Global and Agro-Food Value Chains: Participation, determinants and trade policy with a focus on Sub-Saharan countries

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Jean Balié, FAO
Davide Del Prete, FAO and IMT Lucca (Italy)
Emiliano Magrini, FAO
Pierluigi Montalbano, Sapienza University (Italy) and University of Sussex (UK)
Silvia Nenci, University of Roma 3 (Italy)

Abstract:

In the past twenty years, production has been increasingly unbundled and shared across many countries at different levels of development. The common perception is that Africa, contrary to Latin America, Asia, and China in particular, has not been able so far to intercept the main changes in trade patterns nor enter massively into global production networks. By using the EORA Input-Output Tables and applying for the first time to this data the gross exports decomposition method provided by Wang et al. (2013), we analyze the Global Value Chain participation and position of a large sample of countries, including Sub-Saharan African (SSA) countries. The empirical analysis is carried out both at the aggregate and bilateral level, with a focus on global agro-food-fishery chains. Results show that, despite the low trade shares at the global level, SSA countries are deeply involved in GVC participation and the relevance of their international linkages is increasing over time, although still limited to upstream (likely unprocessed) production stages of the chain. Furthermore, looking at the bilateral trade in value added, we show that the demand pull for SSA agricultural production is not regional but mainly driven by the EU and emerging countries. Finally, our results point to trade policies as key determinants of heterogeneity in GVC participation and position across SSA. By providing a deeper analysis of SSA GVC participation and position, based on a "gravity-like" approach, this work opens the ground to a refinement of the policy mix able to maximize the hoped for benefits for Africa of the so-called "unbundling revolution" going beyond the simple narrative of "upgrading for compete".

Keywords: global value chains, agro-food activities, multi-region input-output tables, gravity model, Sub-Saharan Africa.

JEL codes: F15, L23, O11, O55, Q17.

1. Introduction

Scholars and practitioners are increasingly aware that the emergence of Global Value Chains (GVCs) asks for a rethinking of public strategies aiming at fostering competitiveness, as well as trade and development policies at large (Cattaneo et al., 2015). They also argue that the international fragmentation of production is a golden opportunity for Sub Saharan Africa (SSA) in particular, since those countries are characterized by a limited existing manufacturing or service export base and a large pool of labor (IMF, 2015). By specializing in a specific segment of the supply chain, they can exploit their comparative advantages without having to provide all the upstream capabilities. This implies new opportunities for industrialization and structural transformation. For instance, by triggering pro-competitive market restructuring effects and spurring local production in other sectors through minimum scale achievements (Taglioni and Winkler, 2014). However, the common perception is that Africa, contrary to Latin America, Asia, and China in particular, has not been able so far to intercept the main changes in trade patterns nor enter massively into global production networks.

The specialized literature highlights that to take advantages of GVCs as drivers for the structural transformation African economies should rely on a complex mix of factors: the characteristics of the comparative advantages of each country but also the availability of ancillary services (including transport and logistics) as well as institutional and socio-economic country features (along with human and physical capital). It highlights also the nature of backward and forward linkages' countries, and the characteristics of the final destination markets together with the actual stage of maturity of the specific chain. Among the debate about the key determinants of GVCs, however, the role to be assigned to trade policy still represents an open issue. Since the frontier between policy and non-policy factors is somehow blurry and the specialized literature does not provide sound and clear-cut theoretical underpinnings, the answer is not straightforward.

By exploiting the EORA global multi-region I-O (MRIO) tables, which provide a contiguous, continuous dataset for the period 1990-2013 (Lenzen et al., 2012; 2013), this work provides a comprehensive map of GVC participation and position for a large sample of countries, with a focus on Sub-Saharan African (SSA) countries as well as agriculture, fishing and food and beverages industries. To this end, it applies the most recent gross exports decomposition method provided by Wang et al. (2013) that allows us to investigate bilateral GVC participation in agro-food global/regional value chains and identify direct upstream and downstream trade patterns, filtering out the "pure" double counting components (Koopman et al., 2014). Furthermore, by presenting both aggregate and "gravity-like" bilateral and sectoral estimates, we present robust estimates of the main determinants of aggregate and bilateral value chain integration, highlighting the relevance and the statistical significance of the most common trade policy measures. This is, to the best of our knowledge, the first comprehensive work looking at the phenomenon on a bilateral and sectoral basis , with a focus on SSA region, going beyond the simple narrative of "upgrading for compete".

This work follows up the most recent literature suggesting that Africa is more engaged in GVCs than many other developing countries, as well as developed countries such as the USA (Foster-McGregor et al., 2015). It also suggests that the importance of global linkages has been increasing over time, even if much of Africa's participation in GVCs is essentially in upstream production (i.e., providing primary inputs to firms in countries further down the value chain) and active in low value added stages (Del Prete et al., 2016a). Our outcomes also

suggest that trade policy is among the key determinants of heterogeneity in GVC participation and position across SSA, net to possible confounders.

The paper is organized as follows: Section 2 reviews the existing literature on GVCs for development with a focus on SSA countries; Section 3 presents the methodology for computing GVC indicators and the EORA dataset; Section 4 provides a comprehensive map of GVC participation and relative position of SSA countries both in global and agro-food value chains; Section 5 provides the empirical analysis, both aggregate and bilateral; Section 6 concludes.

2. GVCs in SSA, opportunities and constraints: A review of the literature

The common wisdom is that GVCs are golden opportunities for supporting the transition of the SSA economies towards (IMF, 2015). Thanks to the unbundling of complex production processes (Baldwin, 2013), by assimilating off-shored links of the supply chain, developing countries can industrialize more rapidly without waiting to build the deep industrial base formerly required. By specializing in a specific segment of the production chain, they can have the opportunity to join the global production chains without having to provide all the upstream capabilities. This is supposed to give Africa at last a real new opportunity for industrialization, even though can happen at the expenses of the domestic value added that can be captured locally (the so-called denationalization of comparative advantages).

Boffa et al. (2016) highlight that sharing production allows to specialize while reaching economies of scale thanks to the access to the global markets – a phenomenon not accounted for by traditional trade and foreign direct investment literature. On this, Del Prete et al. (2016b) show that the performance of North African firms, measured by several indicators, is positively associated with the involvement into international fragmented production networks, while SSA region - with abundance of natural capital and labor – is in a good position to attract GVC-oriented investment (Engel, 2016). GVC participation may also represent a key driver for Africa structural transformation by stimulating investments in infrastructure that would otherwise not be profitable and spurring local production in other sectors through minimum scale achievements. This can translate into pro-competitive market restructuring effects that are not limited to GVC suppliers, but also extend to non-participants (Taglioni and Winkler, 2014). It also opens access to unprecedented flows of knowledge, skills, capital, and sophisticated inputs which can lead to an accelerated path of structural transformation and income growth. The transmission channels include backward linkages, i.e. GVC-linked purchases of foreign inputs, spurring production in various upstream sectors, and forward linkages, i.e. sales of GVC-linked intermediates to the recipient economy, spurring production in various downstream sectors. World Bank (2011) distinguishes four types of transfers and spillover effects taking place in GVCs: i) *training and skills*: multinational firms' training programs can provide long-term benefits for the recipients who can apply their newly acquired skills in numerous ways, resulting in positive spillover effects for the country; ii) *technology, know-how, and finance*: a number of private sector efforts revolve around transfers of technology, know-how and efforts to improve the business environment. While benefiting the company at the origin of the transfers, these capacity-building efforts can be expected to have positive spillover effects, including to local small and medium-sized enterprises; iii) *standards*: assistance in meeting quality and safety standards is

particularly important to help incorporate local producers into global value chains (see also Del Prete et al., 2016b); iv) *trade facilitation*: initiatives and projects led by firms and industry groups can range from road safety initiatives to more efficient customs processes achieved through customized software development.

This improved access to inputs can have important spillovers on small-holder farmers and household food security (Swinnen and Vandeplas, 2014). By generating higher incomes, and because of technology spillovers on food production, income stability and the food security of households improves with participation in value and export chains (Bellemare and Marc, 2012; Bellemare et al., 2016; Montalbano et al., 2015). The most recent empirical studies highlight mostly positive effects on small-holder farmers that are included in contract schemes and high value export chains (Minten et al., 2009, and Subervie and Vagneron, 2013, for Madagascar; Handschuch et al., 2013, for Chile; Asfaw et al., 2009, for Kenya).[1] This because standards can reduce transaction costs in the chain by reducing information asymmetries between buyers and suppliers (specifically, about quality, safety and other product characteristics). In this respect, GVC participation is supposed to be associated not only with increasing employment, better remunerated jobs, better use of resources, better governance and political stability, but also with increasing food security (Minten et al., 2009; Cattaneo et al., 2013; Swinnen, 2014; Swinnen and Vandeplas, 2014).. These effects are the strongest for the poorest and remote farmers since their access to fertilizer and other inputs is most constrained.

On the determinants, as Cattaneo et al. (2013) underline, the benefits of the economic transformation of African economies driven by GVCs requires pre-conditions. Moving up from agricultural unprocessed activities to regional and global value chains in the agro-food sector implies, first of all, the availability of efficient ancillary services, including transport and logistics. Second, while GVCs would offer Africa the potential to develop a formal service economy, with many more and much better jobs linked to modern manufacturing for the young labor force, to exploit this potential requires also the availability of adequate human capacity and physical infrastructures. Despite the progress of recent years, it is hard to see how the African economies can insert themselves or move up in the chain without better provision of electricity, telecommunication capabilities, and infrastructure for transport—roads, railroads, airports, and ports. As Devarajan and Fengler (2013) also highlight, exporters from Africa pay some of the highest transport prices in the world. Furthermore, a deeper involvement into GVCs can enhance the volatility of international markets (the 2008-09 crisis revealed a higher trade elasticity and exposure to imported crises through trade, Escaith et al., 2010) with pervasive implications on farmer households' consumption volatility and vulnerability (Montalbano, 2011). It can be also detrimental socioeconomically to a country if the lead chain firm engages in predatory behavior (see Kaplinsky et al., 2010 for the examples of timber in Gabon). Additional concerns include: the depletion of natural resources by foreign companies, land grabbing, the unequal partition of value along the production chains[2], captive market relationships, etc. Cattaneo and Miroudot (2015) argue that the GVCs' potential for assisting a country's socioeconomic development cannot be taken for granted. They flesh out three phases in the maturity of value chains: i) a predation phase in which developing countries are confined to exporting raw materials and importing processed goods and services; ii) a segmentation phase in which

[1] Contracts for quality production with local suppliers in developing countries not only specify conditions for delivery and production processes but also include the provision of inputs, credit, technology, management advice, etc. (Minten et al., 2009).

[2] It is also worth noting that the agro-food industry is increasingly structured around GVCs led by food processors and retailers (e.g. supermarkets) (OECD, 2013).

developing countries benefit from the delocalization of certain production activities, mostly to serve local markets; iii) and a consolidation phase in which local innovation turns into export of processed goods and services to other developing and developed countries. While the last phase has the greatest potential for assisting a country's development, it is also more selective: the consolidation of GVCs corresponds to a diminution of the number of participants in the network, and hence threatens to leave more developing countries outside major trade flows and upgrading paths. Preliminary empirical evidence shows that most of the African GVC participation is still limited to low value added stages of the chains and that the biggest GVC partner for Africa remains the EU, while intra-African GVCs are assumed not to be particularly important (Foster-McGregor et al., 2015).

In conclusion, while the literature on GVC is increasingly obsessed by the participation dogma as the key policy implication, the most recent analyses for Africa highlight that join the value chains needs pre-conditions. In other words, the issues on how much value SSA can capture in terms of jobs, income, technology transfers, sustainable development and whether there are potentials for a green and inclusive growth (but also the likely risks) in a medium term scenario is not independent from the main characteristics of countries, including its main industry specialization, but also the institutional and socio-economic country characteristics (along with human and physical capital). It depends also from the nature of backward and forward linkages' countries, and the characteristics of the final destination markets as well as the actual stage of maturity of the specific chain. Whether this depends strictly also on the policy space is still an open question. We believe that such complex phenomena cannot be addressed by looking only at the available I-O databases, as in previous literature, but rather additional empirical investigations are needed. To this end, along with an overview of bilateral and cross-sectional analyses of SSA GVC participation, a sound empirical assessment of the relevance of policies, with a focus on trade policy, will be also provided.

3. Methodology and data

The increasing international fragmentation of production has challenged the conventional wisdom on how we look at and interpret trade. As different stages of the same production process are now allocated to different countries, intermediate inputs cross borders multiple times and are then counted each time by gross trade flows. As a result, conventional trade statistics become increasingly misleading as a measure of value produced by any particular country (Koopman et al., 2014). The relevance of this issue is confirmed by the many initiatives and efforts that try to address the measurement of trade flows in the context of the fragmentation of world production and try to estimate the so called trade in value-added. The latter reflects the value that is added by industries in producing goods and services and it is equivalent to the difference between industry output and the sum of its intermediate inputs (Montalbano et al., 2015). Looking at trade from a value added perspective better reveals how upstream domestic industries contribute to exports, as well as how much (and how) participate in GVCs (OECD–WTO, 2012).

A new literature has emerged regarding tracing the value added of a country's trade flows by combining input–output tables with bilateral trade statistics and proposing new indicators[3]. In particular, several attempts have

[3] See among others Hummels et al. (2001); Johnson and Noguera (2012); OECD (2012); Koopman et al. (2011); Koopman et al. (2014); Timmer et al. (2015).

been proposed in order to estimate correctly the domestic value added included in a country's exports by separating it from foreign value added and double counting. Koopman et al. (2014) (hereafter KWW) provides a workable decomposition of gross exports in various value added components. While this method already has many useful applications, an important limitation of the approach is that the gross trade decomposition is only done at the aggregate level, not at the bilateral, or bilateral sector level. The KWW methodology can indeed only track the value added linkages between the country of origin and that of final destination (Borin and Mancini, 2015). In this work, we rather follow the methodology developed by Wang et al. (2013)[4], subsequently referred to as WWZ, who compute a single breakdown of bilateral exports that can be exactly mapped into the original KWW decomposition summing all the export flows across the destinations. The framework proposed by the authors is particular informative as it permits not only to extract value added exports from gross exports, but recovers additional useful information about the structure of international production sharing at a disaggregated level.

