# Aid for Trade and Import Product Diversification: To What Extent Does Export Product Diversification Matter?

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Abstract

*The literature on the effect of Aid for Trade (AfT) has shown that AfT flows can be associated with greater export product diversification in recipient-countries. However, the import product diversification effect of AfT interventions has received scant attention in this literature. The present article aims to fill this gap by examining whether AfT flows affect import product diversification when countries diversify their export product baskets. The empirical results suggest that AfT flows are associated with greater import product diversification in countries that diversify their export product baskets. This finding applies both to total AfT flows and its three major components, namely AfT flows for economic infrastructure, AfT flows for productive capacity, and AfT flows dedicated to trade policy and regulation. Additionally, the magnitude of the positive effect of total AfT flows on import product diversification increases as recipient-countries enjoy a convergence of their export product structure towards the world's export product structure. On another note, the empirical analysis reveals that AfT flows induce greater import product diversification in countries that further liberalise their trade policies. These results have important policy implications for both donors and recipient-countries.*

*JEL Classification: F35, F14.*
*Keywords: Aid for Trade; Export Product Diversification; Import Product Diversification.*

## 1. Introduction

Developing countries and, among them, least developed countries (LDCs)[2] are dependent on development aid for realising their development objectives. To help these countries better participate and enjoy the benefits of international trade, members of the World Trade Organisation (WTO) set up in 2005 the Aid for Trade (AfT) Initiative. The main objective of this Initiative is contained in Paragraph 57 of the Hong Kong Ministerial Declaration[3] (WTO 2005), which states that the AfT Initiative aims to help

developing countries, particularly LDCs, to build the supply-side capacity and trade-related infrastructure that they need to assist them to implement and benefit from WTO Agreements, and more broadly to expand their trade. AfT flows are indeed part of total development aid (also referred to as official development aid – ODA) and represent ODA allocated to the trade sector in recipient-countries. While there exist now many studies on the effectiveness of AfT, notably in terms of recipient-countries' export performance (e.g. export volumes and export values), only very few studies (e.g. Gnangnon 2019a, 2019b; Kim 2019) have considered the effect of AfT flows on export product diversification in recipient-countries. Additionally, we are aware of only one recent study (Ly-My *et al* 2020) that has considered the effect of AfT flows on import product diversification: Ly-My *et al* (2020) have explored whether, by reducing trade costs, AfT flows affect import product diversification in recipient-countries. They have found that total AfT flows promote import product diversification, by raising the number of both import commodities and import partner countries, including both member countries of the Development Assistance Committee (i.e. donor-countries) and Non-DAC countries (i.e. non-donor countries).

Many studies[4] (e.g. Agosin *et al* 2012; Zhu and Fu 2013; Amighini and Sanfilippo 2014; Adityaa and Acharyya 2015; Mau 2016; Bahar and Santos 2018) have now explored the macroeconomic determinants of export product diversification, but little attention has been paid to the macroeconomic determinants of import product diversification. One exception is Parteka and Tamberi (2013), who have focused on the effect of economic development on import product diversification. There is, to the best of our knowledge, no other published empirical study[5] that has used international panel data to examine the determinants of import product diversification.[6] In the meantime, the economic implications of import product diversification have been well documented in the literature. Import product diversification can positively affect productivity through enhancing competition: higher imports of new products from abroad drive domestic producers of close substitutes to improve so as to remain competitive, and this helps ensure a better complementarity between imported inputs and domestic varieties (e.g. Levinsohn 1993; Krishna and Mitra 1998; Pavcnik 2002; Trefler 2004; Fernandes 2007). The productivity effect of import product diversification also takes place through lower input prices, greater access to inputs of higher quality, and better access to new technologies (that is, via the learning effects of foreign technology) (e.g. Cadot *et al* 2013). The key role of imported inputs - in particular import of varieties of inputs - for production and eventually exports has also been emphasised by many other authors.[7]

In light of the importance of import product diversification for importing countries, the present study aims to contribute to the literature on the trade diversification effect of AfT flows in recipient-countries, by investigating the effect of AfT flows on import product diversification. It additionally examines whether this effect (if any at all) depends on AfT recipient-countries' degree of

export product diversification, insofar as AfT flows can potentially be associated with export product diversification. In so doing, it complements the work of Ly-My *et al* (2020), as it examines the effect of AfT flows on import product diversification from a different perspective: it primarily uses data on the import product concentration indicator based on the Herfindahl-Hirschman index, and additionally controls for recipient-countries' level of export product diversification in the empirical analysis (this was not the case in the analysis by Ly-My *et al* 2020 who have considered, *inter alia*, the number of export products as a dependent variable).

The importance of addressing the question as to whether the effect of AfT flows on import product diversification depends on the degree of export product diversification lies on the fact that not only do AfT flows affect export product diversification, but more importantly growth in import variety is associated with export product diversification (e.g. Bas and Strauss-Kahn 2014; Feng *et al* 2016; Castellani and Fassio 2019) – which highlights the close relationship between export product diversification and import product diversification.

The empirical analysis covers 128 countries over the period 1996–2016. Results based primarily on the two-step system Generalised Methods of Moments (GMM) shows that, taken separately, AfT flows (both total AfT flows and its components) and export product concentration induce greater import product concentration. However, considered jointly, AfT flows exert a greater import product diversification effect in countries that enjoy a higher level of export product diversification. On another note, the analysis also suggests that AfT flows promote import product diversification in countries that further liberalise trade policies.

The rest of the paper is organised as follows. Section 2 discusses how AfT flows and export product concentration (including their interaction) can affect countries' import product concentration paths. Section 3 describes the model that helps address empirically the issue at the heart of the analysis, and Section 4 presents the data analysis. Section 5 presents the econometric approach to estimate this model. Section 6 interprets the empirical outcomes, and Section 7 undertakes a robustness check. Section 8 concludes.

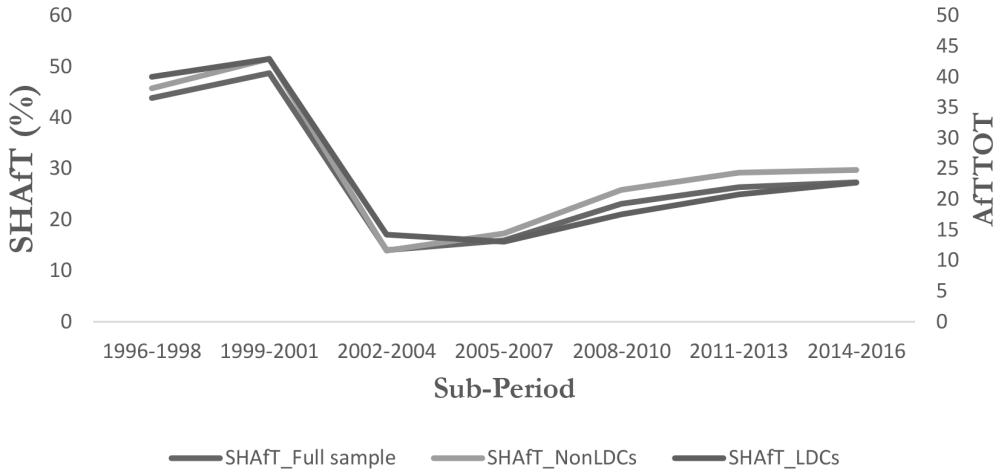
## 2. Theoretical discussion on the relationship between AfT, export product diversification and import product diversification

The Organisation for Economic Cooperation and Development (OECD) has classified AfT flows into three main categories: AfT allocated for economic infrastructure, AfT allocated for building productive capacity, and AfT for trade policy and regulation (see Appendix 1 for more details on the sub-sectors contained in each of these categories). AfT for economic infrastructure helps build hard infrastructure such as physical infrastructure, e.g. roads and ports and information and communication technology (ICT) tools. Likewise, AfT flows for strengthening productive capacity in recipient-countries aim to help the private sector in these countries to expand their productive capacity, i.e. their

capacity to produce a wide range of exportable goods and services of high value-added, and become competitive on international markets. AfT flows for productive capacity building cover the sectors of banking and financial services, business and other services, agriculture, forestry, fishing, industry, mineral resources and mining, and tourism. AfT for trade policy and regulation seeks to enhance the capacity of policymakers in recipient-countries to implement existing WTO Agreements, to negotiate trade agreements, and to implement trade policies tailored to their trade development strategies. This type of AfT flow also helps to compensate losers of trade reforms for the losses incurred during the trade liberalisation process.

We show in Figure 1 the evolution of the share of total AfT flows in the gross disbursements of total official development aid, over the full sample as well over sub-samples of LDCs and NonLDCs. The Figure shows that the three graphs move in the same direction. After a rise from 1996–1998 to 1999–2001, this share has fallen significantly[8] from 1999–2001 to 2002–2004, and then exhibited an upward trend until 2014–2016. In particular, the share of total AfT flows in the gross disbursements of total official development aid has often been higher in NonLDCs than in LDCs over the period. For example, it was 40 per cent (on average) in LDCs (against 45.75 per cent in NonLDCs) in 1996–1998, and 22.7 per cent in LDCs versus 29.75 per cent in NonLDCs over the sub-period 2014–2016. It is important to underline that over the full sample,

Figure 1: Evolution of share of total AfT flows in total ODA over the full sample and sub-samples of LDCs and NonLDCs




Source: Author
Note: The variable "SHAfT" is the share of gross disbursements of total Aid for Trade in total Official Development Aid. Both aid variables are expressed in Millions of US Dollars, constant 2016 prices.

this share has moved from 43.85 per cent in 1996–1998 to 14 per cent in 2002–2004, and then rebounded to reach 27.3 per cent in 2014–2016.

The build-up of economic infrastructure and the expansion of productive capacity in developing countries certainly require the importation of capital goods (e.g. machinery and equipment) and other inputs needed in the process of producing final exportable goods. If this involves imports of a limited number of inputs financed by some part of AfT flows for economic infrastructure and AfT flows for productive capacity, then these two types of AfT flows will result in greater import product concentration. In contrast, as recipient-countries might be willing to diversify their export product basket (given that for many developing countries, in particular LDCs, the export product basket is primarily dependent on primary commodities), they would allocate part of AfT flows for economic infrastructure and AfT flows for productive capacity, for the importation of a variety of inputs (including sophisticated inputs and new inputs that are not produced domestically) to achieve their export product diversification objectives (we discuss below the key role of intermediate inputs for export product diversification). In this context, these two types of AfT interventions can be associated with greater import product diversification. Both AfT for economic infrastructure and AfT flows for productive capacity would, in particular, exert a higher import product diversification effect if governments of recipient-countries facilitated the importation of new varieties and sophisticated inputs, notably by lowering trade barriers on these products. This signifies that these types of AfT flows would result in greater import product diversification as countries further liberalise their trade policies.

By helping to streamline the time, costs, and number of documents involved in export and import procedures (so-called 'trade facilitation', in a narrow sense), AfT for trade policy and regulation can help to improve significantly the flows of traded goods across borders, including imported goods. This would add to the trade cost reduction effect of AfT flows related to economic infrastructure in recipient-countries (i.e. even though this type of AfT does not target any specific sector – see for example, Cirera and Winters 2015). Indeed, many studies have underlined the positive trade performance effect of trade facilitation – considered in a larger sense – both through the build-up of hard and soft economic infrastructure (e.g. Limao and Venables 2001; Anderson and Marcouiller 2002; Wilson *et al* 2003, 2005; Calì and te Velde 2011; Busse *et al* 2012; Portugal-Perez and Wilson, 2012).

On another note, AfT for trade policy and regulation also serves to enhance the capacity of policymakers in developing countries to devise trade policies that tally with their export development strategy, while being consistent with WTO Agreements and Decisions and their commitments at the WTO. In this context, it is not clear whether AfT interventions for trade policy and regulation would be associated with import product concentration or import product diversification, as this would ultimately depend on the trade policies set up by policymakers when implementing their export development strategy. Restrictive

trade policies would likely inhibit the possible import product diversification effect that could be associated with AfT flows. In contrast, if policymakers of recipient-countries implement greater trade policy liberalisation to facilitate the importation of a wide variety of products, then AfT for trade policy and regulation would ultimately lead to greater import product diversification (a discussion on the import product diversification effect of trade policy liberalisation is provided later).

