Title:

Does trade policy impact food and agriculture global value chain participation of Sub-Saharan African countries?

Authors details:

- Jean Balié, Food and Agriculture Organization of the United Nations (FAO) Jean.Balie@fao.org
- Davide Del Prete, Food and Agriculture Organization of the United Nations (FAO) and IMT Lucca, Italy,
 <u>Davide.DelPrete@fao.org</u>
- Emiliano Magrini, Food and Agriculture Organization of the United Nations (FAO)
 Emiliano.Magrini@fao.org
- Pierluigi Montalbano, Department of Economics and Social Sciences, Sapienza University of Rome, Italy and Department of Economics, University of Sussex (UK), <u>pierluigi.montalbano@uniroma1.it</u>
- Silvia Nenci, Department of Economics, Roma Tre University, Italy, <u>silvia.nenci@uniroma3.it</u>

Corresponding Author:

Pierluigi Montalbano, Department of Economics and Social Sciences, Sapienza University of Rome, P.le
 A. Moro, 5 00185 Rome (Italy) T(+39) 06 4991 0739 - F(+39) 06 49690329
 <u>pierluigi.montalbano@uniroma1.it</u>, and Department of Economics, University of Sussex, Jubilee
 Building, Falmer, Brighton, BN1 9SN. E-mail: p.montalbano@sussex.ac.uk

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Abstract

The most recent literature on international trade highlights the key role of global value chains (GVCs) in structural transformation, development and growth. The common perception is that Sub-Saharan African (SSA), unlike most Latin American and Asian countries, has not been able to successfully engage into global production networks. By applying the bilateral gross exports decomposition method developed by Wang et al. (2013) to panel data from EORA Input-Output Tables, we provide two main contributions to the literature: i) an extensive investigation of sectoral and bilateral SSA GVC participation in food and agriculture; ii) a sound empirical test to estimate the impact of bilateral trade protection on their backward and forward linkages. We show that: i) despite their low world trade shares, participation of SSA countries in agriculture and food GVCs is higher than that of many other regions in the world and is increasing over time ii) bilateral protection significantly affects backward and forward GVCs participation; that is, import tariffs may have a depressing impact on the domestic value added content embodied in partner countries' exports as well as provide rents to foreign suppliers of inputs. These results call for a refinement of trade policy priorities in SSA.

Keywords: global value chains, agro-food, trade policy, gravity model, Sub-Saharan Africa. **JEL codes**: F15, L23, O11, O55, Q17.

1. Introduction

Since the last decade of the 20th century, the so-called agri-food global value chains (GVCs) keep growing as more products cross national borders and the international production networks become more organized under the lead of modern food processors and retailers (Lee et al., 2010; De Backer and Miroudot, 2014).¹ The common wisdom is that the emergence of GVCs can represent a golden opportunity for supporting the on-going transformations of Sub-Saharan Africa, especially in agriculture and food markets, which could move from a subsistence oriented and farm-centered agri-food system to a more commercialized, productive and off-farm centered activity (IMF, 2015; Greenville et al., 2016).² A growing number of analyses highlight that GVC participation may stimulate public and private investments in infrastructure that would otherwise not be profitable, and spur local production in the agriculture sector through minimum scale achievements (IMF, 2015; Taglioni and Winkler, 2016). At the micro level, GVC participation is supposed to foster firms' productivity in developing contexts reinforcing the so-called "learning-by supplying" hypothesis emphasized by the theoretical literature (Montalbano

¹ The term GVC refers to the global networks of activities required to bring a product from its conception to end use and beyond (for additional details see Humphrey and Memedovic, 2006; Gereffi and Fernandez-Stark, 2011).

 $^{^{2}}$ Some scholars stress that the impact of globalization on the structural transformation of Africa is occurring mainly via foreign direct investment (FDI) and – to a lesser extent – via international trade (Reardon and Timmer, 2007). According to this strand of the literature, in most developing countries, the liberalization of the FDI in the food industry during the 1990s allowed the diffusion of supermarkets, the transition from local sourcing to global procurement networks, and the diffusion of public and private standards (Reardon et al., 2009).

et al., 2016, 2017a). By generating higher and more stable incomes, higher GVC participation can also have important spillovers on the food security of small-holder farmers since it is associated with increasing employment, better remunerated jobs, use of resources, governance, and political stability (Minten et al., 2009; Bellemare, 2012; Cattaneo et al., 2013; Swinnen, 2014; Swinnen and Vandeplas, 2014; Bellemare et al., 2017; Montalbano et al., 2017b).

Despite these potential benefits, the economic literature has not yet: i) quantitatively assessed the participation and integration of SSA countries in the agriculture and food GVCs; ii) formulated any evidence-based policy recommendations on how to increase this participation. Assessing the level of SSA participation in agriculture and food supply chains implies unpacking the different phases of the production process to identify the amount of each country's contribution to trade flows in terms of value-added (i.e, value that is added by countries/industries in producing goods and services).³ This exercise requires the use of multi-region input-output tables (MRIO) to disaggregate the structure of the world economy between countries and sectors. Thanks to the release of the EORA database (Lenzen et al., 2012; 2013) such a comprehensive database with panel data on Sub-Saharan countries is now available for the first time. Concerning policymaking, the spectrum of policies that can potentially influence GVC participation in agriculture and food is wide. It ranges from agricultural-specific interventions aimed at increasing country's competitiveness and specialization to more general supportive policies that can create the right market environment for boosting production, processing, wholesale, retail, and export activities.⁴ However, the likely effects of trade policies have been theoretically and empirically analyzed only recently in light of the emergence of GVCs (Antràs and Staiger, 2012; Blanchard and Matschke, 2015; Gawande et al., 2015; Caliendo et al., 2016).

Our aim is to study whether bilateral import tariffs and shifts in trade regimes associated with regional trade agreements (RTAs) affect the agriculture and food GVCs and, specifically, the SSA countries' backward participation (i.e., the use of foreign inputs for exports) and forward participation (i.e., the use of domestic intermediates in third country exports). The channels through which these policies are linked to the international fragmentation of production are not straightforward. They imply both a "magnification effect" (i.e., goods that cross national borders multiple times incur tariffs several times) and a "chain effect" (i.e., tariffs on imports may have a depressing impact on the domestic value added content embodied in partner countries' exports as well as provide rents to foreign suppliers of inputs). Also, free trade agreements or customs unions can affect GVC participation by including rules of origins and possible non-tariff issues such as general regulatory policies (Curran and Nadvi, 2015).

The relevance of the link between trade policies and participation in GVCs in the agricultural and food sector is remarkable for several reasons. First of all, the SSA countries' protection in these two sectors is the highest in the world with a high incidence of both tariff peak for some products and tariffs applied as specific duties, suggesting that there is a discrete margin for intervention (Bown and Crowley, 2016; Caliendo et al., 2016). Indeed, policy makers often pursue the stabilization of their domestic markets and isolate consumers from negative global events mainly by means of trade barriers. A good

 $^{^{3}}$ Using conventional gross trade statistics, the final producer appears to capture most of the value of goods, while the role of countries providing inputs upstream – such as SSA countries in the agricultural and food supply chains – could be largely underestimated (Koopman et al., 2014).

⁴Recent empirical literature investigates the determinants of developing countries' involvement in GVCs (Elms and Low, 2013; Kowalski et al., 2015; Greenville et al., 2016; Taglioni and Winkler, 2016) and identifies a number of pre-conditions that need to be observed such as adequate professional skills and human capacity, efficient ancillary services (e.g., electricity, telecommunication capabilities, etc.) and more efficient physical infrastructure for transport and logistics (e.g., roads, railroads, airports, and ports).

example is the recent 2007/08 food price crisis in which a number of SSA governments imposed export restrictions and varied import duties in an attempt to insulate domestic consumers from rapidly rising international food prices (Anderson and Masters, 2009; Abbott and De Battisti, 2011; Anderson and Nelgen, 2012; Magrini et al., 2017). Second, understanding whether and how trade policies incentivize or penalize SSA countries' participation in GVCs would be extremely relevant in a region where agriculture still generates about 25% of GDP (50% if we look at the broader agribusiness sector) and involves roughly 65% of the local population, mostly in family farming activities. Finally, the emerging interdependence between smallholders in exporting countries and processors and retailers in importing ones exacerbates the negative effects of these protectionist measures: even relatively low tariffs can have significant knock-on consequences for a chain by, for example, discouraging either foreign outsourcing (Yi, 2003) or the development of within-firm vertical production networks (Hanson et al., 2005). In this perspective, GVCs may provide new scope for deeper bilateral and multilateral trade agreements, well behind the standard terms-of trade motives (Olper, 2016).