Conceptually, WWZ (2013) decompose a country's total gross exports into the following four main buckets (Figure 11): 1) the country's value added exports that are absorbed abroad (DVA); 2) the part of a country's domestic value added that is first exported but eventually returned home (RDV); 3) the foreign value added that is used in the production of a country's exports and eventually absorbed by other countries (FVA); 4) and the "pure double counted terms", arising from intermediate goods that cross border multiple times (PDC). Some of the terms in the fourth bucket double count value added originated in the home country, while others double count value added originated in foreign countries (WWZ, 2013). Each group is then furtherly disaggregated and sixteen value-added and double counted components are defined (Figure 12 and Figure 13). The DVA share[5] (Figure 12) reflects the direct contribution made by a country in producing a final or intermediate good for export. It is the sum of the domestic value added in final goods exports, T1, and the domestic value added in intermediates exports absorbed by direct importers, T2, to third countries to produce domestic final goods, T3, to produce final goods exports to third countries, T4, and to produce intermediate exports to third countries to produce exports, T5. The FVA share (Figure 13) is the sum of components T11, T12, T14 and T15 as a share of gross exports. It indicates the share of a country's exports that consist of inputs produced in other countries and thus does not add to the GDP of the country of interest. It captures the extent of involvement in GVC for downstream firms and industries (i.e. backward integration). This approach allows to calculate also the 'indirect value added exports' (DVX), which corresponds to the sum of components T3, T4, T5, T6, T7 and T8 as a share of gross exports. It is the share of a country's value added exports embodied in other countries' exports as intermediate inputs, which captures the contribution of the domestic sector to the exports of other countries. Thus, it is a workable way to look at the extent of GVC involvement for relatively upstream sectors (i.e. forward integration).

In the bilateral analysis, we will focus on value added flows between country pairs. To this end, we follow the WWZ's methodology to implement the bilateral sectoral level break down. In the empirical investigation, we use the following bilateral WWZ components: MVA, i.e. the part of the FVA that comes from the direct

[4] For additional details see Quast and Kummritz (2015).

[5] The "pure" DVA share is the domestic value added used exclusively in the trade flows by the country pair (sum of components T1 and T2). We will make use of this, while analyzing the bilateral participation.

importing country (T11 + T12 in Fig. 13 in Appendix A) and the DVA, i.e. the domestic value added absorbed by the direct importer (T1 + T2 in Fig. 12 in Appendix A).

Summing the FVA, the DVX and the PDC components (PDC i.e. the sum of T9, T10, T13 and T16 as a share of gross exports) of a single country/area and sector, we can get a measure of the GVC participation (Rahman and Zhao, 2013; Cappariello and Felettigh, 2015; Borin and Mancini, 2015). The higher (or lower) the value of the *GVC participation index*, the larger (or smaller) is the participation of a country in global supply chains. To complete information on international integration into global markets, we present a second index that characterizes the position of country (or industry) exporters in GVCs: the *GVC position indicator*. It is determined by the extent to which the country (or industry) is upstream or downstream in the GVCs, depending on its specialization (Koopman et al., 2011). A country lies upstream either if it produces inputs and raw materials for others, or provides manufactured intermediates or both; a country lies downstream if it uses a large portion of intermediates from other countries to produce final goods for export (i.e., it is a downstream processor or assembler adding inputs and value toward the end of the production process). The position indicator is given by the log difference between the DVX and the FVA[6]. A value larger than 0 indicates the country lies upstream, while a ratio lower than 0 means the country lies downstream in the GVCs.

Data used in this analysis come from the Eora Multi-Region input–output (MRIO) database[7]. It brings together a variety of primary data sources including national I-O tables and main aggregates data from national statistical offices and combines these primary data sources into a balanced global MRIO, using interpolation and estimation in some places to provide a contiguous, continuous dataset for the period 1990-2013 (Lenzen et al. , 2012; 2013). The Eora tables are particularly useful as they provide access to each country's structure and function - as seen through its input-output tables - and also information on the interactions between trading partners. Hence the world system can be viewed as a single entity with all trade flows reconciled in economic terms. Regarding country coverage, Eora contains data for 186 countries and 25 harmonized ISIC-type sectors (Table A1). Here we focus our attention on 48[8] African countries (Table A2) and the agro-food industry (that includes agriculture, fishing and food and beverages) (see the Methodological Appendix for a comparison between different measures and I-O tables).

4. A full map of Participation/Position of SSA economies in global and agro-food value chains

4.1 SSA in the GVCs

Looking at the WWZ decomposition of gross exports, a preliminary remark is that more than 80% of value added in SSA is domestic (Figure 1). This is actually in line with all the other developing regions, with the relevant exception of ASEAN (which similarly to EU27 produces domestically only about 60% of the value of its

[6] GVC position is the difference between ln(1+DVX) and ln(1+FVA) (Koopman et al., 2011).

[7] The Eora project was funded by the Australian Research Council.

[8] In the original dataset 189 countries are provided, but we exclude from our analysis the recently born South Sudan (2011) and Sudan, and Zimbabwe for data inconsistency.

exports).[9] It is also in line with the previous literature applying different decomposition methods. Differently from standard methods, however, WWZ methodology is able to isolate properly the pure double counted term (i.e., PDC component), which indeed shows to be substantial (e.g., 0.12 for the EU; 0.04 for SSA), thus providing a more realistic picture of the value added of exports worldwide. In other words, 4% of the value added of export from SAA are double counted and is therefore lower by 4% in reality.

According to our computation about 10% of SSA exports contains value added actually produced abroad (FVA), which is a lower but similar figure if compared to other developing regions (e.g. emerging economies such as China and India register an overall FVA of 14% and 13% respectively) with the exception of ASEAN. This latter (with 26% of foreign value added exports), can be considered one of the world "main hubs", together with the EU and NAFTA, whose foreign value added of their export is 21% and 14% respectively. The same holds at the country level: for instance, all the selected SSA countries[10] show a very similar pattern. About 80-90% of their value added exports is domestic (DVA), with the relevant exception of Ethiopia (where, on aggregate, only 57% of the value of its exports is produced domestically). It is also to some extent the case of Rwanda and Tanzania (79% and 70%, respectively).

Figure 1 Gross Exports Decomposition 2013, world regions and selected SSA countries

Source: Authors' elaboration on EORA data

It is worth noting however that the rate of GVC participation of SSA is indeed relatively high at 40% of SSA gross exports and increasing over time (Figure 2). This is also in line with the other developing regions (China and India included). Again, EU27 and ASEAN show the highest rates with more than 50% of gross exports with the EU reaching 55% and overtaking ASEAN after the European Monetary Union. North Africa shows one of the highest rate of GVC participation in the developing world (48%). Note, however, that this measure does not say

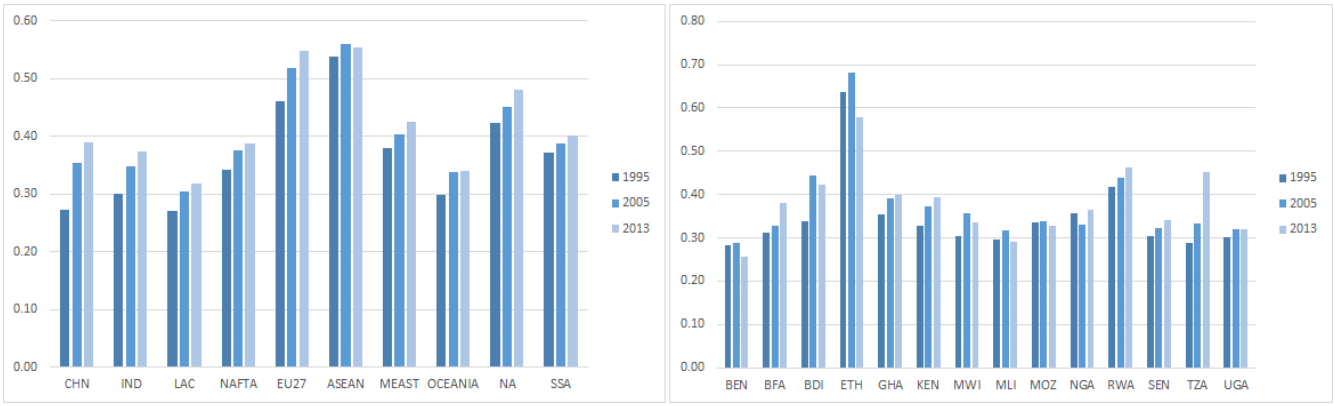
[9] Note that the reported measures tend to be inflated by intermediate flows between countries of the same region. This inserts a bias in favor of the EU relative to other large single countries or smaller regional groups (e.g., NAFTA).

[10] Selected SSA countries are involved in the Monitoring and Analyzing Food and Agricultural Policies (MAFAP) FAO project, namely Bangladesh, Benin, Burkina Faso, Burundi, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania and Uganda.

anything about the actual weight on world trade of each region. Within the group of MAFAP countries, Ethiopia shows one of the highest rate in 2013 (58%), whereas Rwanda reached 46% of GVC involvement in 2013.

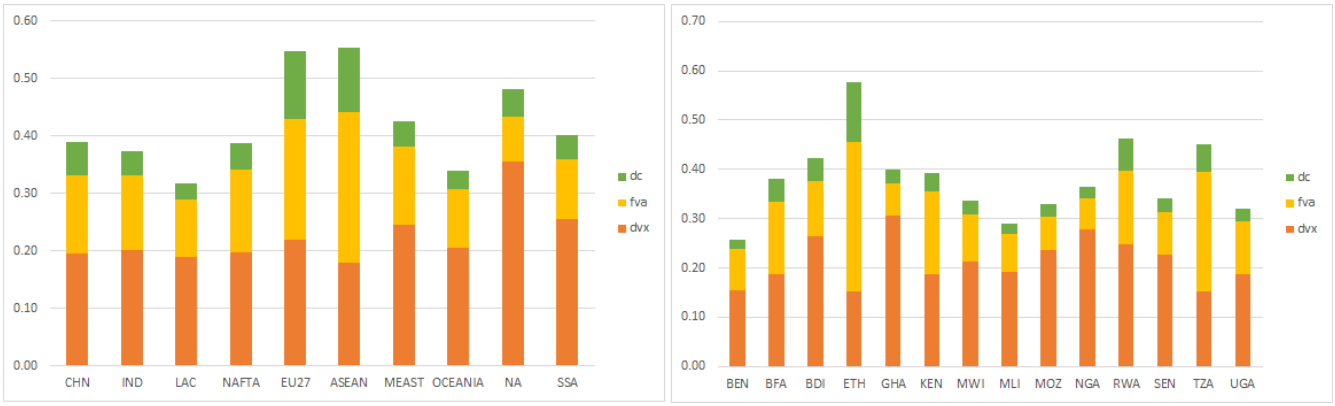
As largely expected – due to the limited percentage of FVA origin of SSA exports – the relative high rate of GVC participation is mainly driven by the domestic value added supplied to other countries' exports (DVX) (Figure 3). After controlling for double counting, SSA shows one of the best performance in terms of DVX (about 26% of the value of gross exports). The best performer in the world is North Africa where 36% of gross exports is value added supplied abroad (higher than the Middle East). More heterogeneity is shown by the group of the MAFAP countries. Ghana, Burundi and Nigeria are the only countries above the average at 31%, 26% and 28% of DVX respectively. It follows that the high rate of GVC participation of Ethiopia is mainly driven by the presence of a high foreign value added content of its exports (more than 30%). A similar pattern is observed in Rwanda where 25% of gross exports' value added are of foreign origin and Tanzania where this rate is 15%. It is worth noting the high rate of double counting that we have identified separately and taken into account in our measure of GVC participation. This reaches 12% for the EU; 11% for ASEAN and 4% for SSA (Figure 3). This allows us to present a cleaner and more reliable index of GVC participation with respect to the previous literature in the field. For MAFAP countries the portion of double counting is notable for Ethiopia (0.12), but also for Rwanda (0.07), confirming that the high rates of GVC involvement highlighted in our analysis can be considered as more reliable if compared to previous estimates in the literature (as a comparison see, among others, African Development Bank, 2015; Foster-McGregor et al., 2015; Kowalski, P. et al., 2015).

Figure 2 GVC Participation, world regions and selected SSA countries



Source: Authors' elaboration on EORA data

Figure 3 GVC Participation composition 2013, world regions and selected SSA countries



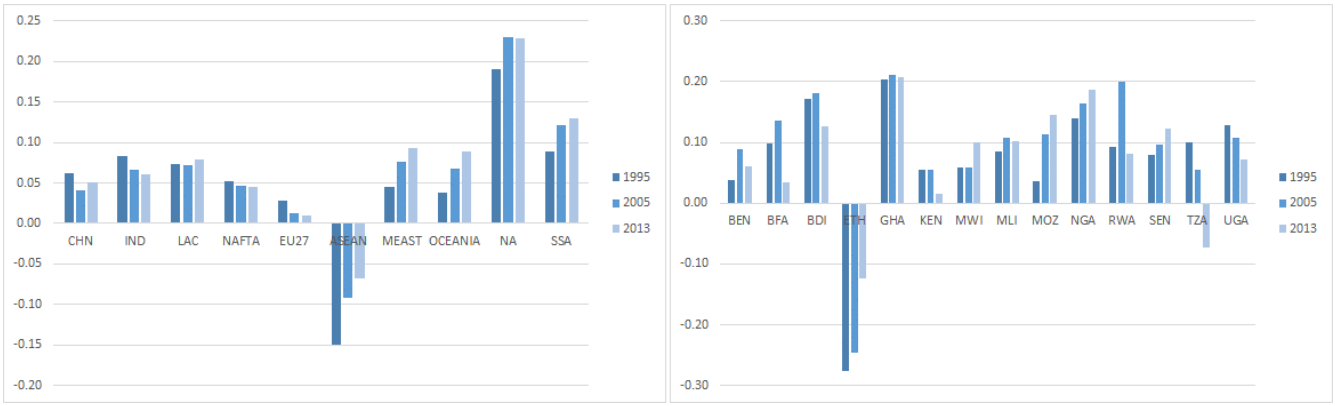
Source: Authors' elaboration on EORA data

As a matter of fact, the common feature of a very high degree of DVA emphasized in Figure 1 actually hides different patterns in terms of GVC participation, with Africa (especially North Africa, but also SSA) being the best performer in providing value added to other countries in the world. About 30% of the domestic value added produced in SSA are inputs for other countries' exports (over 35% in the case of North Africa). As a comparison, these figures are in line with those of the EU (22%) –that are actually inflated by the high degree of intermediate trade flows within the single market - and higher than those of China, India, and NAFTA that register figures around 20%. As for SSA countries, it is worth noting the peculiar case of Ghana that registers one of the highest domestic value added (about 90% of the value of its total exports) of which 31% is value added included in other countries' exports (a performance higher than the oil exporting Nigeria).

