized in these types of goods characterized by falling prices might experience further deterioration in their terms of trade in the long run. An exporting country can escape the *commodity trap* by diversifying its products baskets to include innovation-based and high value added products. Such a strategy might reduce the pressure of declining prices of standardized commodities and thereby avoid further deterioration in the terms of trade.

Razmi and Blecker (2008) find that developing countries that export goods compete primarily with other developing countries due to the low-technology composition of their exports. Those products that are more sophisticated and characterized by higher technological intensity, which a few developing countries may be exporting, are up against strong competition from industrialized countries.

So far, the literature focusing on the supply side factors has been considered. As regards the demand side of trade and the characteristics of importing countries, Kaplinsky (2006) argues that barriers to entry could potentially prohibit products with low standards. Of particular interest here is the role of quality standards and certifications embedded within non-tariff measures (NTMs) imposed internally or in the export destinations[3]. Such regulations may potentially support 'soft commodities' (such as horticultural products and coffee) from underdeveloped countries, reaching niche markets in advanced economies (Kaplinsky, 2006). Moreover, the presence of regulatory standards in the destination market, which are objectively

[3] For an example of domestic regulations, assume a domestic mandatory regulation on 'labelling and packaging' is in place in Iran, which requires producers of saffron to provide detailed information on the package of the product in addition to offering suitable final packaging of saffron products that can easily be used by the final consumer. Complying with such a regulation could further facilitate exports by Iranian producers to a destination market such as the EU, competing with Spanish producers of saffron who enjoy a high value added, primarily from packaging and re-exporting such products.

intended to increase the quality of products and/or the production procedure, might prevent developing countries from falling into a '*commodity trap*' characterized by declining prices or exported products. The reason is that 'soft commodities' are not sophisticated products and therefore, quality upgrading should be managed to meet the regulatory standards in the destination market, which increases the country's terms of trade. However, it might very well be that prior to compliance with those standards and the subsequent prohibition of trade the terms of trade of the exporting country will deteriorate in the short run.

The impact of barriers to entry such as standards and regulations on the terms of trade has not been expansively studied in the literature so far, although it is addressed by several scholars (Kaplinsky, 2006; Daviron and Vagneron, 2011). Non-tariff measures (NTMs) including quality standards and regulations have mostly been analysed in the literature as trade costs (Essaji, 2008; Bao and Qiu, 2012; Disdier et al., 2010; Yousefi and Liu, 2013). Higher standards within these regulations might increase the quality of production processes and products (Wilson and Otsuki, 2004; Trienekens and Zuurbier, 2008). However, these studies have found a mixed impact of NTMs across different products and countries, which are translated as either quality improvements of the traded products based on the standards and regulations within the NTMs or as an obstacle to trade (Beghin et al., 2015; Ghodsi et al., 2016; Bratt, 2017).

3 Methodology and data

3.1 Methodological approach

This paper aims to study the developments of bilateral intra-industry trade in the context of the gravity model framework. The aspects outlined above are introduced in a formal framework in the following way. First, to capture the 'commoditization process' at the detailed industry level, a declining trend in prices of specific products can be interpreted as an indication for an ongoing commoditization process for a country falling into a '*commodity trap*' and whose terms of trade will consequently deteriorate. Though such price declines might lead to short-run gains in the market shares of developing countries, it will not foster technological development or product upgrading. Accumulated negative and positive price trends of the disaggregated products relative to world prices in a specific destination market are defined as two separate indicators of commoditization. A negative price trend signifies declining price pressure while a positive price trend indicates quality upgrading. These indicators serve as a proxy for terms of trade developments.

Second, one specific focus of our analysis is an assessment of the impact of NTMs and their potential role of preventing or escaping the commoditization effect or '*commodity trap*', drawing on detailed data collected in Ghodsi et al. (2017). These NTMs allow countries to impose restrictions on the quality of imported products to comply, for example, with domestic health regulations, global environment issues, safety standards or improvement of market efficiencies by increasing transparency and reducing information asymmetries (e.g. through technological standardization). NTMs targeting the quality of products can have two effects: (i) countries that manage to comply with the quality standards of sophisticated markets are more likely to escape or avoid falling into a '*commodity trap*'. They become specialized in high unit value export goods leading to gains in market shares and higher bilateral terms of trade in the longer run. Alternatively, (ii) countries that do not manage to comply with the quality standards in the destination market are forced to exit the market. Prohibition of imports from such a country could be a first consequence of the imposition of NTMs; this would immediately deteriorate a developing country's bilateral terms of trade. In fact, an observed lack of quality upgrading due to commoditization might indicate that the country is facing prohibitive NTMs which are impeding access to the destination market.

Finally, we control for other determining factors of bilateral intra-industry terms of trade such as size of the economy, economic development and endowments with factors of production, etc. We use the Herfindahl index as a measure of exporter's products. In addition, the Balassa index of an exporter's concentration relative to all other exporters' concentration in a given destination is calculated and used as a measurement for geographical specialization.

Finally, within the framework, insights on the determining factors of terms of trade are derived from bilateral trade relationships including all countries in the world. First, using a bilateral concept of terms of trade, we can take advantage of both the supply and demand side determinants of trade, which is neglected in a unilateral framework. In a theoretical framework, Feenstra and Romalis (2014) conclude that both sides of trade play a role for the quality of traded products. Second, focusing on price trends at disaggregated levels and the sectoral structure of the traded products improves the analysis of intra-industry terms of trade. Third, trade policies are usually imposed at disaggregated levels affecting intensive and extensive margins of exporting firms diversely (Fontagné et al., 2015). In fact, NTMs containing specific standards and regulations usually focus on the detailed characteristics of disaggregated products, which are also sometimes exporter-specific.

3.2 Gravity specification

As already mentioned, a gravity framework is applied to study the determinants of bilateral intra-industry terms of trade. In such a framework, trade flows are modelled as an increasing function of the income of the two trading partners and as a decreasing function of the distance between the two. Anderson (1979) introduced a theoretical framework for the gravity model using constant elasticity of substitution. Since then, the literature has been extended, adding many other variables affecting trade flows such as relative factor endowments or sharing cultural and historical similarities, etc. Eaton and Kortum (2002) and Anderson and van Wincoop (2003) formulated gravity in an imperfect competition framework to further account for multilateral resistance which emerges when the bilateral trade relationship influences the trade relationship with a third country[4].

The intention is to identify the determinants of developments in bilateral intra-industry terms of trade. Drawing on recent contributions in gravity modelling (Anderson and Wincoop, 2003; Head and Mayer, 2014) and combining it with the literature on various determinants of terms of trade (e.g. Debaere and Lee, 2003; Razmi and Blecker, 2008), we empirically address potential determinants of terms of trade with a focus on commoditization and the impact of non-tariff measures. The analysis is based on the following specification:

$$T_{ijHt} = \alpha_0 + \alpha_1 Y_{it} + \alpha_2 Y_{jt} + \alpha_4 xr_{ijt} + \alpha_4 X^x_{ijHt-1} + \alpha_5 X^m_{ijHt-1} + \Psi_{ijHt} + \varepsilon_{ijHt} \qquad (1)$$

where T_{ijHt} indicates the bilateral intra-industry terms of trade defined below. Y_{it} and Y_{jt} are sets of country-specific variables for country *i* and partner *j*, respectively. These include the logarithm of real GDP and real GDP per capita in USD, number of persons employed (emp), real capital stock in USD (cap) and a human capital index (hc), which are all derived from the PWT 9.0[5]. Variable xr_{ijt} denotes the bilateral exchange rate. This variable is calculated by dividing the USD exchange rate of the partner country *j* by the USD exchange rate of country *i*.[6] The bilateral exchange rate is therefore expressed as partner country *j's* in the local currency of the exporting country *i*, $xr_{ijt} = xr_{it}/xr_{jt}$. An exchange rate is also used in unilateral and country level analyses such as in Baffes and Etienne (2016). A number of other bilateral variables are included: X^x_{ijHt-1} and X^m_{ijHt-1} include lagged export-side and import-side variables (e.g. commoditization), which are discussed below in more detail. To reduce the simultaneity bias causing endogeneity between the dependent variable and these industry-

[4] See Head and Mayer (2014) for a detailed discussion on gravity modelling.
[5] For further details, see Feenstra et al. (2015).
[6] The exchange rates are collected from the World Development Indicators (WDI).

country-pair variables, we use the lag of these independent variables in the regression. Variable Ψ_{ijHt} includes different sets of fixed effects and ε_{ijHt} is the error term.

3.3 Variables included in analysis

3.3.1 Bilateral intra-industry terms of trade

This study analyses the determinants of bilateral intra-industry terms of trade. The calculation of this variable builds on the CEPII World Trade Database (BACI, Gaulier and Zigango, 2010) and the Trade Unit Value Database (TUVD, Berthou and Emlinger, 2011). These data provide bilateral trade flows at the Harmonized System (HS) 6-digit product level for the period 1998 to 2014. Originally collected from the UN COMTRADE database, BACI adjusts reported figures such that bilateral trade flows are harmonized and balanced at the detailed product level. Trade flows in these data are provided in free-on-board (f.o.b.) values in current US dollars and corresponding uniform quantities (net weights, kilograms). Based on these, the TUVD provides detailed unit values (values divided by quantities) indicating the prices of bilaterally traded products.

First, our analysis requires the calculation of bilateral terms of trade at industry level. Product-level information from trade data is aggregated to the industry level based on correspondence between the HS Revision 1996 classification (on which trade data are based) and the manufacturing ISIC Rev. 3 industry level. Specifically, using the unit values of bilateral exports and imports at the HS 6-digit level and applying corresponding trade weights, the industry-specific bilateral terms of trade for country *i*, which has a trade relationship with partner *j* in industry *H* at time *t*, is calculated as follows:

$$T_{ijHt} = \frac{u^x_{ijHt}}{u^m_{ijHt}} = \frac{\sum_{h\in H}\left(\frac{v^x_{ijht}}{q^x_{ijht}}\right)\left(\frac{v^x_{ijht}}{\sum_{k\in H} v^x_{ijkt}}\right)}{\sum_{h\in H}\left(\frac{v^m_{ijht}}{q^m_{ijht}}\right)\left(\frac{v^m_{ijht}}{\sum_{k\in H} v^m_{ijkt}}\right)} \quad (2)$$

where the variables q^x_{ijht} and v^x_{ijht} denote the quantity and value of product *h*, respectively, exported from country *i* to country *j* at time *t*. Superscripts *x* (for exports) and *m* (for imports) indicate the direction of the considered trade flow; for example, q^m_{ijht} denotes the quantity of the traded product delivered to country *i* from country *j*. In equation (2), the term v^x_{ijht}/q^x_{ijht} therefore denotes the unit price of exports of the specific product *h* and the term $v^x_{ijht}/\sum_{k\in H} v^x_{ijkt}$ is the corresponding weight of the product in industry H (analogously for imports). This definition of the terms of trade for each industry *H*, T_{ijHt}, follows the traditional definition

of the terms of trade—the ratio of the price of a country's exports to that of the country's imports—though calculated in bilateral terms and at sectoral level, i.e. $u^{x}_{ijHt}/u^{m}_{ijHt}$. Data for bilateral trade flows containing zero values or missing information are excluded.

3.3.2 Explanatory variables

As indicated in Equation (1), a number of explanatory variables are included. These are the proxy for commoditization, trade policy variables with an emphasis on non-tariff measures and the variables capturing the market structure and others. The construction of these and the underlying data sources are presented below. Further, some technical details concerning the use of fixed effects, the way multilateral resistance is controlled for and the treatment of standard errors in the gravity regressions are outlined.

3.3.3 Price changes and commoditization

The first objective in this analysis is to explain trends in the terms of trade driven by price trends in standardized and low-quality products, which—in case they are declining—can be referred to as commoditization. One important feature therefore is the proxy to capture this commoditization.

Commoditization is seen as a process that is driven by developments at the global level. Inspired by Kaplinsky (2006: p. 988, Figure 5), the persistent declines in bilateral unit values at HS 6-digit levels are tracked. In the analysis, we aim to demonstrate the correlation between the terms of trade and commoditization trends, taking into account that the terms of trade might also be affected through market structure indicators and barriers to entry, which are controlled for. A country trying to avoid the global price decline (in case it is an exporter of this product) might nonetheless face a declining trend in its export price owing to global pressure, while its price relative to that of its competitors could increase due to quality improvements. The commoditization indicator to be used in this analysis must therefore be country-specific and constructed in a way to net out global commoditization trends.[7] To remove these global price changes, which are not indications of country-specific commoditization, bilateral unit value ratios (UVR) in destination markets are used. [8] These are calculated as the unit value of a specific product *h* from exporter *i* to importer *j* relative to the average unit value of product imports of country *j* from the entire world:

[7] Moreover, the trade barriers we use in this study are usually unilateral against all trading partners. The outlined strategy also helps observe how these trade barriers affect an individual trading partner's commoditization.

[8] It is important to mention that a similar analysis is being conducted using only unit values instead of UVR, and the results are consistent since we use country-industry-time fixed effects (as explained below) removing the global effects. These results can be provided upon request.

$$r_{ijht}^{x} = \ln\left(\frac{u_{ijht}^{x}}{u_{wjht}^{x}}\right) = \ln\left[\frac{\frac{v_{ijht}^{x}}{q_{ijht}^{x}}}{\frac{\sum_{y\in W} v_{yjht}^{x}}{\sum_{y\in W} q_{yjht}^{x}}}\right] \quad (3)$$

A decline in this ratio indicates that the unit value of country *i*'s exports of this product to destination *j* decreases relative to the average (world) unit value to this destination. This is expected to negatively impact on country *i*'s terms of trade with partner *j*.

Since the analysis covers both sides of trade, similar to that of Equation (3), the UVR on the reverse direction of trade needs to be calculated, that is, the bilateral UVR of exporter *j* to importer i of the product h in year t as follows:

$$r_{ijht}^{m} = \ln\left(\frac{u_{ijht}^{m}}{u_{iwht}^{m}}\right) = \ln\left[\frac{\frac{v_{ijht}^{m}}{q_{ijht}^{m}}}{\frac{\sum_{y\in W} v_{iyht}^{m}}{\sum_{y\in W} q_{iyht}^{m}}}\right] \quad (4)$$

In the following, superscripts *x* or *m* are used to indicate the direction of trade flows (as already introduced above). Based on these unit value ratios, the proxy for commoditization trends in exports from country *i* to its trading partner *j* in industry *H* is calculated as follows:

$$C_{ijHt}^{x-} = \left[\sum_{h\in H}\sum_{\tau=1}^{t}\frac{\Delta r_{ijh\tau}^{x-}}{n_{ijH\tau}^{x}}\right] = \left[\sum_{h\in H}\sum_{\tau=1}^{t} min\left(\frac{\Delta r_{ijh\tau}^{x-}}{n_{ijH\tau}^{x}}, 0\right)\right] \quad (5)$$

where Δr_{ijht}^{x-} is the growth of the unit value ratio[9] when negative and 0 else. We use simple averages by dividing n_{ijHt}^{x} as the number of HS 6-digit products exported in industry *H* by country *i* to country *j* at time *t* instead of trade weights. The reason is that trade weights are closely correlated with those of the dependent variable in Equation (1), which could potentially cause an endogeneity bias and further result in spurious estimators. Using the lag of this variable reduces the potential endogeneity bias. Therefore, C_{ijHt}^{x-} is interpreted as the accumulated negative growth of product prices of the respective industry. In fact, it is the partial sum of negative changes of UVR of HS 6-digit product *h* exported from country *i* to country *j* since 1998 until year t. Analogously, an index C_{ijHt}^{m-} for imports to country *i* using the import UVRs is constructed.