To the best of our knowledge, this paper is the first attempt to assess GVC participation in agriculture and food sectors for SSA and provide empirical evidence on the impact of trade policies on its forward and backward components by using panel data. By applying the bilateral gross exports decomposition method developed by Wang et al. (2013) to the EORA panel data, we provide two main contributions to the literature: i) an extensive investigation of sectoral and bilateral SSA GVC participation in agriculture and food; ii) a set of sound empirical tests to estimate the impact of bilateral trade protection in these sectors (net of multilateral integration) on the total, backward and forward participation of the SSA countries. Since the empirical literature on GVCs does not provide a "gold standard" to investigate the impact of bilateral protection, in this work we rely on the well-established gravity model which is traditionally seen as the workhorse model for empirical issues in international trade (Baier et al, 2017). The solid theoretical foundations of the gravity framework (Anderson, 1979; Bergstrand, 1985; Deardorff, 1998; Eaton and Kortum, 2002) make it the best tool so far to quantify the effects of trade policy in a multi-country environment in a tractable framework. It also provides a convenient approach to address the endogeneity concerns by controlling for characteristics of the source and destination countries in value chain trade (Kowalski et al., 2015). We acknowledge that the gravity equation is not expected to fit perfectly well with value added flows compared to 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 (Johnson and Noguera, 2012; Baldwin and Taglioni, 2014). Since empirical complications arise in trying to capture these additional indirect effects of trade in value added flows (Johnson and Noguera, 2012), in our empirical exercise we isolate the impact of bilateral protection on the *dyadic* relationship between reporter and partner countries, by filtering it out from the influences of third countries. We believe that our identification strategy is the best way to look at the issue by adopting a parsimonious empirical approach.

Our findings are consistent with the most recent literature and suggest that Africa is more integrated into GVCs than many other developing regions (Foster-McGregor et al., 2015). It also highlights that global linkages have been increasing over time even if much of Africa's participation in GVCs is essentially in upstream production activities, specializing in providing primary inputs to firms in countries further down the value chain (Del Prete et al., 2017a). Furthermore, we show that SSA trade in value added in agricultural and food products is primarily addressed to the European and emerging countries rather than to regional partners. Finally, our gravity-like estimates reveal that bilateral trade policies are key determinants of

both backward and forward GVC participation in agriculture and food for the SSA countries analyzed. In other words, these trade policies appear to have an important "chain effect" suggesting that a trade restriction imposed by one country actually impacts other countries but also the country itself through value chain linkages. This has strong policy implications since it confirms the theoretical argument that optimal tariff policy no longer primarily depends on the location of the importing goods, but on the nationality of the value added content embodied in traded goods. In short, given the changes in the trade network that have taken place over the last twenty years, a new "thinking value chain" in trade policy should also be implemented (Hoekman, 2014).

The remainder of the paper is organized as follows: Section 2 presents the methodology for decomposing trade in value added. Section 3 provides a comprehensive map of agro-food GVC participation in SSA and relative trade partners. Section 4 describes the identification strategy. Section 5 presents the outcomes of the empirical analysis; Section 6 adds some robustness checks; Section 7 concludes and suggests policy implications.

2. Measuring GVC participation: the methodological approach

Different stages of the same production process are now likely to be allocated to different countries while intermediate inputs cross borders multiple times and are then counted each time by gross trade flows. Consequently, conventional trade statistics become increasingly misleading as a measure of value produced by any particular country. The recent availability of new input-output data combined with bilateral trade statistics allows us to allocate the value added embedded in trade flows to the countries and sectors of origin and destination and decompose gross exports into various components (Koopman et al., 2014), namely: the domestic value added (DVA) (i.e., value added exported in final goods or in intermediates absorbed by direct importers); the foreign value added (FVA) (i.e., other countries domestic value added in intermediates used in exports); and the "pure double counting" term (PDC), that arises when intermediate goods cross borders back and forth multiple times.⁵ In this work, we calculate the various components of trade flows in value-added and provide measures of GVC participation using the methodology developed by Wang et al. (2013) (hereafter WWZ). The authors generalize the gross exports accounting framework proposed by Koopman et al. (2014) from a country-level perspective to one that decomposes gross trade flows at the sector, bilateral, or bilateral-sector level. The WWZ framework is particular informative because it not only allows us to extract value added exports from gross exports, but also to recover additional useful information on the structure of international production with a high level of disaggregation.

A simple example concerning cocoa beans' exports of Ivory Coast can help to clarify this decomposition. Let us assume that the value of cocoa beans' gross exports from Ivory Coast to France is USD 100. Let also assume that this gross exports' value is composed by USD 50, that is the value of the imported inputs from abroad (e.g. fertilizers, pesticides, insecticides, etc.) and USD 50 that is the value added by Ivorian famers growing cocoa beans. Let us now assume that USD 20 of the value added of cocoa beans exported from Ivory Coast to France is absorbed and consumed into the French domestic market, whereas USD 30 is used as intermediates into the French chocolate production exported abroad. Using the jargon of trade in value-added, the value of the cocoa beans exported by Ivory Coast would embed USD 50 of domestic value added (DVA)

⁵Some of the terms in the PDC bucket double count value added originated in the home country, while other terms in the double count value added originated in foreign countries (WWZ, 2013).

and USD 50 of foreign value added (FVA). Also, the DVA of Ivorian exports should be further decomposed into USD 20 of direct domestic value added (DirDVA), that is the part of cocoa beans' exports directly absorbed - as both final and intermediate goods - by the French market and USD 30 of indirect domestic value added (DVX), that is, the part of cocoa beans' intermediates further re-exported by France to third countries as chocolate primary and confectionary products. Finally, the chocolate products (e.g., cocoa paste, butter etc.) eventually exported by Ivory Coast using the chocolate primary products imported from France (e.g., cocoa powder) includes a PDC term due to the value of cocoa beans originally exported to France.

In our empirical exercise, we calculate the WWZ components at their finest level which relies on the decomposition of the bilateral-sector trade flows. In the WWZ decomposition of bilateral-sector gross exports, the main components (i.e. DVA, FVA and PDC) are further disaggregated into sixteen value-added and double counting terms (see Figure 1A and Figure 2A in the Appendix). For the purpose of our analysis, we exploit some of these sixteen terms to retrieve three key components of value added exports:

i) the *direct domestic value added* (DirDVA), that is, the domestic value added in intermediates and final goods exports absorbed and consumed by direct importers (calculated as the sum of the terms T1 and T2 of the WWZ decomposition, see Figure 1A). In the example above, this represents the USD 20 of Ivorian cocoa beans directly absorbed by France. Since it is the result of a single exchange of goods, in our empirical exercise we use it as a proxy for gross exports;

ii) the *indirect domestic value added* (DVX), that is, the domestic value added in intermediate goods further re-exported by the partner country (i.e., from T3 to T8 in Figure 1A). In the example above, the DVX for Ivory Coast is USD 30, which is the DVA not absorbed by its partner country, i.e. France, but further re-exported to third countries. It measures the joint participation of the bilateral trade partners in a GVC since it contains the exporter's value added of a specific sector that passes through the direct importer for a (or some) stage(s) of production before it reaches third countries (or eventually returns home⁶). More specifically, it captures the contribution of the domestic sector to the exports of other countries and indicates the extent of involvement in GVC for relatively upstream industries. In our empirical analysis, we use this component as a measure of *forward* GVC participation;

iii) the *foreign value added* (FVA) used in the production of a country's exports, which consists of the value added contained in intermediate inputs imported from abroad, exported in the form of final or intermediate goods (that sums the terms from T11 to T15 of the WWZ decomposition, see Figure 2A). In the example above, Ivorian FVA is USD 50 which corresponds to the value of imported inputs from abroad and used to produce and export cocoa beans. It captures the extent of involvement in GVC for relatively downstream industries. We use this component as a measure of *backward* GVC participation.

To isolate the dyadic relationship of the bilateral-sector trade flow which involves only the country pairs, we identify two further sub-components:

iv) from the DVX, we aggregate only the share of re-exported domestic valued added that ultimately returns home exclusively via the partner country (DirRDV) (T6 and T8 in Figure 1A). Following the example above, the DirRDV from

⁶The DVX component includes also the returned value added (RDV), that is the portion of domestic value added that is initially exported but ultimately returned home by being embedded in the imports from other countries and consumed at home.