Overall, we argue that higher AfT flows for economic infrastructure and AfT flows for building productive capacity could help promote import product diversification, if governments of recipient-countries pursued the objective of diversifying their export product basket, which entails, *inter alia*, greater trade policy liberalisation to facilitate the importation of intermediary inputs. Otherwise, the increase in these two categories of AfT inflows would likely be associated with greater import product concentration. In fact, an important strand of the literature has looked at the effect of trade policy liberalisation on import product diversification. For example, according to Srinivasan and Bhagwati (1999), protection reduces efficiency by shielding domestic market from external competition, and restricting access to imported inputs and technologies. In the same vein, Cadot *et al* (2013) found that trade liberalisation allowed countries to diversify their import products, including by increasing their imports at both the intensive margins (i.e. through a rise in the number of already existing imported products) and at the extensive margins (i.e. through a rise in imports of new goods/varieties). Many other studies have shown that trade policy liberalisation plays a critical role for firms' access to a variety of imported inputs, given the importance of the latter for, *inter alia*, productivity growth and technological development (e.g. Rodrik 1992a, 1992b; Kasahara and Lapham 2006; Ardelean and Lugovskyy 2010; Bas 2012). Against this backdrop, we expect greater trade policy liberalisation to facilitate the importation of a wide range of products, including intermediate inputs, and to lead to greater import product diversification.

On the other hand, we expect that AfT trade policy and regulation can be associated either with import product diversification or import product concentration. Nevertheless, Gnangnon (2018) has shown that total AfT flows, as well as its components, namely AfT interventions for economic infrastructure, for productive capacity as well as AfT for trade policy and regulation, are all associated with greater trade policy liberalisation in the recipient-countries. Therefore, we postulate that countries that receive higher AfT flows and concurrently liberalise their trade policies would likely enjoy greater import product diversification.

With regard to the effect of export product diversification on import product diversification, Goldberg *et al* (2010) have underlined that a significant rise in the production of a wide range of domestic varieties, further to greater import product diversification, is not caused by a decline in the prices of intermediate imported inputs, but rather to the greater access to new varieties of imported

inputs. The introduction of more sophisticated intermediate inputs in the production process can help firms upgrade their product quality (e.g. Edwards *et al* 2018). Developing countries could produce more sophisticated goods (including those produced for the export market) if they imported goods that are different from their own exports (e.g. Kugler and Verhoogen, 2009; Puga and Trefler, 2010), as such importation would be associated with a growth in the variety in external knowledge flows (e.g. Frenken *et al* 2007) and induce incremental innovation (see also Liu and Qiu 2016; Chen *et al* 2017). In particular, the quality of exported products is further enhanced if developing countries source a variety of inputs, including more sophisticated inputs, from advanced markets (Verhoogen 2008; Fan *et al* 2015). Using product-level data on production and trade for 25 European countries, Colantone and Crino (2014) have shown that imported new inputs (which widens and improves the set of available intermediates) exerts a strong positive effect on product creation, and promotes growth in manufacturing output.

Bas and Strauss-Kahn (2014) have used Chinese transaction data for 2000–2006 at the firm-HS6 product level to provide evidence that higher imports of intermediate inputs improve firms' total productivity and result in a large number of exports varieties. Castellani and Fassio (2019) have used a dataset on more than 14,000 Swedish manufacturing firms over the period 2001–2012 to examine the determinants of the propensity of firms to export new products. They have demonstrated empirically that the importation of new inputs (including intermediate inputs) is a critical determinant of firms' propensity to expand their export portfolio by adding new products, and this positive effect is particularly stronger for smaller firms. Feng *et al* (2016) have obtained evidence for Chinese firms that the upgrading of products thanks to technology or quality embedded in imported inputs, has helped Chinese firms to increase the scale and breadth of their participation in export markets. In light of the foregoing, we hypothesise that as import product diversification is essential for export product diversification, countries that diversify their export product portfolio are likely also those that import a diversity of products, including sophisticated intermediate inputs. Therefore, we expect greater export product diversification to be associated with greater import product diversification.

Overall, we expect higher AfT flows to result in greater import product diversification in countries that liberalise their trade policies. More importantly, and this is our key hypothesis in the analysis: as AfT flows lead to greater export product diversification, and given that export product diversification induces import product diversification, then AfT flows will likely lead to greater import product diversification in countries that diversify their export products. As for the interaction effect between AfT and export product concentration variables on import product concentration, we expect higher AfT flows to lead to greater import product diversification in countries that enjoy a higher degree of export product diversification. This hypothesis applies to both total AfT flows as well as its components.

## 3. Model specification

The empirical studies on the determinants of import product diversification are scarce. As noted above, only the study of Parteka and Tamberi (2013) has genuinely focused on the determinants of import product diversification, that is, the diversification of imports across a wide range of products. Specifically, the authors considered the effect of economic development on import product diversification. Other studies, such as Jaimovich (2012) and Cadot *et al* (2011) have rather looked at import diversification from the geographical perspective. The unpublished work by Mejia *et al* (2016) has also investigated the determinants of import product diversification.

In the current analysis, we primarily extend the model used by Parteka and Tamberi (2013), and postulate a model that contains the AfT variables (i.e. total AfT flows (denoted "AfTTOT"), or alternatively each of its three categories described in section 2, namely Aid for trade related to economic infrastructure (denoted "AfTINFRA"), AfT for enhancing productive capacity (denoted "AfTPROD"), and AfT for trade policy and regulation (denoted "AfTPOL")), export product diversification and trade policy variables. A set of control variables have also been included in the model, and concerns variables that are deemed to influence the effects of AfT and export product diversification on import product diversification. These variables include real per capita income ("GDPC"), which is a proxy for countries' economic development level; the level of education (denoted "EDU"), the depth of financial development (denoted "FINDEV"), the institutional and governance quality (denoted "INST") and total population size (denoted "POP").

Therefore, we postulate the following baseline model:

$$ICI_{it} = \alpha_0 + \alpha_1 ICI_{it-1} + \alpha_2 AfT_{it} + \alpha_3 GDPC_{it} + \alpha_4 GDPC_{it}^2 + \alpha_5 ECI_{it} + \alpha_6 TP_{it} + \alpha_7 EDU_{it} + \alpha_8 FINDEV_{it} + \alpha_9 INST_{it} + \alpha_{10} POP_{it} + \mu_i + \gamma_t + \omega_{it} \quad (1)$$

The analysis uses an unbalanced panel dataset of 128 countries covering the period 1996-2016. Following the literature (e.g. Gnangnon 2019a, 2019b), we have used non-overlapping sub-periods of 3-year average data to smooth out the effect of business cycles on variables. These sub-periods are 1996–1998; 1999–2001; 2002–2004; 2005–2007; 2008–2010; 2011–2013; and 2014–2016. The subscript $i$ refers to a given country, while the subscript $t$ indicates each of the aforementioned seven sub-periods. $\alpha_0$ to $\alpha_{10}$ are parameters to be estimated. $\mu_i$ are countries' fixed effects; $\gamma_t$ are time dummies, which represent global shocks that affect all countries' import product diversification path together. $\omega_{it}$ is a well-behaving error term.

The dependent variable "ICI" is the Herfindahl-Hirschman index of import product concentration. It has been computed by the United Nations Conference on Trade and Development (UNCTAD), which has used data on products at 3-digit group level (i.e. the SITC[9] Revision 3 classification). The regressor "ECI" is the Herfindahl-Hirschman index of export product concentration, also

computed by the UNCTAD using data on products at 3-digit group level (i.e. the SITC Revision 3 classification). Values of both "ICI" and "ECI" indicators range between 0 and 1, and the higher these values, the greater are respectively the degree of import product concentration, and the degree of export product concentration. Conversely, lower values of ICI and ECI reflect respectively greater import product diversification and greater export product diversification.

The variable "AfT" represents the AfT variable. It stands either for the real total gross disbursement of AfT flows or one of its components described above. All AfT variables are expressed in constant US dollars, 2016 prices. The OECD/CRS (Creditor Reporting System) database provides data on the gross disbursements of AfT flows covering the period from 2002. At the time the present study was being written, AfT data available covered the period 2002–2016. This dataset covers a relatively short period[10], and does not necessary allow to capture the effects of variables of interest in the analysis on import product concentration over a relatively longer time-period. Therefore, we expand the time-period coverage of this dataset to the period 1996–2016. To that effect, we adopt the approach proposed by Clemens *et al* (2012) and Thiele *et al* (2006), also used by Selaya and Sunesen (2012). The approach assumes that the proportion of AfT actually disbursed to sector "x" ($AfT_x$) (for example, AfT disbursed for economic infrastructure; AfT for productive capacity building; and AfT for trade policies and regulations) during a given period is equal to the proportion of aid committed to sector x during this period, and is hence given by $AfT_x = \frac{Commit_x}{\sum_x Commit_x} \sum_x AfT_x$, where $Commit_x$ stands for the amount of real AfT commitments (constant US dollars, 2016 prices) to sector x. $\sum_x AfT_x$ is the total amounts of AfT commitments and disbursements (constant US dollar 2016 prices) received during each period.

There may be some concerns about using sectoral commitments to approximate sectoral disbursements, given the existence of differences in definitions and statistical records (see Clemens *et al* 2012 for more details). However, Odedokun (2003) and Clemens *et al* (2012) have noted that this problem is likely to be small since aid disbursements and commitments (both at the aggregate and sectoral levels) are highly correlated. Therefore, using this formula, and relying on AfT commitments and disbursements data (constant US dollars, 2016 prices) extracted from the OECD/CRS database, we have computed for each country of the sample, and for each year (covering 1996 to 2001), data on gross disbursements of AfT for economic infrastructure, gross disbursements of AfT for productive capacity building, and gross disbursements of AfT for trade policies and regulations. This dataset has been merged with the available dataset on OECD/CRS database on these three types of AfT flows over the period 2002–2016, so as to obtain our final database of 128 countries over the period 1996–2016.

The variable "TP" is the indicator of trade policy, and is measured by the score of the freedom to trade internationally, computed by the Heritage

Foundation (see Miller *et al* 2019). It is a composite indicator of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. This score is graded on a scale of 0 to 100, with higher values indicating lower trade barriers, i.e. higher trade liberalisation, and lower values reflecting rising trade protectionism. In light of the discussion laid out in the previous section concerning the effect of AfT on import product diversification, we hypothesise that AfT flows would exert a higher positive effect on import product diversification as countries further liberalise their trade policies.

To avoid concerns related to units of measurement of variables when interpreting estimations' results, we have standardised all variables contained in model (1) before running regressions. The standardisation procedure involves calculating, for each variable, the ratio of the difference between this variable and its mean (average) over the standard deviation of this variable. Another advantage of the standardisation procedure is that standardised coefficients (that arise from regressions based on standardised variables) allow us to compare variables in terms of their contribution to explaining countries' import product diversification path. Furthermore, in the present analysis, standardised variables eliminate all outlier problems that could plague the empirical analysis. The variables contained in model (1) are described in Appendix 1, while descriptive statistics concerning unstandardised variables (i.e. non-transformed variables) are provided in Appendix 2. The list of countries used in the empirical analysis has been provided in Appendix 3. Appendices 1, 2, and 3 are available on the journal website.