[9] Since unit value ratio is calculated in logarithmic form $\Delta r_{ijht} = r_{ijht} - r_{ijht-1}$ is the growth of unit value relative to the average unit values in the destination market.

To attain consistent estimators, we also include the index capturing persistent price increases which denote the quality upgrade of products over time in an analogous way:

$$C_{ijHt}^{x+} = \left[\sum_{h\in H}\sum_{t=1}^{T}\frac{\Delta r_{ijht}^{x+}}{n_{ijHt}^{x}}\right] = \left[\sum_{h\in H}\sum_{t=1}^{T} max\left(\frac{\Delta r_{ijht}^{x+}}{n_{ijHt}^{x}}, 0\right)\right] \quad (6)$$

where Δr_{ijht}^{x+} is the positive growth of the unit value ratio of the product exported from country *i* to country *j* (and 0 else).

3.3.4 Market structure variable

Additionally, two other indicators that capture the market structure in the destination and home markets are included: (i) the Balassa index of revealed comparative advantage (RCA) as a measurement of the trading partner's geographical concentration in the respective industry; and (ii) the Herfindahl index which measures the diversification of disaggregated products traded bilaterally within the industry. These market structure measures are analogously calculated for both imports and exports (though only discussed for exports below).

The bilateral Balassa index of revealed comparative advantage is calculated as a measure for export and import *geographical specialization*. This bilateral Balassa index in industry *H* of country *i* exporting to country *j* at time *t* is defined as:

$$RCA_{ijHt}^{x} = \frac{\left(\frac{v_{ijHt}^{x}}{v_{ijt}^{x}}\right)}{\left(\frac{v_{Ht}^{x}}{v_{t}^{x}}\right)} = \frac{\left(\frac{\sum_{k\in H} v_{ijkt}^{x}}{\sum_{H}\sum_{k} v_{ijkt}^{x}}\right)}{\left(\frac{\sum_{y}\sum_{z}\sum_{k\in H} v_{yzkt}^{x}}{\sum_{y}\sum_{z}\sum_{H}\sum_{k\in H} v_{yzkt}^{x}}\right)} \quad (7)$$

i.e. the ratio of the share of bilateral industry exports in total bilateral exports to the share of world exports in that industry. A value of RCA_{ijHt}^{x} above 1 indicates that the country has a comparative advantage in the industry over its partner country, thus indicating *geographical specialization* patterns.

The Herfindahl index—a measure of *diversification* of a given industry in the trading partner's market—is calculated as follows:

$$Hf_{ijHt}^{x} = \frac{\sum_{h\in H}\left(\frac{v_{ijht}^{x}}{\sum_{k\in H} v_{ijkt}^{x}}\right)^{2} - \frac{1}{n_{ijHt}^{x}}}{1 - \frac{1}{n_{ijHt}^{x}}} \quad (8)$$

where n^{x}_{ijHt} is the number of HS 6-digit products exported in industry *H* by country *i* to country *j* at time *t.* This index ranges from 0 when there is a high diversification of exported products within the industry to 1 when the industry is fully concentrated in the export of one product only.

As discussed earlier, a possible strategy to avoid the *commodity trap* is to increase the diversity of a country's exported products. Therefore, these variables are additionally interacted with the commoditization variable to determine whether the effect of commoditization on the terms of trade will be enforced or hampered by diversification strategies.

Variable X^{x}_{ijHt} in the gravity Equation (2) also includes an indicator for market share MS^{x}_{ijHt} of the exporting country *i* in the destination export market *j* in industry *H* at time *t,* which is calculated as follows:

$$MS^{x}_{ijHt} = \frac{v^{x}_{ijHt}}{\sum_{j \in W} v^{x}_{ijHt}} = \frac{\sum_{h \in H} v^{x}_{ijht}}{\sum_{j \in W} \sum_{h \in H} v^{x}_{ijht}} \quad (9)$$

These market shares control for the exporter's market power in the destination market.

In addition, export and import values in logarithmic forms v^{x}_{ijHt} and v^{m}_{ijHt} are included in the regressions to control for the size of trade flows, capturing potential scale effects.

3.3.5 Trade policy measures

Regulations concerning product characteristics and quality embedded in trade policy measures can be another important determinant influencing a country's exports or imports and related terms of trade. Two broad categories of NTMs, technical barriers to trade (TBT) and sanitary and phytosanitary measures (SPS) are used in our analysis. According to the NTM classification of the Multi Agency Support Team (MAST)[10] provided in UNCTAD (2012), the latter are defined as follows: "Measures that are applied to protect human or animal life from risks arising from additives, contaminants, toxins or disease-causing organisms in their food; to protect human life from plant- or animal-carried diseases; to protect animal or plant life from pests, diseases, or disease-causing organisms; to prevent or limit other damage to a country from the entry, establishment or spread of pests; and to protect biodiversity. These include measures taken to

[10] As of July 2008, MAST is composed of: Food and Agriculture Organisation of the United Nations (FAO), International Monetary Fund (IMF), Organisation for Economic Cooperation and Development (OECD) Trade and Agriculture Directorate, United Nations Conference on Trade and Development (UNCTAD), United Nations Industrial Development Organisation (UNIDO), World Bank (WB), World Trade Organisation (WTO), International Trade Centre UNCTAD/WTO (ITC).

protect the health of fish and wild fauna, as well as of forests and wild flora" (UNCTAD, 2012: 7). Based on the same source, TBT are defined as "… measures referring to technical regulations, and procedures for assessment of conformity with technical regulations and standards, excluding measures covered by the SPS Agreement. A technical regulation is a document which lays down product characteristics or their related processes and production methods, including the applicable administrative provisions, with which compliance is mandatory. It may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method. A conformity assessment procedure is any procedure used, directly or indirectly, to determine that relevant requirements in technical regulations or standards are fulfilled; it may include, inter alia, procedures for sampling, testing and inspection; evaluation, verification and assurance of conformity; registration, accreditation and approval as well as their combinations" (UNCTAD, 2012: 15).

NTM notifications to the WTO are provided through the WTO Integrated Trade Intelligence Portal (I-TIP). This data is completed and improved by imputing missing HS codes to notifications as documented by Ghodsi et al. (2017). Specifically, the numbers of TBT and SPS notifications in force within each bilateral trade flow are used. In other words, TBT_{ijHt}^{x} and SPS_{ijHt}^{x} refer to the number of all types of TBT and SPS (including specific trade concerns, STCs) that are in force by country *j* in time *t* for exports of country *i* in industry *H*[11]. Analogously, the same definitions are used for the import side, i.e. the NTMs imposed by country *i* against industry *H* products imported from country *j*. To arrive at reliable and consistent measurements for the number of NTMs, the information in the data from the most disaggregated product level is aggregated to industry level. Duplicates are removed, such that when a specific notification covers several products within an industry, it is only counted once for that particular industry. As discussed earlier, countries that manage to export to a destination that applies NTMs are more likely to circumvent commoditization. Therefore, the interaction of these variables with the commoditization variable will tell us how these impact the commoditization process.

[11] The I-TIP database used in Ghodsi et al. (2017) is augmented by imputing HS codes. In that study, some approximation matching was also added in the imputation procedure, which increased the number of affected tariff lines extensively. However, here we exclude the approximating procedure in imputing the HS codes. For the difference between the databases used here and in Ghodsi et al. (2017), refer to Step 5 in Ghodsi et al. (2017) page 26.

3.3.6 Specifications of the gravity model

Several specifications of gravity Equation (1) are tested. In the first specification, we include year-specific ω_t and bilateral-industry-specific ω_{ijH} fixed effects. According to recent gravity literature, when bilateral trade between two countries is studied, one needs to control for specific effects that each of the two partners faces against all its trading partners. In fact, trade relationships of a given country for an industry and year could be a function of the domestic supply and demand conditions in this industry and to the multilateral trade costs and barriers it is exposed to. This multilateral resistance (MLR) is usually controlled for by using country-industry-year fixed effects (ω_{iHt}, ω_{jHt}). However, these fixed effects are collinear with the other country-level variables introduced in the equation and were therefore excluded from the regressions[12]. Hence, in the second specification, we control for MLR to check the consistency of the variables of interests—namely the abovementioned price trends, market structures and trade policy measures—that change across bilateral industries and over time.

To control for heteroscedasticity, which may potentially be due to shocks within country-dyadic-industries, we cluster the standard errors within each country-dyadic-industry to achieve robust estimations. This means that clusters are classified according to jiH groups which are symmetric, i.e. $ijH = jiH$. This procedure is firstly motivated by the characteristics of the dependent variable, i.e. the ratio of the two sides of trade, imports and exports. Secondly, it corresponds to the assumption of symmetric transportation costs between the two trading partners. Specifically, it is assumed that the transportation costs of exports or imports of a given industry between the two countries are the same from any direction; any other differences are considered to be idiosyncratic shocks causing a heteroscedastic error term.

[12] Baltagi et al. (2013) suggest using country-pair variables instead of country variables. For instance, instead of two separate GDP variables, one can use the summation of the two trading partners' GDPs while controlling for MLR. However, including country-pair variables in this analysis gives us larger information criteria statistics and we therefore opted to exclude them. The reason is that country-industry-time FE and country-pair FE are very collinear with the generated country-pair time-variant variables.

4 Results

In this section, after providing some summary statistics on the bilateral intra-industry terms of trade, the regression results on the determinants of the bilateral intra-industry terms of trade as outlined in Equation (1) are presented. In addition to the main regression results comprising the entire sample, regressions are also estimated for four country groups defined in terms of their development levels following the UNIDO classification (Upadhyaya, 2013). These four distinct groups of countries are the group of Advanced Industrial Economies (AIE) and Developing Countries which are themselves divided into three groups: Emerging Industrialized Economies (EIE), Other Developing Economies (ODE) and Least Developed Economies (LDE)[13].

4.1 Overall results

Table 1 presents the determinants of the bilateral terms of trade in the manufacturing sector estimated over the period 1998-2014 for the total sample, and then separated by the groups of exporting countries. As the direction of trade matters for interpretation, it should be noted that the exporting country is subscribed with *i* and its partner is subscribed with *j*. Specification 1 reports the estimation results including bilateral-industry-specific ω_{ijH} and time ω_t fixed effects separately. Specification 2 presents the estimation results when controlling for multilateral resistance (MLR) terms by including importer-industry-time ω_{iHt}, exporter-industry-time ω_{jHt}, and bilateral-industry ω_{ijH} fixed effects. All models show a reasonably high goodness of fit as indicated by the R-square. This is slightly higher when including the multilateral resistance terms.

4.11 The effect of commoditization on the terms of trade

Let us first consider the indicator for cumulative price changes which is used as a proxy for commoditization. In all regressions (except for the group of Least Developed Economies (LDEs) in the second specification, where the coefficient is not significant), the coefficients on price trends have their expected signs.

[13] The list of country groups can be found in Table 3 in the appendix.

Table 1 Regressions on bilateral industrial terms of trade by exporting groups – 1998-2014

	Specification 1					Specification 2 including MLR				
	Whole	**AIE**	**EIE**	**ODE**	**LDE**	**Whole**	**AIE**	**EIE**	**ODE**	**LDE**
C^{x-}_{ijHt-1}	-0.091***	-0.11***	-0.054***	-0.072***	-0.091***	-0.082***	-0.092***	-0.076***	-0.063***	-0.079
	(0.0055)	(0.0069)	(0.012)	(0.016)	(0.034)	(0.0058)	(0.0072)	(0.013)	(0.020)	(0.056)
C^{x+}_{ijHt-1}	0.13***	0.14***	0.15***	0.10***	0.057*	0.12***	0.13***	0.15***	0.091***	0.054
	(0.0055)	(0.0069)	(0.012)	(0.016)	(0.033)	(0.0058)	(0.0072)	(0.013)	(0.020)	(0.056)
C^{m-}_{ijHt-1}	-0.11***	-0.14***	-0.094***	-0.061***	-0.020	-0.081***	-0.11***	-0.080***	-0.018	0.024
	(0.0053)	(0.0074)	(0.010)	(0.012)	(0.024)	(0.0055)	(0.0080)	(0.011)	(0.013)	(0.034)
C^{m+}_{ijHt-1}	0.13***	0.15***	0.12***	0.095***	0.052**	0.11***	0.14***	0.10***	0.064***	0.000079
	(0.0054)	(0.0075)	(0.011)	(0.012)	(0.025)	(0.0055)	(0.0081)	(0.011)	(0.014)	(0.037)
TBT^{x}_{ijHt-1}	-0.019***	-0.017***	-0.022***	-0.012	-0.024	-0.15**	-0.22***	0.0034	0.14	216.8
	(0.0035)	(0.0044)	(0.0069)	(0.011)	(0.024)	(0.066)	(0.082)	(0.15)	(0.34)	(5308116.5)
SPS^{x}_{ijHt-1}	-0.0069	-0.011*	-0.0093	0.021	0.027	0.0041	-0.13	0.18	-0.11	340.0***
	(0.0051)	(0.0067)	(0.0094)	(0.014)	(0.033)	(0.11)	(0.14)	(0.20)	(0.95)	(87.4)
TBT^{m}_{ijHt-1}	-0.0083**	-0.013**	0.0047	-0.015	-0.078**	0.19***	0.16	0.038	0.31	31.4
	(0.0035)	(0.0051)	(0.0057)	(0.0096)	(0.033)	(0.069)	(0.095)	(0.12)	(0.35)	(2875555.1)
SPS^{m}_{ijHt-1}	0.0079	0.0011	0.0048	0.039**	0.056	-0.042	-0.077	0.26	0.95	-1285.3
	(0.0051)	(0.0068)	(0.0084)	(0.016)	(0.14)	(0.11)	(0.14)	(0.22)	(0.81)	(78511965.3)
MS^{x}_{ijHt-1}	0.041	0.018	0.21**	-0.12	-0.21	-0.012	-0.030	0.077	-0.052	-0.48
	(0.040)	(0.051)	(0.086)	(0.12)	(0.22)	(0.041)	(0.052)	(0.12)	(0.19)	(0.42)
MS^{m}_{ijHt-1}	-0.093**	-0.058	-0.079	-0.18***	0.078	-0.050	0.035	-0.032	-0.20***	0.16