Ivory Coast to France would be the share of Ivorian DVX contained in the French primary and confectionary chocolate products that are re-exported to Ivory Coast;

v) from the FVA, we aggregate only the share of the foreign value added that comes from the direct importing country (MVA) (T11 and T12 in Figure 2A). For example, assuming that France is one of the foreign countries providing inputs to the production of cocoa beans (e.g. fertilizers, pesticides, insecticides, etc.), the MVA of the Ivorian exports to France would be the share of FVA from France embedded in the Ivorian exports of cocoa beans to France.

Data used in this work come from the EORA Multi-Region Input–Output (MRIO) database. This database 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 sources into a balanced global MRIO, using interpolation and estimation to provide a contiguous, continuous dataset for the period 1990-2013 (Lenzen et al., 2012; 2013).⁷ The EORA tables are particularly useful since they provide access to each country's structure and function and also information on the interactions between trading partners. Hence, the world trading system can be viewed as a single entity with all trade flows reconciled in economic terms. EORA contains data for 186 countries - of which 43 are in SSA - and 25 harmonized ISIC-type sectors.⁸ Specifically, we focus on the agriculture (ISIC codes 1, 2) and food and beverages (ISIC codes 15, 16) sectors.

3. Mapping agriculture and food GVC participation in SSA

In this section, we map agriculture and food GVC participation in SSA. To get a comprehensive picture of trade in value added for a single country across all partners in each sector we sum up the DVX, the FVA and the PDC components derived in section 2 and provide an overall *GVC participation index* (Koopman et al., 2011; 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) the participation of a country in global supply chains. The maximum value of GVC index is 1 in the extreme case where gross exports are only determined by the above components.

Figure 1a shows the aggregate GVC participation index in 2013 (the last available year) across all sectors and by regions, distinguishing between the FVA, DVX and PDC components. As a preliminary remark, we can notice that the EU27 and ASEAN countries are the most integrated.⁹ Nevertheless, the SSA participation rate is surprisingly high (40%), matching the level found for China and India, in line with the previous literature applying different decomposition methods (see, among others, African Development Bank, 2015; Foster-McGregor et al., 2015; Kowalski et al., 2015). This means that almost half

⁷ The use of EORA database is the only option to look at the issue for a comprehensive set of countries in Sub-Saharan Africa. None of the other similar efforts such as the Asian IO tables (IDE-Jetro), the GTAP project, the OECD-WTO TiVA initiative and the WIOD project has the same extension in terms of country coverage and the same level of detail for end-use categories in Sub-Saharan Africa. Notwithstanding the growing use of the EORA database to carry out GVC studies (see, among others Caliendo et al., 2015; and Del Prete et al., 2017b), we made additional sensitivity analysis by comparing EORA and WIOD for overlapping sectors and countries. This highlighted consistent trends and a slight upward bias from WIOD (both at the country level and at the world level) likely due to the fact that the latter includes 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.

⁸ We exclude from our analysis the recently born South Sudan (2011) and Sudan, and Zimbabwe for data inconsistency.

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 EU27 relative to other large single countries or smaller regional groups (e.g., NAFTA).

of all trade activities in SSA are GVC-related. Then, looking at the different components of the GVC participation, Africa (especially North Africa, denoted NA) seems to be the best performer in providing value added to other countries in the world (DVX). About 25% of the domestic value added produced in SSA are inputs for other countries' exports (over 35% in the case of NA). As a comparison, these figures are in line with those of the Middle East region (25%) and higher than those of the EU27, China, and NAFTA that register rates of around 20% (see the DVX component in Figure 1a). Note, however, that as opposed to other methods, the WWZ methodology allows us to properly isolate the pure double counted term (i.e., PDC in the figure) which appears to be substantial (e.g., 12% for the EU; 4% for SSA). Figure 1b, on the other hand, shows the emergence of the international fragmentation of production over the last two decades. Although GVC participation is increasing worldwide, China experienced the highest growth rate at 40% especially after WTO accession in 2001, whereas the SSA growth rate between 1995 and 2013 is about 8%.







1a: Components (2013) Source: Authors' elaboration on EORA data

In Figure 2 and Figure 3, we compute the sectoral contributions of agriculture and food to the measures of GVC participation described above.¹⁰ Figure 2 shows that the SSA agricultural sector is the most involved in GVC if compared to other regions of the world (Figure 2a) and its participation is increasing over time (Figure 2b). About 3% out of 40% of total GVC participation is due to the agriculture sector, i.e. a contribution equal to 7% across all 25 EORA sectors. For instance, the same figure for the EU27 is only 2%. Furthermore, the sector presents a relatively high domestic value added components used by other countries' exports (DVX) with respect to foreign value added components (FVA), confirming its upstream position along the chain where it acts as a supplier of intermediate inputs.

¹⁰ The sum across all the sectors therefore equals the value of total GVC participation reported in Figure 1.







Source: Authors' elaboration on EORA data

For the food sector (Figure 3), the EU27 and Latin American countries, on the other hand, present the highest participation rates (Figure 3a). Only 4% of the total GVC participation in SSA is due to food activities and its share does not change over time (Figure 3b). Unlike the agricultural sector, its position lies closer to the final consumers (i.e, downstream position) as shown by the more balanced ratio between the DVX and FVA components.





3a: Components (2013) Source: Authors' elaboration on EORA data

To sum up, SSA takes part in GVCs by contributing mainly to the upstream phases, being confined to low value added stages of production, but with important heterogeneity in value added trade between agriculture and food exports. Also, these overall figures hide a substantial degree of heterogeneity within the region. To shed more light on this, in Table 1A (Appendix A) we report the same GVC components for the 43 SSA countries present in our data, together with the sectoral contribution of Agriculture and Food in 2013. Some SSA countries, such as DR Congo, Ethiopia, Lesotho and Guinea, register relatively high involvement in the international fragmentation of production compared with the other countries in the region, probably thanks to their production structure being biased towards the export of natural resources (DR Congo) or the small dimension of their economy (Lesotho). Others, such as Benin, Chad and Mali, seem to be more excluded from the global market probably because of geographical remoteness and/or lack of resources. Note also that in almost all SSA countries, GVC participation mainly relies on the supply of inputs for other countries' exports (DVX component), whereas only a few of them (mainly

Botswana, Ethiopia, Lesotho, Namibia, Swaziland and Tanzania) participate mostly as buyers of foreign inputs for their exports (FVA component). In the latter group, it is interesting to note the peculiar case of Ethiopia where the GDP has been growing at a rate of about 10% over the last ten years. The country is among the most integrated in GVCs and the contribution of the agricultural sector to this process is among the highest in the region (31%). Cote d'Ivoire (33%), Ghana (34%), Kenya (30%), Madagascar (38%), Malawi (39%) and Uganda (32%) are the other countries in the region where the contribution of the agricultural sector to their total GVC participation is quite remarkable, i.e. above 30%. Finally, the last column in Table 1A clearly shows that the contribution of the food sector to the countries' GVC participation is, on average, much smaller than what is observed for the agricultural sector with rates usually below 10%. The only countries registering noteworthy performances are Cote d'Ivoire (15%), Kenya (15%), Mauritania (21%), Namibia (28%), Senegal (42%), and Swaziland (16%).

As underlined in Section 2, the WWZ (2013) decomposition method also allows us to disentangle the value added components of the bilateral gross trade flows. Tables 2A-5A (Appendix A) report the percentages of value added components (DVX and FVA) of the agriculture and food sector that go to groups of partner countries across the main destination regions (Europe, NAFTA, LAC, Africa, South and East Asia). As Tables 2A-5A show, the European countries (EU27) are the main importers of both FVA and DVX from the SSA countries for both the agricultural and food sectors. While the percentage of FVA absorbed by EU27 is around or below 50%, the percentage of DVX is 68% for agriculture and 62% for food.¹¹ In other words, European countries are mainly importing intermediates to be processed domestically and re-introduced in the GVC. Conversely, European countries are importing less final goods or intermediates which have been already processed by the SSA countries. The same pattern does not apply to the other importing regions (especially Africa) where the FVA component is usually bigger than the DVX one. The very high share of the DVX component of SSA countries to EU27 suggests that the SSA agricultural and food products are first exported to the main European hubs (Netherlands¹², Germany, France and the UK) and, once processed, further re-exported to third countries. This is associated with the fact that for the SSA producers, it appears difficult to have direct access to the European market because of issues related to preferences as well as public and private safety and quality standards (Lee et al. 2010). The policy implications are not trivial for SSA economies. If the strategy to increase GVC participation in these two sectors is coupled with the ambition to acquire new downstream stages of production and increase the share of value-added captured by domestic producers, probably the simplest choice would be to reinforce the intra-regional agricultural and food networks through the removal of trade and other barriers still standing between SSA countries (World Bank, 2012).