*Discussion on the effect of other control variables on import product concentration.* The effect of real per capita income (denoted by "GDPC") - which acts as a proxy for the economic development level - on import product diversification arises from the "love-of variety" both in consumption and production. According to international trade models, trade liberalisation allows consumers to enjoy access to a wider range of goods at lower prices, and improves consumers' welfare. Hence, on the demand side, the love-of-variety argument reflects the fact that as real incomes increase, consumers show a "love-of-variety", i.e. wealthier individuals widen the set of varieties they consume by demanding a wide range of imported products if for some reasons (such as high fixed costs of production), countries cannot satisfy their demand through domestic production (e.g. Krugman 1979; Broda and Weinstein 2006; Sauré 2012).

On the supply side, the love-of-variety in production arises from the fact that greater access to a wider variety of imports can enhance production and supply through three channels: enhancement of competition (e.g. Helpman and Krugman 1985; Grossman and Helpman 1991); access to better, cheaper, and domestically unavailable inputs and equipment; and finally, access to foreign technology embedded in imported inputs and equipment (e.g. Grossman and Helpman 1991; Aghion and Levitt 1992; Coe and Helpman 1995). Parteka and Tamberi (2013) have utilised highly disaggregated trade data (4963 product

lines) for 163 countries over the period 1988–2010, to document, *inter alia*, that countries tend to diversify their imported products as their income rises, but some of them can re-specialise (i.e. re-concentrate on a smaller number of imported products). This suggests the eventual existence of a non-linear relationship between countries' real per capita income and their level of import product diversification. In the present study, we test the existence of a non-linear relationship[11] between real per capita income and import product diversification by including in model (1) both the real per capita income variable and its squared term. In so doing, we bear in mind that as the present study focuses on developing countries (whereas Parteka and Tamberi, 2013, incorporated both developed and developing countries), we might eventually obtain a non-linear pattern different from the one obtained by Parteka and Tamberi (2013).

The population size variable ("POP") aims to capture the size of a given country, and may therefore complement real per capita income in capturing the love of variety argument. Thus, we can expect a rise in the population size to be positively associated with import product diversification. As for other control variables introduced in model (1), the variable representing the education level aims to capture the import product diversification effect of an improvement in the education level. As the latter is essential for export product diversification (e.g. Jetter and Hassan 2015) and given the close link between import product diversification and export product diversification, it is likely that an improvement in the education level also influences import product diversification. The depth of financial development is another factor that could affect countries' path of import product diversification. However, this effect would depend on whether the credit obtained by investors from financial institutions, including banks, is used (at least partially) to finance the import of new varieties. In such a case, financial development would contribute to promoting import product diversification. In contrast, when the credit is used to finance the importation of a limited number of (selected) products used in the production process, then financial development will be associated with a rise in import product specialisation.

Finally, the institutional and governance quality variable aims to capture the institutional and governance setting in which importing countries operate. In light of the positive association between the institutional and governance quality and export product diversification (e.g. Hausmann *et al* 2007; Zhu and Fu 2013; Omgba 2014), we postulate that an improvement in institutional and governance quality would help promote the diversification of imported products.

## 4. Data Analysis

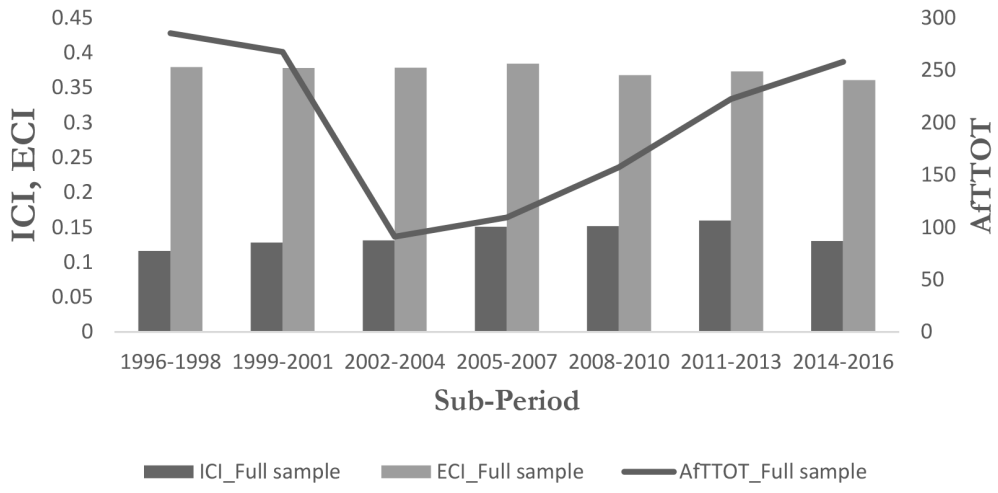
Before turning to the discussion on the empirical method used to estimate model (1), we present in Figures 3 and 4 the development of the three main variables of interest in the analysis (unstandardised variables) – that is, total AfT, export product concentration and import product concentration – over the

full sample, as well as the sub-samples of LDCs and NonLDCs. Non-overlapping sub-periods (average values of these variables) have been computed to construct these figures. Figures 5 and 6 shows the correlation pattern between the three indicators respectively over the full sample, and the sub-samples of LDCs and NonLDCs (note that graphs for LDCs and NonLDCs are based exclusively on standardised variables, while those for the full sample use on both standardised and unstandardised variables).

Figure 2 shows that the import product concentration index has exhibited a rising trend from 0.116 in 1996-1998 to 0.16 in 2011–2013. However, from 2011–2013 to 2014–2016, it declined to 0.13 (this reflects a tendency for import product diversification). Meanwhile, "ECI" has declined very slightly over the full period which suggests that, on average, countries have not seen a significant extent of export product diversification, although this pattern may hide different patterns across countries in the sample. As for total AfT flows, AfT amounts have declined significantly, from $285.3 million in 1996–1998 to $90.98 million in 2002–2004. Since 2005–2007, these resource flows have shown a strong upward trend to reach $258.1 million in 2014–2016. The increase in AfT flows is likely explained by the effectiveness of the AfT Initiative in boosting AfT flows that accrue to developing countries (Gnangnon 2019c).

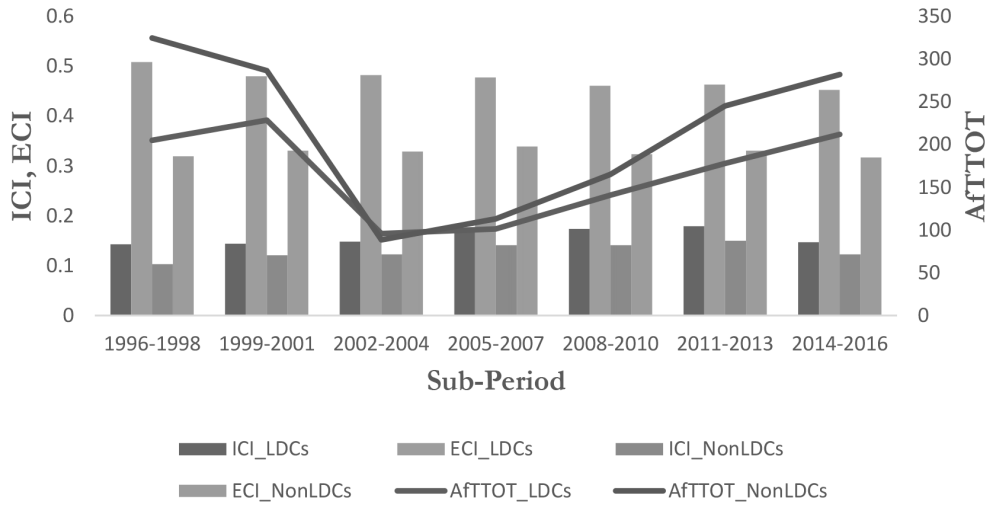
Figure 3 shows trends of total AfT flows over LDCs and NonLDCs that are similar to the one observed in Figure 2. Additionally, AfT flows allocated to NonLDCs are, on average, higher than those provided to LDCs (this is in line with the trends observed in Figure 1). Incidentally, the level of export product

Figure 2: Evolution of AfT, ECI, and ICI over the Full sample




Source: Author
Note: Total Aid for Trade (AfTTOT) is expressed in Millions of US Dollars, constant 2016 prices.

Figure 3: Evolution of AfT, ECI, and ICI over the sub-sample of LDCs




Source: Author
Note: Total Aid for Trade (AfTTOT) is expressed in Millions of US Dollars, constant 2016 prices.

concentration in LDCs has been higher than that of NonLDCs over the full period. While export product concentration has exhibited a slight declining trend over the period (which reflects a tendency for LDCs to diversify their export products), the level of export product concentration has fluctuated in NonLDCs. Thus, NonLDCs alternatively experience greater export product diversification, and greater export product concentration over the full period. Finally, the degree of import product concentration has been higher in LDCs than in NonLDCs over the period. There is an upward trend (that indicates a tendency for greater import product concentration) from 1996–1998 to 2011–2013, and a downward trend for the rest of the period (countries tend to diversify their import products baskets).[12]

## 5. Empirical Method

Several regressors contained in model (1) can be subject to endogeneity concerns, caused by reverse causality from the dependent variable to each of these regressors. These regressors include AfT variables, export product concentration, trade policy, education level, financial development depth, and institutional and governance quality. For example, the reverse causality issue can arise from the fact that countries that experience a high degree of import product concentration (i.e. those that focus on a small number of imported products) might receive higher amounts of AfT as donors may wish to incentivise them to expand their import products basket, including by sourcing these

imports from donor-countries. Hühne *et al* (2014) have shown that AfT flows lead to a rise in recipients' exports to donors, as well as to higher recipients' imports from donors, with the first effect dominating the latter effect. Meanwhile, countries with a high degree of import product concentration that wish to diversify their import product baskets with a view to promoting economic diversification (including export product diversification) may adopt appropriate measures to reduce trade barriers, improve the education level, promote financial development (if the latter is expected to spur import product diversification by providing credit to trading firms), and develop an institutional and governance environment conducive to business development.

Given the nature of the panel dataset used in the present analysis (small time-period and relatively large number of countries), model (1) could also suffer from endogeneity bias, i.e. the Nickell bias (Nickell 1981) associated with the correlation between the one-period lag of the dependent variable and countries' time invariant specific effects, if this model were to be estimated using the standard fixed effects or random effects estimators. Given the difficulties encountered in finding appropriate instruments that would help address all of the above-mentioned endogeneity concerns, and in light of the importance of considering the dynamic specification of model (1) (i.e. with the lagged dependent variable as a regressor) to capture the mean reversion in import product concentration, we estimate model (1) and its variants described below using the two-step system Generalised Methods of Moments (GMM) estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998). This estimator is particularly useful when series under analysis, in particular the dependent variable, exhibit a strong persistence over time. In addition, the two-step system GMM is more appropriate than the first-difference GMM estimator in the context of an unbalanced panel dataset, as the first-difference GMM estimator has a weakness of magnifying gaps (e.g. Roodman 2009). The use of the two-step system GMM estimator implies the estimation of a system of equations in level and in differences, where lagged values are used as instruments for the first-differenced regressors, and first-differences as instruments for the equation levels.

We use three diagnostic tests to examine the consistency of this estimator, and the estimator is consistent if we fail to reject the null hypothesis of each of these tests. These tests are the Arellano-Bond (AB) test of presence of first-order serial correlation in the error term (denoted AR(1)), the Arellano-Bond (AB) test of no second-order autocorrelation in the residuals (denoted AR(2)), and the Sargan/Hansen test of over-identifying restrictions (OID). Incidentally, while researchers have the freedom to specify the lag structure for the instruments used in the regressions (i.e. in using the second (or third) lag of the instrumented variables up to the $n^{th}$ lag ($n \geq 2$)), it is equally important to ensure that the number of instruments should be lower than the number of countries. Otherwise, results would be biased towards outcomes based on the ordinary least squares estimations (Roodman 2009), and the diagnostic tests

may lose power (e.g. Bowsher 2002; Roodman 2009). We have used 3 lags of the dependent variable as instruments and 2 lags of endogenous variables as instruments in the regressions, to ensure that this rule of thumb is met. AfT variables and the variables ECI", "TP", "EDU", "FINDEV" and "INST" have been considered as endogenous in the regressions, and the technique by Windmeijer (2005) has been applied to correct standard errors of estimates.