	Specification 1					Specification 2 including MLR				
	Whole	**AIE**	**EIE**	**ODE**	**LDE**	**Whole**	**AIE**	**EIE**	**ODE**	**LDE**
	(0.040)	(0.087)	(0.090)	(0.065)	(0.095)	(0.040)	(0.078)	(0.097)	(0.076)	(0.16)
v^{x}_{ijHt-1}	-0.10***	-0.096***	-0.12***	-0.092***	-0.081***	-0.077***	-0.073***	-0.088***	-0.071***	-0.024
	(0.0023)	(0.0030)	(0.0044)	(0.0066)	(0.015)	(0.0025)	(0.0033)	(0.0052)	(0.0087)	(0.027)
v^{m}_{ijHt-1}	0.042***	0.044***	0.048***	0.040***	0.022**	0.030***	0.024***	0.041***	0.034***	0.011
	(0.0022)	(0.0033)	(0.0040)	(0.0048)	(0.0095)	(0.0024)	(0.0037)	(0.0044)	(0.0055)	(0.016)
Hf^{x}_{ijHt-1}	0.11***	0.071***	0.18***	0.13***	0.14*	0.053***	0.019	0.096***	0.069*	-0.021
	(0.011)	(0.013)	(0.022)	(0.032)	(0.073)	(0.011)	(0.014)	(0.023)	(0.037)	(0.12)
Hf^{m}_{ijHt-1}	-0.036***	-0.070***	0.018	-0.043**	-0.053	0.0075	-0.0037	0.057***	-0.026	-0.043
	(0.010)	(0.016)	(0.019)	(0.022)	(0.041)	(0.010)	(0.016)	(0.020)	(0.023)	(0.063)
RCA^{x}_{ijHt-1}	0.0029***	0.0021*	0.0023	0.0045**	0.0096**	0.0018**	0.0013	0.0026	0.0023	-0.0038
	(0.00087)	(0.0012)	(0.0017)	(0.0018)	(0.0045)	(0.00089)	(0.0013)	(0.0020)	(0.0037)	(0.010)
RCA^{m}_{ijHt-1}	-0.0039***	-0.0026	-0.0035**	-0.0071***	-0.0047	-0.0024**	-0.0019	-0.0027	-0.0021	-0.0077
	(0.00096)	(0.0016)	(0.0018)	(0.0019)	(0.0032)	(0.00098)	(0.0017)	(0.0022)	(0.0023)	(0.0063)
GDP_{it}	-0.058	-0.34***	-0.10	0.045	-0.42					
	(0.059)	(0.089)	(0.14)	(0.17)	(0.43)					
$GDPpc_{it}$	-0.025	0.22***	0.029	-0.020	0.45					
	(0.057)	(0.082)	(0.14)	(0.18)	(0.42)					
cap_{it}	0.040**	-0.050	0.096***	-0.035	-0.14*					
	(0.020)	(0.033)	(0.030)	(0.049)	(0.075)					
emp_{it}	0.099**	0.34***	0.10	-0.16	0.63*					
	(0.042)	(0.067)	(0.068)	(0.10)	(0.35)					

	Specification 1					Specification 2 including MLR				
	Whole	**AIE**	**EIE**	**ODE**	**LDE**	**Whole**	**AIE**	**EIE**	**ODE**	**LDE**
hc_{it}	-0.12	0.39***	-0.43**	0.34*	-0.29					
	(0.082)	(0.13)	(0.17)	(0.19)	(0.63)					
GDP_{jt}	-0.065	-0.012	0.18	-0.66***	-0.28					
	(0.060)	(0.074)	(0.13)	(0.19)	(0.41)					
$GDPpc_{jt}$	0.059	-0.014	-0.11	0.67***	0.16					
	(0.057)	(0.071)	(0.12)	(0.18)	(0.42)					
emp_{jt}	-0.0063	-0.086*	-0.0096	0.56***	0.011					
	(0.041)	(0.051)	(0.083)	(0.13)	(0.32)					
cap_{jt}	-0.10***	-0.14***	-0.16***	-0.066	0.019					
	(0.020)	(0.028)	(0.035)	(0.053)	(0.097)					
hc_{jt}	-0.015	-0.063	0.13	0.041	0.76					
	(0.081)	(0.10)	(0.16)	(0.24)	(0.48)					
xr_{ijt}	0.17***	0.24***	0.22***	0.11**	-0.15*					
	(0.021)	(0.031)	(0.035)	(0.052)	(0.083)					
N. Obs.	1050511	617651	268287	134395	30178	1123380	640959	280457	151337	22935
R-sq	0.507	0.523	0.500	0.461	0.427	0.577	0.595	0.602	0.618	0.703
adj. R-sq	0.455	0.478	0.447	0.389	0.323	0.481	0.506	0.474	0.402	0.291
ω_{ijh}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ω_{t}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ω_{iht}	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
ω_{jht}	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, clustered by dyadic country-pair-sectors
* p<0.1, ** p<0.05, and *** p<0.01
Source: Own calculations

The cumulated negative growth of price levels in the exporting industries C_{ijHt}^{x-} is negatively related to the bilateral intra-industry terms of trade. According to the second specification, a 1 per cent additional decline in the lagged price of exports reduces the terms of trade by 0.082 per cent. Similarly, the cumulated positive growth of price levels in the importing industries C_{ijHt}^{m+} also impact negatively on the bilateral intra-industry terms of trade with a coefficient of -0.081.

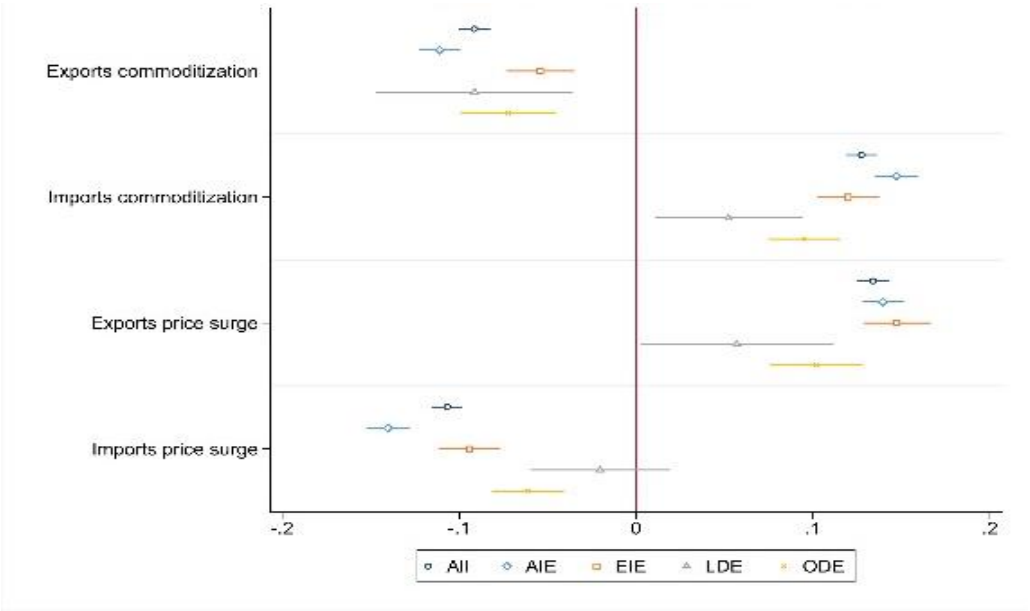
However, negative price trends in exports are more than off-set by the effects of an increase in export prices on the terms of trade with a coefficient of around 0.012. Thus, on average, price trends for exports tend to impact positively on bilateral intra-industry terms of trade of around +0.04 per cent. Analogously, negative price trends in imports impact positively on the terms of trade with an elasticity of 0.011 (thus, a coefficient which is higher compared to the positive price trends for imports). This results in an overall effect of around +0.03 per cent.

To summarize, an increase in export prices has a stronger impact on the terms of trade than a 1 per cent decrease in export prices, which indicates specialization towards higher priced products. Similarly, a 1 per cent increase in import prices has a weaker effect than a 1 per cent decrease in import prices, which might indicate that import substitution is more difficult. In terms of magnitude, the impact of commoditization is strongest for the group of Advanced Industrial Economies (AIEs) and less so for Other Developing Economies (ODEs) and Emerging Industrial Economies (EIEs). No significant effect is found for Least Developed Economies (LDEs), which might result from the small sample size or the specific segment of manufacturing products exported and imported.

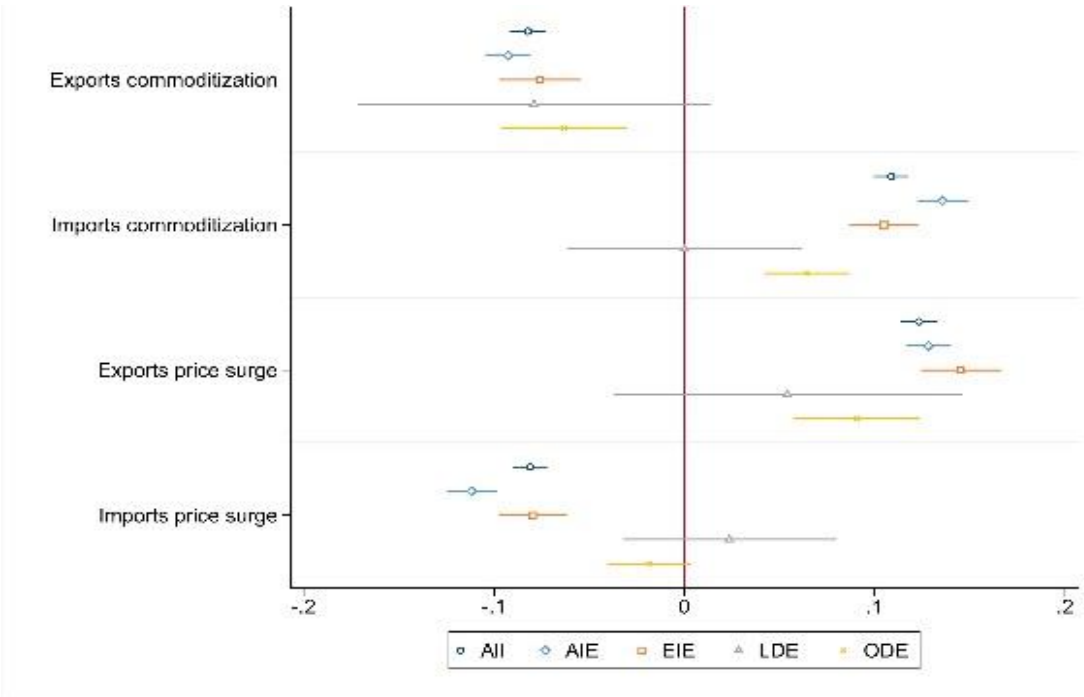
When comparing the coefficients of accumulated export and import prices, there are remarkable differences across country groups. For the AIEs, the increase in import prices has a much larger negative impact on the terms of trade than the decline in export prices. For ODE and LDE, the import price surge has no statistically significant impact at all (in Specification 2). Overall, the deterioration of terms of trade for LDEs is mainly driven by the exports side.

Figure 1 **Coefficients and confidence intervals of regressions from the entire sample, by exporting groups**

Specification 1



Specification 2



Note: 10 per cent confidence intervals.

Source: Own calculations based on results presented in Table 1.

4.1.2 The impact of non-tariff measures on the terms of trade

Second, let us discuss the impact of NTMs on the terms of trade, starting with TBTs. The results suggest that exporting countries facing technical barriers to trade (TBT) have lower terms of trade on average. However, this is only the case for exports from AIEs when considering country groups separately.[14] This deterioration in terms of trade could imply that the trade-weighted price of the exporting industry from the AIE to any destination in the world is reduced due to the proliferation of TBT that are imposed by the destination market. This impact could either be attributable to lower export prices or less trade caused by the technical barriers. For the other country groups, the effects are statistically insignificant in both specifications.

The other way round, TBT imposed by the exporting country on its imports from the trading partner are positively related with its terms of trade when controlling for the MLR (Specification 2) and when considering the entire sample. In this specification, i.e. when the supply shocks are fully controlled for (by including ω_{iHt}), the domestically imposed TBTs against the imports could affect the terms of trade via higher export prices for two reasons. First, domestic TBT could improve the market efficiencies for a specific country by fostering better and more transparent information. This could decrease the unit values of the products imported from a specific partner over time, resulting in higher bilateral terms of trade. Second, producing in an environment with high standards (reflected in domestic TBT) might increase the quality of exports to a specific destination, resulting in a higher terms of trade.[15] However, this result does not hold for the individual country groups, indicating that this is mostly a cross-country relationship for which the above explanation is appropriate.

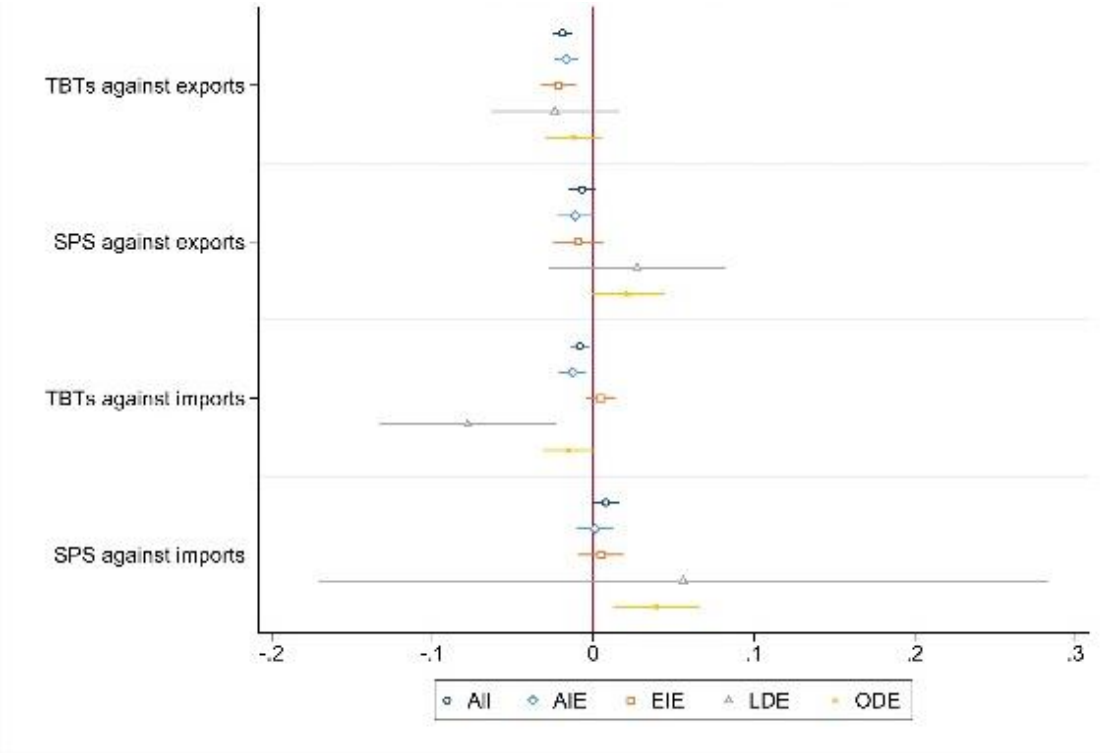
In contrast to the impact of TBT, sanitary and phytosanitary measures (SPS) faced by the exporting country, SPS^{x}_{ijHt}, are generally not significant. Only in the case of the LDEs are these positively related to the bilateral terms of trade, according to Specification 2. Including the MLR in this specification renders a very large coefficient of SPS for LDE exporters, which indicates a very sensitive relationship between their terms of trade and the SPS they face.