4. Identification strategy and empirical analysis

The aim of our empirical analysis is to identify the relevance and significance of bilateral trade protection in explaining SSA backward and forward GVC participation in the agriculture and food sectors. The channels through which trade policies are

¹¹In some cases, such as for Uganda, Zambia and Niger, the EU absorbs almost 80% of the DVX despite the fact that the main destination for their gross exports is Africa.

¹² In this case, there is also the so called "Rotterdam effect", that is the possibility that the trade in goods with the Netherlands is artificially inflated by the goods dispatched from or arriving in Rotterdam even though the ultimate destination or country of origin differs.

linked to the international fragmentation of production are not straightforward. The most recent literature underlines two potential effects of bilateral protection: 1) the well-known "magnification effect" for which, on the one hand, goods that cross national borders multiple times incur tariffs several times and, on the other hand, the fact that tariffs are applied to gross trade values, even though trade flows in value added between direct partner countries may be only a fraction of this amount. Different ways of participating in global production chains affect the extent to which countries are affected by this cost magnification (Yi, 2003; 2010; Muradov, 2017); 2) a further "chain effect" which influences all the upstream and downstream activities of GVCs and, consequently, a country's backward and forward participation. In terms of forward participation, all else equal, tariffs on imports may have a depressing impact also on the domestic value added content embodied in partner countries' exports via intermediates. In terms of backward participation, tariffs on imports pass protectionist rents from the domestic supplier of final goods on to their foreign suppliers of inputs. This could represent an incentive to foreign suppliers to move to countries/sectors characterized by higher tariffs to get the benefits of the protection (Blanchard et al., 2016). Also, while the majority of observed bilateral preferences are unilateral, some of them are the result of free trade agreements or customs unions which can affect GVC participation differently and enlarge the notion of preferential trade regimes, including rules of origins and possible non-tariff issues such as general regulatory policies (Curran and Nadvi, 2015). Moreover, the specialized literature does not provide a sound and clear-cut reduced form to investigate this relationship empirically (Kowalski et al., 2015). So far, the few available studies on the topic have focused on understanding the effect of a broad basket of possible determinants of the GVC participation for developing countries (see, inter alia, Kowalski et al., 2015; Greenville et al., 2016; Taglioni and Winkler, 2016) related to logistics performance, labor skills, geographical location, market size, industrial structure, economic dimension, level of development, and trade policy. These works generally provide cross-country panel estimates of the GVC integration at aggregate or sectoral level. Hence, they overlook the fact that trade is primarily the result of a network of bilateral preferences and that trade policy is often meant at the level of industries or even products.

The link between SSA trade policies and participation in GVCs in the agricultural and food sector is remarkable since the SSA countries' protection in these two sectors is the highest in the world (Bown and Crowley, 2016; Caliendo et al., 2016). As Figure 3A in the Appendix shows the average level of tariff rates is still above 10% for agriculture (Figure 3Aa) and well above 15% for food (Figure 3Ab). These stylized facts confirm the larger scope for tariff reductions in the agriculture and food sectors of the SSA region. Also, Figure 4A shows that despite an increasing number of signed RTAs, SSA countries' involvement in trade agreements still lags behind. The average number of RTAs signed by each SSA country is about 20, well below the level of OECD economies (about 60), without taking into account the weak implementation abilities of SSA due to the lack of skills, knowledge, and political commitment (Torres and van Seters, 2016).

To assess empirically the relation between trade policy and GVC participation, we rely on the well-established gravity model, considering that is so far the best tool to measure the effects of trade policy in a multi-country environment. (Anderson, 1979; Bergstrand, 1985; Deardorff, 1998; Eaton and Kortum, 2002). We identify the effect of bilateral trade policies on the participation of SSA countries in the agricultural and food GVCs using the following specification:

$$GVC_{ijt} = \alpha_0 + \alpha_1 \operatorname{tariff}_{jit} + \alpha_2 \operatorname{rta}_{ijt} + \theta_{it} + \gamma_{jt} + \phi_{ij} + \mu_{ijt}$$
(1)

where *i* identifies the reporter country, *j* the partner country, and *t* denotes time. GVC stands for selected bilateral components of exports in value added derived from the WWZ decomposition (see Section 2). More specifically, we use three alternative dependent variables:

i) the exporting country's value added embodied in the agriculture and food gross exports absorbed by the direct importer (i.e. DirDVA);

ii) the exporting country's value added embodied in the agriculture and food gross exports which the direct importer reexports to third countries or eventually returns home (i.e. DVX); and

iii) the country's value added sourced from foreign countries embodied in the imports from the direct partner used as inputs for agricultural and food exports (i.e. FVA).

The DVX and FVA are used as proxies for GVC participation since they measure the share of value added flows belonging to a production process fragmented in at least two stages. DirDVA, on the other hand, captures the part of value added that does not enter into the GVCs (i.e., it does not entail any production process fragmentation). It provides a baseline estimate to proxy the impact of bilateral trade policies on gross exports.

Traditionally, gravity equations identify the effects of the bilateral trade policy by using a series of time varying observable trade policy variables, such as FTAs' participation and/or bilateral tariffs, and controlling for a set of time-invariant (or very slowly time varying) covariates and/or fixed effects. Here, we proxy bilateral tariffs by using the applied tariff rate in agriculture (food) of the partner country j to the reporter i $(tariff_{jit})^{13}$ and a dummy variable proxying their mutual participation to the same Regional Trade Agreements (RTAs).¹⁴ According to the new theoretical framework of trade policy that includes cross-border supply chain linkages (Blanchard et al., 2016), the government should reduce tariffs to stimulate the country's GVC participation by fostering the foreign content embodied in domestic final goods, including the domestic value-added inputs embodied in its partner country's imports coming both from the direct importer and its foreign suppliers. Hence, if policymakers adopt the right incentives, we should find a positive sign on β_1 in all the specifications. Conversely, if we find a negative sign, it will mean that the existing bilateral trade tariffs are hampering, on average, a country's GVC participation characterized by multiple exchanges of intermediates and final goods. RTA provides information on cooperation in bilateral tariff preferences as well as a broader measure of existing preferential trade regimes, including rules of origins and possible non-tariff issues such as general regulatory policies. Since RTAs are meant to introduce bilateral preferences between members, we should find a positive impact on trade in value added in presence of RTAs (Baier and Bergstrand, 2007). However, this positive impact could be, totally or partially, offset by strict rules of origins (asking for additional domestic

¹³ The use of the applied tariffs controls directly for the actual utilization rates. Here we use simple averages giving the same weight to all products (not imported as well as very large imports). This is because 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 significant enough 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 SSA countries and for agriculture and food products, the use of weighted average tariffs could lead to incorrect interpretations. Furthermore, weighted tariffs could lead to simultaneity bias in the estimated coefficients. For the sake of comparison, in Section 5 related to robustness checks, we also present the outcomes of weighted average where the imports value (in US dollars) of the reporter country are used as weights, showing that there are no meaningful differences between the two estimates.