Against this backdrop, the empirical analysis based on the two-step system GMM estimator goes as follows. Table 1 displays the outcomes arising from the estimations of different specifications of model (1) that contain each AfT variable, namely variables capturing the total AfT flows, as well as each of its three components. Results in Table 2 present the net effect of AfT variables and of export product concentration on import product concentration in LDCs versus NonLDCs. These outcomes arise from the estimation of different variants of model (1) that include a dummy variable denoted "LDC" (which takes the value "1" when a country is an LDC, and "0", otherwise) and the interaction between this dummy and each AfT variable, on the one hand, and between this dummy and the export product concentration variable on the other hand. Table 3 displays the estimation outcomes showing the extent to which the effect of AfT flows on import product concentration depends on importing countries' level of export product concentration. To perform this analysis, we estimate four different variants of model (1), which include each AfT variable, interacted with the export product concentration variable. In Table 4, we report the estimates for whether the effect of AfT flows on import product concentration depends on countries' level of trade policy liberalisation. This involves estimating four other specifications of model (1) in which we introduce (once) the interaction between each AfT variable and the trade policy variable.

## 6. Empirical Results

The outcomes of the diagnostic tests that allow for the checking of the consistency of the two-step system GMM approach are reported at the bottom of each table. All outcomes are satisfactory as the null hypotheses of each of these tests are not rejected. In addition, the positive sign and statistical significance of the coefficient of the one-period lag of the dependent variable confirms the mean reversion of countries' import product concentration path, hence the relevance of considering the dynamic specification of model (1). On the basis of these, we conclude that the two-step system GMM estimator is appropriate for conducting the empirical analysis.

We now take up results in Tables 1 to 4. Starting with Table 1, we note across the four columns that higher AfT flows are positively and significantly (at the 1 per cent level) associated with import product concentration. In particular, a 1 standard deviation increase in total AfT flows is associated with a 0.14 standard deviation increase in the index of import product concentration. Likewise, a 1 standard deviation increase in AfT flows for economic infrastructure, AfT flows for productive capacity, and AfT flows for trade policy and regulation

Table 1: Effect of AfT and export product concentration on import product concentration

***Estimator***: Two-step system GMM

| *Variables* | *ICI (1)* | *ICI (2)* | *ICI (3)* | *ICI (4)* |
|---|---|---|---|---|
| $ICI_{t-1}$ | 0.309*** | 0.309*** | 0.297*** | 0.300*** |
| | (0.0219) | (0.0218) | (0.0209) | (0.0217) |
| AfTTOT | 0.141*** | | | |
| | (0.0304) | | | |
| AfTINFRA | | 0.204*** | | |
| | | (0.0384) | | |
| AfTPROD | | | 0.0872*** | |
| | | | (0.0319) | |
| AfTPOL | | | | 0.118*** |
| | | | | (0.0380) |
| ECI | 0.245*** | 0.226*** | 0.183*** | 0.225*** |
| | (0.0302) | (0.0279) | (0.0321) | (0.0299) |
| TP | 0.228*** | 0.302*** | 0.229*** | 0.348*** |
| | (0.0396) | (0.0351) | (0.0422) | (0.0517) |
| GDPC | 0.100*** | 0.0571** | 0.153*** | 0.0144 |
| | (0.0324) | (0.0284) | (0.0340) | (0.0449) |
| $GDPC^2$ | –0.345*** | –0.343*** | –0.297*** | –0.262*** |
| | (0.0248) | (0.0294) | (0.0269) | (0.0302) |
| EDU | –0.0421 | –0.0768* | –0.0608 | –0.0829* |
| | (0.0414) | (0.0403) | (0.0424) | (0.0439) |
| FINDEV | 0.0808*** | 0.0507** | 0.0637* | 0.103*** |
| | (0.0294) | (0.0256) | (0.0360) | (0.0358) |
| INST | –0.362*** | –0.366*** | –0.361*** | –0.322*** |
| | (0.0428) | (0.0420) | (0.0403) | (0.0401) |
| POP | –0.177*** | –0.196*** | –0.190*** | –0.160*** |
| | (0.0379) | (0.0357) | (0.0413) | (0.0355) |
| Constant | 0.311*** | 0.317*** | 0.273*** | 0.241*** |
| | (0.0226) | (0.0251) | (0.0197) | (0.0291) |
| Observations – Countries | 632 – 128 | 632 – 128 | 632 – 128 | 602 – 125 |
| AR1 (P-Value) | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| AR2 (P-Value) | 0.2222 | 0.2717 | 0.1271 | 0.0906 |
| OID (P-Value) | 0.1315 | 0.1937 | 0.1787 | 0.1985 |

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parentheses. In the two-step system GMM estimations, the variables "AfTTOT", "AfTINFRA", "AfTPROD", "AfTPOL", "ECI", "TP", "EDU", "FINDEV", "INST" and the interaction variables have been considered as endogenous. The regressions have used 3 lags of the dependent variable as instruments, and 2 lags of endogenous variables as instruments. All variables have been standardised.

Table 2: Effect of AfT and export product concentration on import product concentration in LDCs versus NonLDCs

***Estimator***: Two-step system GMM

| *Variables* | *ICI (1)* | *ICI (2)* | *ICI (3)* | *ICI (4)* |
|---|---|---|---|---|
| $ICI_{t-1}$ | 0.300*** | 0.300*** | 0.297*** | 0.306*** |
| | (0.0228) | (0.0230) | (0.0217) | (0.0219) |
| AfTTOT | 0.220*** | | | |
| | (0.0382) | | | |
| AfTTOT*LDC | –0.150*** | | | |
| | (0.0570) | | | |
| AfTINFRA | | 0.296*** | | |
| | | (0.0478) | | |
| AfTINFRA*LDC | | –0.182*** | | |
| | | (0.0623) | | |
| AfTPROD | | | 0.151*** | |
| | | | (0.0415) | |
| AfTPROD*LDC | | | –0.123** | |
| | | | (0.0617) | |
| AfTPOL | | | | 0.295*** |
| | | | | (0.0437) |
| AfTPOL*LDC | | | | –0.222*** |
| | | | | (0.0545) |
| ECI*LDC | –0.570*** | –0.530*** | –0.472*** | –0.557*** |
| | (0.0600) | (0.0618) | (0.0598) | (0.0479) |
| ECI | 0.419*** | 0.407*** | 0.337*** | 0.392*** |
| | (0.0338) | (0.0341) | (0.0359) | (0.0444) |
| LDC | 0.0985 | 0.120 | 0.0796 | –0.0724 |
| | (0.0828) | (0.0790) | (0.0842) | (0.0754) |
| TP | 0.234*** | 0.310*** | 0.238*** | 0.296*** |
| | (0.0360) | (0.0330) | (0.0414) | (0.0459) |
| GDPC | 0.0919** | 0.0707** | 0.143*** | 0.0236 |
| | (0.0361) | (0.0334) | (0.0361) | (0.0395) |
| $GDPC^2$ | –0.371*** | –0.370*** | –0.309*** | –0.310*** |
| | (0.0271) | (0.0304) | (0.0255) | (0.0291) |
| EDU | –0.103** | –0.152*** | –0.124*** | –0.130*** |
| | (0.0443) | (0.0454) | (0.0423) | (0.0451) |
| FINDEV | 0.0862*** | 0.0284 | 0.0846** | 0.105*** |
| | (0.0302) | (0.0280) | (0.0401) | (0.0379) |
| INST | –0.370*** | –0.368*** | –0.366*** | –0.326*** |
| | (0.0429) | (0.0429) | (0.0436) | (0.0431) |
| POP | –0.142*** | –0.154*** | –0.171*** | –0.133*** |
| | (0.0415) | (0.0406) | (0.0428) | (0.0354) |
| Constant | 0.286*** | 0.284*** | 0.255*** | 0.285*** |
| | (0.0354) | (0.0336) | (0.0325) | (0.0359) |

| | | | | |
|---|---|---|---|---|
| Observations – Countries | 632 – 128 | 632 – 128 | 632 – 128 | 602 – 125 |
| AR1 (P-Value) | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| AR2 (P-Value) | 0.3028 | 0.3393 | 0.1858 | 0.3408 |
| OID (P-Value) | 0.4184 | 0.3932 | 0.2749 | 0.3953 |

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parentheses. In the two-step system GMM estimations, the variables "AfTTOT", "AfTINFRA", "AfTPROD", "AfTPOL", "ECI", "TP", "EDU", "FINDEV", "INST" and the interaction variables have been considered as endogenous. The regressions have used 3 lags of the dependent variable as instruments and 2 lags of endogenous variables as instruments. All variables have been standardised.

Table 3: Effect of AfT on import product concentration for varying levels of export product concentration

***Estimator***: Two-step system GMM

| *Variables* | *ICI (1)* | *ICI (2)* | *ICI (3)* | *ICI (4)* |
|---|---|---|---|---|
| $ICI_{t-1}$ | 0.293*** | 0.331*** | 0.301*** | 0.320*** |
| | (0.0208) | (0.0271) | (0.0197) | (0.0186) |
| AfTTOT | 0.137*** | | | |
| | (0.0253) | | | |
| AfTTOT*ECI | 0.231*** | | | |
| | (0.0218) | | | |
| AfTINFRA | | 0.173*** | | |
| | | (0.0439) | | |
| AfTINFRA*ECI | | 0.346*** | | |
| | | (0.0577) | | |
| AfTPROD | | | 0.0998*** | |
| | | | (0.0258) | |
| AfTPROD*ECI | | | 0.132*** | |
| | | | (0.0378) | |
| AfTPOL | | | | 0.176*** |
| | | | | (0.0245) |
| AfTPOL*ECI | | | | 0.273*** |
| | | | | (0.0245) |
| ECI | 0.238*** | 0.253*** | 0.205*** | 0.195*** |
| | (0.0257) | (0.0432) | (0.0280) | (0.0239) |
| TP | 0.228*** | 0.338*** | 0.229*** | 0.356*** |
| | (0.0304) | (0.0543) | (0.0351) | (0.0294) |
| GDPC | 0.139*** | 0.0953** | 0.163*** | 0.0476* |
| | (0.0253) | (0.0441) | (0.0303) | (0.0252) |
| $GDPC^2$ | –0.303*** | –0.313*** | –0.267*** | –0.264*** |
| | (0.0195) | (0.0318) | (0.0235) | (0.0194) |
| EDU | –0.0173 | –0.190*** | –0.0754** | –0.0662 |
| | (0.0246) | (0.0646) | (0.0333) | (0.0412) |

| | | | | |
|---|---|---|---|---|
| FINDEV | –0.0325* | 0.0429 | 0.0348 | 0.0162 |
| | (0.0194) | (0.0408) | (0.0238) | (0.0252) |
| INST | –0.336*** | –0.403*** | –0.363*** | –0.270*** |
| | (0.0348) | (0.0452) | (0.0319) | (0.0287) |
| POP | –0.116*** | –0.219*** | –0.154*** | –0.174*** |
| | (0.0341) | (0.0544) | (0.0331) | (0.0165) |
| Constant | 0.286*** | 0.302*** | 0.253*** | 0.258*** |
| | (0.0158) | (0.0284) | (0.0177) | (0.0176) |
| Observations – Countries | 632 – 128 | 632 – 128 | 632 – 128 | 602 – 125 |
| AR1 (P-Value) | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| AR2 (P-Value) | 0.1854 | 0.2236 | 0.1232 | 0.1087 |
| OID (P-Value) | 0.2158 | 0.1311 | 0.3305 | 0.3879 |

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parentheses. In the two-step system GMM estimations, the variables "AfTTOT", "AfTINFRA", "AfTPROD", "AfTPOL", "ECI", "TP", "EDU", "FINDEV", "INST" and the interaction variables have been considered as endogenous. The regressions have used 3 lags of the dependent variable as instruments, and 2 lags of endogenous variables as instruments. All variables have been standardised.