Consistently with the high performance in the indirect value added to other countries' export, SSA exhibits a clear and increasing upstream position along the GVC (the highest performance in the world after North Africa). While in 2013 SSA shows an average rate of GVC position about .15, Ghana and Nigeria register a rate around .20. Other countries above the average are in 2005 Burkina Faso, Burundi and Rwanda, while in 2013 Mozambique and Senegal climb the ladder. It is worth noting the peculiar case of Ethiopia that moved from -.28 in 1995 to -.12 in 2013.

This comprehensive map of SSA GVC participation and position for the 25 sectors included in the EORA database confirms the high degree of GVC participation of African countries and their overall upstream position. This involves likely natural-resource production as well as simple manufacturers. In the next section we will focus on the agro-food sector to provide a more detailed investigation of the agro-food value chain and its involvement into global production networks.

Figure 4 GVC position, world regions and selected SSA countries



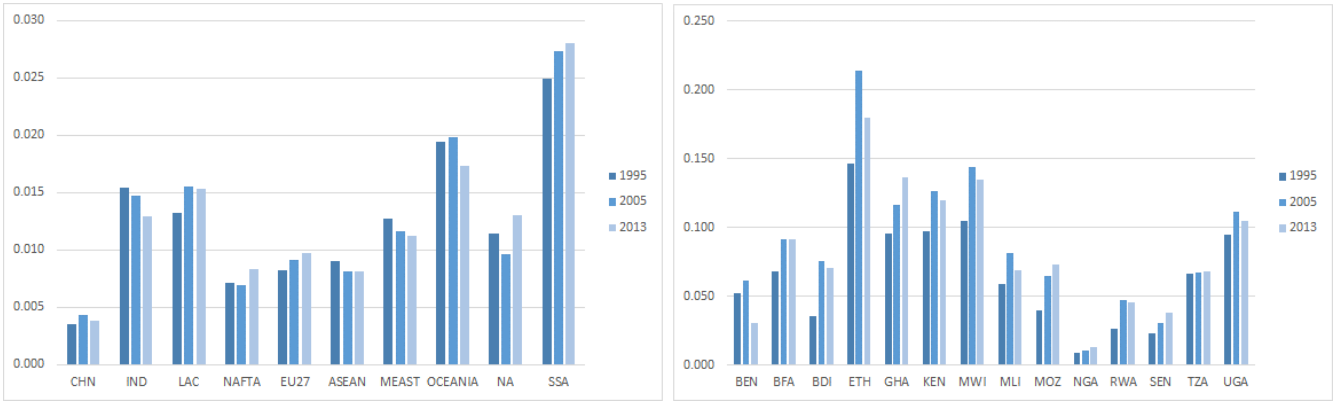
Source: Authors' elaboration on EORA data

4.2 SSA in the Agriculture GVCs

Tab. A3 in the Appendix provides a complete picture of the bilateral flows of value added in agro-food in SSA. It reports for each SSA country the use and consumption of foreign value added and the source of its valued added used or consumed elsewhere. The relative intensity of the shading indicates the share of the total value added imported or exported. As it is easy to see from the picture, South Africa is the leading supplier for SSA also in agro-food sector whereas other relevant flows are apparent across Kenya, Tanzania and Uganda.

Regarding our measures of GVC participation, Fig. 6 shows that over the past twenty years, agriculture has steadly increased its involvement into global networks with the exception of NAFTA and SSA countries. However, Burundi and Mozambique present the highest growth rates in SSA, with 98% and 82% respectively.

Figure 5 Agriculture GVC Participation, world regions and selected SSA countries



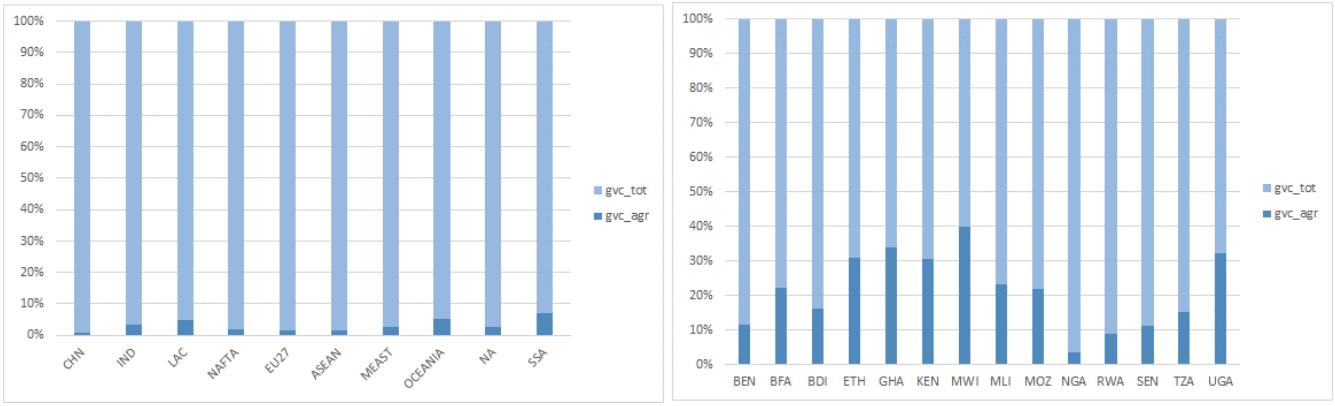
Source: Authors' elaboration on EORA data

Overall, agriculture participation in GVC accounts for less than 5% of the total worldwide. It is worth noting that the agricultural sector of SSA countries is the most involved in GVC if compared to other regions in the world

(7%) (Figure 7). This suggests that most of the value added in the sector is produced for final demand consumption and does not enter agri-food GVC. However, turning to individual MAFAP countries the figure radically changes as the average agriculture participation is above 20%. Malawi (40%) followed by Ghana and Uganda present the highest shares, with about one third of the total measure, while conversely, Nigeria (3%) and Rwanda (8%) confirm their different specialization pattern, mainly in oil and mineral-related activities (Figure 7).

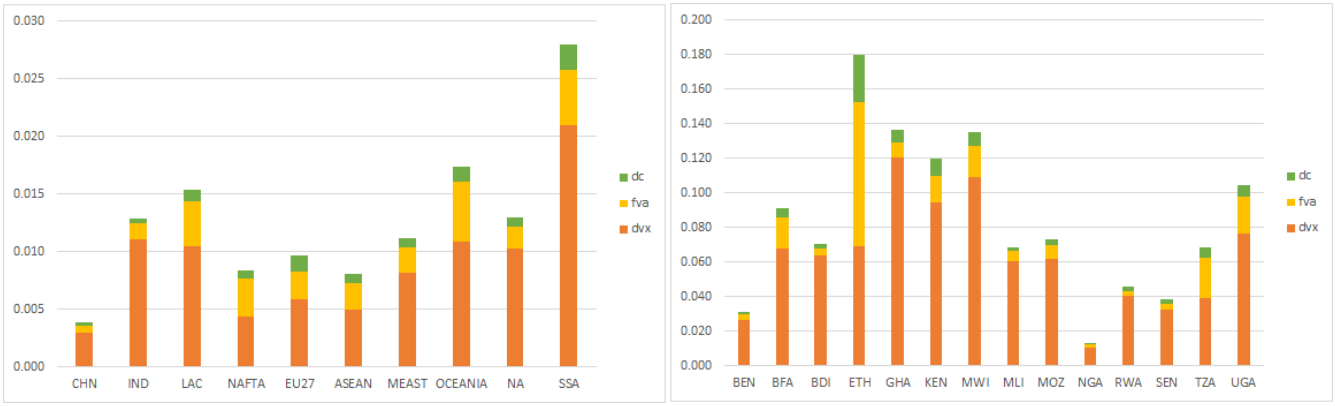
Figures 8 and 9 confirm the relatively high share of the DVX component with respect to FVA and DC also for agriculture, meaning that its value added is mainly used as input for other countries' exports, likely in the form of unprocessed inputs. In comparison, in the more advanced regions, such as NAFTA and EU27, the two main components are more balanced, suggesting an intensive use of foreign agricultural inputs for their exports.

Figure 6 Agriculture as percentage of Total GVC participation 2013, world regions and selected SSA countries



Source: Authors' elaboration on EORA data

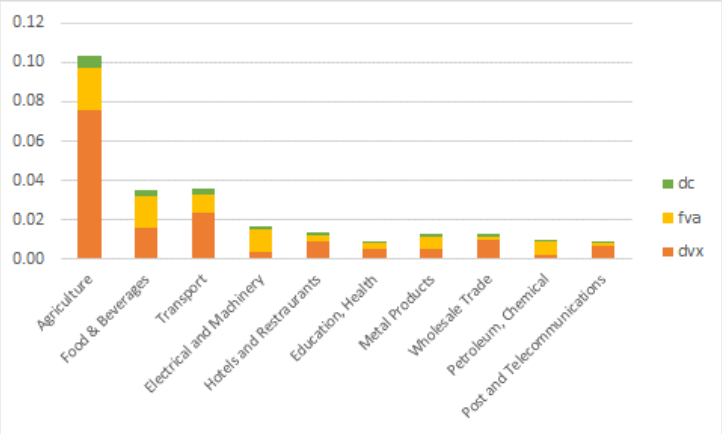
Figure 7 Agriculture GVC participation composition 2013, world regions and selected SSA countries



Source: Authors' elaboration on EORA data

4.3 Bilateral evidence

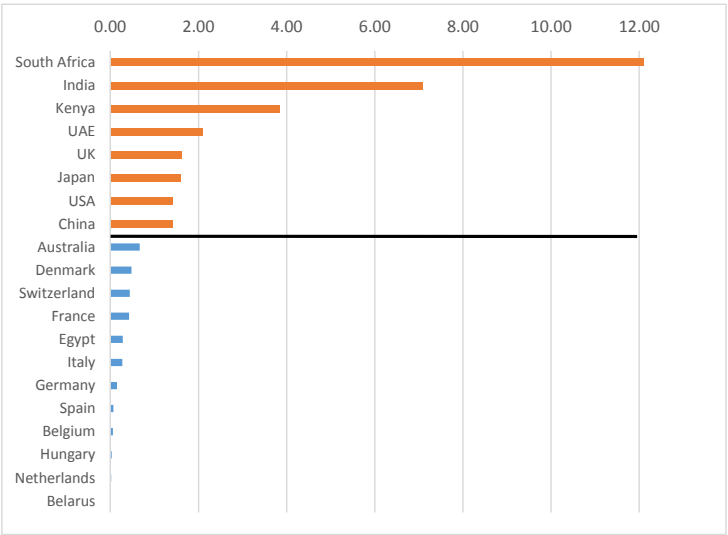
Figure 8 Uganda sectoral GVC composition 2013



Source: Authors' elaboration on EORA data

As underlined in section 3, thanks to the WWZ (2013) decomposition method, we are also able to look at the relative position of each country in the dataset with respect to all the other countries in the world as well as to disentangle the value added components of bilateral trade flows. Specifically, both at the country and at the industry level, we can see, for each reference country, what are its main trade in value added partners upstream and the corresponding ones downstream (Fig.9) and also investigate the relative importance of each value added component of exports in the bilateral relationship (Fig.10).

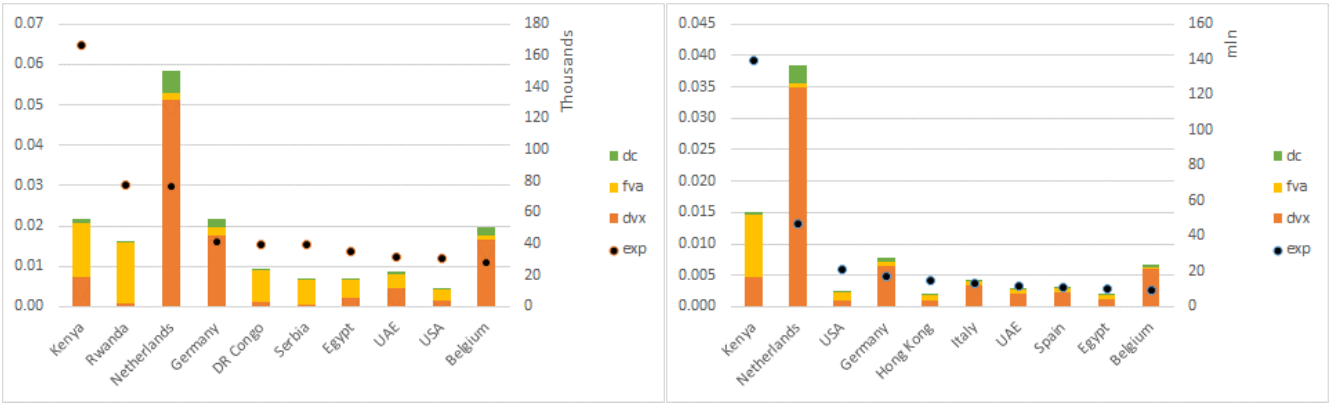
Figure 9 Bilateral relative position of Uganda - trade in value added (2013)



Source: Authors' elaboration on EORA data

The figures report for brevity only the relative position of Uganda at the aggregate level (but a similar picture is available for each country in the EORA dataset). It is interesting to see that, among Ugandan main upstream partners (i.e., countries that provide value added for Ugandan' exports) other than the regional partners, such as South Africa and Kenya, there are also industrialized countries, namely USA and the UK. Similarly, among the main downstream partners (i.e., countries that use added value inputs from these countries for their exports) there are a number of industrialized countries such as Australia, Switzerland and Germany. This additional piece of information will be key to better identify the role of trade policy in the bilateral trade relationship in our "gravity-like" estimates (see section 6).