¹⁴ 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) and updated to 2015. Outcomes for alternative temporal lags for RTAs are available upon request.

stages of production), prolonged phase-in periods, as well as a high influence of multilateral inputs on foreign value added that do not directly benefit from bilateral preferences (Blanchard et al., 2016; Curran and Nadvi, 2015). Finally, θ_{it} and γ_{it} in equation (1) represent reporter-time and partner-time fixed effects, respectively; ϕ_{ii} represents country-pair fixed effect, and μ_{iit} is the error term. While the panel specification controls for unobserved heterogeneity in the data, the exporter-time and importer-time effects control for all time-variant unobservable country characteristics. The country-pair effects account for any additional time invariant country pair influence on bilateral trade flows, including the unobservable linkages between the endogenous trade policy covariate and the error term, and prevent possible "reverse causality" bias between bilateral trade flows and bilateral trade protection.¹⁵ These absorb all bilateral time-invariant covariates that are used in standard gravity regressions (e.g. bilateral distance) but let us identify the effects of the time-varying bilateral trade policy.¹⁶ The use of a full set of country-time and pair fixed effects also absorbs all variations in multilateral MFN tariffs in the data. Moreover, it also allows us to account for any unobservable time invariant trade cost components, such as the time-varying Multilateral Resistance Terms that influence the dyadic relationship (Anderson and van Wincoop, 2003). This is thus considered a fair identification strategy for investigating the role of bilateral protection in value added bilateral trade flows since it actually softens the well-known "third-countries" effect problem¹⁷, i.e. the fact that the flows in value added between any country pair are affected – even more than in the case of gross export flows - by trading partners' interactions with the rest of the world. The drawback is that we cannot exclude the fact that some of the policy impact we are interested in could be captured by fixed effects. Hence, we should assume that our estimated coefficients are prudent estimates of the phenomena we analyze. All the continous variables in equation (1) are in natural logs including the value added components of bilateral exports which are reported in monetary values (thousands of US dollars) and not as exports' shares as in the descriptive analysis (section 3). In such a log-log setting, the coefficients can be interpreted as elasticities cleaned of both observable and unobservable confounding factors.¹⁸

We acknowledge that the gravity approach needs improvements to take on board the key features of value added trade (Johnson and Noguera, 2012; Baldwin and Taglioni, 2014), such as the fact that 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, as Johnson and Noguera (2012) show, the relative importance of these additional effects varies significantly across countries and types of trade costs. Also, 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. For this reason, we present our empirical results as "gravity like" interpretations of the phenomena under investigation. Moreover, to soften the additional bias due to value added trade we re-estimate equation (1) using only the *dyadic* relationship between

¹⁵ This controls also for self-selection bias due to the fact that countries that join RTAs are unlikely to be randomly chosen. Non-parametric alternatives to the standard gravity specification have also been proposed to account for the presence of nonlinearities in the relationship between FTAs, trade flows and the other covariates (Baier and Bergstrand; 2009; Montalbano and Nenci, 2014; Magrini et al., 2017).

¹⁶ We acknowledge that because of the lack of reliable instruments, early attempts to account for endogeneity with standard instrumental variable (IV) treatments have not been successful in addressing the problem (see, for example, Magee, 2003 and Baier and Bergstrand, 2004).

¹⁷ For additional details on this issue and to look at alternative network applications of MRT to gravity equations, see De Benedictis and Tajoli (2011) and Montalbano et al. (2015).

¹⁸ Since all the other controls usually used in the gravity equation - including the mass variables - are time invariant or time-varying only for the reporter and/or the partner dimension alternatively, our specification cannot identify them separately because of collinearity constraints and, as a result, these controls cannot be taken into account (Head and Mayer, 2014).

reporter and partner. To do this, we use as proxy for forward and backward participation the part of domestic value added reexported that ultimately returns home via the partner country (DirRDV), and the foreign value added that comes from the direct importing country (MVA), respectively. In this case, the specification takes the following form:

$$Dyadic_GVC_{ijt} = \beta_0 + \beta_1 \operatorname{tariff}_{jit} + \beta_2 \operatorname{tariff}_{ijt} + \beta_3 \operatorname{rta}_{ijt} + \sigma_{it} + \delta_{jt} + \eta_{ij} + \varepsilon_{ijt}$$
(2)

where *tariff*_{*jit*} is the well-known applied tariff rate in agriculture (food) of the partner country *j* to the reporter *i* whereas *tariff*_{*ijt*} is the applied tariff rate of the reporter *i* to partner *j* in the agriculture (food) sector. *rta_{ij}* is the dummy variable proxying the mutual participation to the same RTA; σ_{it} , δ_{jt} , and η_{ij} represent reporter-time, partner-time and country-pair fixed effects respectively, and ε_{ijt} is the error term. The interpretation of the new trade policy variable (*tariff_{ijt}*) is less straightforward than the previous one (*tariff_{jit}*) because it shows the effect of a country's level of domestic protection on its ability to export. Such a link is virtually non-existent except in the case of vertical fragmentation of production whereby a multi-stage production system would facilitate trade in parts and components and bilateral protection on imports could have a significant effect on both dyadic forward (DirRDV) and backward (MVA) GVC participation. In the first case, we expect the reporter country's tariff to also depress the domestic value-added inputs embodied in its partner country's imports. In the second case, the expected effect is less clear since the negative impact of the import taxation on the cost of the foreign value added sourced from the partner country may be counterbalanced by the fact that the protection can boost the development of the import-competing sectors - i.e. for agriculture and food - and increase the incentive of the direct importer to increase its input supply by taking advantage of the protectionist rents. Table 6A in Appendix reports the variables applied in the empirical analysis and the related main descriptive statistics.

5. Empirical outcomes

Tables 1 and 2 report the outcomes of our "gravity like" estimates of eq. 1 and 2 over the period 1990-2013 for agriculture and food, respectively. The first five columns (from 1a to 5a) show the coefficients at the global level (for the 186 countries included in the EORA dataset), whereas the second set of five columns (from 1b to 5b) show the same estimates for the sub-sample of 43 SSA countries. Table 1 shows that, as expected, the average bilateral tariff applied by the partner countries to the reporters' agricultural exports (*tariff_{ji}*) is negatively correlated with the direct domestic value added of the reporting countries' exports, both at the global level and for SSA economies (columns 1a and 1b). This is straightforward if we bear in mind that direct domestic value added is the component that best proxies the gross exports. Consequently, the above estimated coefficient reflects the standard negative impact of bilateral protection on agricultural imports. The table also shows the negative impact of the partner country bilateral protection on the reporter country's forward (DVX) and backward (FVA) GVC participation in agriculture, both at the global level (columns 2a and 3a) and for SSA countries (columns 2b and 3b). Therefore, bilateral trade protection is not only hampering the single exchange of goods between two countries, but it undermines the capacity of an exporting country to participate in longer value chains characterized by multiple exchanges of intermediates and final goods.

Columns 4a and 5a, and columns 4b and 5b report the results on dyadic components estimated for all countries and SSA respectively using equation (2). The coefficients on $tariff_{ii}$ are still significant and similar in magnitude to those associated with the DVX and FVA variables, confirming the goodness of fit of our estimates. The only exception is for the MVA of the SSA countries which is still negative but not significant, probably because of the low influence of the foreign value-added sourced from their direct main importers of agricultural intermediates and final goods. More interestingly (see Table 1, second row), the estimated coefficients associated with the bilateral tariffs applied by the reporter country to its partners (*tariffi*) show a significant and negative effect on the dyadic forward participation (column 4a) and a significant and positive effect on the dyadic backward participation (column 5a) in the global case, whereas there is no effect for the SSA case (columns 4b and 5b). The global case indicates that where there is fragmentation of production with multiple border crossings, a country's GVCs performance does not only depend on the level of protection it faces from other countries, but also on its own level of import taxation in the same sector. Note that for dyadic backward participation, the prevailing effect of the domestic protection on the supply of foreign value-added sourced from the direct importer seems to be positive, but it turns out to be negative once we use instrumental variables (see Table 5 in section 6). In terms of policy recommendations, there is a need to take into account the fact that in the agricultural sector the domestic value added component is always predominant with regard to the foreign-value added (see Figure 2). Therefore, it would not be wise to try to stimulate the GVC participation through an increase in import taxation since the multiple costs would probably outweigh these limited benefits.