Table 4: Effect of AfT on import product concentration for varying degrees of trade policies

***Estimator***: Two-step system GMM

| *Variables* | *ICI (1)* | *ICI (2)* | *ICI (3)* | *ICI (4)* |
|---|---|---|---|---|
| $ICI_{t-1}$ | 0.303*** | 0.318*** | 0.269*** | 0.292*** |
| | (0.0157) | (0.0123) | (0.0173) | (0.0206) |
| AfTTOT | 0.0849*** | | | |
| | (0.0223) | | | |
| AfTTOT*TP | –0.181*** | | | |
| | (0.0235) | | | |
| AfTINFRA | | 0.164*** | | |
| | | (0.0238) | | |
| AfTINFRA*TP | | –0.0748** | | |
| | | (0.0326) | | |
| AfTPROD | | | 0.0595** | |
| | | | (0.0262) | |
| AfTPROD*TP | | | –0.119*** | |
| | | | (0.0306) | |
| AfTPOL | | | | 0.152*** |
| | | | | (0.0314) |
| AfTPOL*TP | | | | –0.178*** |
| | | | | (0.0337) |
| ECI | 0.201*** | 0.207*** | 0.148*** | 0.192*** |
| | (0.0324) | (0.0279) | (0.0233) | (0.0205) |

| | | | | |
|---|---|---|---|---|
| TP | 0.188*** | 0.206*** | 0.265*** | 0.293*** |
| | (0.0322) | (0.0330) | (0.0354) | (0.0236) |
| GDPC | 0.138*** | 0.102*** | 0.168*** | 0.0631** |
| | (0.0265) | (0.0206) | (0.0285) | (0.0302) |
| $GDPC^2$ | –0.318*** | –0.329*** | –0.272*** | –0.269*** |
| | (0.0202) | (0.0245) | (0.0208) | (0.0207) |
| EDU | –0.0473* | –0.0441 | –0.0131 | –0.0322 |
| | (0.0262) | (0.0307) | (0.0273) | (0.0308) |
| FINDEV | 0.0564** | 0.0356* | 0.0278 | 0.0812*** |
| | (0.0224) | (0.0214) | (0.0259) | (0.0255) |
| INST | –0.292*** | –0.312*** | –0.357*** | –0.348*** |
| | (0.0282) | (0.0311) | (0.0319) | (0.0334) |
| POP | –0.122*** | –0.166*** | –0.193*** | –0.137*** |
| | (0.0319) | (0.0318) | (0.0317) | (0.0345) |
| Constant | 0.298*** | 0.315*** | 0.245*** | 0.252*** |
| | (0.0182) | (0.0186) | (0.0152) | (0.0214) |
| Threshold of "TP" | **71.3** = [(0.0849/0.181) *13.571 + 64.966] | **102.34** = [(0.206/0.0748) *13.571 + 64.966] | **71.75** = [(0.0595/0.119) *13.571 + 64.966] | **76.55** = [(0.152/0.178) *13.571 + 64.966] |
| Threshold of "AfT variable" (in millions of US dollars) | 598.8 = [(0.188/0.181) * 3.83e+08 + 2.01e+08] | 785 = [(0.206/0.0748) * 2.44e+08 + 1.13e+08] | 515.6 = [(0.206/0.0748) * 1.57e+08 + 8.32e+07] | 37.416 = [(0.206/0.0748) * 1.22e+07 + 3817410] |
| Observations - Countries | 632 - 128 | 632 - 128 | 632 - 128 | 602 - 125 |
| AR1 (P-Value) | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| AR2 (P-Value) | 0.2766 | 0.2500 | 0.1733 | 0.1336 |
| OID (P-Value) | 0.3164 | 0.2832 | 0.3896 | 0.4136 |

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parentheses. In the two-step system GMM estimations, the variables "AfTTOT", "AfTINFRA", "AfTPROD", "AfTPOL", "ECI", "TP", "EDU", "FINDEV", "INST" and the interaction variables have been considered as endogenous. The regressions have used 3 lags of the dependent variable as instruments, and 2 lags of endogenous variables as instruments. All variables have been standardised. The thresholds of "TP" in Columns [1] to [4] have been obtained as follows. We start by calculating the ratio of the estimated coefficient of the relevant "AfT variable" to the estimated coefficient of the interaction variable between this AfT variable and "TP". The value of this ratio has then been multiplied by the value of the standard deviation of the variable "TP" (see Appendix 2), and the resulting outcome is added to the mean of "TP" (see Appendix 2). Similarly, the thresholds of "AfT variables" in Columns [1] to [4] have been obtained as follows. We first calculate the ratio of the estimate of "TP" to the estimate associated with the interaction variable between the relevant AfT variable and "TP". The value of this ratio has then been multiplied by the value of the standard deviation of the relevant AfT variable (see Appendix 2), and the resulting outcome is added to the mean of the same AfT variable (see Appendix 2).

are respectively associated with an increase in the standard deviation of import product concentration by 0.20, 0.087, and 0.118 standard deviations. Thus, among components of total AfT, AfT related to economic infrastructure appears to exert the highest positive effect (in terms of standard deviations) on import product concentration. The contribution of this type of AfT flows to the dynamics of import product concentration is followed by that of AfT for trade policy and regulation and finally by that of AfT for productive capacity (which exerts the lowest positive effect on import product concentration). These results are different from those of Ly-My *et al* (2020) who found a positive effect of AfT flows (both total AfT flows and its components) on import product concentration. The difference in these findings may be explained by the nature of the dependent variable used: Ly-My *et al* (2020) have used the number of imported commodities, while the present study has used the Herfindahl-Hirschman index of import product concentration. Additionally, Ly-My *et al* (2020) have not controlled for countries' level of export product diversification in their model specifications, but have instead used the number of exported products to examine the effect of AfT flows on export product diversification.

As discussed in Section 2, the positive effects of AfT flows on import product concentration may reflect the fact that the effect of AfT flows on import product concentration might depend on other factors, such as the level of export product concentration and trade policies implemented. We shall consider these later in the analysis. We also find, across the four columns of Table 1, that export product concentration is positively and significantly (at the 1 per cent level) associated with import product concentration. This shows that countries that diversify their export products are those that also diversify their import products, and the greater the level of export product diversification, the higher is the magnitude of the positive effect of export product diversification on import product diversification. Trade policy liberalisation induces a greater degree of import product concentration. This outcome contradicts our theoretical expectation, and may suggest that the import product concentration effect of trade policies can eventually depend on the amount of AfT received because, as noted above, AfT flows also influence recipient-countries' trade policies.

Among other variables, we observe that the real per capita income variable and its squared term are both statistically significant at the 1 percent level, with the former being positive and the latter being negative. Thus, real per capita income exerts a non-linear effect on import product concentration, in the form of an inverted U (see results in Column [1] of Table 1), whereby at earlier stages of development, countries tend to experience greater import product concentration, but above a certain threshold of real per capita income, they tend to diversify their import product basket. This threshold[13] of real per capita income amounts to $5641.27 [= (0.100/0.345)*4750.850 + 4264.215], where the coefficients 0.100 and 0.345 are the estimates respectively of the variable "GDPC" and its squared term (see Column 1 of Table 1), and the numbers 4750.85 and 4264.215 (expressed in US$) stand respectively for the

standard deviation and the mean (average) of (non-standardised) real per capita income (see Appendix 2a). Put differently, countries with a real per capita income lower than $5641.3 tend to experience a positive effect of real per capita income on import product concentration, while countries that enjoy a real per capita income higher than $5641.3 tend to diversify their import product basket. The education level does not exert a significant effect (at conventional levels) on import product concentration, but greater financial development influences positively and significantly import product concentration. Finally, a rise in population size and an improvement in the quality of institutions and governance lead to greater import product diversification.

Based on results in Column [1] of Table 1, we observe that among all regressors (except real per capita income and its squared term), the institutional and governance quality variable appears to be the one that contributes the most to explaining countries' levels of import product concentration. This is because, compared to other variables, "INST" exhibits the highest coefficient (in absolute terms). This regressor is followed (in descending order) by the variables capturing, respectively, export product concentration, trade policy, population size, total AfT flows, and financial development. This ranking indicates that even though AfT flows do not appear to be among the two/three most important factors that affect countries' import product concentration path, they do influence import product diversification, and as noted above, their impact might depend on some of the major key factors that affect import product concentration.

Turning now to the results in Table 2, we find across the four columns that AfT variables exert a lower positive and significant effect on import product concentration in LDCs than in NonLDCs. For LDCs, the net effects of the each of the four AfT variables, namely total AfT flows, AfT flows for economic infrastructure, AfT flows for productive capacity, and AfT flows for trade policy and regulation, on import product concentration amount respectively to 0.07 (= 0.220–0.150), 0.114 (= 0.296–0.182), 0.028 (= 0.151–0.123), and 0.073 (= 0.295–0.222). It appears, once again, that among the three components of total AfT, AfT for economic infrastructure is the one that shows the highest positive effect on import product concentration in LDCs. This is followed by AfT for trade policy and regulation, and AfT flows for productive capacity building. For NonLDCs, the net effects of total AfT flows, AfT for economic infrastructure, AfT for productive capacity, and AfT for trade policy and regulation on import product concentration are given respectively by 0.22, 0.296, 0.151, and 0.295. These show that for NonLDCs, AfT flows for economic infrastructure and AfT flows for trade policy and regulation exert a similar positive effect (in terms of magnitude) on import product concentration.

Concerning the export product concentration variable, we find across the four columns of Table 2 that it exerts a lower (and significant) positive effect (although with different magnitudes) on import product concentration in LDCs than in NonLDCs. Based on results in Column [1] of Table 2, the net effects of

export product concentration on import product concentration in LDCs and NonLDCs amount respectively to -0.15 (= 0.419–0.570) and 0.419. Thus, export product concentration induces import product diversification in LDCs, but is positively associated with import product concentration in NonLDCs. For LDCs, this outcome may reflect the fact that as LDCs' export products are heavily concentrated on a few primary commodities, they tend to diversify their import product basket with a view to diversifying later the range of exported products (although in spite of doing so, their export product diversification patterns have not substantially changed). The result concerning the effect of export product concentration on import product concentration obtained for NonLDCs is consistent with the theoretical prediction. The estimates related to the control variables are consistent with those obtained in Table 1, in particular in Column [1] of this table. However, here an improvement in the education level is significantly associated (at the 1 per cent level) with import product diversification, whereas in column [1] of Table 1, the education variable exerts no significant effect on import product concentration.

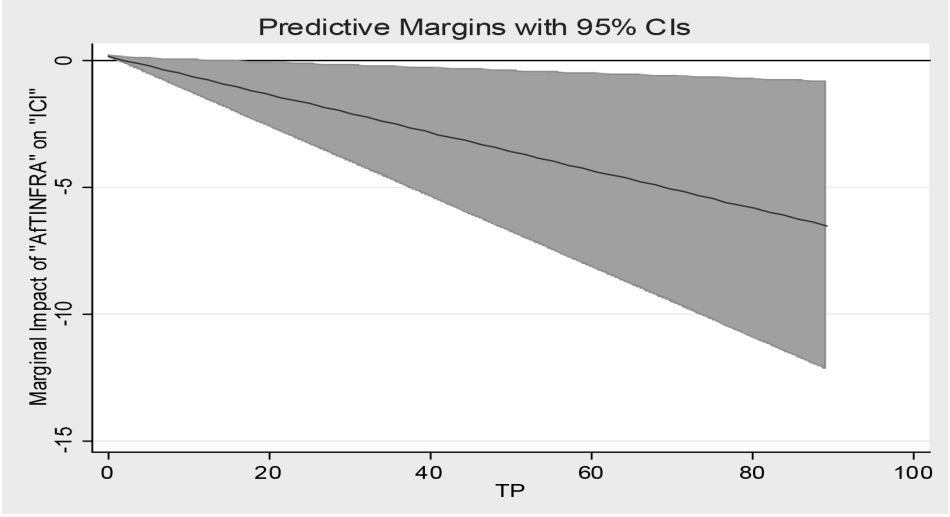
Taking up now results in Table 3, we note that the coefficient of each AfT variable (see Columns [1] to [4]) is always positive and significant at the 1 per cent level, while the interaction term (associated with the variable capturing the interaction between the relevant AfT variable and the export product concentration variable) is always positive and significant at the 1 per cent level. Taking together, these two outcomes (for each AfT variable) suggest that AfT flows induce greater import product diversification in countries that diversify their export products. In addition, the greater the level of export product diversification, the higher is the magnitude of the positive effect of AfT flows on import product diversification. Similarly, the positive effect of AfT flows on import product concentration rises as the degree of export product concentration increases. These findings apply to both total AfT flows as well as to each of its three components. Once again, estimates of control variables are consistent with those provided in Table 1.