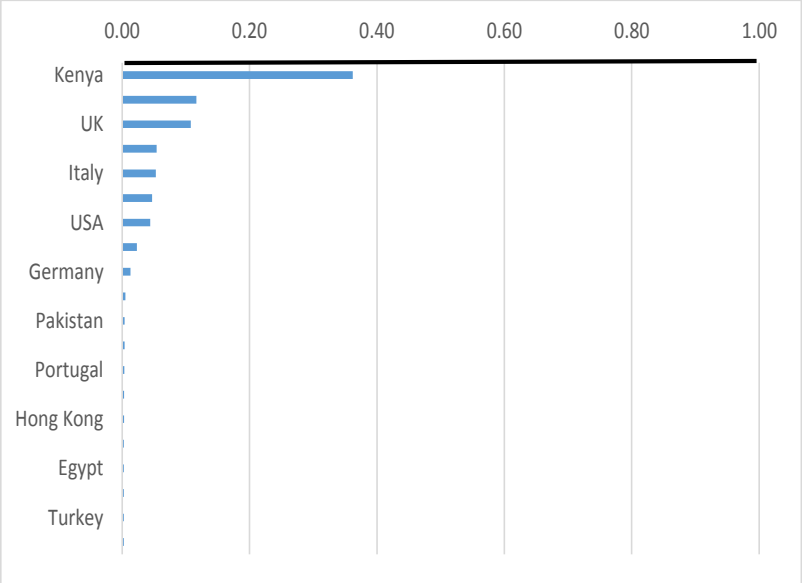
Figure 10 Uganda bilateral value added flows (Total and agriculture) 2013



Source: Authors' elaboration on EORA data

Thanks to the WWZ (2013) decomposition we can look at the relative position of each country in the dataset with respect to all the other countries in the world also for the agro-food sector. Also in this case we report for brevity in the Figures only the relative position of Uganda in the agro-food sector. The agri-food case is particularly interesting for Uganda since it shows that, differently from the aggregate case, Uganda has not any upstream partner but a broad range of downstream direct partners, both developing and industrialized ones (i.e., countries that use Ugandan added value for their own exports).

Figure 11 Bilateral relative position of Uganda – agriculture trade in value added (2013)



Source: Authors' elaboration on EORA data

5. Empirical analysis

The aim of our empirical analysis is to identify the relevance and significance of the policy factors that could be correlated with the above heterogeneity in GVC participation and position across countries, with a focus on agriculture-food-fishery and SSA. This task is not straightforward since the specialized literature does not provide sound and clear-cut theoretical underpinnings and the frontier between openness in practice and openness in policy is somehow blurry. The most recent literature is increasingly paying attention to the determinants of GVC performances for development (see, inter alia, Kowalski et al., 2015; Greenville et al., 2016; Taglioni and Winkler, 2016) in the heroic attempt to cover all the relevant factors by looking at a broad basket of possible variables (logistics performance, labor skills, geographical distance, market size, industrial structure, economic dimension, level of development, etc.). They generally provide cross-country aggregate panel estimates of GVC integration based on the following broad specification:

$$\mathrm{GVC}_{it} = (\mathrm{X}_{it}; \mathrm{Z}_{it}; \theta_t; \varepsilon_{it}) \qquad [1]$$

Where *i* identifies the reporting countries; X_{it} and Z_{it} are, respectively, the structural and policy variables; θ_t are dummies to control for longitudinal time variation, and ε_{it} is the error term.

In our empirical exercise, we rely on a different identification strategy. We select some relevant policy indicators, related to trade, and test for the presence of strong statistical correlations with our measures of GVC participation and position, by controlling for any other possible confounding factors (both observable and

unobservable). To this end, we use a Least Squares Dummy Variables (LSDV) model with a full set of country, industry and time fixed effects, as follows:

$$GVC_{it} = \alpha_0 + \alpha_1 TP_{it} + \theta_t + \theta_c + \theta_s + \varepsilon_{it} \qquad [2]$$

where TP_{it} stands for our measures of trade policy. Although the frontier between policy and non-policy factors is somehow blurry in the empirical literature, in this first empirical exercise we test the following variables as proxies for trade policy: applied weighted mean of tariff rate[11] and participation to Regional Trade Agreements-RTAs.[12] While the first variable proxies trade policy "strictu sensu" - i.e., specifically with reference to applied tariffs - the RTA provides a broader look at the impact of the actual trade policy mix relevant for the agreement, included non-tariff barriers.

Tab. 1 presents the outcomes for the cross-country analysis using the available EORA 23 year panel (1990-2013). The first two columns show the coefficients estimated for all countries included in the EORA dataset (185 reporting countries), whereas columns 3-4 show the same coefficients for 153 non-OECD reporting countries and columns 5-6 for 43 SSA countries. For each group of countries we present two different specifications. The first one is our baseline specification: it includes the most common set of regressors applied by the empirical literature so far along with our policy variables. Tab. A2 in Appendix lists all the variables applied in the subsequent empirical analysis and their summary statistics. According to this baseline specification (columns 1, 3 and 5 of Tab.1), our proxies for trade policy are significant and show the expected signs, with the relevant exception of SSA. Specifically, the higher the number of RTAs signed, the higher the GVC participation; the lower the tariff rate, the higher the involvement into international production networks). This confirms the standard narrative about the need to adopt pro-trade policies to benefit from GVC integration. Also the set of selected regressors are significant and show the usual signs: a positive coefficient for the FDI net inflows and for the share of manufacturing (as % of GDP); a negative coefficient for the geographical distance to the main manufacturing hubs; a negative correlation with the countries' economic dimension (highlighting the relative self-sufficiency of the bigger countries). The coefficients for the policy variables are still robust for the restricted sample of non-OECD countries (the same happens for the control variables), and weakly significant for the restricted sample of SSA countries. It is worth noting, however, that the overall fit of this specification performs quite poorly. It means that, as expected, a large number of both observable and unobservable factors are missing from the analysis. To enhance the robustness of this empirical

[11] The use of the applied tariffs controls directly for the actual utilization rates. Since simple averages give the same weight to all products (not imported as well as very large imports), the imports value (in US dollars) of the reporter country are used as weights. We should acknowledge that the level of nominal tariffs might influence the effective value of imports (e.g. a prohibitive tariff, wearing away imports, and tariff revenue, could be interpreted as a zero tariff rate). This problem is not sufficiently significant to affect the analysis at the aggregate level (and indeed most of the previous literature actually applies weighted averages). However, since tariffs in developing countries are higher than in industrialized countries, and are very high in absolute terms, specifically in the case of the non-OECD countries the use of weighted average tariffs could lead to incorrect interpretations. Furthermore, weighted tariffs could lead to simultaneity bias in the estimated coefficients. Considering this, in our bilateral analysis we will rely on simple averages (presenting the outcomes of weighted averages as a robustness check).

[12] RTAs are collected on the basis of the date the agreement entered into force and then lagged (t-n) to include the effects associated with implementation and phase-in. Data are sourced from Egger and Larch (2008) (for additional details, see also Grant and Lambert, 2008).

exercise, in the second specification (column 2), we substitute all the observables with a full set of country and year fixed effects. This strategy allows us to capture all the counfounding factors that can influence the correlation between GVC participation and our policy variables both at the country level and over time, cleaning up the estimated coefficients of the policy variables for possible confounders. The estimated coefficients of this preferred empirical specification are reported in columns 2, 4 and 6 of Tab. 1. As is apparent from Table 1, the overall fit of this specification greatly improves compared with the baseline (adjusted R2 is now .87 for the entire sample) but now the coefficients for the trade policy variables are not always significant. For instance, tariffs are significant only in the restricted sample of non-OECD countries (column 4) whereas RTAs are significant only in the overall unrestricted sample (column 2). This casts some doubts on the standard narrative of the relevance of the trade policy variables highlighted by the previous literature in the field. This is not surprising since, as it is well known by scholars and pratictioners, trade is a bilateral business and trade policy is meant at the level of industries (even products) whereas measures of world tariff averages at the level of countries (as well as the overall number of signed agreements) cannot be considered much informative of the trade policy patterns.

Table 1 - LSDV estimates at the country level: dependent variable GVC participation

	(1)	(2)	(3)	(4)	(5)	(6)
Dep variable: GVC participation	**ALL**	**ALL**	**non-OECD**	**non-OECD**	**SSA**	**SSA**
Tariff rate (applied weighted mean)	-0.200***	-0.010	-0.190***	-0.018**	-0.127**	-0.041
	(0.031)	(0.007)	(0.031)	(0.008)	(0.059)	(0.042)
Nr RTAs lagged	1.662***	0.517**	1.626***	0.438+	0.743	2.081+
	(0.307)	(0.217)	(0.364)	(0.285)	(0.716)	(1.404)
FDI (net inflows)	0.138***		0.155***		0.004	
	(0.034)		(0.041)		(0.052)	
Manufacturing value added	0.215***		0.184***		-0.101+	
	(0.042)		(0.049)		(0.065)	
Distance from hubs	-8.326***		-9.947***		2.215	
	(0.433)		(0.793)		(1.601)	
GDP (constant 2011 int.l $)	-1.088***		-0.893**		-0.858**	
	(0.324)		(0.373)		(0.413)	
Population	-0.823***		-0.689**		-0.732	
	(0.290)		(0.319)		(0.529)	
Constant	142.070***	18.192***	148.920***	21.665***	52.569***	28.107***
	(7.668)	(1.293)	(10.904)	(2.309)	(15.271)	(2.113)
Observations	2,609	2,920	2,017	2,236	554	576
R-squared	0.334	0.867	0.223	0.831	0.060	0.888
Year dummies	NO	YES	NO	YES	NO	YES
Country dummies	NO	YES	NO	YES	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10, + p<0.15

All variables are in logs except for dummies and percentages

Tab. 2 presents the same baseline specification by splitting GVC participation into backward and forward participation. The backward participation index (i.e., the FVA component, see section 3) captures the extent to which domestic firms use foreign intermediate value added for exporting activities in a given country. The forward GVC participation index (i.e., the DVX component, see section 3) captures the extent to which a given

country's exports are used by firms in partner countries as inputs into their own exports. This further empirical exercise is to test whether our policy variables are correlated differently to the relative weight of the upstream and downstream components of GVC participation. This gives additional insights on the heterogeneity of driving factors (and policies) related to the countries relative position in GVCs. Column 1 shows, for the entire dataset, that the tariffs applied by the reporter country to its suppliers matter in terms of backward GVC participation whereas column 7 shows that the number of RTAs is significantly and positively correlated with the upstream component of GVC participation. It is worth noting that also the control variables present asymmetries: i.e., FDI inflows are positively correlated with higher FVA content of countries' exports and negatively correlated with domestic content of value added for other countries' exports; a similar pattern is shown by the share of manufacturing (as % of GDP) highlighting that upstreamness is mainly driven by non-manufacturing sectors; whereas the opposite pattern is shown by our proxies for economic dimension (i.e., population) highlighting, as largely expected, that GVC participation for bigger countries is mainly forward. Consistently with the outcomes in Table 1, also in this case our preferred specification (columns 2 and 8) greatly improves the overall fit of the specification but weakens the coefficients for the trade policy variables. This confirms the doubts already expressed about the standard narrative proposed by previous literature in the field. Note that the same pattern is substantially confirmed also for the restricted samples of non-OECD and SSA countries.

Table 2 - LSDV estimates at the country level: dependent variables Backward and Forward GVC participation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ALL	ALL	non-OECD	non-OECD	SSA	SSA	ALL	ALL	non-OECD	non-OECD	SSA	SSA
Dep variable: GVC participation	**Backward**	**Backward**	**Backward**	**Backward**	**Backward**	**Backward**	**Forward**	**Forward**	**Forward**	**Forward**	**Forward**	**Forward**
Tariff rate (applied weighted mean)	-0.128***	-0.015**	-0.126***	-0.019***	-0.080+	-0.052	-0.005	-0.003	-0.004	0.001	-0.016	0.030*
	(0.021)	(0.006)	(0.021)	(0.007)	(0.049)	(0.038)	(0.009)	(0.005)	(0.010)	(0.005)	(0.026)	(0.016)
Nr RTAs lagged	-0.212	0.069	-0.367	-0.011	-0.660	1.836+	1.221***	-0.047	1.479***	0.058	1.580**	-0.046
	(0.274)	(0.199)	(0.314)	(0.270)	(0.493)	(1.214)	(0.176)	(0.111)	(0.217)	(0.148)	(0.680)	(0.546)
FDI (net inflows)	0.126***		0.161***		-0.018		-0.057***		-0.074***		0.002	
	(0.036)		(0.046)		(0.038)		(0.018)		(0.025)		(0.037)	
Manufacturing value added	0.521***		0.492***		0.185***		-0.450***		-0.449***		-0.281***	
	(0.038)		(0.043)		(0.044)		(0.025)		(0.028)		(0.033)	
Distance from hubs	-3.980***		-6.057***		9.547***		-1.075***		-0.269		-9.122***	
	(0.392)		(0.773)		(1.181)		(0.204)		(0.393)		(1.105)	
GDP (constant 2011 int.l $)	-0.636**		-0.464		0.180		0.035		0.020		-0.687**	
	(0.301)		(0.344)		(0.347)		(0.179)		(0.214)		(0.332)	
Population	-1.214***		-1.155***		-0.751+		0.669***		0.643***		-0.053	
	(0.262)		(0.289)		(0.518)		(0.166)		(0.189)		(0.336)	
Constant	77.191***	4.283***	90.037***	7.077***	-62.544***	2.846+	19.789***	15.882***	13.127**	14.707***	118.379***	23.866***
	(7.121)	(1.025)	(10.421)	(2.010)	(11.245)	(1.840)	(3.795)	(0.607)	(5.223)	(0.811)	(11.807)	(0.973)
Observations	2,609	2,920	2,017	2,236	554	576	2,609	2,920	2,017	2,236	554	576
R-squared	0.251	0.817	0.226	0.793	0.191	0.905	0.159	0.881	0.157	0.872	0.222	0.928
Year dummies	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Country dummies	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10, + p<0.15

All variables are in logs except for dummies and percentages

Tabs. 3 and 4 report the same estimates with a focus on agriculture, food and fishing. In these empirical exercises a number of additional, industry specific variables have been added in the baseline specification to test the relevance of the same trade policy variables. The new variables are: rural population used as a proxy for the industry economic dimension and FDI inflows specifically to food, beverages and tobacco and to agriculture, forestry and fishing as a proxy for investment policy (see Tab A3 for a summary statistics of these

new variables). However, while in the baseline specification the standard narrative of the high significance of a pro-trade trade policy (reducing tariffs and signing preferential agreements) seems to hold also in the agro-food and fishing sectors, when we control for confounding factors at the country, time and industry level, the trade policy proxied by the number of RTAs looses significance also in the case of the unrestricted sample. Note also that, due to constraints in the actual availability of controls in agro-food-fishing sectors, the number of observations used to carried out the baseline standard specification are dramatically lower compared to our preferred LSDV specification, thus reducing the overall fit of the former emprical analysis.