	All countries					SSA countries (reporters)					
		forward	backward	forward	backward		forward	backward	forward	backward	
				dyadic	dyadic				dyadic	dyadic	
	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)	
Dep Var:	dirDVA	DVX	FVA	dirRDV	MVA	dirDVA	DVX	FVA	dirRDV	MVA	
tariff rate (applied mean)_ji	-0.007***	-0.005***	-0.007***	-0.007***	-0.004***	-0.004**	-0.004**	-0.004**	-0.004**	-0.002	
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	
tariff rate (applied mean)_ij				-0.002***	0.002**				0.003	0.004	
				(0.001)	(0.001)				(0.002)	(0.003)	
RTA (yes=1)^	0.008***	0.007***	0.008***	0.018***	-0.002	0.007	0.013**	0.007	0.055***	0.010	
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.007)	(0.006)	(0.007)	(0.008)	(0.009)	
Observations	541,522	541,395	544,209	435,017	433,773	126,533	126,506	126,533	99,624	98,626	
R-squared	0.995	0.995	0.995	0.997	0.997	0.991	0.993	0.992	0.994	0.996	
Country pair fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Reporter*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Partner*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	

Table 1 Gravity-like estimates for Agriculture

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

^ three years lags from the entry into force of the agreement

The third row in Table 1 shows the effects of the existing preferential trade regimes (RTAs) on backward and forward GVC participation in agriculture. The estimated coefficients register a positive and significant impact of the RTAs on almost all the components in the global case (columns from 1a to 4a), except for the dyadic backward participation which is not significant. The results confirm the positive effect of the vertical integration between partners and downsize the potential negative diversion effect of the RTA on the GVC participation for this sector. A similar picture emerges from the impact of RTA on the GVC participation of the SSA countries (columns from 1b to 5b) even if the only significant coefficients are

those of the two components associated with the domestic value added (DVX and dirRDV). As expected, this suggests that existing agreements in SSA are mainly re-inforcing the export capacity of domestic value-added of the members' countries.¹⁹

Table 2 reports the same analysis for the food and beverage sector. Results appear consistent. In the first row, the average bilateral tariff applied by the partner countries to the reporters' exports ($tariff_{ji}$) is always significant and negatively associated with all the components of trade in value added at both the global level and for the subsample of SSA economies. Also, the second row of coefficients – pertaining to the tariffs applied by the reporter country to its partners ($tariff_{ij}$) - shows a significant and negative impact on both the dyadic components for the global case (columns 4a and 5a) and on the forward participation for SSA countries (column 4b).

As for the agricultural sector, the negative impact of a country's import taxation on its capacity to participate in GVCs through food exports highlights the need for policy makers to reconsider their policy strategy by taking into account both virtuous and vicious cycles created by a globally integrated production process. It is worth noting that the negative relationship also holds for the subsample of SSA and this is particularly relevant if we consider that the taxation on food imports in the region is the highest with respect to the rest of the world (see Section 3). This result contrasts with the case of agriculture and suggests, from a policy point of view, that there are ample opportunities to improve the SSA countries' participation in GVCs food and beverages through the reduction of their bilateral level of protection.

	All countries					SSA countries (reporters)					
		forward	backward	forward	backward		forward	backward	forward	backward	
				dyadic	dyadic				dyadic	dyadic	
	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)	
Dep Var:	dirDVA	DVX	FVA	dirRDV	MVA	dirDVA	DVX	FVA	dirRDV	MVA	
tariff rate (applied mean)_ji	-0.016***	-0.013***	-0.016***	-0.014***	-0.015***	-0.021***	-0.017***	-0.021***	-0.017***	-0.019***	
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	
tariff rate (applied mean)_ij				-0.012***	-0.007***				-0.008***	-0.001	
				(0.001)	(0.001)				(0.002)	(0.002)	
RTA (yes=1)^	0.018***	0.019***	0.018***	0.029***	0.001	-0.035***	-0.024***	-0.035***	0.024***	-0.012	
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.008)	(0.007)	(0.008)	(0.009)	(0.011)	
Observations	542,307	542,189	544,209	435,320	434,007	126,533	126,503	126,533	99,632	98,672	
R-squared	0.996	0.996	0.996	0.998	0.998	0.991	0.991	0.991	0.994	0.996	
Country pair fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Reporter*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Partner*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	

Table 2 Gravity-like estimates for Food and Beverages

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

^ three years lags from the entry into force of the agreement

Finally, if we look at the third row, we can see that the estimated impacts of RTAs on GVC participation in food and beverages are highly consistent with those for agriculture at the global level: i.e., the presence of a general positive and significant impact of the existing RTAs on all the components except for dyadic backward participation that ultimately returns

¹⁹RTAs are key since they can determine meaningful shifts in trade regime – also in terms of rules of origins - with pervasive effect on GVC participation of source countries apart from pure variations in applied tariffs. However, often they are characterized by gradualism in the implementation and also the various measures take time before impacting on trade flows. On top of that, these impacts change according to the different provisions. The recent literature is increasingly questioning the direction of causality between bilateral changing regimes (RTAs) and GVCs, who are the winner and the losers, and especially the time span of the causal evidences (Bair and Peters, 2006; Pickles and Smith, 2011; Curran and Nadvi, 2015). These further dimensions of investigation lie however outside the scope of the present analysis.

home (column 5a). Looking at the SSA economies, the outcomes are more mixed with, as in the previous case, a positive impact of the existing RTAs on DirRDV (column 4b) but a significant negative effect on dirDVA, DVX, and FVA (columns 1b, 2b and 3b). Due to the presence of multiple factors that can in principle outweigh the positive benefits of RTAs, pointing to a specific reason behind this outcome is a complex task. In addition, we recognize that the over-ambitious objectives of the preferential agreements are usually followed by weak implementation due to the lack of skills, knowledge, and political commitment as well as the absence of real monitoring systems on trade policies (Torres and van Seters, 2016).

6. Robustness checks

Our previous findings on the effects of bilateral trade policy on backward and forward GVC participation are robust to several empirical checks. We first verify whether appreciable differences can be registered running the same estimates by using weighted measures of tariffs instead of the simple ones. Using weighted tariffs offers both advantages and disadvantages. On the positive side, weighted measures can adequately take into account the strong heterogeneity of tariffs and likely peaks for products characterized by lower elasticity of demand. On the negative side, the weights are built using import flows causing additional sources of endogeneity in the estimates. To soften the problem, we apply one year lagged weighted tariffs. Table 3 and Table 4 report the same estimates of baseline equation using weighted tariffs instead of simple ones. The two outcomes do not differ significantly.

	All countries					SSA countries (reporters)				
		forward	backward	forward	backward		forward	backward	forward	backward
				dyadic	dyadic				dyadic	dyadic
	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)
Dep Var:	dirDVA	DVX	FVA	dirRDV	MVA	dirDVA	DVX	FVA	dirRDV	MVA
tariff rate (applied weighted mean)_ji ^^	-0.009***	-0.008***	-0.009***	-0.008***	-0.007***	-0.006***	-0.004**	-0.006***	-0.003	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
tariff rate (applied weighted mean)_ij ^^				-0.003***	0.001				0.003	0.003
				(0.001)	(0.001)				(0.002)	(0.002)
RTA (yes=1)^	0.006**	0.004	0.006**	0.015***	-0.004	0.006	0.011	0.006	0.058***	0.012
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.007)	(0.007)	(0.007)	(0.009)	(0.010)
Observations	518,017	517,890	520,676	407,729	406,447	121,069	121,042	121,069	92,528	91,601
R-squared	0.995	0.995	0.995	0.997	0.998	0.991	0.993	0.992	0.994	0.996
Country pair fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Reporter*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Partner*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 3 Gravity-like estimates for Agriculture (weighted tariffs)

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

^ three years lags from the entry into force of the agreement

^^ one year lag

Table 4 Gravity-like estimates for Food and Beverages (weighted tariffs)

			All countries	5			SSA co	untries (rep	orters)	
		forward	backward	forward	backward		forward	backward	forward	backward
				dyadic	dyadic				dyadic	dyadic
	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)
Dep Var:	dirDVA	DVX	FVA	dirRDV	MVA	dirDVA	DVX	FVA	dirRDV	MVA
tariff rate (applied weighted mean)_ji ^^	-0.016***	-0.014***	-0.016***	-0.015***	-0.016***	-0.019***	-0.016***	-0.019***	-0.015***	-0.018***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
tariff rate (applied weighted mean)_ij ^^				-0.012***	-0.009***				-0.008***	-0.005**
				(0.001)	(0.001)				(0.002)	(0.002)
RTA (yes=1)^	0.014***	0.014***	0.014***	0.024***	-0.002	-0.039***	-0.027***	-0.039***	0.024***	-0.010
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.008)	(0.007)	(0.008)	(0.009)	(0.012)
Observations	518,805	518,687	520,676	407,867	406,667	121,069	121,039	121,069	92,536	91,647
R-squared	0.996	0.996	0.996	0.998	0.998	0.991	0.991	0.992	0.994	0.996
Country pair fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Reporter*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Partner*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

^ three years lags from the entry into force of the agreement

^^ one year lag

Second, although our analysis focuses on how trade policy influences GVC participation, we cannot underestimate the risk of reverse causality, i.e., whether trade policy responds to increasing GVC participation. In fact, while it is undeniable that trade policy gives policymakers in developing countries a significant policy space to enhance their participation into GVCs and capture the hoped for benefits in terms of structural transformation, government objectives over final good tariffs may well depend on the nationality of the value-added content embodied in home and foreign final goods (for additional details see Blanchard et al., 2016). Indeed, the discussion about the direction of causality between bilateral protection and trade flows in value added can be endless. Our aim here is to provide evidence that the alternative direction of causality (i.e., from value added trade flows to bilateral protection) is not driving our empirical results. To this end, we provide a further test by using an instrumental variable approach. As an instrument for $tariff_{ij}$ we use the average protection level applied by the exporter country i to all countries z located in the same region²⁰ of j but exporter j. This instrument is well grounded in the standard domino effect of tariff liberalization (Baldwin and Jaimovich, 2012), for which countries in the same region face similar export tariff because they tend to mimic liberalization policies of neighbor countries to avoid diversion effect.²¹ Results are in line with our main findings and, as expected, the coefficients on tariff_{ii} are larger than in baseline OLS regressions of Table 1 and Table 2, reflecting the attenuation bias of OLS due to positive covariance between *tariff*_{ii} and value added trade flows. This suggests that our gravity specification properly accounts for possible "reverse causality" through the use of pair fixed effects as argued by the literature in the field. Furthermore, controlling for possible additional sources of endogeneity, applied bilateral tariffs confirms also in the agriculture sector a negative impact on both the domestic value added embedded into the imports from partner countries (column 3a) and the foreign value added that comes from the direct importing country (column 4a).