[14] Controlling for the bilateral industry and time fixed effects only as in Specification 1, the terms of trade are statistically and negatively related to the TBTs that the exporting industries of Advanced Industrialized Economies (AIEs) and Economic Industrialized Economies (EIEs) face.

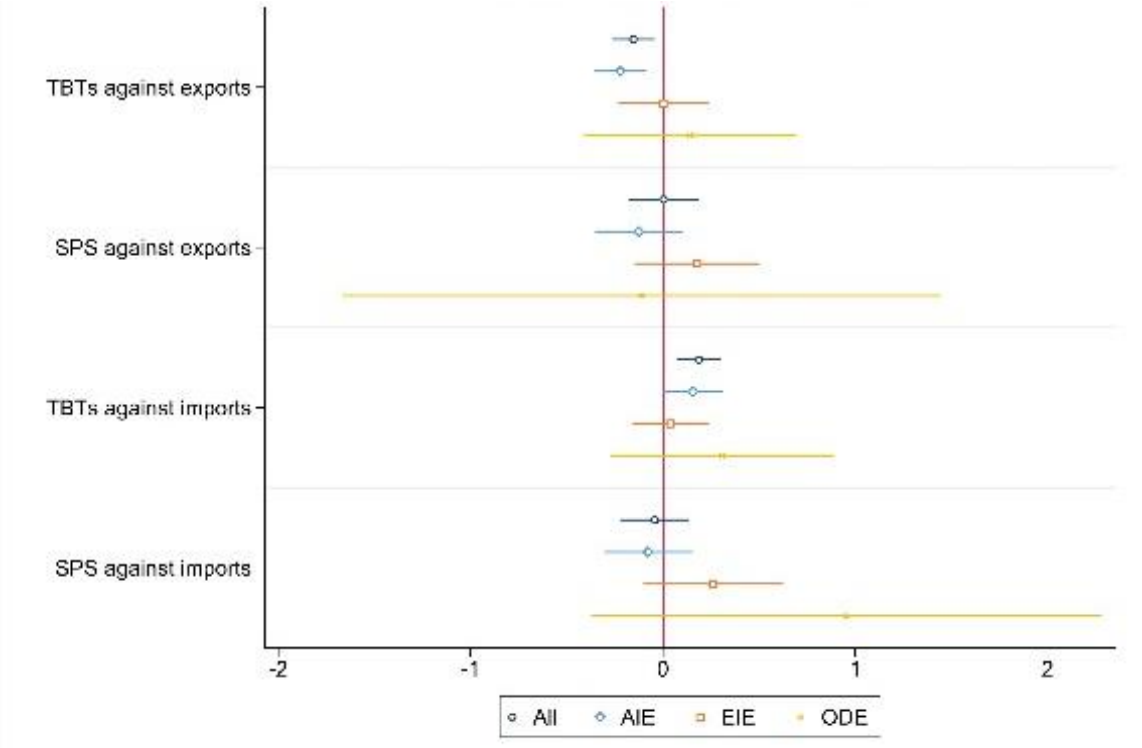
[15] A packaging and labelling requirement is a good example of such a causal interpretation.

Figure 2 **Coefficients and confidence intervals of regressions from the entire sample, by exporting groups**

Specification 1



Specification 2



Note: 10 per cent confidence intervals; LDEs are omitted from the graph.
Source: Own calculations based on results presented in Table 1.

This positive relationship between such trade barriers and the terms of trade of LDEs could support the argument made by Kaplinsky (2006). Accordingly, barriers to entry encourage the exporters from less developed countries to search for niche markets. A product that complies with the high standard regulations could improve the exporting country's terms of trade.[16] SPS imposed by the exporting country has no statistically significant impact on the bilateral terms of trade (except in Specification 1 for Other Developing Economies (ODEs), indicating a positive relationship).

In summary, non-tariff measures generally impact bilateral intra-industry terms of trade very weakly; only for the group of AIEs and LDEs is a significant impact of SPS found.

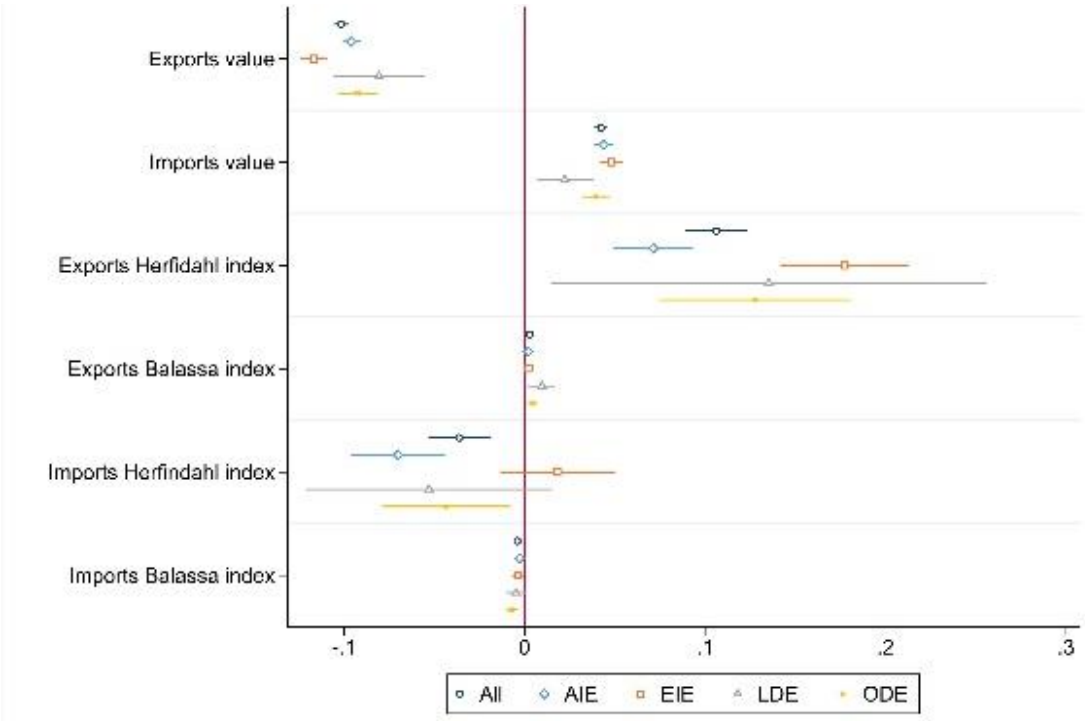
4.1.3 Other variables

Let us now turn to the other determinants. Market shares of exports in destination countries MS^{x}_{ijHt} do not show a statistically significant impact in any of the regressions in Specification 2 (and only once in Specification 1). However, the import market shares of the trading partner MS^{m}_{ijHt} are negatively related to the terms of trade of Other Developing Economies (ODEs). This might suggest that the larger the supplier of a given industry in ODEs is attributable to higher import prices, the lower are the terms of trade.

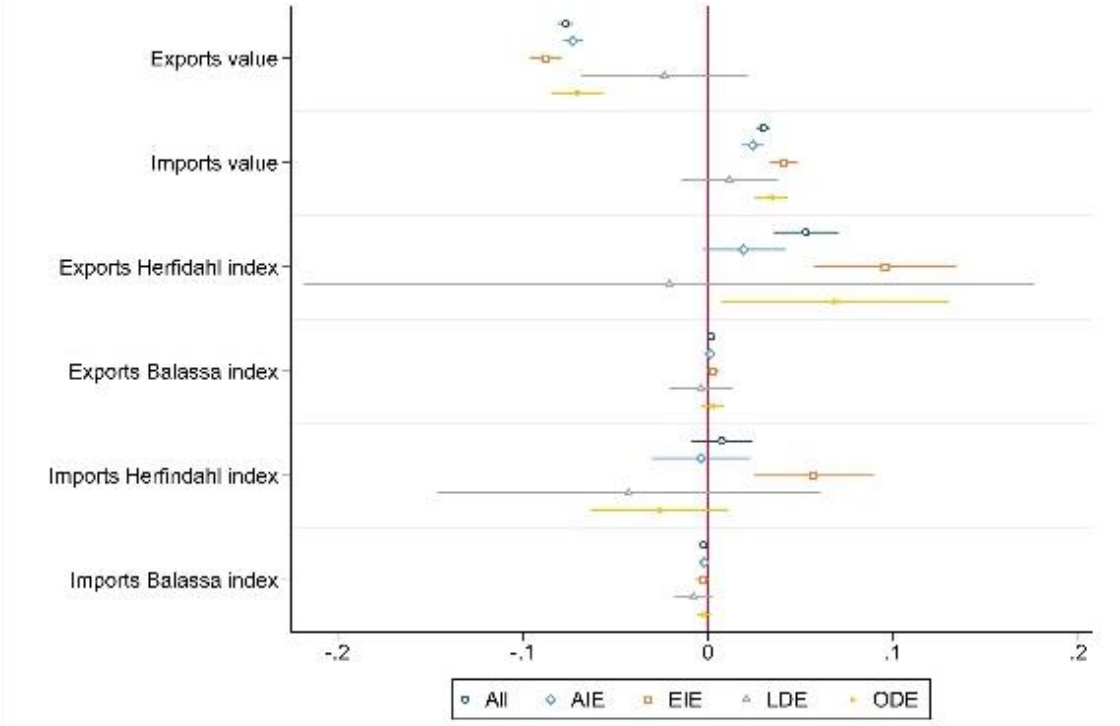
[16] Kaplinsky (2006) gives an example of Kenyan exotic products such as fresh vegetables and salads that find niche demands in Europe.

Figure 3 **Coefficients and confidence intervals of regressions from the entire sample, by exporting groups**

Specification 1



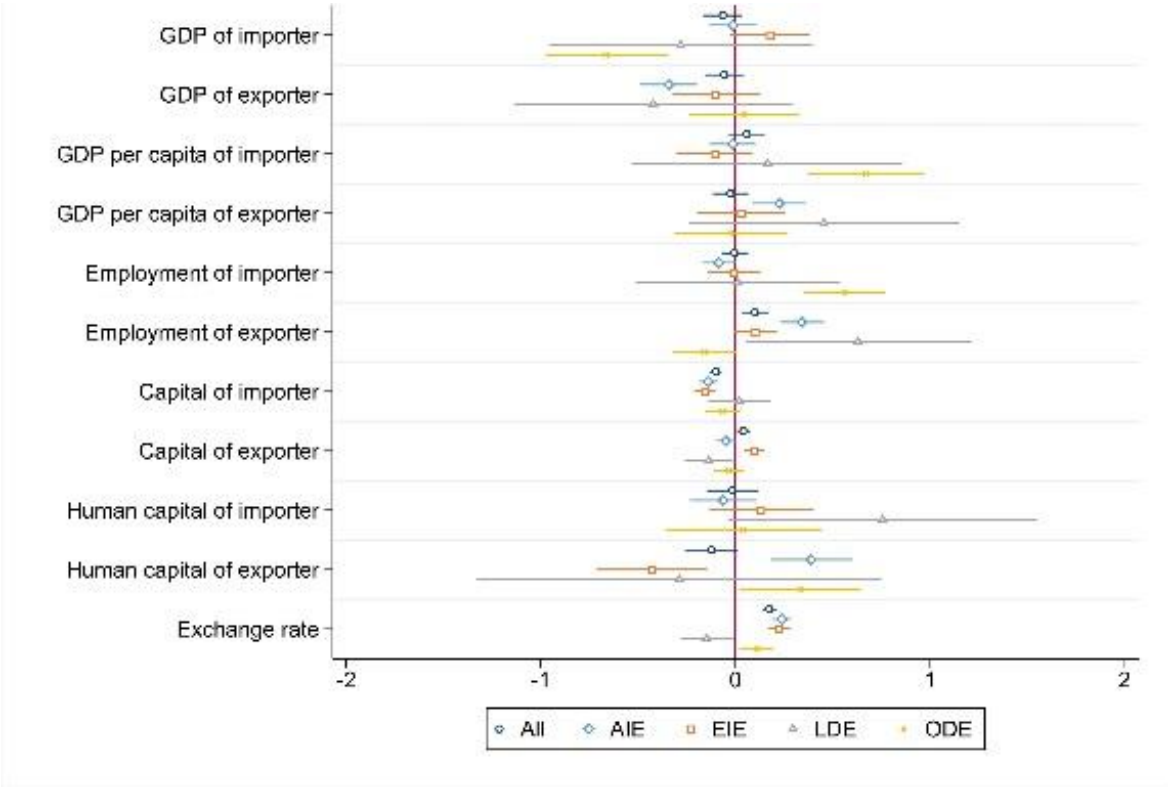
Specification 2



Note: 10 per cent confidence intervals.
Source: Own calculations based on results presented in Table 1.

Figure 4 **Coefficients and confidence intervals of regressions from the entire sample, by exporting groups**

Specification 2



Note: 10 per cent confidence intervals.
Source: Own calculations based on results presented in Table 1.

Higher export values v^{x}_{ijHt-1} imply that the terms of trade decrease in all exporting groups (except for LDEs in Specification 2). The relationship contrasts for import values v^{m}_{ijHt-1}. Both relationships could indicate the existence of scale effects of delivering to the other country. Both higher export and import volumes are associated with lower prices, implying the respective impacts on the terms of trade.

A higher **diversification in exports** (measured by the Herfindahl index Hf^{x}_{ijHt-1}) in most cases increases the intra-industry bilateral terms of trade. Analogously, more diversification in imports (measured by the Herfindahl index Hf^{m}_{ijHt-1}) tend to decrease the terms of trade. Both results indicate that a larger diversification in the exports of a country to another is related to higher prices of the traded goods basket.

Moreover, statistically significant coefficients of RCA, RCA^{x}_{ijHt-1} and RCA^{x}_{ijHt-1}, in Specification 1 and the entire sample in Specification 2 indicate that the geographical specialization in the exports of a given industry can increase the bilateral terms of trade; analogously, highly specialized imports weaken it.

The exporter's GDP shows a statistically significant relationship with the bilateral terms of trade for the AIEs group only. An increase in real GDP of an AIE exporter weakens its terms of trade within an industry. This could be related to the economies of scale in these countries, which results in outputs and exports at lower prices. On the other side of trade, the importer's GDP is statistically significantly related to the terms of trade of only ODE exporters, which is a negative relationship. In fact, the larger the importer from ODE is, the lower are the country's terms of trade vis-à-vis the importer. According to Engel's law, one can argue that the products exported by ODEs are of a relatively lower quality and negative income elasticity. Therefore, ODEs could enjoy larger bilateral terms of trade if they exported to smaller countries. GDP per capita shows a similar pattern, but with opposite signs. In fact, the terms of trade of AIEs improves when their GDP per capita increases. Feenstra and Romalis (2014) argue that the level of development translated in the country's per capita income is related to a higher quality of production and higher demand for better quality. More advanced countries should therefore produce and export higher quality products, but also demand and import products of higher quality. This, in turn, should be reflected in higher prices. The net effect is larger bilateral terms of trade. Moreover, the terms of trade of ODEs improves when their importing partners become more developed, which is reflected in a higher GDP per capita.