Table 3 - LSDV estimates for agriculture, food and fishing: dependent variable GVC participation

	(1)	(2)	(3)	(4)	(5)	(6)
Dep variable: GVC participation	**ALL**	**ALL**	**non-OECD**	**non-OECD**	**SSA**	**SSA**
Tariff rate (primary products)	-0.370***	-0.019**	-0.353***	-0.018**	-0.775***	-0.015
	(0.040)	(0.008)	(0.042)	(0.008)	(0.183)	(0.027)
Nr RTAs lagged	0.630**	-0.185	-0.058	-0.094	-18.679***	0.842
	(0.290)	(0.344)	(0.334)	(0.399)	(3.258)	(1.700)
FDI agriculture (net inflows)	0.663***		0.871***		-1.075**	
	(0.096)		(0.118)		(0.424)	
Manufacturing value added	-0.134		-0.022		1.669***	
	(0.094)		(0.108)		(0.430)	
Distance from hubs	-8.180***		-6.732***		-53.920***	
	(0.317)		(0.448)		(8.428)	
GDP (constant 2011 int.l $)	-3.888***		-4.044***		7.227***	
	(0.257)		(0.269)		(2.173)	
Population rural	0.745**		1.240***		6.633***	
	(0.302)		(0.357)		(1.794)	
Constant	186.178***	25.858***	170.217***	25.397***	288.683***	23.139***
	(5.950)	(1.777)	(6.903)	(1.751)	(73.380)	(4.615)
Observations	4,275	8,352	3,264	6,507	486	1,707
R-squared	0.165	0.534	0.094	0.523	0.221	0.513
Year dummies	NO	YES	NO	YES	NO	YES
Country dummies	NO	YES	NO	YES	NO	YES
Industry dummies	NO	YES	NO	YES	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10, + p<0.15

All variables are in logs except for dummies and percentages

The usual pattern is confirmed splitting backward and forward participation also in the agro-food and fishing sectors, with our proxies of trade policies that show a different behavior: the tariff rate holds its significance in quite almost the backward participation's estimates but loses significance in the forward ones while the RTAs proxy shows an opposite trend (Table 4).

Table 4 - LSDV estimates for agriculture, food and fishing: dependent variables Backward and Forward GVC participation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ALL	ALL	non-OECD	non-OECD	SSA	SSA	ALL	ALL	non-OECD	non-OECD	SSA	SSA
Dep variable: GVC participation	Backward	Backward	Backward	Backward	Backward	Backward	Forward	Forward	Forward	Forward	Forward	Forward
Tariff rate (primary products)	-0.221***	-0.013***	-0.203***	-0.011**	-0.541***	-0.016	-0.049**	-0.004	-0.053**	-0.005	0.013	0.007
	(0.036)	(0.005)	(0.038)	(0.005)	(0.172)	(0.022)	(0.022)	(0.003)	(0.023)	(0.004)	(0.088)	(0.014)
Nr RTAs lagged	-1.088***	-0.608**	-1.570***	-0.535+	-19.817***	0.487	1.586***	0.394**	1.680***	0.398*	8.082***	0.289
	(0.265)	(0.299)	(0.294)	(0.343)	(3.122)	(1.489)	(0.155)	(0.185)	(0.194)	(0.226)	(1.455)	(0.955)
FDI agriculture (net inflows)	0.329***		0.717***		-0.550		0.175***		-0.047		-0.188	
	(0.081)		(0.098)		(0.389)		(0.064)		(0.075)		(0.289)	
Manufacturing value added	0.053		0.095		1.659***		-0.104***		-0.083*		-0.581**	
	(0.090)		(0.102)		(0.422)		(0.036)		(0.042)		(0.250)	
Distance from hubs	-4.191***		-4.007***		-32.451***		-1.708***		-1.075***		-6.948*	
	(0.294)		(0.403)		(7.771)		(0.190)		(0.284)		(4.106)	
GDP (constant 2011 int.l $)	-2.082***		-1.950***		6.820***		-0.896***		-1.142***		-2.331**	
	(0.236)		(0.243)		(2.140)		(0.127)		(0.142)		(1.090)	
Population rural	0.038		-0.001		9.079***		0.559***		0.863***		-5.337***	
	(0.285)		(0.334)		(1.732)		(0.134)		(0.155)		(0.850)	
Constant	103.666***	0.194	99.305***	0.043	46.750	-2.586	38.724***	25.163***	34.748***	24.911***	201.247***	26.651***
	(5.399)	(0.958)	(6.240)	(0.927)	(69.075)	(3.859)	(3.052)	(1.839)	(3.861)	(1.829)	(42.130)	(2.777)
Observations	4,275	8,352	3,264	6,507	486	1,707	4,275	8,352	3,264	6,507	486	1,707
R-squared	0.081	0.506	0.065	0.508	0.220	0.529	0.043	0.556	0.038	0.528	0.179	0.552
Year dummies	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Country dummies	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Industry dummies	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10, + p<0.15

All variables are in logs except for dummies and percentages

6. Bilateral analysis

To improve our understanding of the determinants of value added trade, following a recent strand of the theoretical and applied literature (Noguera, 2012; Baldwin and Taglioni, 2014; Kowalski, P. et al., 2015), we look also at bilateral trade flows (i.e., trade flows between pairs of countries). This allows us to investigate the relative significance of the selected trade policy measures applied by countries to bilateral trade flows as well as to take benefit of the well-established "gravity model" to identify the phenomena under investigation. In this empirical exercise, we also take benefit of the bilateral GVC indicators computed according to the WWZ (2013)'s decomposition, already described in section 3.

Scholars warn about the fact that gravity approach needs improvements to take on board the key features of value added trade (Noguera, 2012; Baldwin and Taglioni, 2014;) and there is still no empirical "gold standard" for investigating the determinants of GVC trade (Kowalski, P. et al. , 2015). Broadly speaking, the standard gravity equation is expected to fit less well value-added flows compared with gross exports because bilateral value added flows do not depend only on bilateral trade costs but also on costs with third countries through which value added transits from source to destination. Moreover, Noguera (2012) shows that the relative importance of these additional effects varies significantly across countries and types of trade costs, whereas

Baldwin and Taglioni (2014) underline that when trade in parts and components is relevant, GDPs in both the exporting and importing countries are poor proxies for supply and demand. These authors recognize that this problem softens when the gravity equation is estimated by controlling for a full set of country-time fixed effects. This helps to account for time-varying Multilateral Resistance Terms (Anderson and van Wincoop, 2003) influencing the dyadic relationship (i.e., to control for the effects of "third countries").[13]

All that considered, we thus provide additional bilateral estimates using the following full country-time fixed effects "gravity-like equation": :

$$GVC_{ijt} = \beta_0 + \beta_1 \mathrm{TP}_{ijt} + \phi_{it} + \phi_{jt} + \phi_{ij} + \mu_{ijt} \qquad [3]$$

Where *i* identifies, as before, the reporting country, *j* the partner country and *t* denotes time; GVC_{ijt} are selected bilateral components of WWZ(2013)' s decomposition (see below); TP_{ijt} are our measures of trade policy computed at a bilateral level (see below); ϕ_{it} and ϕ_{jt} represent reporter-time and partner-time fixed effects, respectively; ϕ_{ij} represents country-pair fixed effect, and μ_{ijt} is the error term.

Tab. 5 reports the outcomes of Eq. 3 applied to the same panel of countries over the usual time span (1990-2013). Note, however, that we are now observing bilateral trade relations. To this end, according to WWZ (2013), our dependent variables are now MVAij as a proxy for backward GVC participation and DVAij as a proxy of forward GVC participation, respectively. MVA is the part of the FVA that comes from the direct importing country (T11 + T12 in Fig. 13 in Appendix A); DVA bilateral, is the domestic value added absorbed by the direct importer (T1 + T2 in Fig. 12 in Appendix A). Consistently, also our proxies for trade policies are now bilateral. Specifically, we test for the relevance of the simple averages of tariffs applied by the reporter country to the direct importing contry in determining the amount of FVA that comes to the direct importing county (i.e., MVA). We also test for the relevance of the simple averages of the tariffs applied by the direct importer to the reporter country in determining its amount of DVA. We further test for the relevance of the existing regional trade agreements between pair of countries by using a dummy variable RTAijt indicating the existence of a RTA between countries i and j.[14] As usual, in this empirical exercise, we first present a baseline specification by using the usual set of controls applied by the previous empirical literature and compare it with our preferred specification that is supposed to provide a better fit of bilateral trade in intermediates. In the baseline specification (columns 1-3-5-7-9-11), we thus report the estimates of Eq. 3 with the usual controls, whereas in our preferred specification (columns 2-4-6-8-10-12), we substitute all the controls by using a full set of country-time and country pair fixed effects. Country pair fixed effects control for bias due to omitted time invariant factors due to the presence of possible other events specific to the country pair and contemporaneous to the policy as well as the likely selection-bias of countries trade flows which are independent from trade policy.

[13] For additional details about this issue and to look at alternative network applications of MRT to gravity equations see Montalbano et al., (2015).

Country-time fixed effects proxy for time-varying multilateral resistance factors, included the input-output structure of the global economy (Head and Mayer, 2013; Noguera, 2012).

Since all the usual controls - included the mass variables - are time invariant or time-varying only for the exporter and/or the importer dimension alternatively, they cannot be identified separately, with country time fixed effects because of collinearity constraints (Head and Mayer, 2013). At the same time, thanks to this specification we can estimate the coefficients for our proxies of trade policy (which in a log-log setting such in our gravity-like approach can be interpreted as elasticities) cleaned from both observable and unobservable confounding factors. Table 5 shows that our proxies for trade policy are significant and show the expected signs. Specifically, the average tariffs applied by the reporting countries to the partner countries ($tariffs_{ij}$) is negatively correlated with MVA (i.e., the component of the FVA that comes directly from the partner) and the average tariffs applied by the partner countries to the reporter countries ($tariffs_{ji}$) is negatively correlated with DVA (i.e., the domestic value added absorbed directly by the partner countries) and also with MVA (as expected, also the trade policy of the direct importer ultimately influences all the value added components of the direct exporters). Furthermore, consistently with the theory of trade integration, membership to RTAs determines positive spillovers in terms of increasing the value added content of the member countries' exports, but surprisingly not the foreign value added content from the direct importer. In this respect, SSA are a relevant exception, which calls for additional investigation on the policy mix of RTAs actually in place in the region. Note also that in this case the baseline specification and the preferred one show inconsistent results, demonstrating that our preferred specification with the full set of fixed effects may better identify the significance of trade policy coefficients for the selected bilateral trade policy measures. On the other hand, the baseline one highlights the significance, also in the case of bilateral GVC integration, of the standard set of determinants, which cannot be identified otherwise.

Table 6 reports the same estimates with a focus on the Agriculture, Food and Fishery sectors. Compared with previous estimates, additional sectoral dummies are included to control for sectoral heterogeneity. The outcomes of Table 6 demonstrate that the same empirical approach and the usual set of controls hold also in the case of agriculture since all the variables (trade policies and covariates) are robust and show the usual signs. Note, however, that the supposed exception of the relevance of the policy mix of RTAs in driving the MVA component in the dyadic relationship for SSA actually disappears when we are focusing on agriculture. Generally speaking, however, this analysis provides scholars and policymakers with a useful framework to test the importance of alternative sectoral policy measures on bilateral trade relationship, included value chain interactions between pairs of countries that are the stepping stones of regional and global value chains.