Estimates in Table 4 show across the four columns that the coefficients of AfT variables are positive and significant at the 1 per cent level, whereas the interaction terms of the interaction variables (between the concerned AfT variable and the trade policy variable) are all negative and significant at the 1 per cent level. These suggest that AfT variables (both total AfT flows and each of its three components) exert a positive effect on import product diversification, once the degree of trade policy liberalisation exceeds a certain threshold. This threshold of "TP" associated with each AfT variable is reported at the bottom of the columns of Table 4. Above these thresholds, AfT variables influence positively import product diversification, and the magnitude of this positive effect rises as countries further liberalise their trade policies. These thresholds amount to 71.3; 102.3; 71.75; and 76.55 respectively for the import product concentration effect of the total AfT flows, AfT flows for economic infrastructure, AfT flows for productive capacity, and AfT flows for trade policy and regulation.

It is worth noting that values of "TP" (unstandardised trade policy variable) range between 0 and 89.2 (see Appendix 2a). Therefore, we conclude that AfT flows (total AfT, AfT for productive capacity, and AfT for trade policy and regulation) induce greater import product diversification when recipient-countries significantly reduce their trade barriers. However, it appears for AfT for economic infrastructure that the related threshold of "TP" exceeds the maximum value of "TP".

Based on this outcome, we could be tempted to conclude that on average over the full sample, AfT flows for economic infrastructure are always associated with import product concentration, irrespective of the level of trade policy liberalisation. However, as this outcome reflects an average effect across all countries in the full sample, it may hide differentiated effects (in terms of statistical significance, sign and magnitude) across countries in the sample of AfT flows for economic infrastructure on import product concentration for varying levels of trade policy liberalisation. We get a better picture on this effect by providing in Figure 4, at the 95 per cent confidence intervals, the developments of the marginal impact of AfT flows for economic infrastructure on import product concentration, for varying degrees of trade policy liberalisation. The figure suggests that apart from very low levels of trade policy liberalisation (and for which AfT for economic infrastructure is associated with import product concentration), AfT interventions for economic infrastructure always induce greater import product diversification, with the magnitude of this positive effect

Figure 4: Marginal Impact of "AfTINFRA" on "ICI"
for varying degrees of trade policy liberalisation




Source: Author

rising as countries further liberalise their trade policies. This validates the findings obtained above, based on average effects.

We can also offer another interpretation of these results by considering the coefficient of the trade policy variable, and the interaction term related to the interaction variable between each AfT variable and the trade policy variable. Specifically, the coefficient of "TP" is always positive and significant at the 1 per cent level across all columns of Table 4. Combined with the positive interaction terms (of the interaction variable between AfT and the trade policy variables), we can conclude that trade policy liberalisation induces a higher degree of import product concentration when AfT flows are below a certain amount; as above this amount (of each AfT variable), trade policy becomes positively associated with import product diversification. The turning points of values of AfT variables are reported at the bottom of each column of Table 4. Finally, and consistent with previous findings, export product diversification is positively associated with import product diversification.

## 7. Robustness Check Analysis

### *7.1. First robustness check analysis: use of other indicators of export product diversification*

We check the robustness of findings in Table 3, particularly those in Column [1], by running several other variants of model (1) using the two-step system GMM approach. In these variants of the model, the variable "ICI" has been replaced with the total number of imported products, and the index of export product concentration has been replaced with an index of export product diversification. It is important to underline here that the index of export product diversification is not the inverse of the index of export product concentration used so far in the analysis. Rather, the export product diversification index (denoted "FKIEDI") reflects, for a given country (and for a given year), the absolute deviation of its export structure from the world's export product structure. The indicator "FKIEDI" has been developed by UNCTAD using the modified measure of similarity in trade proposed by Finger and Kreinin (1979). Values of this index range between 0 and 1, with lower values reflecting a convergence of a country's export structure towards the world's export structure. In other words, the country in question is improving its competitiveness on the world export market. In contrast, higher values of this index indicate an increasing dissimilarity between a given country's export structure and the world export structure. In this case, the country's level of export product concentration would increase, and its export product structure would diverge from the world's export structure.

To perform the robustness check analysis whose results are provided in Table 5, we estimate two different variants of model (1). The first variant is model (1) where "ICI" is used as the dependent variable, and where "ECI" is replaced with "FKIEDI". Additionally, we include in this model the interaction variable between "FKIEDI" and total AfT flows. Results of the estimation of this

Table 5: Robustness check analysis
– Effect of AfT on import product concentration ("EDI")

***Estimator***: Two-step system GMM

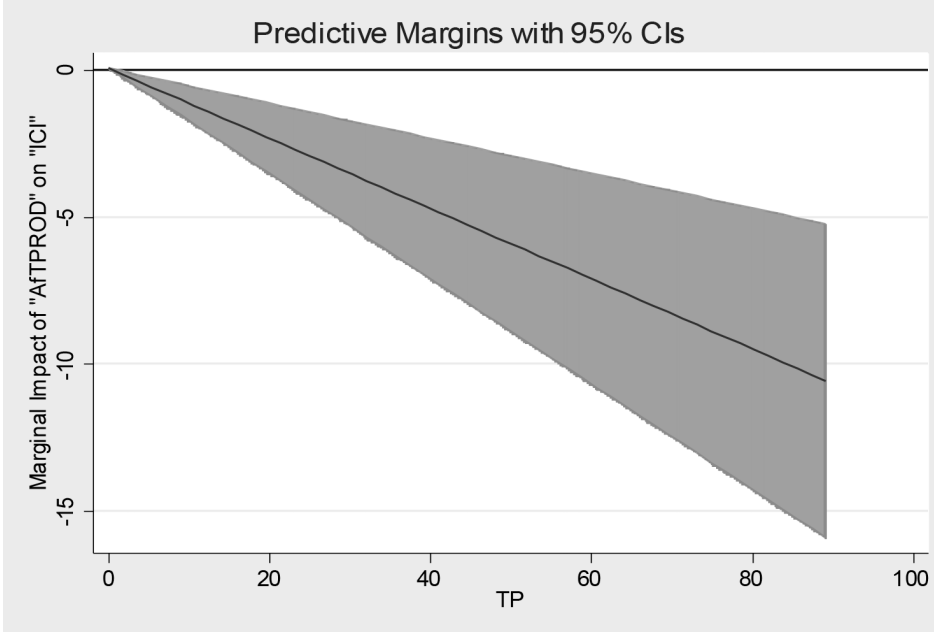
| Variables | ICI (1) | NUMBIMP (2) |
|---|---|---|
| One-period lag of the dependent variable | 0.303*** | 0.276*** |
| | (0.0244) | (0.0117) |
| AfTTOT | 0.0775*** | –0.0956*** |
| | (0.0261) | (0.0151) |
| AfTTOT*FKIEDI | 0.157*** | –0.0430** |
| | (0.0305) | (0.0197) |
| FKIEDI | –0.139*** | –0.138*** |
| | (0.0237) | (0.0188) |
| TP | 0.143*** | 0.230*** |
| | (0.0324) | (0.0201) |
| GDPC | 0.128*** | 0.345*** |
| | (0.0249) | (0.0197) |
| $GDPC^2$ | –0.349*** | –0.173*** |
| | (0.0177) | (0.0171) |
| EDU | –0.0122 | 0.0595*** |
| | (0.0304) | (0.0209) |
| FINDEV | –0.0939*** | 0.0522*** |
| | (0.0253) | (0.0169) |
| INST | –0.190*** | –0.0772*** |
| | (0.0267) | (0.00982) |
| POP | –0.0717* | 0.0585** |
| | (0.0397) | (0.0234) |
| Constant | 0.330*** | 0.197*** |
| | (0.0174) | (0.0147) |
| Observations – Countries | 632 – 128 | 632 – 128 |
| AR1 (P-Value) | 0.0000 | 0.0001 |
| AR2 (P-Value) | 0.2739 | 0.8954 |
| AR3 (P-Value) | 0.4386 | 0.9202 |
| OID (P-Value) | 0.1788 | 0.4352 |

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parentheses. In the two-step system GMM estimations, the variables "AfTTOT", "ECI", "TP", "EDU", "FINDEV", "INST" and the interaction variables have been considered as endogenous. The regressions have used 3 lags of the dependent variable as instruments, and 2 lags of endogenous variables as instruments. All variables have been standardised.

model are reported in Column [1] of Table 5. Column [2] contains results arising from the estimation of the second variant of model (1) where the dependent variable is the total number of imported products (denoted "NUMBIMP") and where "ECI" is replaced with "FKIEDI". In this specification of model (1), "FKIEDI" is interacted with the total AfT flows variable.

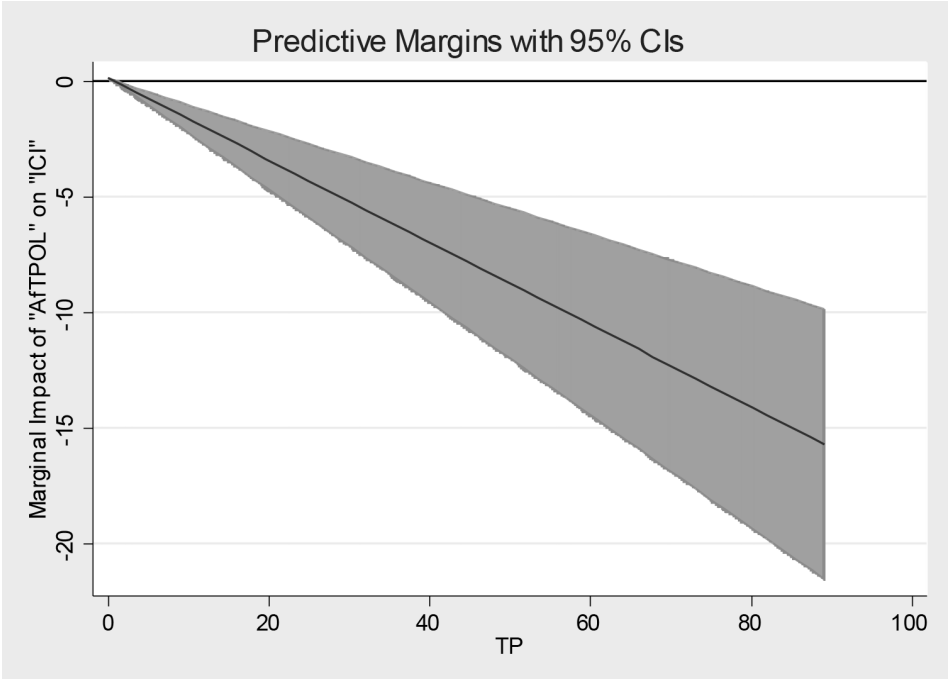
The results of the diagnostic tests that help check the usefulness of the two-step system GMM estimator for estimating these two variants of model (1) are provided at the bottom of the two columns of Table 5. As expected, these results are fully satisfactory. Concerning the estimates obtained, we note from Column [1] of the Table that the coefficient of "AfTTOT" and the interaction term of the variable ["AfTTOT*FKIEDI"] are both positive and significant at the 1 per cent level. The combination of these two results indicates that total AfT flows exert a positive effect on import product concentration, as countries' export structure diverges from the world's export structure: the greater this divergence (or the lower this divergence), the higher is the magnitude of the positive effect of total AfT flows on import product concentration (import product diversification). Estimates in Column [2] show a negative and significant coefficient of "AfTTOT" (at the 1 per cent level) and a negative and significant interaction term associated with the variable ["AfTTOT*FKIEDI"] (at the 5 per cent level). These two outcomes

Figure 5: Marginal Impact of "AfTPROD" on "ICI"
for varying degrees of trade policy liberalisation




Source: Author

Figure 6: Marginal Impact of "AfTPOL" on "ICI"
for varying degrees of trade policy liberalisation




Source: Author

show that total AfT flows reduce the number of imported products as countries' export structure diverges from the world's export structure. In other words, as countries' export structure converges towards the world's export structure, total AfT flows induce an increase in the number of imported products, and the greater this convergence, the higher is the magnitude of the positive effect of total AfT flows on import product diversification.