The sectoral terms of trade of AIE and EIE exporters decrease with the physical capital of importing countries. However, an increase in the physical capital of an AIE is related to its higher bilateral terms of trade, while the opposite relationship is observed for LDE.

The sectoral terms of trade of AIE exporters increase with the number of people employed in their economy and reduce employment in their importing partners. However, the terms of trade of an LDE country are positively related to its own employment, while those of an ODE are positively related to its trading partner's employment.

Human capital plays a differentiated role in the bilateral terms of trade of different exporters. Higher human capital for AIEs and for ODEs is related to their larger sectoral terms of trade, while for EIEs this is not the case. However, human capital trading partners do not have any statistical significant relationship with the terms of trade of an exporter.

Except for LDEs, the exchange rate variable is significantly positive. $xr_{ijt} = xr_{it}/xr_{jt}$ suggests that when the currency of exporter *i* depreciates relative to that of its trading partner *j*, its terms of trade would be higher, a similar result as reported in Baffes and Etienne (2016). Although exchange rate appreciation could be caused by an improvement of the aggregate net barter terms of trade, it can affect sectoral terms of trade differently. Depreciation of an exporter's currency would make the exported product to a given destination cheaper than before. *Ceteris paribus*—controlling for the value of trade and GDP in the regression—the same price for the same commodity would bring higher revenues to the exporter in local currency units, thus improving the terms of trade. However, this situation is reversed for LDEs, but at a weaker level of significance.

4.2 Non-tariff measures hamper commoditization

An important part of the analysis is to investigate at which point the market structure and barriers to entry could change the commoditization process. In doing so, we interact the commoditization variable with variables for non-tariff measures and market structures. Table 2 presents the results of this analysis using the specification that controls for multilateral resistances (MLR) with importer-industry-time ω_{jHt} and exporter-industry-time ω_{iHt} fixed effects in addition to bilateral industry ω_{ijH} fixed effects (Specification 2 in Table 1). The interaction terms are first introduced separately and reported in Columns 1-7. The eighths column to the right includes all interaction terms simultaneously.

The results for most of the coefficients are similar to those reported in Table 1 for the entire sample. Exceptions are that MS^{x}_{ijHt} becomes statistically significant, including its interaction with commoditization, and RCA^{x}_{ijHt} loses its significance when including the interactions. The signs, significance and interpretation for the remaining variables are the same as before.

By interacting the commoditization variable (for exports) with variables on export markets, i.e. structural variables and policy variables, allows analysing whether such variables reduce or enforce the commoditization impact on the bilateral intra-industry terms of trade. Figures 2 and 3 present these marginal effects with respect to the changes in the seven variables.

In these figures, the y-axes indicate the marginal effect of the commoditization variable and the x-axes represent the change of the respective structural and policy variables. At the origin, where the change of other variables is zero, the solid line is at the level of the commoditization variable's coefficient as reported in models M1-M7. The impact of commoditization on the terms of trade is negative, *ceteris paribus*, however, by changing the respective variables (e.g.

TBT), this negative impact becomes smaller and even reaches a positive area on the y-axis. Dashed lines indicate the 95 per cent confidence intervals. If the dashed lines diverge so that one stays in the positive and the other in the negative area of the y-axis, a marginal impact of commoditization will become statistically insignificant at the 5 per cent level

Table 2 Regressions on bilateral sectoral terms of trade – commoditization effect – 1998-2014

	M1	M2	M3	M4	M5	M6	M7	M8
C^{x-}_{ijHt-1}	-0.092***	-0.087***	-0.099***	-0.089***	-0.088***	-0.085***	-0.085***	-0.11***
	(0.0066)	(0.0059)	(0.0068)	(0.0059)	(0.0058)	(0.0062)	(0.0058)	(0.0076)
$TBT^{x}_{ijHt-1} \times C^{x-}_{ijHt-1}$	0.0074***							0.0038
	(0.0025)							(0.0029)
$SPS^{x}_{ijHt-1} \times C^{x-}_{ijHt-1}$		0.017***						0.0093*
		(0.0042)						(0.0050)
$TBT^{m}_{ijHt-1} \times C^{x-}_{ijHt-1}$			0.0097***					0.0044*
			(0.0022)					(0.0026)
$SPS^{m}_{ijHt-1} \times C^{x-}_{ijHt-1}$				0.018***				0.0096**
				(0.0035)				(0.0043)
$MS^{x}_{ijHt-1} \times C^{x-}_{ijHt-1}$					0.18***			0.16***
					(0.018)			(0.019)
$Hf^{x}_{ijHt-1} \times C^{x-}_{ijHt-1}$						0.0084		0.0033
						(0.0074)		(0.0075)
$RCA^{x}_{ijHt-1} \times C^{x-}_{ijHt-1}$							0.0031***	0.0022***
							(0.00061)	(0.00061)
C^{x+}_{ijHt-1}	0.12***	0.12***	0.12***	0.12***	0.12***	0.12***	0.12***	0.12***
	(0.0058)	(0.0058)	(0.0058)	(0.0058)	(0.0058)	(0.0058)	(0.0058)	(0.0058)
C^{m-}_{ijHt-1}	0.11***	0.11***	0.11***	0.11***	0.11***	0.11***	0.11***	0.11***
	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)
C^{m+}_{ijHt-1}	-0.081***	-0.081***	-0.081***	-0.081***	-0.081***	-0.081***	-0.081***	-0.082***
	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)	(0.0055)
TBT^{x}_{ijHt-1}	-0.16**	-0.15**	-0.15**	-0.15**	-0.16**	-0.15**	-0.15**	-0.16**
	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)
SPS^{x}_{ijHt-1}	0.0045	-0.0032	0.0074	0.012	-0.0011	0.0039	0.0059	0.0027
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)

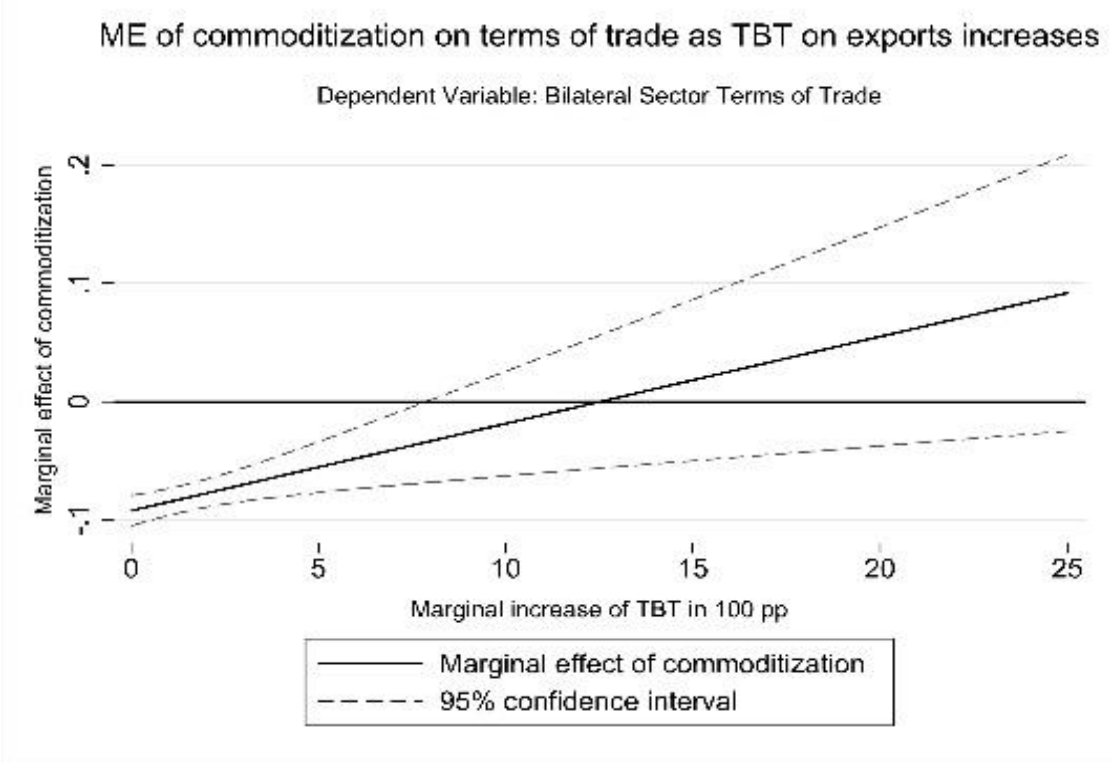
TBT^{m}_{ijHt-1}	0.19***	0.19***	0.18***	0.19***	0.19***	0.19***	0.19***	0.19***
	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)
SPS^{m}_{ijHt-1}	-0.040	-0.037	-0.039	-0.045	-0.046	-0.042	-0.041	-0.040
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
MS^{x}_{ijHt-1}	-0.015	-0.014	-0.011	-0.012	-0.19***	-0.012	-0.012	-0.18***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.045)	(0.041)	(0.041)	(0.045)
MS^{m}_{ijHt-1}	-0.050	-0.050	-0.052	-0.051	-0.051	-0.050	-0.051	-0.053
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
v^{x}_{ijHt-1}	-0.077***	-0.077***	-0.077***	-0.077***	-0.077***	-0.077***	-0.077***	-0.077***
	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)	(0.0025)
v^{m}_{ijHt-1}	0.030***	0.030***	0.030***	0.030***	0.030***	0.030***	0.030***	0.030***
	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Hf^{x}_{ijHt-1}	0.053***	0.053***	0.053***	0.053***	0.052***	0.043***	0.052***	0.048***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.013)	(0.011)	(0.014)
Hf^{m}_{ijHt-1}	0.0076	0.0075	0.0073	0.0075	0.0074	0.0074	0.0073	0.0073
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
RCA^{x}_{ijHt-1}	0.0018**	0.0018**	0.0018**	0.0018**	0.0018**	0.0018**	-0.0014	-0.00050
	(0.00089)	(0.00089)	(0.00089)	(0.00089)	(0.00089)	(0.00089)	(0.0011)	(0.0011)
RCA^{m}_{ijHt-1}	-0.0024**	-0.0024**	-0.0024**	-0.0024**	-0.0024**	-0.0024**	-0.0024**	-0.0024**
	(0.00098)	(0.00098)	(0.00098)	(0.00098)	(0.00097)	(0.00098)	(0.00098)	(0.00098)
N. Obs.	1123380	1123380	1123380	1123380	1123380	1123380	1123380	1123380
R-sq	0.577	0.577	0.577	0.577	0.577	0.577	0.577	0.577
adj. R-sq	0.481	0.481	0.481	0.481	0.481	0.481	0.481	0.481
AIC	3044001.8	3043984.2	3043981.9	3043964.6	3043883.1	3044017.4	3043969.2	3043796.0
BIC	3044204.6	3044187.0	3044184.8	3044167.4	3044086.0	3044220.2	3044172.0	3044070.4
ω_{ijh}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ω_{iht}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ω_{jht}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, clustered by dyadic country-pair-industries