²⁰ Regions here refer to the world areas already used in the descriptive analysis (section 3).

²¹ This variable is highly correlated with the bilateral *tariff*_{ij} (0.88) and mainly uncorrelated with bilateral value added flows. Indeed, as suggested by Di Comite et al. (2017) it is unlikely that country *i* modifies tariff level against country *z* when changes in *i*'s imports from *j* are experienced.

Table 5 Gravity-like estimates for Agriculture and Food. 2SLS estimations

		Agric	ulture		Food					
	All cou	intries	SSA (re	porters)	All cou	untries	SSA (reporters)			
	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)		
Dep Var:	dirRDV	MVA	dirRDV	MVA	dirRDV	MVA	dirRDV	MVA		
tariff rate (applied mean)_ji	-0.004***	-0.003***	0.002	0.005	-0.008***	-0.011***	-0.017***	-0.016***		
	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)		
tariff rate (applied mean)_ij^^	-0.062***	-0.019***	-0.118***	-0.120***	-0.062***	-0.045***	-0.003	-0.050**		
	(0.006)	(0.006)	(0.032)	(0.035)	(0.003)	(0.003)	(0.017)	(0.020)		
RTA (yes=1)^	0.010***	-0.005	0.034***	-0.012	0.019***	-0.007**	0.026***	-0.024**		
	(0.003)	(0.003)	(0.010)	(0.011)	(0.003)	(0.003)	(0.010)	(0.012)		
Observations	435,017	433,773	99,624	98,626	435,320	434,007	99,632	98,672		
R-squared	0.997	0.997	0.993	0.996	0.998	0.998	0.994	0.996		
Country pair fe	YES	YES								
Reporter*year fe	YES	YES								
Partner*year fe	YES	YES								

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

 $\ensuremath{^{\mbox{three}}}$ years lags from the entry into force of the agreement

^^ tariff rate (applied mean)_iz as instrument

Note: All the multivariate F-tests for excluded instruments reject the null hypothesis that the instruments are not correlated with the endogenous regressors

Third, we test the robustness of our outcomes by controlling for dyadic error correlation. This involves allowing for intragroup correlation in standard errors and relaxing the usual requirement that the observations are independent. This can result in larger standard errors especially when each individual is paired with many other individuals, i.e., when the network is particularly dense as is the case for the network of international trade flows. The use of country-pair fixed effects is supposed to not fully account for this further source of error correlation. This is because trade flows between *i* and *j* are serially correlated with all the other country pairs that include also *i* or *j* (Cameron and Miller, 2014). Table reports the outcomes of the amended estimates for agriculture. They show, of course, the same results as those presented in Table 1, but with differences in terms of significance. More specifically, at the global level, all the estimated coefficients associated with the bilateral tariffs in agriculture applied by the partner countries (*tariff_{ji}*) keep their significance (first row) as well as the coefficients of the existing RTAs on dirRDV. However, it is no longer the case for the coefficients also lose significance when we look at the SSA economies as reporter countries.²² Table reports the dyadic error correlation results for food and beverages. In this case, the results are more in line with those of Table 2 for the global case but less robust for the SSA case.

²²In this case, however, we can get even more significant results, even if limited to the bilateral tariffs applied by the partner countries (*tariff_{ji}*) if we remove all SSA economies acting as partner countries from the sample. This is probably because, as shown by the descriptive analysis (Section 3), SSA GVC participation is overwhelmingly related to trade linkages outside the region, mainly with the European Union and the emerging countries. These results are available upon request.

Table 6 Gravity-like estimates for Agriculture (country pair clustered SE)

	All countries						SSA co	untries (rep	orters)	
		forward	backward	forward	backward		forward	backward	forward	backward
				dyadic	dyadic				dyadic	dyadic
	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)
Dep Var:	dirDVA	DVX	FVA	dirRDV	MVA	dirDVA	DVX	FVA	dirRDV	MVA
tariff rate (applied mean)_ji	-0.007***	-0.005***	-0.007***	-0.007***	-0.004**	-0.004	-0.004	-0.004	-0.004	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
tariff rate (applied mean)_ij				-0.002	0.002				0.003	0.004
				(0.002)	(0.002)				(0.005)	(0.006)
RTA (yes=1)^	0.008	0.007	0.008	0.018***	-0.002	0.007	0.013	0.007	0.055***	0.010
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.016)	(0.015)	(0.016)	(0.019)	(0.019)
Observations	541,522	541,395	544,209	435,017	433,773	126,533	126,506	126,533	99,624	98,626
R-squared	0.995	0.995	0.995	0.997	0.997	0.991	0.993	0.992	0.994	0.996
Country pair fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Reporter*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Partner*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Country pair clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

^ three years lags from the entry into force of the agreement

Table 7 Gravity-like estimates for Food and Beverages (country pair clustered SE)

	All countries					SSA countries (reporters)					
		forward	backward	forward	backward		forward	backward	forward	backward	
				dyadic	dyadic				dyadic	dyadic	
	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)	
Dep Var:	dirDVA	DVX	FVA	dirRDV	MVA	dirDVA	DVX	FVA	dirRDV	MVA	
tariff rate (applied mean)_ji	-0.016***	-0.013***	-0.016***	-0.014***	-0.015***	-0.021***	-0.017***	-0.021***	-0.017***	-0.019***	
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	
tariff rate (applied mean)_ij				-0.012***	-0.007***				-0.008**	-0.001	
				(0.001)	(0.002)				(0.003)	(0.004)	
RTA (yes=1)^	0.018***	0.019***	0.018***	0.029***	0.001	-0.035*	-0.024	-0.035*	0.024	-0.012	
	(0.006)	(0.005)	(0.006)	(0.006)	(0.007)	(0.018)	(0.015)	(0.018)	(0.019)	(0.024)	
Observations	542,307	542,189	544,209	435,320	434,007	126,533	126,503	126,533	99,632	98,672	
R-squared	0.996	0.996	0.996	0.998	0.998	0.991	0.991	0.991	0.994	0.996	
Country pair fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Reporter*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Partner*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	

Country pair clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

^ three years lags from the entry into force of the agreement

Finally, following Santos Silva and Tenreyro (2006) we use non-linear Poisson maximum-likelihood estimators (PPML) as a further robustness check to deal with econometric problems resulting from heteroskedastic residuals in log-linear gravity equations due to Jensen's inequality (and zero bilateral trade flows). As highlighted by Head and Mayer (2014), although PPML has many virtues it cannot replace OLS as the new workhorse estimator of gravity equations. In this gravity exercise, we estimate the equation in levels rather than in logs. Since the Poisson estimator does not achieve convergence including time-varying fixed effects in addition to country-pair fixed effects, as in Gil- Pareja et al., (2017) we use the usual gravity controls in place of country-time fixed effects, but we keep country-pair clustered standard errors. Tables 8 and 9 report the PPML outcomes. PPML coefficients are larger than OLS counterparts due to possible heteroskedasticity bias. However, the significance and the signs of the coefficients are still consistent with our main results. Specifically, both at the global level and for SSA, the estimated coefficients confirm their ambigous patterns, being positively associated with value added trade in the case of MVA in food). RTAs coefficients confirm their ambigous patterns, being positively associated with value added trade in the case of agriculture and negatively or not significantly correlated in the case of food. The "chain effect" of trade policy is confirmed at the global level, whereas in the case of SSA the boosting impact of the reporter country trade policy on value added imports due to the increasing protectionist rents seems to prevail using PPML.