*7.2. Second robustness check analysis: Analysis restricted to the period 2002–2016*

So far, we have examined the effect of AfT on import product diversification, by relying on a dataset of AfT flows where the initial period for available AfT data (i.e. 2002–2016) has been extended to the period 1996–2016 (using AfT commitments and disbursements data from 1996 to 2001). The present section restricts the analysis to the period 2002–2016 and examines the effect of total AfT flows (and its components) on import product diversification, including whether countries diversify their export product baskets.

To perform the empirical analysis here, we first estimate four different variants that contain respectively the total AfT flows variable, as well as each of its components. We then move on to the estimation of another set of four other specifications of model (1) where each AfT variable is interacted with the export product concentration (i.e. "ECI") indicator. The results of all of these estimations using the two-step system GMM approach are provided in Table 6. We note from all columns in this table that not only is the coefficient of the one-period lag of the dependent variable always positive and significant at the 1 per cent level (this justifies the importance of relying on a dynamic model), but more generally, all conditions for the consistency of the two-step system GMM estimator are also met (see results presented at the bottom of Table 6). Taking up the estimates in Table 6, we observe that total AfT flows exert a positive and significant effect (at the 1 per cent level) on import product concentration (see Column [1]). This effect is driven by a positive and significant effect (at the 1 per cent level) of AfT flows allocated for economic infrastructure on import product concentration (see Column [2]), and a positive and significant effect (at the 5 per cent level) of AfT flows related to trade policy and regulation on import product concentration (see Column [4]). These findings are in line with those obtained in Table 1. However, in contrast with findings from Table 1, we note here that there is no significant effect (at the 10 per cent level) of AfT flows for productive capacity on import product concentration (see Column [3]).

On another note, results in Column [5] of Table 6 show positive and significant coefficients at the 1 per cent level, for both the variable capturing total AfT flows and the interaction variable "AfTTOT*ECI". These suggest that total AfT flows are positively associated with import product concentration (import product diversification) in countries that experience greater export product concentration (export product diversification). The same conclusions apply to results based on AfT allocated for economic infrastructure (see Column [6] of Table 6), as both variables "AfTINFRA" and "AfTINFRA*ECI" have coefficients that are positive and significant at the 1 per cent level. Results in Column [7] of the same table show a positive and significant interaction term (at the 1 per cent level) of the variable "AfTPROD*ECI", while the coefficient of "AfTPROD" is not significant at the 10 per cent level. Therefore, we deduce that AfT flows related to productive capacity building induce greater import product concentration (diversification) in countries that experience a higher level of export product concentration (diversification).

These findings, based on outcomes in Columns [5] to [7], align well with those based on results in Table 2. However, results in Column [8] of Table 6 are consistent with those in Table 2 only at the 10 per cent level for results in Table 6. In fact, we see from Column [8] of Table 6 that whilst the coefficient of "AfTPOL" is positive and significant at the 1 per cent level, the interaction term of the variable "AfTPOL*ECI" is significant only at the 10 per cent level. We conclude that it is only at the 10 per cent level that aid flows allocated for trade policies and regulation influence positively import product diversification in

Table 6: Effect of AfT on import product concentration, including for varying levels of export product concentration over the period 2002–2016

***Estimator***: Two-step system GMM

| Variables | ICI (1) | ICI (2) | ICI (3) | ICI (4) | ICI (5) | ICI (6) | ICI (7) | ICI (8) |
|---|---|---|---|---|---|---|---|---|
| $ICI_{t-1}$ | 0.294*** | 0.278*** | 0.309*** | 0.254*** | 0.353*** | 0.359*** | 0.354*** | 0.346*** |
| | (0.0204) | (0.0185) | (0.0206) | (0.0194) | (0.0246) | (0.0256) | (0.0232) | (0.0202) |
| AfTTOT | 0.139*** | | | | 0.194*** | | | |
| | (0.0370) | | | | (0.0465) | | | |
| AfTINFRA | | 0.174*** | | | | 0.297*** | | |
| | | (0.0337) | | | | (0.0464) | | |
| AfTPROD | | | –0.0317 | | | | –0.0321 | |
| | | | (0.0425) | | | | (0.0499) | |
| AfTPOL | | | | 0.0698** | | | | 0.0887** |
| | | | | (0.0287) | | | | (0.0438) |
| AfTTOT*ECI | | | | | 0.316*** | | | |
| | | | | | (0.0548) | | | |
| AfTINFRA*ECI | | | | | | 0.282*** | | |
| | | | | | | (0.0611) | | |
| AfTPROD*ECI | | | | | | | 0.296*** | |
| | | | | | | | (0.0507) | |
| AfTPOL*ECI | | | | | | | | 0.113* |
| | | | | | | | | (0.0579) |
| ECI | 0.110*** | 0.0830*** | 0.0977*** | 0.119*** | 0.105** | 0.104** | 0.0572 | 0.151*** |
| | (0.0303) | (0.0314) | (0.0307) | (0.0342) | (0.0495) | (0.0469) | (0.0493) | (0.0386) |
| TP | 0.281*** | 0.290*** | 0.346*** | 0.369*** | 0.234*** | 0.269*** | 0.339*** | 0.355*** |
| | (0.0374) | (0.0314) | (0.0372) | (0.0365) | (0.0465) | (0.0503) | (0.0559) | (0.0479) |
| GDPC | –0.147*** | –0.184*** | –0.144*** | –0.142*** | –0.202*** | –0.201*** | –0.107** | –0.145** |
| | (0.0379) | (0.0387) | (0.0432) | (0.0385) | (0.0559) | (0.0570) | (0.0457) | (0.0596) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $GDPC^2$ | –0.185*** | –0.201*** | –0.124*** | –0.161*** | –0.215*** | –0.192*** | –0.152*** | –0.202*** |
| | (0.0313) | (0.0343) | (0.0306) | (0.0325) | (0.0373) | (0.0426) | (0.0341) | (0.0363) |
| EDU | –0.0871** | –0.101** | –0.0917** | –0.199*** | –0.143*** | –0.148*** | –0.115** | –0.188*** |
| | (0.0416) | (0.0401) | (0.0384) | (0.0262) | (0.0461) | (0.0478) | (0.0495) | (0.0447) |
| FINDEV | –0.000853 | 0.0437 | 0.0352 | 0.0657* | 0.134** | 0.110** | 0.0870 | 0.112** |
| | (0.0355) | (0.0369) | (0.0376) | (0.0392) | (0.0576) | (0.0530) | (0.0556) | (0.0498) |
| INST | –0.144*** | –0.118*** | –0.0806** | –0.0733* | –0.127*** | –0.0982** | –0.127*** | –0.0972** |
| | (0.0356) | (0.0296) | (0.0360) | (0.0407) | (0.0401) | (0.0420) | (0.0440) | (0.0424) |
| POP | –0.237*** | –0.277*** | –0.251*** | –0.250*** | –0.245*** | –0.355*** | –0.253*** | –0.251*** |
| | (0.0316) | (0.0335) | (0.0348) | (0.0328) | (0.0479) | (0.0504) | (0.0415) | (0.0431) |
| Constant | 0.210*** | 0.221*** | 0.176*** | 0.206*** | 0.247*** | 0.232*** | 0.219*** | 0.218*** |
| | (0.0181) | (0.0190) | (0.0187) | (0.0220) | (0.0226) | (0.0242) | (0.0245) | (0.0244) |
| Countries | 123 | 123 | 123 | 122 | 123 | 123 | 123 | 122 |
| AR1 (P-Value) | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| AR2 (P-Value) | 0.2977 | 0.3748 | 0.2865 | 0.1565 | 0.7374 | 0.9575 | 0.3141 | 0.1044 |
| AR3 (P-Value) | 0.1636 | 0.2293 | 0.2510 | 0.3206 | 0.4750 | 0.6252 | 0.5020 | 0.3797 |
| OID (P-Value) | 0.2742 | 0.2070 | 0.3001 | 0.3765 | 0.2048 | 0.1634 | 0.2063 | 0.1282 |

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parentheses. In the two-step system GMM estimations, the variables "AfTTOT", "AfTINFRA", "AfTPROD", "AfTPOL", "ECI", "TP", "EDU", "FINDEV", "INST" and the interaction variables have been considered as endogenous. The regressions have used 3 lags of the dependent variable as instruments, and 2 lags of endogenous variables as instruments. All variables have been standardised.

countries that diversify their export product baskets. Differences between findings in Tables 2 and 6 may be attributed to the size of the sample, having restricted the sample to the period 2002–2016.

## 8. Conclusions

The present article has examined the effect of AfT flows on import product diversification, including when countries diversify their export product baskets. The analysis has covered a set of 128 countries over the period 1996–2016, which has been restricted to 2002–2016 for the sake of robustness checks. The findings have shown that, considered separately, AfT variables (both total AfT and its three components) and export product concentration, influence positively import product concentration. However, AfT flows lead to a higher degree of import product diversification in countries that diversify their export product baskets. These findings apply to both total AfT flows as well as to each of its three components. The findings are also confirmed by the fact that the magnitude of the positive effect of total AfT flows on import product diversification increases as importing countries (i.e. AfT recipients) enjoy a convergence of their export product structure towards the world's export product structure.

Further, AfT flows variables induce greater import product diversification as countries further liberalise their trade policies. Results obtained over the restricted period are, to a large extent, consistent with previous findings, although with few exceptions: while total AfT flows and its AfT flows for economic infrastructure, and AfT flows for trade policy and regulation appear to influence positively and significantly import product concentration, AfT flows for productive capacity building does not affect significantly import product concentration. At the same time, we find evidence (for the analysis based on the restricted period) that both total AfT flows and all its three components affect positively and significantly import product diversification in countries that diversify their export product baskets.

Summing-up, in light of the positive potential economic implications of import product diversification, this analysis suggests that if higher AfT flows are to promote import product diversification, recipient-countries should not only devise export strategies that aim to diversify their export product baskets, but they should also further liberalise their trade policies, to encourage the import of a wide range of new varieties of products. While scaling up AfT flows is highly desirable, donor-countries might also need to facilitate the importation by recipient-countries of a variety of imported products, including sophisticated products (e.g. capital goods as well as other intermediate inputs) that are key for export product diversification in these countries. This is particularly relevant, given that developing countries significantly improve their export products quality when they source a variety of inputs, including more sophisticated inputs from advanced countries.

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## Endnotes

1. Economist, World Trade Organization, Rue de Lausanne 154, CH-1211 Geneva 21, Switzerland. senakimm.gnangnon@wto.org

2. According to the United Nations, the group of LDCs contains the poorest and most vulnerable countries in the world to economic and environmental shocks (for further information, see online at: http://unohrlls.org/).