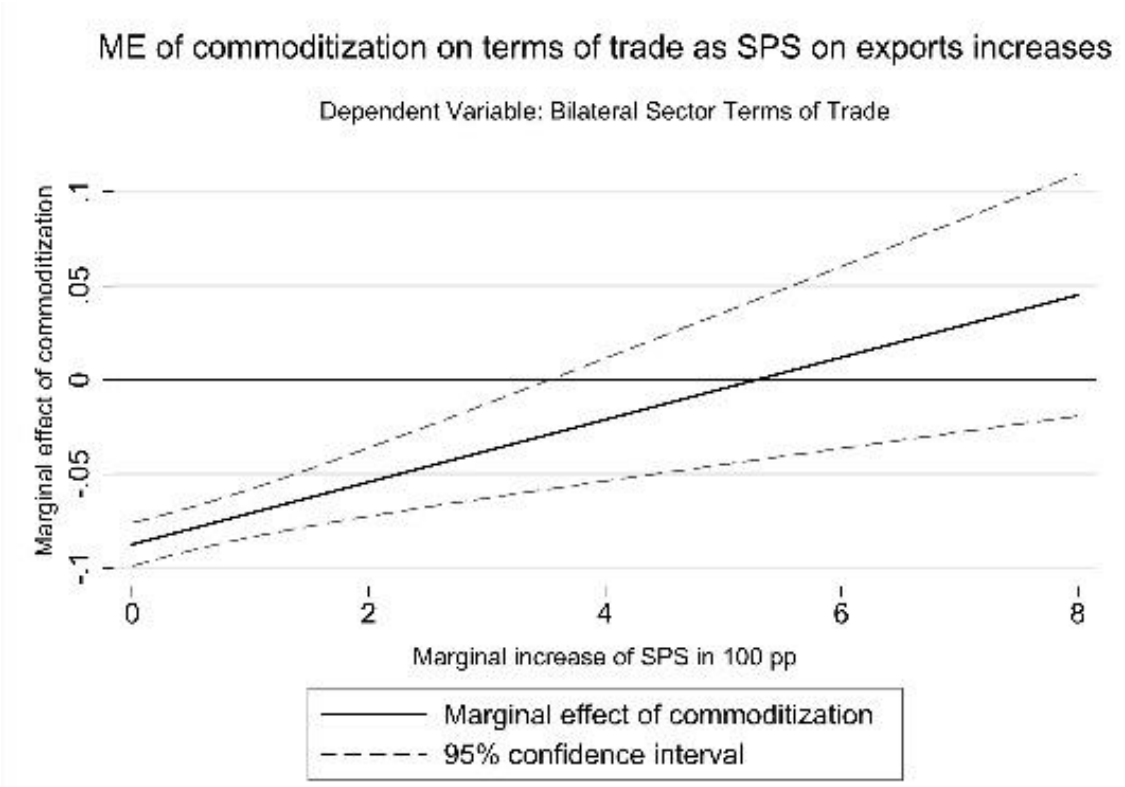
* p<0.1, ** p<0.05, and *** p<0.01

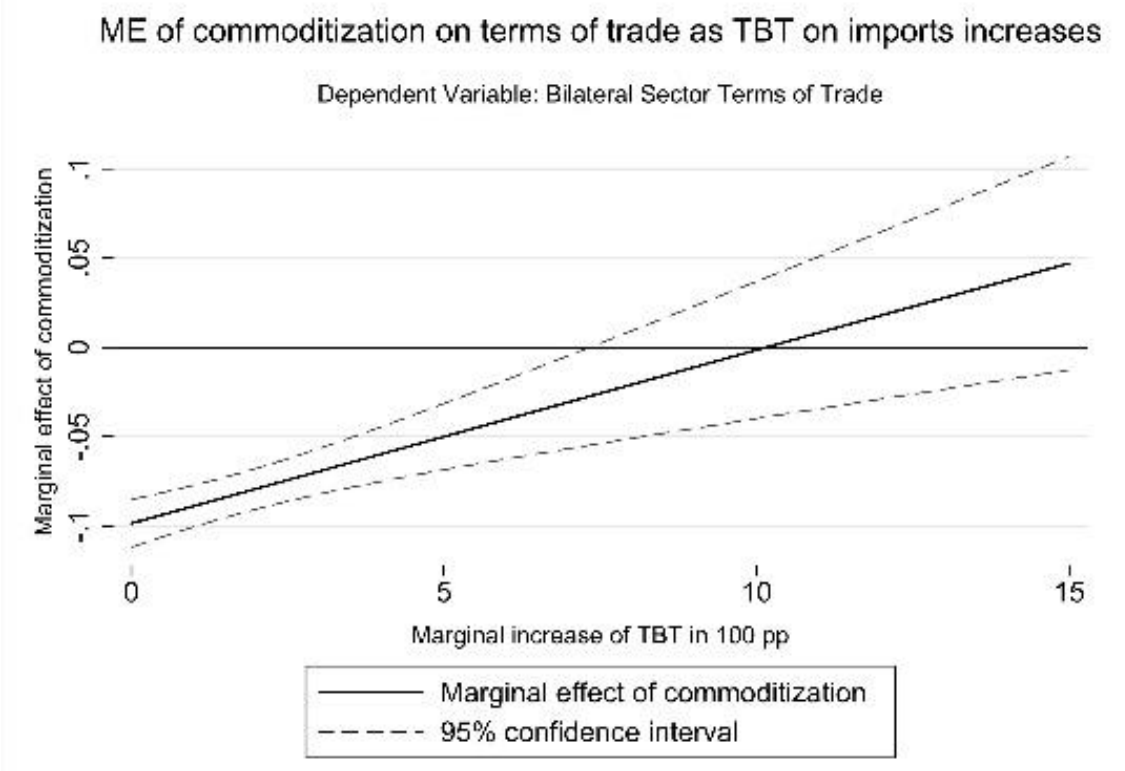
The first four top panels show that a larger number of TBT and SPS measures imposed on the exporting or by the importing country tends to reduce the negative impact of commoditization on the bilateral terms of trade. In fact, after products entered the market through quality barriers, the exporter might still opt for a declining price of the product that is then in line with the existing standards. Therefore, the quality barrier could potentially neutralize the negative impact of commoditization on the bilateral terms of trade for that exporting country. As Kaplinsky (2006) argues on niche markets and certifications, compliance with certain standards (in terms of quality, for example) may help avoid commoditization. With this empirical evidence supporting Kaplinsky's argument, one can argue that these types of trade policy measures (focusing on the quality of products, production procedure improvement, etc.) force developing countries to strengthen their capacities to comply with these standards, preventing a declining trend of their terms of trade. However, one has to bear in mind that such measures might restrict trade (mostly of lower quality) and these have to be taken into account for an overall assessment of their effects.[17]

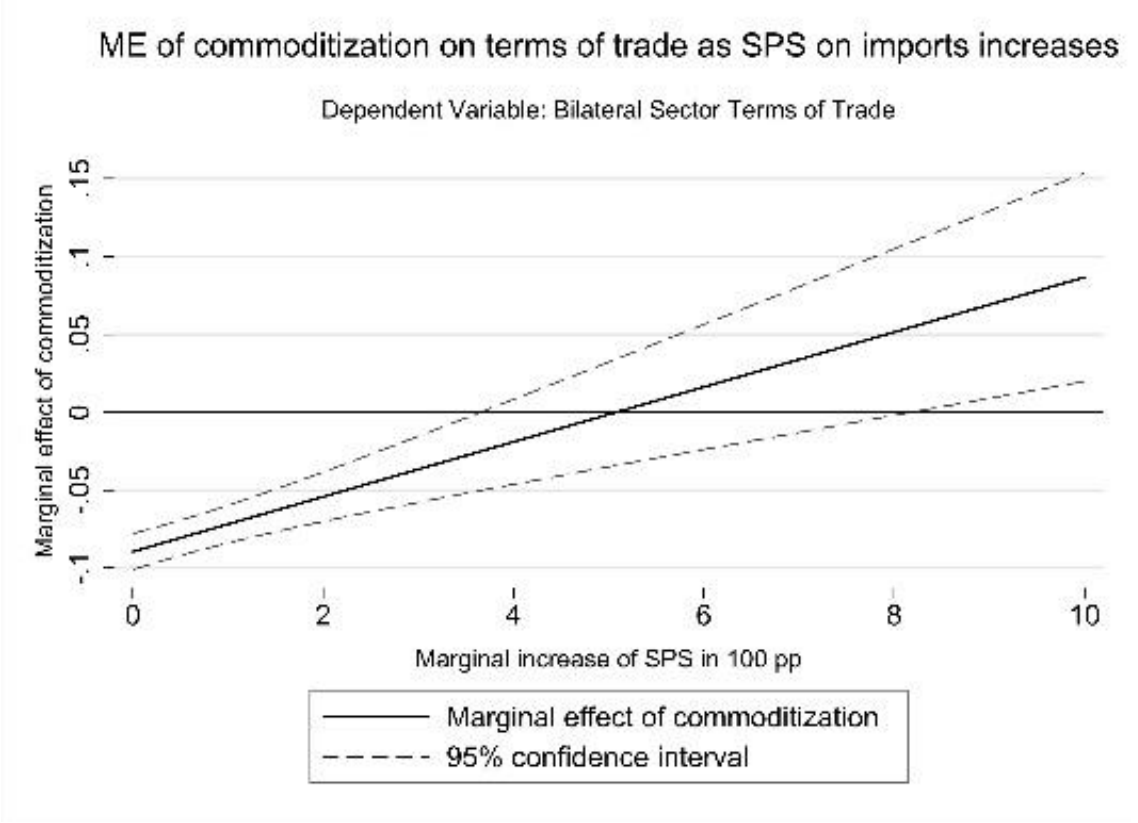
Figure 5 Marginal effect of commoditization on terms of trade for policy variable changes



[17] Note that the positive terms of trade effect could also be driven by a reduction of low quality exports from these countries.


ME of commoditization on terms of trade as SPS on exports increases
Dependent Variable: Bilateral Sector Terms of Trade
Marginal effect of commoditization
-.1
-.05
0
.05
.1
0
2
4
6
8
Marginal increase of SPS in 100 pp
Marginal effect of commoditization
95% confidence interval


ME of commoditization on terms of trade as TBT on imports increases
Dependent Variable: Bilateral Sector Terms of Trade
Marginal effect of commoditization
-.1
-.05
0
.05
.1
0
5
10
15
Marginal increase of TBT in 100 pp
Marginal effect of commoditization
95% confidence interval



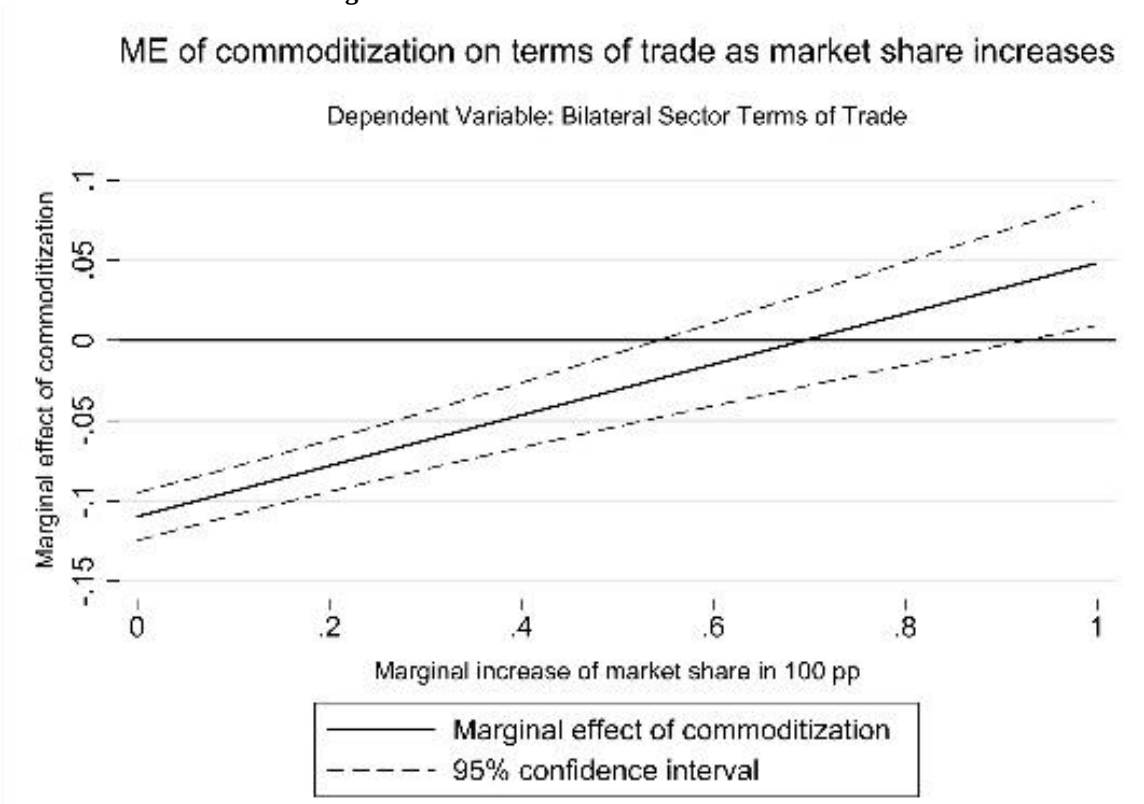
Source: Based on estimation results reported in Table 2.

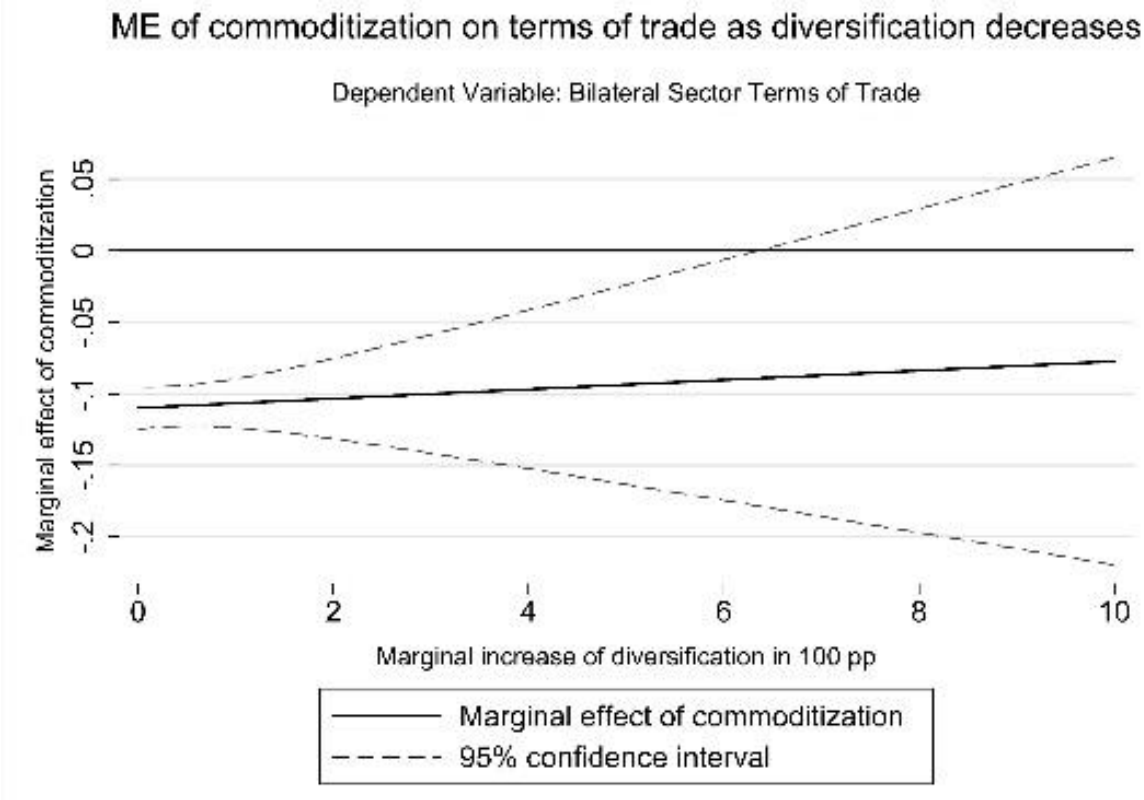
The traditional Prebisch-Singer hypothesis emphasizes the role of innovative strategies in production to achieve development via exports and trade, standards—embedded within quality NTMs, enforcing better technology—could open a door through better terms of trade and moving away from the commoditization of manufacturing products. Even countries can introduce these qualitative NTMs to improve exporters' domestic production environment.

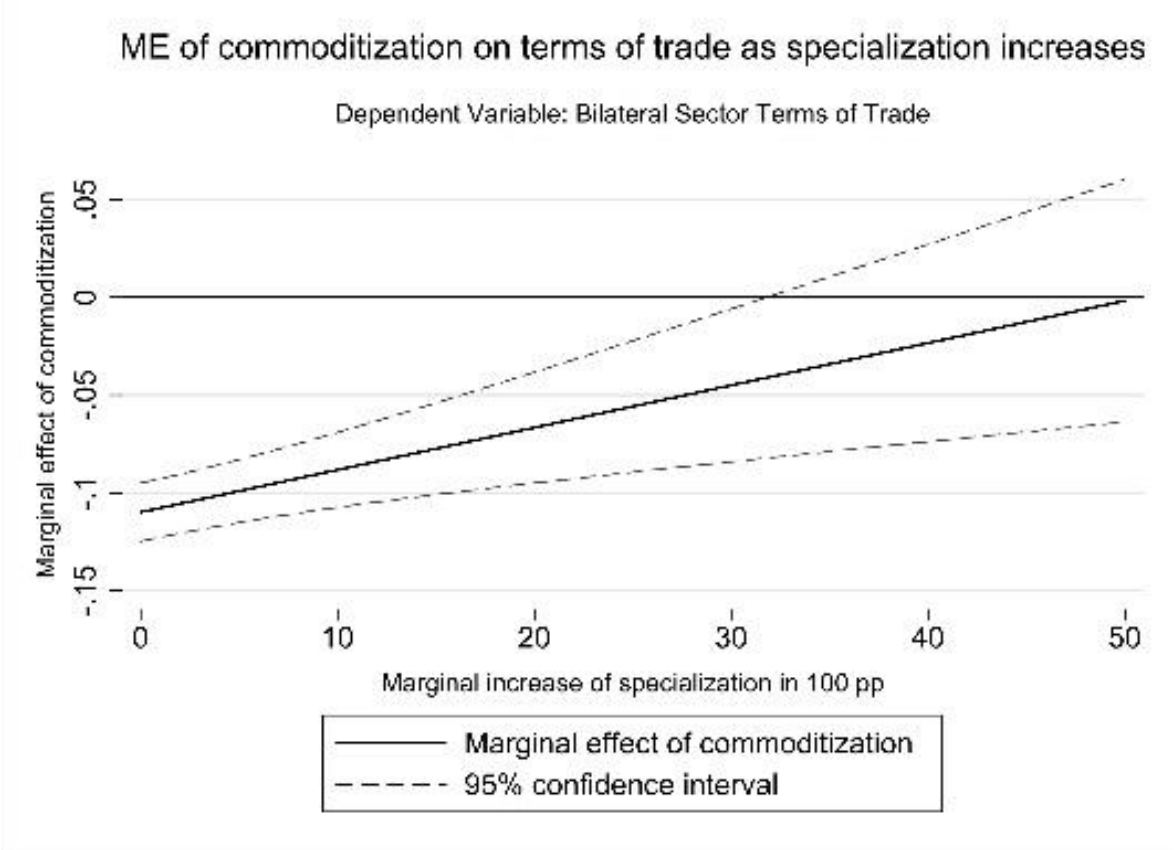
As regards the interaction terms of market structure variables with those of the commoditization shows that both the exporters' market share and geographical specialization further reduces the negative impact of commoditization significantly.