Table 5 – Gravity-like estimates: dependent variables Backward and Forward bilateral GVC participation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ALL	ALL	ALL	ALL	non-OECD	non-OECD	non-OECD	non-OECD	SSA	SSA	SSA	SSA
Dep variable:	**DVA**	**DVA**	**MVA**	**MVA**	**DVA**	**DVA**	**MVA**	**MVA**	**DVA**	**DVA**	**MVA**	**MVA**
tariff ji	-0.009***	-0.000***	-0.014***	-0.000***	-0.009***	-0.000***	-0.013***	-0.000***	-0.009***	-0.000+	-0.011***	-0.000**
	(0.001)	(0.000)	(0.003)	(0.000)	(0.001)	(0.000)	(0.003)	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)
tariff ij			-0.014***	-0.000***			-0.010***	-0.000***			-0.006***	0.000
			(0.003)	(0.000)			(0.002)	(0.000)			(0.001)	(0.000)
RTA lagged ij	0.522***	0.011***	0.711***	-0.001	0.373***	0.012***	0.476***	-0.003	0.258***	0.019***	0.304***	0.027**
	(0.010)	(0.002)	(0.015)	(0.003)	(0.011)	(0.003)	(0.017)	(0.004)	(0.020)	(0.007)	(0.034)	(0.011)
FDI i	0.001***		0.009***		0.003***		0.019***		0.010***		0.007***	
	(0.000)		(0.000)		(0.000)		(0.001)		(0.001)		(0.001)	
FDI j	0.000		0.002***		-0.000		0.002***		0.001*		0.002***	
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.001)	
Manufacturing value added (%) i	0.014***		0.034***		0.022***		0.045***		0.012***		0.010***	
	(0.000)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
Manufacturing value added (%) j	-0.015***		-0.006***		-0.017***		-0.010***		-0.021***		-0.016***	
	(0.000)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
GDP i	1.037***		0.731***		0.848***		0.512***		0.758***		0.315***	
	(0.003)		(0.009)		(0.003)		(0.007)		(0.007)		(0.012)	
GDP j	0.846***		1.889***		0.750***		1.673***		0.557***		1.239***	
	(0.005)		(0.008)		(0.005)		(0.009)		(0.006)		(0.010)	
Population i	0.743***		0.481***		0.657***		0.367***		0.504***		0.194***	
	(0.002)		(0.003)		(0.002)		(0.004)		(0.004)		(0.008)	
Population j	0.642***		1.386***		0.588***		1.253***		0.513***		1.041***	
	(0.002)		(0.003)		(0.002)		(0.004)		(0.003)		(0.006)	
Distance from hub i	-0.128***		-0.313***		0.218***		-0.033***		0.171***		0.475***	
	(0.005)		(0.009)		(0.006)		(0.011)		(0.023)		(0.041)	
Distance from hub j	-0.063***		-0.133***		-0.074***		-0.153***		-0.073***		-0.175***	
	(0.005)		(0.009)		(0.005)		(0.010)		(0.008)		(0.014)	
Contiguity	1.509***		2.548***		1.608***		2.769***		1.267***		2.342***	
	(0.027)		(0.041)		(0.033)		(0.052)		(0.058)		(0.084)	
Common language	0.820***		1.268***		0.714***		1.215***		0.453***		1.044***	
	(0.010)		(0.017)		(0.011)		(0.019)		(0.015)		(0.026)	
Common colonizer	0.049***		0.157***		0.083***		0.054**		-0.041**		-0.235***	
	(0.012)		(0.022)		(0.012)		(0.021)		(0.017)		(0.029)	
Colonizer 1945	1.454***		2.204***		1.517***		2.806***		1.634***		3.274***	
	(0.031)		(0.047)		(0.043)		(0.072)		(0.062)		(0.097)	
Distance ij	-0.455***		-1.025***		-0.446***		-0.954***		-0.327***		-0.540***	
	(0.005)		(0.009)		(0.006)		(0.010)		(0.010)		(0.018)	
Constant	-26.353***		-42.615***		-24.628***		-37.793***		-19.015***		-33.429***	
	(0.103)		(0.174)		(0.118)		(0.202)		(0.246)		(0.439)	
Observations	315,769	439,929	243,317	301,002	254,396	363,458	185,824	232,144	80,764	101,959	54,566	63,819
R-squared	0.702	0.997	0.726	0.999	0.619	0.996	0.661	0.998	0.515	0.992	0.592	0.997
Country pair fe	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Exporter*year fe	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Importer*year fe	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10, + p<0.15

All variables are in logs, except dummies and percentages

Tab. 6 – Gravity-like estimates for Agriculture, Food and Fisheries: dependent variables Backward and Forward bilateral GVC participation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ALL	ALL	ALL	ALL	non-OECD	non-OECD	non-OECD	non-OECD	SSA	SSA	SSA	SSA
Dep variable:	**DVA**	**DVA**	**MVA**	**MVA**	**DVA**	**DVA**	**MVA**	**MVA**	**DVA**	**DVA**	**MVA**	**MVA**
tariff ji	0.001**	-0.000***	0.001**	0.000*	-0.001***	-0.001***	-0.001***	-0.000***	-0.016***	-0.001***	-0.024***	-0.001***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
tariff ij			0.002***	-0.001***			0.002***	-0.000			0.010***	0.011***
			(0.000)	(0.000)			(0.000)	(0.000)			(0.002)	(0.000)
RTA lagged ij	0.472***	0.007	0.481***	-0.001	0.313***	0.013	0.315***	-0.001	-0.065**	-0.001	-0.486***	0.015
	(0.012)	(0.009)	(0.016)	(0.014)	(0.013)	(0.010)	(0.017)	(0.016)	(0.029)	(0.022)	(0.044)	(0.040)
FDI agr i	0.180***		0.199***		0.105***		0.143***		-0.016**		-0.070***	
	(0.002)		(0.003)		(0.002)		(0.003)		(0.007)		(0.010)	
FDI agr j	0.090***		0.212***		0.079***		0.194***		0.073***		0.170***	
	(0.002)		(0.003)		(0.002)		(0.003)		(0.005)		(0.007)	
Manufacturing value added (%) i	0.012***		0.023***		0.040***		0.071***		0.040***		0.057***	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.005)		(0.008)	
Manufacturing value added (%) j	-0.015***		0.002		-0.016***		-0.002*		-0.016***		-0.005+	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.002)		(0.004)	
GDP i	0.882***		0.503***		0.737***		0.248***		0.817***		0.877***	
	(0.006)		(0.009)		(0.006)		(0.009)		(0.025)		(0.039)	
GDP j	0.998***		2.329***		0.929***		2.232***		0.806***		1.607***	
	(0.006)		(0.009)		(0.007)		(0.010)		(0.014)		(0.022)	
Population rural i	0.450***		0.141***		0.452***		0.071***		0.624***		0.826***	
	(0.003)		(0.004)		(0.003)		(0.005)		(0.028)		(0.044)	
Population rural j	0.428***		1.011***		0.414***		0.973***		0.422***		0.826***	
	(0.003)		(0.004)		(0.003)		(0.005)		(0.007)		(0.010)	
Distance from hub i	0.372***		0.042***		0.702***		0.533***		0.673***		0.760***	
	(0.008)		(0.011)		(0.009)		(0.013)		(0.089)		(0.140)	
Distance from hub j	-0.049***		0.124***		-0.017**		0.189***		-0.095***		0.032	
	(0.008)		(0.011)		(0.008)		(0.011)		(0.017)		(0.025)	
Contiguity	1.921***		3.100***		1.849***		3.004***		1.787***		3.061***	
	(0.040)		(0.051)		(0.044)		(0.060)		(0.106)		(0.148)	
Common language	0.852***		1.378***		0.834***		1.229***		0.471***		1.559***	
	(0.018)		(0.025)		(0.018)		(0.026)		(0.037)		(0.058)	
Common colonizer	0.101***		0.375***		0.059***		0.322***		0.067*		-0.485***	
	(0.019)		(0.030)		(0.019)		(0.030)		(0.037)		(0.057)	
Colonizer 1945	1.881***		2.803***		2.098***		3.090***		3.902***		5.268***	
	(0.082)		(0.117)		(0.095)		(0.148)		(0.187)		(0.273)	
Distance ij	-0.373***		-0.960***		-0.333***		-0.984***		-0.392***		-0.722***	
	(0.007)		(0.011)		(0.008)		(0.011)		(0.025)		(0.039)	
Constant	-27.254***		-43.389***		-28.651***		-43.360***		-29.284***		-54.273***	
	(0.170)		(0.243)		(0.181)		(0.271)		(1.143)		(1.750)	
Observations	270,263	1,307,540	218,155	897,551	212,317	1,080,101	163,111	691,740	30,238	303,859	22,399	188,986
R-squared	0.400	0.833	0.557	0.874	0.377	0.809	0.536	0.861	0.305	0.774	0.520	0.836
Country pair fe	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Exporter*year fe	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Importer*year fe	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Industry fe	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10, + p<0.15

All variables are in logs, except dummies and percentages

7. Conclusions

The capacity to take advantages of GVCs as drivers for the structural transformation of African economies relies on a complex mix of factors that go beyond the simple narrative of upgrading. The most recent literature underlines the role of the characteristics of the comparative advantages of each country but also the availability of ancillary services (including transport and logistics) as well as institutional and socio-economic country features (along with human and physical capital). It highlights also the nature of backward and forward linkages' countries, and the characteristics of the final destination markets together with the actual stage of maturity of the specific chain. Among the debate about the key determinants of GVCs, the role to be assigned to trade policy still represents an open issue. Since the frontier between policy and non-policy factors is somehow blurry and the specialized literature does not provide sound and clear-cut theoretical underpinnings, this task is not straightforward.

By exploiting the EORA global multi-region I-O (MRIO) tables, and applying for the first time to these data the most recent gross exports decomposition method provided by Wang et al. (2013), this work provides a robust empirical analysis of the relationship between tariffs and GVC integration for the period 1990-2013 both at the aggregate and bilateral level, with a focus on agriculture, food and fishery and SSA countries. Our empirical results highlight the relevance and significance of the most common trade policy measures. This is, to the best of our knowledge, the first comprehensive work looking at the phenomenon on a bilateral and sectoral basis , with a focus on SSA region, going beyond the simple narrative of "upgrading for compete". This preliminary outcomes provide scholars and policymakers with a useful framework to test the importance of alternative sectoral policy measures on bilateral trade relationship, included value chain interactions between pairs of countries that are the stepping stones of regional and global value chains.

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Appendix A: Tables and Figures

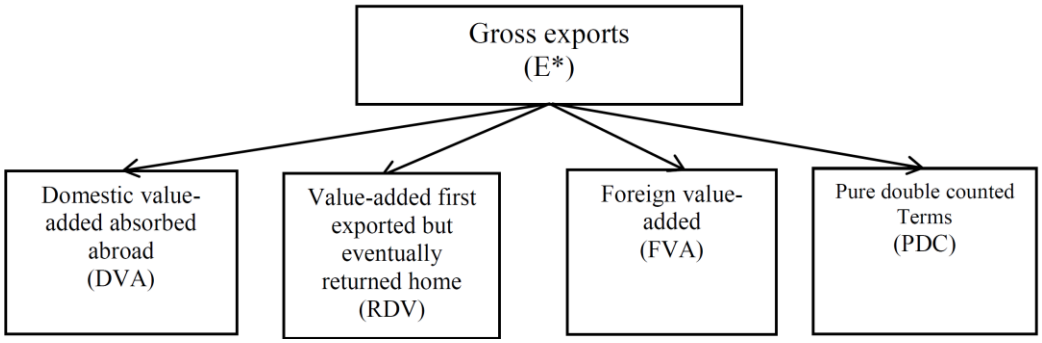
Table A1 - Common 25 ISIC-type classification

Sector name	ISIC Rev.3 correspondence
Agriculture	1,2
Fishing	5
Mining and quarrying	10,11,12,13,14
Food and beverages	15,16
Textiles and wearing apparel	17,18,19
Wood and paper	20,21,22
Petroleum, chemical and non-metallic mineral products	23,24,25,26
Metal products	27,28
Electrical and machinery	29,30,31,32,33
Transport equipment	34,35
Other manufacturing	36
Recycling	37
Electricity, gas and water	40,41
Construction	45
Maintenance and repair	50
Wholesale trade	51
Retail trade	52
Hotels and restaurants	55
Transport	60,61,62,63
Post and telecommunications	64
Financial intermediation and business activities	65,66,67,70,71,72,73,74
Public administration	75
Education, health and other services	80.85,90,91,92,93
Private households	95
Others	99

Table A2 African countries available in Eora (Mafap countries in red).

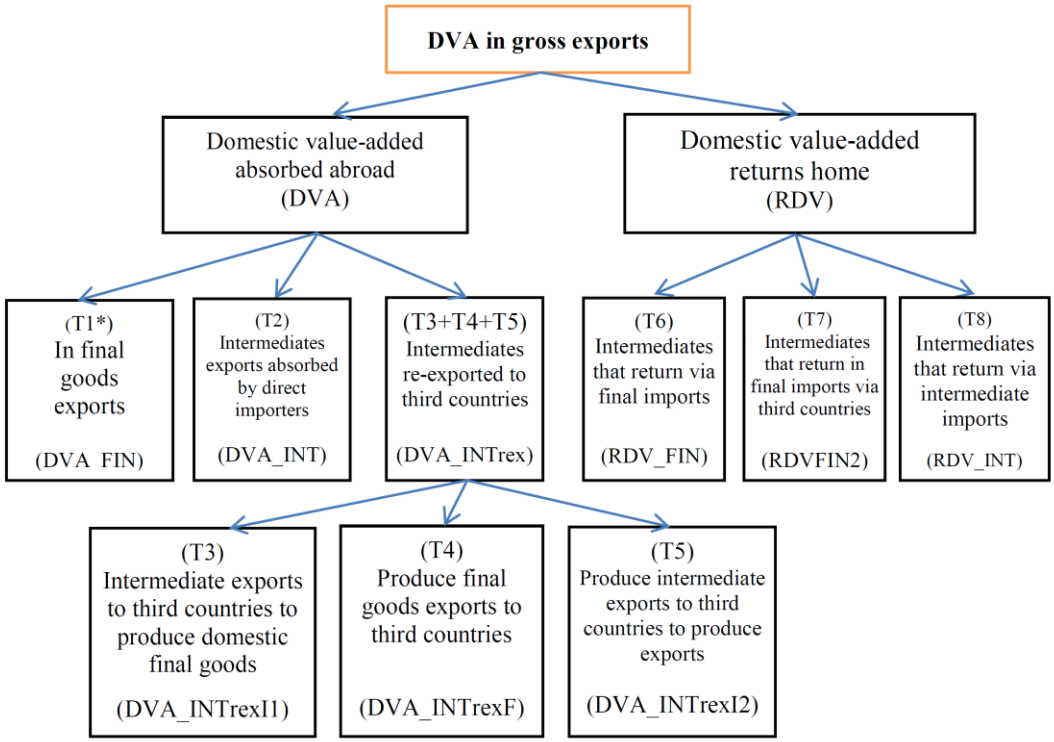
1	Algeria	11	Congo	21	Ghana	31	Mauritius	41	Somalia
2	Angola	12	Cote d'Ivoire	22	Guinea	32	Morocco	42	South Africa
3	Benin	13	Democratic Republic of the Congo	23	Kenya	33	Mozambique	43	Swaziland
4	Botswana	14	Congo	24	Lesotho	34	Namibia	44	Tanzania
5	Burkina Faso	15	Djibouti	25	Liberia	35	Niger	45	Togo
6	Burundi	16	Egypt	26	Libya	36	Nigeria	46	Tunisia
7	Cameroon	17	Eritrea	27	Malawi	37	Rwanda	47	Uganda
8	Cape Verde	18	Ethiopia	28	Madagascar	38	Sao Tome and Principe	48	Zambia
9	Central African Republic	19	Gabon	29	Mali	39	Senegal		
10	Chad	20	Gambia	30	Mauritania	40	Sierra Leone		