3. This Declaration contains the outcome of the WTO Ministerial Conference held in Hong Kong China in 2005.

4. Other works include, for example, Imbs and Wacziarg (2003); Hausmann *et al* (2007); Harding and Javorcik (2012); Parteka and Tamberi (2013); Mau 2016; Gnangnon and Roberts (2017); Osakwe *et al* (2018); and Gnangnon (2019a, 2019b, 2019c).

5. It is worth noting that the unpublished work of Mejia *et al* (2016) has examined the determinants of import product diversification.

6. The studies of Jaimovich (2012) and Cadot *et al* (2011) have used panel datasets not to explore the diversity of imported products in the context of the development process, but rather to focus on the geographical side of the imports diversification process (concerning concentration of imports across origin countries).

7. Cadot *et al* (2013) have provided a literature review on this matter. Other studies include, for example, Romer (1994); Melitz (2003); Strauss-Kahn (2004); Broda and Weinstein (2006); Amiti and Konings (2007); Bas (2012); Amighini and Sanfilippo (2014); Colantone and Crino (2014); Halpern *et al* (2015); Sharma and Mishra (2015); Andersson (2016); and Castellani and Fassio (2019).

8. This sharp decline and rebound of total AfT flows is not surprising, as this was the rationale for the launch of the AfT Initiative by WTO members in 2005, in a context where developing countries were experiencing serious difficulties in integrating into the global trading system. In fact, in light of the substantial decline in AfT flows, in particular after 2002-2004 compared to the preceding periods, WTO members launched the AfT Initiative in 2005, with a view to mobilising financial resources in favour of the trade sector in developing countries (although not at the expense of donor-countries' aid supply in favour of other sectors in the economy). Gnangnon (2019c) has demonstrated empirically that, as observed in Figure 1, the AfT Initiative is achieving its objectives, as it has contributed to a rise in total AfT flows after 2005 compared to the preceding period.

9. SITC refers to the Standard International Trade Classification.

10. It takes time for countries to diversify their export product basket. So, it can be useful to expand the AfT data backwards so as to capture not only the effect of export

product diversification on import product diversification, but also the extent to which the effect of AfT flows on import product diversification depends on the degree of export product diversification.

11. Graphs on the correlation pattern (i.e. scatter plot) between the unstandardised indicator of import product concentration show the existence of a non-linear relationship in the form of a U-curve between the two variables. Nevertheless, this is a correlation pattern, as in terms of causality, we may find a different non-linear pattern. The graphs can be obtained from the author upon request.

12. Other graphs, based on both unstandardised variables and standardised variables, show negative correlation patterns between total AfT flows and import product concentration on the one hand, and export product concentration and import product concentration, on the other. These findings apply to the full sample as well as the sub-samples of LDCs and NonLDCs. These graphs have not been provided here to save space, but can be obtained from the author upon request.

13. The computation of this threshold is derived from the formula (described above) used to calculate the standardised variables.

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# APPENDICES *

## for the paper titled "*Aid for Trade and Import Product Diversification: To What Extent Does Export Product Diversification Matter?*"

**Appendix 1:** Definition and Source of variables

| Variables | Definition | Sources |
|---|---|---|
| ICI | This is the import product concentration index. It is calculated using the Herfindahl-Hirschmann Index and its values are normalized so that they range between 0 and 1. An index value closer to 1 indicates whether a country's imports are highly concentrated on a few products. On the contrary, values closer to 0 reflect imports are more homogeneously distributed among a series of products. The indicator is computed using import products data at the 3-digit level of SITC, Revision 3. | United Nations Conference on Trade and Development (UNCTAD) Database. See online: http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=120 |
| NUMBIMP | Number of products exported (or imported) at the 3-digit SITC, Revision 3 level. | United Nations Conference on Trade and Development (UNCTAD) Database. |
| AfTTOT, AfTINFRA, AfTPROD, AfTPOL | "AfTTOT" is the total real gross disbursements of Aid for Trade (expressed in constant prices 2016, US Dollar). "AfTINFRA" is the real gross disbursements of Aid for Trade allocated to the buildup of economic infrastructure (expressed in constant prices 2016, US Dollar). "AfTPROD" is the real gross disbursements of Aid for Trade for building productive capacities (expressed in constant prices 2016, US Dollar). "AfTPOL" is the real gross disbursements of Aid allocated for trade policies and regulation (expressed in constant prices 2016, US Dollar). | Author's calculation based on data extracted from the database of the OECD/DAC-CRS (Organization for Economic Cooperation and Development/Donor Assistance Committee)-Credit Reporting System (CRS). Aid for Trade data cover the following three main categories (the CRS Codes are in brackets): Aid for Trade for Economic Infrastructure ("AfTINFRA"), which includes transport and storage (210), communications (220), and energy generation and supply (230); Aid for Trade for Building Productive Capacity ("AfTPROD"), which includes banking and financial services (240), business and other services (250), agriculture (311), forestry (312), fishing (313), industry (321), mineral resources and mining (322), and tourism (332); and |

* This online Appendix is only available in the online publication.

| | | |
|---|---|---|
| | | Aid for Trade policy and regulations ("AfTPOL"), which includes trade policy and regulations and trade-related adjustment (331). |
| ECI | This is the export product concentration index. It is calculated using the Herfindahl-Hirschmann Index and its values are normalized so that they range between 0 and 1. An index value closer to 1 indicates whether a country's exports are highly concentrated on a few products. On the contrary, values closer to 0 reflect exports are more homogeneously distributed among a series of products. The indicator is computed using export products data at the 3-digit level of SITC, Revision 3. | United Nations Conference on Trade and Development (UNCTAD) Database. |
| FKIEDI | The export diversification index is computed by measuring the absolute deviation of the export structure of a country from world export structure. This index is a modified Finger-Kreinin measure of similarity in trade. The diversification index takes values between 0 and 1. A value closer to 1 indicates greater divergence from the world pattern. Data used are export products data at the 3-digit level of SITC, Revision 3. | UNCTAD Database. |
| TP | This is the index of trade policy. Trade policy is measured by the score of the freedom to trade internationally. This is a component of the Economic Freedom Index. It is composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. This score is graded on a scale of 0 to 100, with a rise in its value indicating lower trade barriers, i.e., higher trade liberalization, while a decrease in its value reflects rising trade protectionism. | Heritage Foundation (see Miller et al., 2019) |
| EDU | This is the measure of the education level. It is calculated as the average of the gross primary school enrolment rate (in percentage), the secondary school enrolment rate (in | World Development Indicators (WDI) |

| | | |
|---|---|---|
| | percentage) and the tertiary school enrolment rate (in percentage). | |
| FINDEV | This is the measure of the depth of financial development. It is measured by the domestic credit to private sector (% of GDP), where missing values have been replacing with the domestic credit to private sector by banks (% of GDP). | WDI |
| GDPC | Per capita Gross Domestic Product (constant 2010 US$) | WDI |
| POP | This is the measure of the total Population | WDI |
| INST | This is the variable representing the institutional and governance quality in a given country. It has been computed by extracting the first principal component (based on factor analysis) of the following six indicators of governance. These include a measure of political stability and absence of violence/terrorism; the regulatory quality; an index of rule of law index; the government effectiveness index; the index of voice and accountability; and the index of corruption. Higher values of this index are associated with better governance and institutional quality, while lower values reflect worse governance and institutional quality. | Data on the components of the variable "INST" has been collected from World Bank Governance Indicators (WGI) developed by Kaufmann, Kraay and Mastruzzi (2010) and recently updated. |

**Appendix 2:** Descriptive statistics on unstandardized (non-transformed) variables

| Variable | Observations | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| ICI | 904 | 0.138 | 0.084 | 0.047 | 0.890 |
| FKIIDI | 904 | 0.453 | 0.090 | 0.239 | 0.881 |
| NUMBIMP | 904 | 212.942 | 39.363 | 47.000 | 258.667 |
| AfTTOT | 875 | 201,000,000 | 383,000,000 | 10851.5 | 3,650,000,000 |
| AfTINFRA | 855 | 113,000,000 | 244,000,000 | 10851.5 | 3,040,000,000 |
| AfTPROD | 861 | 83,200,000 | 157,000,000 | 16521.67 | 1,960,000,000 |
| AfTPOL | 741 | 3817410 | 12200000 | -28318 | 264,000,000 |
| POP | 909 | 40,600,000 | 154,000,000 | 69749.67 | 1,370,000,000 |
| ECI | 904 | 0.378 | 0.213 | 0.071 | 0.975 |
| FKIEDI | 904 | 0.716 | 0.112 | 0.372 | 0.922 |
| TP | 820 | 64.966 | 13.571 | 0.000 | 89.200 |
| EDU | 861 | 69.465 | 22.541 | 1.912 | 138.724 |
| FINDEV | 883 | 32.951 | 28.507 | 0.186 | 155.407 |
| GDPC | 900 | 4264.215 | 4750.813 | 194.926 | 24892.790 |
| INST | 901 | -0.982 | 1.511 | -4.806 | 3.345 |

**Appendix 3:** List of countries contained in the full Sample

| **Entire sample** | | | | **LDCs** | |
|---|---|---|---|---|---|
| Albania | Croatia | Liberia | Sao Tome and Principe | Angola | Solomon Islands |
| Algeria | Dominica | Libya | Saudi Arabia | Bangladesh | Sudan |
| Angola | Dominican Republic | Macedonia, FYR | Senegal | Benin | Tanzania |
| Argentina | Ecuador | Madagascar | Serbia | Bhutan | Timor-Leste |
| Armenia | Egypt, Arab Rep. | Malawi | Seychelles | Burkina Faso | Togo |
| Azerbaijan | El Salvador | Malaysia | Sierra Leone | Burundi | Uganda |
| Bahrain | Equatorial Guinea | Maldives | Slovenia | Cambodia | Vanuatu |
| Bangladesh | Eritrea | Mali | Solomon Islands | Central African Republic | Yemen, Rep. |
| Barbados | Eswatini | Mauritania | South Africa | Chad | Zambia |
| Belarus | Ethiopia | Mauritius | Sri Lanka | Comoros | |
| Belize | Fiji | Mexico | St. Lucia | Congo, Dem. Rep. | |
| Benin | Gabon | Micronesia, Fed. Sts. | St. Vincent and the Grenadines | Equatorial Guinea | |
| Bhutan | Gambia, The | Moldova | Sudan | Eritrea | |
| Bolivia | Georgia | Mongolia | Suriname | Ethiopia | |
| Bosnia and Herzegovina | Ghana | Montenegro | Tajikistan | Gambia, The | |
| Botswana | Guatemala | Morocco | Tanzania | Guinea | |
| Brazil | Guinea | Mozambique | Thailand | Guinea-Bissau | |
| Burkina Faso | Guinea-Bissau | Myanmar | Timor-Leste | Lao PDR | |
| Burundi | Guyana | Namibia | Togo | Lesotho | |
| Cabo Verde | Honduras | Nepal | Tonga | Liberia | |
| Cambodia | India | Nicaragua | Trinidad and Tobago | Madagascar | |
| Cameroon | Indonesia | Niger | Tunisia | Malawi | |
| Central African Republic | Iran, Islamic Rep. | Nigeria | Turkey | Mali | |
| Chad | Jamaica | Oman | Uganda | Mauritania | |

| | | | | | |
|---|---|---|---|---|---|
| Chile | Jordan | Pakistan | Ukraine | Mozambique | |
| China | Kazakhstan | Panama | Uruguay | Myanmar | |
| Colombia | Kenya | Papua New Guinea | Vanuatu | Nepal | |
| Comoros | Korea, Rep. | Paraguay | Venezuela, RB | Niger | |
| Congo, Dem. Rep. | Kyrgyz Republic | Peru | Vietnam | Rwanda | |
| Congo, Rep. | Lao PDR | Philippines | Yemen, Rep. | Sao Tome and Principe | |
| Costa Rica | Lebanon | Rwanda | Zambia | Senegal | |
| Cote d'Ivoire | Lesotho | Samoa | Zimbabwe | Sierra Leone | |