However, there is no indication that an increasing diversification proxied by the Herfindahl index (see upper right panel in Figure 3) has a significant impact on intra-industry terms of trade.

Figure 6 **Marginal effect of commoditization on the terms of trade for market structure variable changes**







Source: Based on estimation results reported in Table 2

5 Conclusions

This study analyses the determinants of terms of trade developments at the bilateral and sectoral level—that the ratio of a given industry's export prices to import prices, thus bilateral intra-industry terms of trade—for which only little evidence exists. Moreover, most existing studies usually investigate unilateral terms of trade only, and thus neglect supply and demand side factors when analysing their development. The results presented here are based on detailed bilateral trade data at the HS 6-digit level which allow the calculation of bilateral intra-industry terms of trade at the ISIC Rev. 3 industry level. A gravity model framework was then applied to study the determinants of these bilateral intra-industry terms of trade in detail.

Controlling for other factors affecting the terms of trade as suggested in previous studies, the focus here was on the impact of commoditization on bilateral sectoral terms of trade. The concept of commoditization and the '*commodity trap*' is traditionally studied in the context of falling prices of primary commodities exports by developing economies, leading to the deterioration of their terms of trade. The strand of literature based on the Prebisch-Singer hypothesis argues that commoditization impedes long-run growth, e.g. due to a lack of

technological gains. Commoditization is defined as a persistent decline in the price of products within the manufacturing sector. This is proxied as the accumulated negative growth of export prices at the detailed product level. Some developing countries might remain specialized in low-quality products or products with less sophistication in production, and might therefore remain or fall into a *commodity trap* as they are forced to sell at low or even decreasing prices in order to keep or even gain market shares. As the econometrics analysis shows, these persistent price trends are correlated with a deterioration in the terms of trade. However, the combined impact of accumulated price growth on the terms of trade that amounts to around 7 per cent could hint at specialization patterns across trade flows.

Another important focus in this study was testing whether non-tariff measures (NTMs), barriers to entry and other factors like market structure potentially reduce the negative impact of commoditization on a country's bilateral intra-industry terms of trade. Technical barriers to trade (TBT) and sanitary and phytosanitary measures (SPS) are the two most important quality NTMs and were therefore included in the analysis. These trade policy tools are usually implemented by importing countries to increase the quality of products, guarantee specific requirements in the production procedure or protect environmental and animal health. Further, such regulations can improve market efficiencies by reducing information asymmetries. Specifically, we account for this by including the number of TBT and SPS notified by members of the World Trade Organization (WTO) in the econometric analysis. In addition, further control variables capturing diversification, geographical specialization and market shares were included in the analysis.

The results suggest that TBT and SPS have a negative impact on bilateral intra-industry terms of trade. However, TBT imposed by the home country could improve the terms of trade. Domestic TBT regulations could improve the quality of produced products before exports with higher prices, which could possibly enable the exporter to enter a foreign destination with similar barriers to entry. This, overall, could lead to higher exports and terms of trade for an exporter operating in an environment with many TBT regulations in force.

The results further indicate that for EIE and ODEs' terms of trade are higher when trade relations are characterized by lower diversification. Geographical specialization of exports to a destination market positively impacts the bilateral intra-industry terms of trade, while market shares do not show significant impacts.

Higher export specialization and market shares tend to reduce the negative impact of commoditization on the terms of trade. Despite the negative influence of TBT and SPS on the

terms of trade of the exporting industry, it is found that compliance with these measures by the exporter reduces the negative impact of commoditization on the terms of trade. It would be more intuitive to claim that from the importer's perspective, NTMs would have a negative effect in terms of trade since they rule out low-quality imports which are typically cheaper.

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Appendix

Table 3 Summary statistic of variables, simple averages by exporting country across industries and trading partners, 2014

Group	Exporter	Exporter Name	$\frac{v_{it}^x}{v_t^x}$**	T_{it}	C_{it}^{x-}	C_{it}^{x+}	Hf_{it}^x	RCA_{it}^x	TBT_{it}^x	SPS_{it}^x
AIE	ABW	Aruba	0.09%	2.88	1.39	1.39	0.19	2.24	2.75	1.19
AIE	AND	Andorra	0.12%	3.43	1.57	1.55	0.23	2.62	3.17	1.13
AIE	ARE	United Arab Emirates	1.28%	5.22	2.42	2.34	0.30	1.82	2.17	0.78
AIE	ATF	French Southern Territories	0.00%	3.97	0.39	0.33	0.44	5.57	3.86	0.91
AIE	AUS	Australia	1.45%	4.37	2.02	2.06	0.25	1.40	2.03	0.75
AIE	AUT	Austria	1.48%	5.22	1.80	1.86	0.26	1.51	2.09	0.75
AIE	BEL	Belgium	1.74%	5.49	1.90	1.89	0.30	1.54	1.89	0.69
AIE	BHR	Bahrain	0.48%	4.90	2.29	2.38	0.25	1.48	2.55	0.89
AIE	BMU	Bermuda	0.05%	4.74	1.46	1.54	0.14	1.60	3.67	1.87
AIE	CAN	Canada	1.56%	5.56	1.67	1.63	0.27	1.41	1.95	0.72
AIE	CHE	Switzerland	1.60%	4.19	1.88	1.89	0.28	1.50	1.97	0.72
AIE	CXR	Christmas Island	0.00%	3.12	0.44	0.19	0.33	1.17	1.02	0.00
AIE	CYM	Cayman Islands	0.04%	4.51	1.51	1.41	0.30	10.60	3.01	1.45
AIE	CZE	Czech Republic	1.34%	5.03	2.13	2.16	0.27	1.45	2.20	0.81
AIE	DEU	Germany	2.37%	5.27	2.22	2.31	0.28	1.52	1.69	0.60
AIE	DNK	Denmark	1.29%	4.25	2.18	2.18	0.28	1.70	2.21	0.83
AIE	ESP	Spain	1.79%	5.68	2.29	2.32	0.28	1.69	1.91	0.70
AIE	EST	Estonia	0.76%	4.76	2.24	2.22	0.23	1.29	2.73	1.11

Group	Exporter	Exporter Name	$\frac{v_{it}^x}{v_t^x}$**	T_{it}	C_{it}^{x-}	C_{it}^{x+}	Hf_{it}^x	RCA_{it}^x	TBT_{it}^x	SPS_{it}^x
AIE	FIN	Finland	1.11%	4.79	2.07	2.09	0.26	1.49	2.41	0.90
AIE	FRA	France	2.30%	5.34	2.09	2.15	0.28	1.48	1.54	0.55
AIE	GBR	United	2.19%	5.32			0.29	1.49	1.66	0.59
		Kingdom			2.62	2.63				
AIE	GIB	Gibraltar	0.06%	5.76	2.16	2.00	0.27	4.03	3.08	0.72
AIE	GRL	Greenland	0.04%	5.18	1.31	1.45	0.24	2.51	2.92	1.42
AIE	GUM	Guam	0.04%	5.33	1.32	1.39	0.30	4.17	2.05	0.68
AIE	HKG	Hong Kong	1.35%	6.23			0.29	1.60	2.07	0.76
		SAR, China			2.41	2.30				
AIE	HUN	Hungary	1.14%	4.61	2.20	2.31	0.28	1.73	2.41	0.91
AIE	IRL	Ireland	1.01%	4.07	2.17	2.20	0.27	1.59	2.50	0.95
AIE	ISL	Iceland	0.46%	3.17	2.07	2.07	0.24	1.49	3.05	1.27
AIE	ISR	Israel	1.06%	3.97	1.86	1.82	0.27	1.35	2.46	0.97
AIE	ITA	Italy	1.99%	5.78	2.29	2.37	0.29	1.92	1.83	0.66
AIE	JPN	Japan	1.45%	5.69	2.26	2.30	0.28	1.60	2.14	0.80
AIE	KOR	Korea, Rep.	1.43%	7.21	1.98	2.01	0.30	1.75	2.04	0.75
AIE	KWT	Kuwait	0.58%	5.54	1.92	1.94	0.22	1.45	2.54	0.81
AIE	LTU	Lithuania	0.85%	4.56	2.06	2.02	0.25	2.33	2.55	1.00
AIE	MAC	Macao	0.26%	5.19			0.28	1.58	2.82	1.13
		SAR, China			2.28	2.24				
AIE	MLT	Malta	0.48%	4.40	2.66	2.62	0.27	2.36	2.88	1.08
AIE	MNP*	Northern	0.01%	4.57			0.37	7.52	1.37	0.26
		Mariana								
		Islands			0.44	0.60				
AIE	MYS	Malaysia	1.17%	5.97	2.61	2.56	0.26	1.53	2.15	0.79
AIE	NCL	New	0.17%	3.54			0.17	1.52	2.68	0.94
		Caledonia			2.11	2.21				

Group	Exporter	Exporter Name	$\frac{v_{it}^x}{v_t^x}$**	T_{it}	C_{it}^{x-}	C_{it}^{x+}	Hf_{it}^x	RCA_{it}^x	TBT_{it}^x	SPS_{it}^x
AIE	NLD	Netherlands	2.02%	4.85	2.31	2.33	0.29	1.27	1.78	0.64
AIE	NOR	Norway	1.23%	4.47	2.16	2.15	0.25	1.76	2.35	0.87
AIE	NZL	New Zealand	0.90%	4.81	2.10	2.13	0.23	1.57	2.31	0.87
AIE	PRT	Portugal	1.03%	6.74	2.04	2.05	0.27	1.54	2.32	0.90
AIE	PYF	French Polynesia	0.12%	2.79	2.36	2.40	0.18	1.30	2.94	1.24
AIE	QAT	Qatar	0.57%	4.70	2.14	2.20	0.22	1.32	2.67	0.86
AIE	RUS	Russian Federation	1.40%	5.35	2.52	2.61	0.25	1.53	2.27	0.82
AIE	SGP	Singapore	1.45%	5.05	2.04	1.99	0.29	1.82	1.98	0.71
AIE	SMR	San Marino	0.06%	5.49	0.56	0.55	0.35	3.60	3.60	1.45
AIE	SVK	Slovak Republic	0.98%	5.56	2.24	2.25	0.26	1.44	2.54	0.96
AIE	SVN	Slovenia	0.92%	5.77	1.87	1.92	0.25	1.43	2.47	0.96
AIE	SWE	Sweden	1.44%	4.30	1.87	1.85	0.27	1.52	2.09	0.76
AIE	TCA*	Turks and Caicos Islands	0.01%	3.00	0.59	0.39	0.21	1.37	2.80	1.32
AIE	USA	United States	2.65%	5.35	2.35	2.27	0.30	1.32	1.55	0.54
AIE	VGB	British Virgin Islands	0.04%	3.30	1.17	1.03	0.32	12.05	2.84	1.40

Group	Exporter	Exporter Name	$\frac{v_{it}^x}{v_t^x}$**	T_{it}	C_{it}^{x-}	C_{it}^{x+}	Hf_{it}^x	RCA_{it}^x	TBT_{it}^x	SPS_{it}^x
EIE	ARG	Argentina	0.72%	5.61	2.28	2.33	0.25	1.67	2.68	1.02
EIE	BGR	Bulgaria	0.91%	5.29	2.16	2.17	0.26	1.44	2.52	0.94
EIE	BLR	Belarus	0.52%	6.44	2.13	2.10	0.21	1.29	2.68	0.95
EIE	BRA	Brazil	1.18%	6.57	2.11	2.13	0.27	1.32	2.32	0.81
EIE	BRN	Brunei	0.21%	3.70			0.21	1.22	2.56	1.10
		Darussalam			1.73	1.88				
EIE	CHL	Chile	0.76%	4.96	2.38	2.44	0.24	1.54	2.56	1.04
EIE	CHN	China	1.80%	8.60	2.01	1.92	0.31	1.93	1.87	0.72
EIE	COL	Colombia	0.81%	5.15	2.19	2.20	0.25	1.67	2.47	0.95
EIE	CRI	Costa Rica	0.43%	3.54	2.71	2.67	0.27	1.57	2.76	1.11
EIE	CYP	Cyprus	0.52%	4.13	2.39	2.37	0.23	1.57	2.84	1.15
EIE	GRC	Greece	1.02%	4.70	2.68	2.71	0.27	1.66	2.47	0.93
EIE	HRV	Croatia	0.72%	4.71	2.18	2.30	0.23	1.72	2.67	1.04
EIE	IDN	Indonesia	0.95%	7.26	2.40	2.49	0.26	1.70	2.37	0.87
EIE	IND	India	1.39%	7.30	2.09	2.07	0.28	1.36	2.10	0.77
EIE	KAZ	Kazakhstan	0.56%	3.66	2.63	2.84	0.23	2.08	2.38	0.81
EIE	LVA	Latvia	0.74%	4.84	2.14	2.12	0.25	1.54	2.65	1.04
EIE	MEX	Mexico	1.33%	5.89	2.90	2.90	0.28	1.32	2.28	0.86
EIE	MKD	Macedonia,	0.46%	4.60			0.23	1.53	2.81	1.15
		FYR			1.90	1.90				
EIE	MUS	Mauritius	0.41%	3.22	2.05	2.02	0.22	2.53	2.50	0.96
EIE	NRU*	Nauru	0.00%	4.42	0.25	0.26	0.23	0.48	1.95	0.77
EIE	OMN	Oman	0.47%	5.18	2.42	2.48	0.26	1.89	2.70	0.97
EIE	POL	Poland	1.44%	4.86	2.01	1.99	0.27	2.60	2.22	0.84
EIE	ROM	Romania	1.07%	5.22	0.00	0.00	0.26	1.30	2.43	0.88
EIE	SAU	Saudi	0.84%	5.64			0.28	1.32	2.48	0.89
		Arabia			3.04	3.07				