Figure 11 Gross exports accounting: Major categories



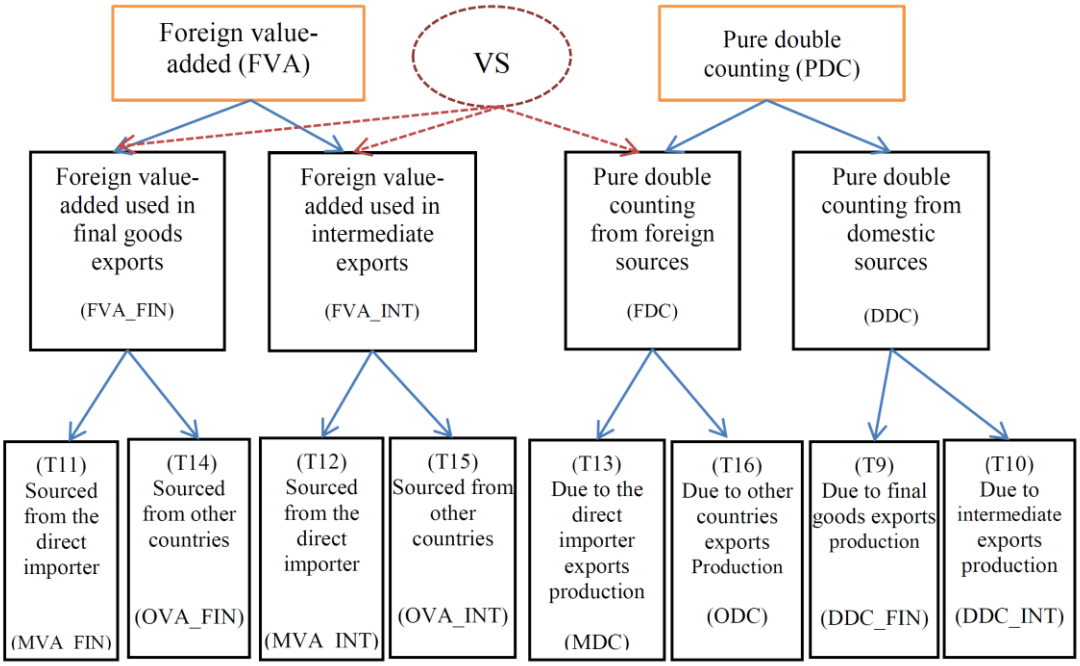
Source: WWZ, 2013

Figure 12 Gross exports accounting: Domestic value added



Source: WWZ, 2013

Figure 13 Gross exports accounting: Foreign value added and Pure Double counting



Source: WWZ, 2013

Tab. A3 - Bilateral flows of value added in agro-food in SSA (shading represents relative size measured in USD millions, 2013)

	Angola	Benin	Botswana	Burkina Fa	Burundi	Cameroon	Cape Verd	Central Af	Chad	Congo	Cote dIvo	Djibouti	DR Congo	Eritrea	Ethiopia	Gabon	Gambia	Ghana	Guinea	Kenya	Lesotho	Liberia	Madagasc	Malawi	Mali	Mauritani	Mauritius	Mozambiq	Namibia	Niger	Nigeria	Rwanda	Sao Tome	Senegal	Seychelle	Sierra Le	Somalia	South Afri	Swaziland	Tanzania	Togo	Uganda	Zambia
Angola		0.55	0.55	1.62	0.47	1.59	0.22	0.31	1.19	0.85	6.09	0.47	0.60	0.15	19.14	2.05	0.19	5.04	1.00	10.40	0.27	4.02	5.04	2.94	0.66	9.26	3.95	1.02	612.45	0.26	5.28	0.35	2.68	4.21	3.49	0.77	0.13	12.94	1.65	2.65	1.87	1.55	8.76
Benin	0.09		0.55	1.77	0.32	1.15	0.14	0.21	0.81	4.22	22.83	0.32	0.39	0.10	12.66	18.80	0.13	5.57	0.66	7.82	0.18	2.84	3.10	2.03	0.50	6.88	16.12	0.81	3.67	14.86	174.78	0.19	0.41	195.16	2.46	0.52	0.10	162.17	1.67	1.41	282.04	1.07	1.05
Botswana	0.05	0.15		0.41	0.15	0.44	0.06	0.09	0.31	0.23	1.69	0.15	2.03	0.05	5.17	0.55	0.07	1.43	0.27	2.99	4.73	1.16	1.25	9.66	0.17	2.53	1.09	0.34	61.63	0.09	0.31	0.09	0.21	1.15	1.05	0.23	0.05	1.93	5.60	0.68	0.57	0.44	29.88
Burkina Faso	0.05	0.83	0.18		0.24	0.82	0.11	0.15	0.51	0.39	3.67	0.24	0.26	0.08	10.28	6.51	0.12	4.43	0.46	4.65	0.11	1.94	2.08	1.31	8.35	4.46	61.14	0.46	1.51	16.45	0.98	0.15	0.33	2.45	1.76	0.35	0.07	3.70	0.76	0.96	353.16	0.78	0.62
Burundi	0.08	0.47	0.38	1.13		1.34	0.18	0.29	0.89	0.73	5.19	0.42	0.46	0.14	22.31	1.64	0.22	4.63	0.84	9.47	0.23	3.80	3.63	2.42	0.54	7.84	3.18	0.92	2.90	0.26	0.89	0.28	0.62	3.61	3.31	0.71	0.13	6.15	1.41	1.60	1.70	9.07	1.35
Cameroon	0.30	0.47	0.68	0.82	0.24		0.18	9.75	22.41	84.83	31.80	0.26	23.46	0.08	11.34	916.74	0.25	6.15	0.72	9.83	0.14	1.98	54.43	1.70	0.49	7.84	12.94	0.82	4.71	0.20	17.02	0.16	0.47	472.18	2.13	0.47	0.07	298.11	1.88	2.28	5.19	1.12	1.01
Cape Verde	0.05	0.19	0.17	0.48	0.21	0.58		0.14	0.36	0.32	2.10	0.21	0.18	0.07	12.00	0.71	0.13	1.76	0.34	4.13	0.10	1.48	1.53	1.01	0.22	80.62	1.51	0.41	1.24	0.12	0.39	0.11	0.33	1.41	1.54	0.32	0.08	1.68	0.71	0.71	0.76	0.57	0.54
Central African Republic	0.07	0.28	0.23	0.72	0.26	8.29	0.12		1.32	26.17	3.22	0.27	3.20	0.09	15.10	1.01	0.13	2.67	0.49	5.52	0.14	2.22	2.28	1.48	0.33	4.94	1.96	0.58	1.72	0.15	0.54	0.18	0.38	2.44	1.99	0.43	0.10	3.30	0.88	1.01	1.01	0.76	0.70
Chad	0.30	0.82	0.54	2.11	0.71	117.87	0.43	0.58		1.25	9.97	0.77	0.74	0.25	31.70	3.24	0.27	6.80	1.41	13.72	0.41	6.83	5.83	4.41	0.86	15.30	5.51	1.45	4.65	0.46	120.34	0.40	0.88	5.96	5.45	1.13	0.20	10.42	2.36	2.93	2.90	2.19	2.00
Congo	0.15	0.39	0.40	1.00	0.35	6.34	0.19	0.24	0.77		4.97	0.35	0.40	0.11	16.34	2.43	0.18	4.15	0.66	8.74	0.19	2.86	3.35	2.03	0.44	8.53	3.34	0.85	13.44	0.19	1.47	0.20	0.52	4.75	2.53	0.60	0.11	48.52	1.32	1.71	1.31	1.17	0.97
Cote divoire	0.41	11.84	1.58	1.12	0.19	43.69	0.25	0.15	0.52	0.74		0.28	0.90	0.07	13.53	70.58	3.59	15.68	33.87	26.44	0.10	1.40	34.95	1.90	84.60	156.42	28.01	1.17	11.59	27.54	153.07	0.15	0.26	1240.29	3.04	0.73	0.06	708.06	3.78	5.33	102.57	1.78	1.49
Djibouti	0.06	0.32	0.23	0.65	0.31	0.98	0.14	0.21	0.65	0.53	3.76		0.32	0.10	29.39	1.16	0.11	2.87	0.56	11.68	0.17	2.87	2.63	1.83	0.39	5.65	1.95	0.64	1.87	0.18	0.44	0.22	0.33	2.37	2.42	0.50	0.09	2.20	0.93	1.04	1.19	0.91	0.80
DR Congo	0.16	0.53	0.52	1.54	0.46	11.66	0.23	0.81	1.12	0.86	5.99	0.47		0.15	19.71	2.41	0.20	4.92	0.95	208.73	0.25	3.99	4.08	2.80	0.61	9.57	4.03	1.09	3.76	0.76	1.66	0.37	0.66	4.15	3.47	0.76	0.15	63.62	1.73	10.26	4.59	6.76	18.42
Eritrea	0.07	0.46	0.37	1.19	0.46	1.30	0.19	0.29	0.89	0.68	5.16	0.46	0.40		28.99	1.61	0.27	4.35	0.82	8.71	0.24	3.71	3.86	2.51	0.54	8.14	3.18	0.92	2.89	0.27	0.70	0.27	0.74	3.38	3.37	0.72	0.16	3.59	1.58	1.60	1.69	1.29	1.17
Ethiopia	0.11	0.45	0.43	1.05	0.38	1.69	0.18	0.24	0.74	0.64	6.28	0.38	0.57	0.12		1.73	0.22	5.84	0.83	180.75	0.18	2.75	3.69	2.17	0.48	7.26	27.28	0.86	3.23	0.24	2.40	0.23	0.54	4.49	3.13	0.72	0.12	44.56	1.44	3.02	1.64	3.44	1.15
Gabon	0.13	0.30	0.30	0.67	0.21	12.30	0.12	0.14	0.50	6.74	6.54	0.22	0.36	0.07	10.18		0.10	3.62	0.73	7.38	0.12	1.73	3.55	1.36	0.30	5.24	2.95	0.57	2.23	0.13	1.50	0.15	3.19	20.21	1.67	0.36	0.07	49.18	0.95	1.57	0.93	0.83	0.69
Gambia	0.05	0.29	0.34	0.77	0.41	3.23	0.14	0.24	0.55	0.49	3.58	0.26	0.35	0.11	14.02	1.27		77.86	3.38	8.18	0.14	2.51	2.35	1.73	2.33	31.10	25.86	0.64	2.18	0.21	0.69	0.17	0.59	3.15	2.95	0.55	0.13	13.45	1.23	1.21	1.38	1.13	1.05
Ghana	0.45	8.65	5.45	1.75	0.32	6.46	0.34	0.21	0.76	0.89	16.27	0.36	1.22	0.12	20.29	8.18	1.44		1.28	27.84	0.19	2.48	5.62	2.35	5.44	10.73	11.37	1.16	7.26	8.50	199.08	0.24	0.47	76.58	3.31	1.26	0.10	296.36	2.47	6.45	608.75	2.23	14.71
Guinea	0.07	0.39	0.28	0.91	0.32	2.42	0.14	0.21	0.69	0.53	204.86	0.32	0.38	0.10	14.08	1.42	0.14	7.98		7.37	0.16	2.77	27.56	1.85	4.73	68.57	11.46	0.72	2.46	0.21	10.84	0.21	0.39	9.36	2.65	22.43	0.09	16.03	1.12	1.42	1.94	1.05	0.91
Kenya	4.47	9.87	6.19	8.33	6.12	18.79	1.55	2.02	6.99	12.77	102.47	26.88	134.88	6.90	821.71	16.96	1.74	307.90	6.16		1.48	24.29	56.97	45.23	4.58	110.99	407.30	10.11	42.69	2.22	191.19	13.60	5.03	142.39	281.70	8.80	1.91	1178.65	15.42	2073.60	14.39	2858.21	54.09
Lesotho	0.02	0.15	0.75	0.35	0.16	0.44	0.07	0.11	0.32	0.22	1.66	0.17	0.14	0.06	6.92	0.55	0.09	1.43	0.87	3.33		1.11	1.15	0.81	0.18	2.63	1.19	0.32	1.01	0.09	0.24	0.08	0.25	1.09	1.23	0.25	0.06	1.43	0.61	0.60	0.59	0.44	0.41
Liberia	0.04	0.23	0.25	0.53	0.21	0.84	0.08	0.13	0.37	0.32	7.90	0.20	0.23	0.06	10.68	0.89	0.11	2.58	0.39	5.25	0.10		2.08	1.14	0.26	3.73	1.88	0.47	1.74	0.13	1.76	0.12	0.30	42.53	1.58	0.34	0.07	28.41	0.81	0.85	6.88	0.65	0.61
Madagascar	0.17	0.40	0.91	0.70	0.22	2.71	0.13	0.15	0.46	0.49	9.71	0.25	0.52	0.07	38.10	4.72	0.14	5.67	0.66	12.42	0.10	1.73		1.45	0.35	6.22	1450.38	0.77	6.05	0.18	3.56	0.12	0.33	34.28	14.87	0.41	0.07	360.97	2.34	10.05	7.49	1.10	1.09
Malawi	0.35	0.42	15.21	0.77	0.52	17.70	0.16	0.18	0.56	21.52	23.83	0.40	2.51	0.09	13.40	27.21	1.84	40.89	0.61	248.99	2.14	4.20	3.50		0.38	166.21	39.37	34.83	31.57	0.17	3.42	0.20	0.38	4.29	12.74	13.27	0.09	2714.71	12.68	334.88	1.24	6.80	265.20
Mali	0.14	1.45	0.33	73.82	0.39	1.44	0.20	0.26	0.93	0.73	228.62	0.40	0.50	0.13	20.10	19.36	0.14	4.62	0.82	9.03	0.22	3.47	4.34	2.34		8.62	255.50	0.90	2.73	9.93	1.08	0.22	0.44	118.31	3.24	0.64	0.11	10.45	1.33	2.11	9.71	1.32	10.48
Mauritania	0.10	9.81	0.40	1.25	0.44	101.34	0.19	0.28	0.86	0.77	5.93	0.44	0.49	0.13	18.38	10.47	0.25	42.57	0.84	9.58	0.21	3.20	3.87	2.47	1.22		18.14	0.93	2.98	0.34	302.67	0.27	0.66	4.97	3.19	0.75	0.15	6.34	1.48	1.72	84.99	1.36	1.21
Mauritius	0.18	0.85	0.91	1.94	1.28	2.76	0.36	0.53	1.72	1.32	11.00	0.83	1.02	0.28	31.03	3.22	0.48	11.03	1.55	108.79	0.36	6.45	430.48	5.13	0.97	14.13		3.88	8.96	0.49	25.32	0.66	1.11	7.49	461.43	1.31	0.27	101.24	3.36	14.70	3.19	23.20	13.08
Mozambique	0.42	0.36	9.52	0.91	0.33	1.25	0.20	0.20	0.72	0.60	5.25	0.32	1.17	0.10	11.66	1.46	0.13	6.26	0.63	77.64	0.16	2.52	3.81	246.13	0.42	6.88	42.27		39.95	0.19	1.67	0.21	0.37	3.23	3.62	0.52	0.09	3184.47	375.87	4.44	1.29	14.00	28.70
Namibia	216.95	0.33	103.66	0.74	0.28	14.51	0.98	0.18	0.61	13.71	11.91	0.29	3.01	0.09	10.43	1.38	0.15	14.56	13.54	57.20	1.83	2.14	2.82	12.24	0.62	78.19	63.94	10.65		0.17	9.16	0.17	0.70	3.42	2.14	0.48	0.10	11.99	2.44	39.62	1.18	1.84	74.23
Niger	0.08	0.44	0.34	115.41	0.37	1.13	0.16	0.23	18.48	0.62	633.26	0.36	0.43	0.11	17.30	16.91	0.16	105.94	0.67	11.72	0.16	2.86	3.19	1.83	5.44	6.41	2.67	0.82	2.44		8.90	0.19	0.51	4.10	2.51	0.59	0.12	8.24	1.25	2.02	36.49	1.19	1.23
Nigeria	0.44	4.90	9.43	1.39	0.34	78.86	0.27	0.23	56.82	0.87	30.02	0.38	1.12	0.12	20.73	24.46	3.73	200.76	8.58	95.69	0.16	2.64	5.87	18.86	6.23	9.12	14.38	2.06	18.88	163.60		0.23	0.55	56.68	3.89	0.90	0.10	1405.38	7.20	13.81	66.37	3.04	2.83
Rwanda	0.05	0.31	0.23	0.75	0.29	0.85	0.13	0.19	0.57	0.46	3.29	0.29	0.30	0.09	12.81	1.08	0.14	2.80	0.51	6.42	0.15	2.42	2.36	1.59	0.35	4.91	2.00	0.61	1.85	0.16	0.56		0.42	2.09	2.18	0.46	0.09	6.61	0.97	1.23	1.10	25.53	0.77
Sao Tome and Principe	4.18	0.22	0.22	0.61	0.26	0.63	0.10	0.15	0.41	0.34	2.61	0.24	0.24	0.07	12.17	0.83	0.12	2.24	0.41	4.50	0.12	1.84	1.95	1.26	0.27	4.11	1.74	0.52	1.65	0.15	0.37	0.13		1.80	1.83	0.43	0.08	2.13	0.80	0.78	0.94	1.54	0.63
Senegal	0.37	32.12	0.36	5.45	0.32	98.58	7.53	0.23	1.14	15.83	533.23	0.38	0.84	0.11	12.68	46.72	6.53	394.22	10.76	12.32	0.15	3.22	13.63	1.80	41.27	1688.07	10.74	0.92	4.77	0.39	14.91	0.19	0.43		2.81	4.90	0.09	31.65	1.32	2.71	72.48	1.50	1.02
Seychelles	0.06	0.27	0.27	0.74	0.27	0.88	0.12	0.16	0.46	0.42	3.59	0.25	0.30	0.08	11.80	1.11	0.11	3.09	0.46	19.76	0.13	1.92	59.66	1.44	0.30	4.50	112.72	0.58	1.93	0.17	0.81	0.16	0.34	2.44		0.30	0.08	13.10	0.92	1.17	1.09	0.91	0.75
Sierra Leone	0.08	0.48	0.42	1.23	0.45	1.34	0.20	0.29	0.96	0.74	5.09	0.44	0.49	0.14	29.35	1.72	0.91	4.28	7.33	9.33	0.23	4.02	3.90	2.48	0.56	8.92	3.06	0.95	3.14	0.27	0.84	0.28	0.57	3.62	3.27		0.13	25.48	1.54	1.66	1.77	1.81	1.35
Somalia	0.02	0.12	0.11	0.33	0.13	0.34	0.05	0.08	0.23	0.18	1.43	0.12	0.13	0.04	5.27	0.44	0.08	1.23	0.21	3.02	0.06	0.84	1.00	0.65	0.14	1.90	0.94	0.27	0.80	0.08	1.22	0.08	0.18	0.98	0.88	0.23		1.26	0.44	0.46	0.48	0.35	0.33
South Africa	496.91	24.02	9024.32	8.54	5.63	293.32	34.11	3.05	13.22	92.48	2624.59	4.42	1023.91	2.54	2552.43	500.90	5.35	4750.59	19.63	4099.22	2.88	24.21	1095.91	3353.68	20.85	114.49	9801.82	3824.25	5042.75	3.73	524.10	5.19	5.92	539.65	1729.98	16.21	1.63		20035.41	2202.18	68.79	626.62	4559.91
Swaziland	0.11	0.46	0.34	1.09	0.38	1.42	0.18	0.25	0.85	0.74	5.31	0.39	0.52	0.12	21.06	1.60	0.19	4.90	0.79	112.73	8.05	3.41	33.63	65.24	0.49	227.78	376.69	763.30	2.94	0.23	3.26	0.25	0.47	3.70	3.30	0.64	0.11	23.92		33.49	1.64	2.01	15.39
Tanzania	0.42	0.23	10.58	1.52	2.77	1.20	0.10	0.11	0.32	0.75	4.04	1.05	10.23	0.07	219.10	0.85	1.36	42.38	0.38	995.44	0.52	1.04	3.82	269.59	7.41	63.79	16.84	15.16	26.44	0.11	1.58	6.14	0.19	4.44	16.27	2.09	0.32	277.61	1.85		0.78	116.76	73.59
Togo	0.10	161.43	0.40	51.88	0.42	1.46	0.19	0.57	0.88	18.90	57.92	0.41	0.52	0.12	20.77	96.80	0.18	778.99	2.84	9.82	0.22	3.37	3.73	2.29	11.67	7.67	3.66	0.93	2.96	4.45	61.47	0.24	0.54	54.33	2.91	0.69	0.14	17.69	1.38	1.80		1.31	1.15
Uganda	0.14	0.31	0.28	0.77	2.66	1.12	0.14	0.15	0.54	33.86	11.28	0.26	66.17	0.09	49.58	1.15	0.87	4.45	0.55	3929.30	0.12	1.92	2.80	1.67	3.41	5.49	103.21	0.86	51.11	0.14	1.60	21.20	0.93	76.81	2.14	0.44	0.07	15.66	19.90	119.03	1.02		0.97
Zambia	17.29	0.98	53.12	2.33	4.04	3.46	0.40	0.59	1.88	4.11	11.54	0.90	857.48	0.30	84.52	3.55	5.88	15.39	1.59	283.61	7.14	6.71	7.86	560.61	24.51	15.49	17.02	5.41	95.14	8.38	2.71	2.72	1.08	7.55	8.09	1.30	0.28	4326.16	21.69	437.83	3.29	15.46	