EIE	SUR	Suriname	0.12%	4.74	1.46	1.50	0.21	1.61	3.10	1.28
EIE	THA	Thailand	1.21%	6.78	1.89	1.88	0.27	1.47	2.13	0.79
EIE	TUN	Tunisia	0.47%	5.22	2.48	2.51	0.27	1.50	2.78	1.04
EIE	TUR	Turkey	1.48%	6.76	1.79	1.86	0.29	1.50	2.09	0.77
EIE	UKR	Ukraine	0.89%	5.80	2.35	2.39	0.24	1.48	2.51	0.90
EIE	URY	Uruguay	0.40%	5.04	1.95	1.95	0.23	1.72	2.77	1.07
EIE	VEN	Venezuela, RB	0.31%	5.20	3.47	3.49	0.28	1.74	2.84	1.05
EIE	ZAF	South Africa	1.34%	5.52	2.21	2.17	0.28	1.67	1.99	0.72

Group	Exporter	Exporter Name	$\frac{v_{it}^x}{v_t^x}$**	T_{it}	C_{it}^{x-}	C_{it}^{x+}	Hf_{it}^x	RCA_{it}^x	TBT_{it}^x	SPS_{it}^x
LDE	AFG	Afghanistan	0.11%	3.15	1.76	1.83	0.29	1.91	2.91	0.79
LDE	BDI	Burundi	0.06%	5.12	1.44	1.39	0.31	2.00	2.21	0.26
LDE	BEN	Benin	0.18%	4.48	1.70	1.72	0.27	1.47	1.95	0.70
LDE	BFA	Burkina Faso	0.19%	3.89	1.74	1.87	0.25	1.30	2.08	0.71
LDE	BGD	Bangladesh	0.33%	6.27	2.15	2.11	0.26	1.60	2.61	1.05
LDE	BTN	Bhutan	0.01%	8.22	0.98	0.78	0.24	1.53	3.13	1.04
LDE	CAF	Central African Republic	0.01%	5.15	1.21	1.25	0.37	4.09	2.12	0.42
LDE	COD	Congo, the Dem. Rep. of	0.12%	4.76	1.89	2.01	0.24	1.52	2.47	0.70
LDE	COM	Comoros	0.01%	3.72	2.58	2.61	0.17	1.12	2.73	1.02
LDE	DJI	Djibouti	0.03%	3.04	1.67	1.73	0.18	2.82	3.26	1.11
LDE	ERI	Eritrea	0.00%	2.34	1.37	1.74	0.20	1.37	3.03	0.68
LDE	ETH	Ethiopia	0.32%	4.65	2.14	2.22	0.22	1.47	2.78	0.81
LDE	GIN	Guinea	0.12%	3.99	2.20	2.27	0.23	3.75	2.81	1.14
LDE	GMB	Gambia, The	0.03%	4.27	2.42	2.30	0.32	3.54	2.75	1.04
LDE	GNB	Guinea-Bissau	0.00%	1.61	0.84	0.88	0.31	8.84	3.89	2.25
LDE	HTI	Haiti	0.07%	3.67	1.34	1.35	0.23	1.91	3.30	1.67
LDE	KHM	Cambodia	0.21%	5.44	2.18	2.12	0.26	2.41	2.55	1.16
LDE	KIR	Kiribati	0.00%	8.01	0.55	0.60	0.18	0.24	1.59	0.94
LDE	LAO	Lao PDR	0.09%	4.00	1.01	1.07	0.25	1.35	2.62	1.07
LDE	LBR	Liberia	0.05%	5.77	1.52	1.43	0.29	9.04	2.51	0.54
LDE	MDG	Madagascar	0.18%	5.54	2.32	2.46	0.23	1.34	2.80	1.11

LDE	MLI	Mali	0.10%	3.42	2.57	2.58	0.26	1.51	2.50	0.91
LDE	MMR	Myanmar	0.19%	5.52	1.53	1.47	0.22	1.52	2.53	1.16
LDE	MOZ	Mozambique	0.21%	4.97	2.03	2.09	0.24	1.56	2.28	0.71
LDE	MRT	Mauritania	0.09%	4.47	2.04	2.15	0.25	1.32	2.50	0.74
LDE	MWI	Malawi	0.12%	5.50	2.03	2.11	0.24	3.00	2.04	0.42
LDE	NER	Niger	0.16%	4.18	2.00	2.05	0.32	6.02	2.36	1.02
LDE	NPL	Nepal	0.15%	5.98	1.50	1.46	0.23	1.29	2.84	1.43
LDE	RWA	Rwanda	0.14%	3.99	1.41	1.42	0.25	2.45	2.19	0.47
LDE	SEN	Senegal	0.32%	4.69	2.06	2.08	0.23	1.30	2.42	0.89
LDE	SLB	Solomon Islands	0.02%	5.63	1.11	1.08	0.17	2.11	1.45	0.80
LDE	SLE	Sierra Leone	0.10%	6.27	1.14	1.11	0.19	1.46	3.16	1.23
LDE	SOM	Somalia	0.01%	3.89	0.48	0.68	0.24	2.45	2.77	0.48
LDE	STP	São Tomé and Principe	0.01%	3.18	0.88	0.83	0.12	2.03	3.05	1.24
LDE	TCD	Chad	0.03%	4.73	1.30	1.31	0.25	1.91	3.26	0.97
LDE	TGO	Togo	0.08%	5.68	2.17	2.11	0.29	3.46	2.35	1.15
LDE	TLS	Timor-Leste	0.02%	4.93	0.87	1.04	0.17	0.69	2.08	0.90
LDE	TZA	Tanzania	0.36%	5.05	2.97	3.05	0.25	1.34	2.56	0.80
LDE	UGA	Uganda	0.26%	3.70	2.51	2.58	0.26	1.45	2.54	0.73
LDE	VUT	Vanuatu	0.02%	3.83	1.81	1.48	0.17	8.49	0.92	0.98
LDE	WSM	Samoa	0.05%	4.47	1.56	1.56	0.19	1.62	2.19	1.33
LDE	YEM	Yemen, Rep.	0.19%	5.35	2.26	2.26	0.23	1.69	2.99	1.06
LDE	ZMB	Zambia	0.20%	4.12	2.40	2.40	0.25	1.48	2.27	0.65

Group	Exporter	Exporter Name	$\frac{v_{it}^x}{v_t^x}$**	T_{it}	C_{it}^{x-}	C_{it}^{x+}	Hf_{it}^x	RCA_{it}^x	TBT_{it}^x	SPS_{it}^x
ODE	AGO	Angola	0.20%	3.54	2.48	2.53	0.26	3.19	2.76	0.83
ODE	AIA	Anguila	0.01%	1.30	0.64	0.64	0.15	0.95	4.09	2.04
ODE	ALB	Albania	0.25%	4.25	2.48	2.45	0.24	1.58	2.97	1.15
ODE	ARM	Armenia	0.25%	3.80	1.69	1.65	0.22	2.04	2.72	1.14
ODE	ASM*	American Samoa	0.01%	10.68	0.29	0.27	0.32	3.11	1.73	0.63
ODE	ATG	Antigua and Barbuda	0.07%	3.28	1.96	2.10	0.22	3.49	2.68	1.17
ODE	AZE	Azerbaijan	0.33%	4.13	2.33	2.24	0.23	1.59	2.51	0.92
ODE	BHS	Bahamas, The	0.11%	4.48	1.67	1.61	0.29	6.61	3.08	1.24
ODE	BIH	Bosnia and Herzegovina	0.49%	4.46	1.90	1.92	0.22	1.61	2.82	1.15
ODE	BLZ	Belize	0.11%	3.52	2.13	2.12	0.26	10.48	2.81	1.39
ODE	BOL	Bolivia	0.23%	5.51	2.50	2.55	0.23	1.27	2.73	1.20
ODE	BRB	Barbados	0.16%	4.22	2.13	2.20	0.24	2.58	2.51	1.00
ODE	CIV	Côte d'Ivoire	0.33%	5.14	1.86	1.89	0.26	1.98	2.13	0.85
ODE	CMR	Cameroon	0.30%	3.95	2.13	2.15	0.23	1.81	2.64	0.93
ODE	COG	Congo, Rep.	0.23%	3.88	1.61	1.64	0.23	2.27	2.19	0.83
ODE	COK	Cook Islands	0.01%	3.10	0.97	1.03	0.21	1.80	2.12	1.49
ODE	CPV	Cabo Verde	0.05%	3.82	2.35	2.49	0.19	1.67	3.63	1.43
ODE	CUB	Cuba	0.11%	4.34	3.29	3.33	0.22	2.68	2.99	1.26
ODE	DMA	Dominica	0.02%	2.40	2.09	2.06	0.22	1.73	3.18	1.53
ODE	DOM	Dominican Republic	0.50%	4.94	1.53	1.49	0.24	2.15	2.59	1.10
ODE	DZA	Algeria	0.34%	4.77	3.23	3.32	0.23	1.50	2.92	1.10
ODE	ECU	Ecuador	0.52%	5.03	2.24	2.30	0.24	1.21	2.71	1.07

ODE	EGY	Egypt, Arab Rep.	0.85%	6.98	2.29	2.27	0.25	1.86	2.54	0.92
ODE	FJI	Fiji	0.18%	4.18	1.99	2.00	0.23	1.80	2.16	1.18
ODE	FSM	Micronesia, Fed. Sts.	0.00%	8.46	0.77	1.02	0.41	3.26	3.12	1.43
ODE	GAB	Gabon	0.13%	3.37	2.59	2.65	0.27	2.06	2.54	0.67
ODE	GEO	Georgia	0.46%	3.64	1.77	1.80	0.24	1.62	2.65	1.10
ODE	GHA	Ghana	0.28%	4.28	2.98	3.01	0.25	1.35	2.50	0.92
ODE	GNQ	Equatorial Guinea	0.06%	5.01	1.73	1.64	0.20	1.78	2.78	0.59
ODE	GRD	Grenada	0.02%	2.76	1.85	1.75	0.26	2.15	2.78	1.09
ODE	GTM	Guatemala	0.45%	4.85	2.30	2.33	0.24	1.35	2.50	1.08
ODE	GUY	Guyana	0.08%	5.95	2.34	2.37	0.22	1.46	2.51	1.18
ODE	HND	Honduras	0.43%	4.24	2.16	2.11	0.25	3.18	2.77	1.23
ODE	IRN	Iran, Islamic Rep.	0.35%	6.48	2.67	2.70	0.25	1.70	2.88	1.20
ODE	IRQ	Iraq	0.18%	3.80	1.73	1.65	0.25	1.37	3.05	0.95
ODE	JAM	Jamaica	0.19%	5.20	2.38	2.38	0.22	1.90	2.67	1.06
ODE	JOR	Jordan	0.58%	4.73	2.30	2.30	0.23	2.77	2.61	1.00
ODE	KEN	Kenya	0.36%	5.61	3.16	3.12	0.24	1.84	2.56	0.90
ODE	KGZ	Kyrgyz Republic	0.09%	4.42	2.40	2.37	0.22	3.91	2.10	0.86
ODE	KNA	St. Kitts and Nevis	0.02%	4.24	1.31	1.35	0.25	8.71	2.96	0.79
ODE	LBN	Lebanon	0.63%	4.68	2.19	2.23	0.23	2.40	2.54	1.05
ODE	LBY	Libya	0.15%	4.13	2.77	2.78	0.27	1.43	3.12	1.14
ODE	LCA	St. Lucia	0.12%	3.83	1.35	1.40	0.22	2.68	2.23	0.97
ODE	LKA	Sri Lanka	0.55%	5.52	2.18	2.23	0.26	1.67	2.52	1.03
ODE	MAR	Morocco	0.72%	4.62	1.91	1.95	0.24	1.80	2.52	0.92

ODE	MDA	Moldova	0.37%	4.27	1.62	1.65	0.22	1.61	2.74	1.03
ODE	MDV	Maldives	0.09%	3.54	1.82	1.80	0.16	2.01	2.42	0.92
ODE	MHL	Marshall Islands	0.02%	8.59	1.35	1.49	0.24	22.56	2.78	1.23
ODE	MNG	Mongolia	0.21%	3.74	1.67	1.58	0.22	1.39	2.99	1.30
ODE	MSR	Montserrat	0.01%	3.44	0.67	0.89	0.21	2.37	2.89	1.07
ODE	NGA	Nigeria	0.46%	4.72	3.24	3.23	0.25	1.64	2.52	0.92
ODE	NIC	Nicaragua	0.23%	3.77	2.38	2.32	0.23	2.07	2.65	1.20
ODE	PAK	Pakistan	0.66%	6.71	1.92	1.91	0.26	1.25	2.55	0.99
ODE	PAN	Panama	0.52%	5.04	2.09	2.03	0.25	2.44	2.47	1.03
ODE	PER	Peru	0.67%	5.31	2.09	2.15	0.24	1.34	2.67	1.10
ODE	PHL	Philippines	0.82%	5.08	2.56	2.69	0.26	1.42	2.40	0.91
ODE	PLW	Palau	0.02%	2.73	0.30	0.44	0.16	1.14	2.99	1.26
ODE	PNG	Papua New Guinea	0.13%	3.78	2.72	2.79	0.24	1.69	2.41	0.85
ODE	PRK	Korea, Dem. People's Rep.	0.06%	5.16	1.17	1.18	0.23	2.14	2.75	1.28
ODE	PRY	Paraguay	0.24%	4.42	2.13	2.16	0.23	1.81	2.66	1.17
ODE	PSE	Palestine, State of	0.08%	3.52	0.46	0.45	0.24	2.33	3.15	1.33
ODE	SLV	El Salvador	0.35%	4.53	2.29	2.31	0.23	1.61	2.48	1.08
ODE	SYC	Seychelles	0.08%	5.15	2.54	2.50	0.23	2.91	2.69	0.86
ODE	SYR	Syrian Arab Republic	0.10%	6.40	2.33	2.36	0.23	1.93	2.42	1.07
ODE	TJK	Tajikistan	0.05%	2.39	1.46	1.50	0.26	2.44	2.21	0.65
ODE	TKM	Turkmenistan	0.09%	4.28	1.84	1.88	0.28	2.93	2.07	0.62
ODE	TON	Tonga	0.03%	2.12	1.59	1.55	0.17	1.76	1.40	0.73
ODE	TTO	Trinidad and Tobago	0.16%	5.59	2.62	2.57	0.30	1.79	2.57	0.96

ODE	TUV*	Tuvalu	0.00%	6.25	0.15	0.21	0.15	2.59	1.24	0.28
ODE	UZB	Uzbekistan	0.14%	5.26	1.85	1.90	0.27	1.51	2.50	0.93
ODE	VCT	St. Vincent and the Grenadines	0.02%	4.79	1.60	1.57	0.32	15.34	2.09	0.76
ODE	VNM	Viet Nam	0.90%	6.85	1.74	1.68	0.27	2.07	2.47	1.00
ODE	ZWE	Zimbabwe	0.15%	4.08	2.30	2.31	0.25	1.59	2.44	0.68

County groups according to the UNIDO classification as defined in Upadhyaya (2013).

**countries and territories not listed in the UNIDO classification have been attributed to a particular group based on their GDP per capita values.*

***$\frac{v_{it}^x}{v_t^x}$ is the share of country's exports relative to global exports in the sample of analysis.

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