Source: Authors'elaboration on EORA data

Tab. A4 - Variables applied in the empirical analysis: summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
gvc participation	4,440	41.08	33.05	-1.90	1792.50
gvc position =ln(1+tot_dvx)-ln(1+tot_fva)	4,419	0.35	0.88	-4.55	3.67
backward participation	4,440	16.06	33.15	-20.57	1829.23
forward participation	4,440	19.55	9.00	-230.87	49.95
Tariff rate, applied, weighted mean, all products (%)	3,584	8.45	11.15	0.00	254.58
number of rta signed 3 years before	4,632	3.10	0.90	0.00	4.66
Foreign direct investment, net inflows (% of GDP)	4,413	5.51	24.57	-82.89	466.56
Manufacturing, value added (% of GDP)	4,112	14.23	7.35	0.24	45.67
weighted distance (pop-wt, km) from the closest hub (China, USA, Germany)	6,408	8.03	0.78	5.71	9.23
GDP, PPP (constant 2011 international $)	4,383	24.79	2.07	19.47	30.54
population, total	4,860	15.55	2.06	9.67	21.04

Tab. A3 - Variables applied in the empirical analysis (focus on Agriculture): summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
gvc participation	13,320	35.49	22.21	-515.73	538.34
backward participation	13,320	15.34	19.76	-535.05	508.68
forward participation	13,320	15.92	10.42	-176.14	154.91
Tariff rate, applied, weighted mean, primary products (%)	9,609	9.03	19.12	0.00	571.77
number of regional trade agreements (RTA). Egger and Larch 2008	9,951	3.18	0.87	0.00	4.65
weighted distance (pop-wt, km) from the closest hub (China, USA, Germany)	12,816	8.03	0.78	5.71	9.23
GDP, PPP (constant 2011 international $) WDI	11,700	24.77	2.06	19.47	30.41
rural population WDI	12,558	14.66	2.18	4.39	20.58
FDI inflows to Food, Beverages and Tobacco + FDI inflows to Agriculture, Forestry and Fishing USD 2005 prices FAOSTAT (filled)	5,691	3.21	2.45	-2.81	9.66

Appendix B: Methodology

Nowadays a number of world I–O tables exist providing a measurement of value added trade and thus allowing, in principle, a benchmarking exercise, at least for the common countries and indicators that can be identified within each dataset. In Table B1 we report the DVX, FVA, DC and GVC participation for France, Germany, Italy and Spain as retrieved directly from Cappariello and Felettigh (2015), which use the Koopman et al. (2014)'s decomposition on WIOD data, and computed from KWW on EORA, WWZ on WIOD and WWZ on EORA respectively.

The FVA is easily comparable across datasets. Cappariello and Felettigh (2015), working with the WIOD database and the KWW methodology, estimate that the foreign content of exports in 1995 is for instance 15.5% in France. The same figure for the EORA data is at 17.4%. This confirm the slight upper bias (both at the country level and at the world level) the latter has with respect to WIOD (UNCTAD, 2013). However this can be expected, considering that EORA is the only one covering all individual countries in the world and as such it does not include an artificial 'Rest of the World' country whose I–O matrix has been derived through a proportionality assumption based on an 'average' world technology. As pointed by the UNCTAD (2013) this assumption could yield a downward bias in the computed world FVA, as the world average I–O includes by definition large, relatively close, countries, while most excluded countries in the 'Rest of the World' aggregate tend to be small, relatively more open, economies[15]. In a dynamic perspective, Figure 14 below reports the extent of the difference in world FVA share between EORA and the WIOD data for various years. As it can be

[15] PDC terms follow a similar pattern.

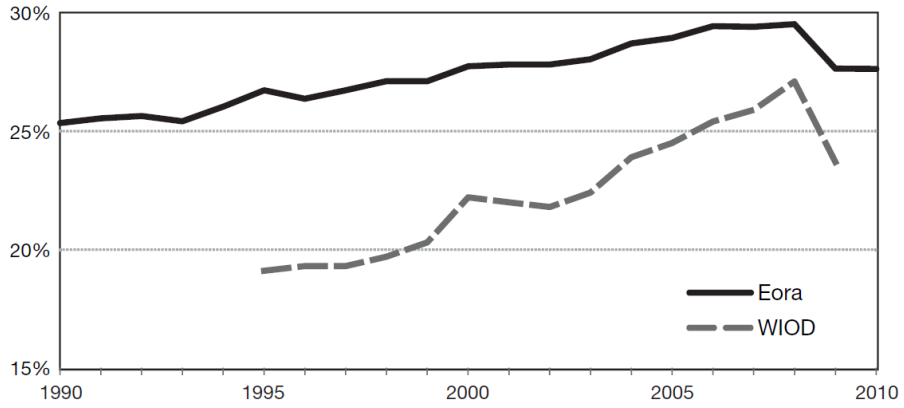
seen, within a common time trend of increasing FVA over time, level differences in the two datasets are not large, and are getting smaller over time.

Secondly, KWW do not properly allocate the DVA embedded in intermediate exports between the share going to direct importers and the share absorbed in third markets (Nagengast and Stehrer, 2014). Borin and Mancini (2015), exploiting the WIOD dataset and a revised version of the WWZ methodology, find a considerably larger weight of global GVCs participation in total trade than the KWW decomposition (35.2 against 29.5 in 1995), where the bulk of the difference is due to the alternative classification of the value added absorbed by direct importers (i.e. T1 and T2 components). Therefore both the DVX(C&F) and DVX(eoraKWW) measures are steadily lower than those computed making use of the WWZ decomposition (respectively 9.1, 11.1, 15.2 and 20.7 for France in Table B1).

Table B1 GVC components in 1995

	FVA(C&F)	FVA(eoraKWW)	FVA(wiodWWZ)	FVA(eoraWWZ)	DVX(C&F)	DVX(eoraKWW)	DVX(wiodWWZ)	DVX(eoraWWZ)
FRA	15.5	17.4	15.4	18.6	9.1	11.1	15.2	20.7
GER	13.4	18.5	13.3	18.4	10.3	10.7	17	20.1
ITA	15.4	16.3	15.3	18.0	7.7	8.9	13	16.9
ESP	16.9	19.5	16.8	21.0	8	8.1	13.6	17.5
	PDC(C&F)	**PDC(eoraKWW)**	**PDC(wiodWWZ)**	**PDC(eoraWWZ)**	**GVC(C&F)**	**GVC(eoraKWW)**	**GVC(wiodWWZ)**	**GVC(eoraWWZ)**
FRA	4.4	8.5	4.3	8.5	29	37.7	35	47.8
GER	4.5	9.3	4.4	8.7	28.3	38.5	34.8	47.2
ITA	3.5	7	3.4	6.0	26.7	32.3	31.7	40.8
ESP	3.8	6.2	3.7	7.2	28.7	33.9	34.1	45.7

Figure 14 FVA, comparison between EORA and WIOD



Source: UNCTAD/Eora, WIOD.