	All countries					SSA countries (reporters)				
		forward	backward	forward	backward		forward	backward	forward	backward
				dyadic	dyadic				dyadic	dyadic
	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)
Dep Var:	dirDVA	DVX	FVA	dirRDV	MVA	dirDVA	DVX	FVA	dirRDV	MVA
tariff rate (applied mean)_ji	-0.207***	-0.243***	-0.179***	-0.341***	-0.198***	-0.252*	-0.357**	-0.308**	-0.265**	-0.480***
	(0.041)	(0.041)	(0.040)	(0.101)	(0.059)	(0.146)	(0.180)	(0.143)	(0.118)	(0.170)
tariff rate (applied mean)_ij				-0.249***	-0.238***				-0.025	0.138
				(0.079)	(0.070)				(0.096)	(0.111)
RTA (yes=1)^	0.229**	0.206**	0.164**	0.592***	0.326**	0.597***	0.403**	0.597***	0.880**	1.288***
	(0.089)	(0.082)	(0.081)	(0.221)	(0.127)	(0.195)	(0.177)	(0.188)	(0.363)	(0.268)
contiguity	0.341***	0.433***	0.437***	0.873***	0.752***	1.235***	1.285***	0.745*	0.834	1.406**
	(0.104)	(0.113)	(0.113)	(0.174)	(0.132)	(0.410)	(0.423)	(0.431)	(0.511)	(0.588)
commmon language	0.327***	0.384***	0.326***	0.788***	0.626***	0.432**	0.569***	0.390*	1.721***	1.638***
	(0.103)	(0.105)	(0.107)	(0.204)	(0.145)	(0.190)	(0.171)	(0.212)	(0.353)	(0.349)
colony	0.127	0.125	0.062	0.248	-0.037	0.003	-0.412	-0.063	0.082	1.208***
	(0.198)	(0.174)	(0.236)	(0.364)	(0.343)	(0.306)	(0.271)	(0.314)	(0.350)	(0.446)
distance	-1.005***	-0.809***	-1.012***	-1.380***	-1.776***	-0.887***	-0.600**	-1.011***	-2.422***	-2.364***
	(0.044)	(0.050)	(0.044)	(0.132)	(0.087)	(0.263)	(0.279)	(0.293)	(0.424)	(0.389)
Observations	510,929	510,929	510,929	419,588	419,588	120,416	120,416	120,416	95,311	95,311
R-squared	0.861	0.895	0.888	0.967	0.995	0.608	0.870	0.705	0.945	0.852
Country pair fe	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Exporter*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 8 PPML estimates for Agriculture (country pair clustered SE)

Country pair clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

^ three years lags from the entry into force of the agreement

Table 9 PPML estimates for Food and Beverag	ges (country pair clustered SE)
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		ŀ	All countrie	s			SSA co	untries (rep	orters)	
		forward	backward	forward	backward		forward	backward	forward	backward
				dyadic	dyadic				dyadic	dyadic
	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)
Dep Var:	dirDVA	DVX	FVA	dirRDV	MVA	dirDVA	DVX	FVA	dirRDV	MVA
tariff rate (applied mean)_ji	-0.047*	-0.137***	-0.046	-0.160***	0.095**	-0.224***	-0.168***	-0.245***	-0.107	-0.215*
	(0.025)	(0.031)	(0.036)	(0.051)	(0.048)	(0.062)	(0.055)	(0.055)	(0.082)	(0.121)
tariff rate (applied mean)_ij				-0.055	-0.128**				-0.034	0.400**
				(0.051)	(0.051)				(0.120)	(0.174)
RTA (yes=1)^	0.136*	-0.003	0.174**	0.659***	0.700***	-0.377***	-0.513***	-0.434***	0.230	0.343
	(0.074)	(0.089)	(0.084)	(0.178)	(0.152)	(0.146)	(0.130)	(0.141)	(0.521)	(0.333)
contiguity	0.487***	0.552***	0.485***	0.978***	0.773***	0.920***	1.159***	0.874**	0.926**	1.895**
	(0.076)	(0.086)	(0.087)	(0.188)	(0.151)	(0.296)	(0.326)	(0.361)	(0.458)	(0.872)
commmon language	0.447***	0.463***	0.474***	0.907***	0.891***	1.035***	0.969***	0.973***	1.341**	2.342***
	(0.075)	(0.085)	(0.085)	(0.161)	(0.134)	(0.268)	(0.252)	(0.236)	(0.661)	(0.319)
colony	0.198	0.044	0.118	0.467	0.051	-0.535***	-0.625***	-0.431**	0.001	0.356
	(0.219)	(0.197)	(0.211)	(0.335)	(0.299)	(0.166)	(0.168)	(0.174)	(0.260)	(0.411)
distance	-0.928***	-0.738***	-0.928***	-1.422***	-1.546***	-1.362***	-1.126***	-1.470***	-3.204***	-2.518***
	(0.036)	(0.050)	(0.039)	(0.116)	(0.099)	(0.194)	(0.206)	(0.292)	(0.377)	(0.562)
Observations	512,159	512,159	512,159	420,125	420,125	120,543	120,543	120,543	95,379	95,379
R-squared	0.908	0.934	0.899	0.973	0.979	0.786	0.775	0.734	0.970	0.921
Country pair fe	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Exporter*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer*year fe	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Country pair clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

^ three years lags from the entry into force of the agreement

7. Conclusions

The capacity of Sub Saharan African economies to take advantages of agricultural and food GVCs as drivers for their structural transformation 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 and human and physical capital. The need to account for the nature of backward and forward linkages between countries, the actual stage of maturity of the specific chain and the characteristics of the final destination markets is also highlighted. The fierce debate about the key determinants of increased participation in GVCs dedicates a special space to the role to be assigned to trade policy although the discussion is still open. Since the frontier between policy and non-policy factors is somewhat 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, the most recent gross exports decomposition method provided by WWZ to these data, this work provides a robust empirical analysis of the relationship between bilateral trade policy and GVC integration in agriculture, food and beverages during the 1990-2013 period. This is, to the best of our knowledge, the first comprehensive study that looks at the phenomenon on a bilateral and sectoral basis with a focus on SSA regions that has also relevant implications for policymaking.

First, our decomposition of bilateral gross exports provides a light and shadow picture of the actual SSA participation in agriculture and food global value chains. On the one hand, it shows that despite low trade shares at the global level, SSA countries are deeply involved in GVCs and often more than many other developing regions. Participation by SSA countries in agricultural GVCs is substantial - higher than any other regions in the world - and actually increasing over time. On the other hand, the demand for SSA agricultural production in trade in value added is not regional, but mainly driven by the European and emerging countries. Moreover, SSA involvement in GVC is still limited to upstream production stages, i.e. the region is relatively specialized in providing primary inputs to firms in countries further down the value chain. This confirms the difficulties of local producers of processed inputs or final goods to have direct access to the European market because of issues related to preferences as well as public and private safety and quality standards. In this respect, a better strategy for SSA countries is to remove the barriers that prevent intra-regional trade since the SSA countries are more prone to importing SSA processed agricultural and food products than traditional trade partners such as the European countries.

Second, our empirical results highlight the relevance and significance of the most common trade policy measures as tariffs or RTAs. We find that trade policies are key determinants of the heterogeneity in GVC participation across SSA. We also find evidence of a "chain" effect of domestic trade policy vis-a-vis partner-countries upstream and downstream the chain. This has possibly important policy implications since trade policies no longer primarily depend on the location of the importing goods, but rather on the nationality of the value added content embodied in traded goods. Consequently, tariffs on imports may depress the domestic valued added used by trading partners as inputs. This means that there may be a need to reformulate trade policy priorities, especially in the food sector.

Finally, we believe that these results provide scholars and policymakers with a useful framework for testing the importance of alternative sectoral policy measures on bilateral trade relationships, including value chain interactions between pairs of countries that are the stepping stones of regional and global value chains.

References

- Abbott, P., and De Battisti, A. B. (2011). "Recent global food price shocks: Causes, consequences and lessons for African governments and donors". *Journal of African Economies*, 20 (suppl 1), i12-i62.
- African Development Bank, Organisation for Economic Co-operation and Development, United Nations Development Programme (2015). "African Economic Outlook: Regional Development and Spatial Inclusion".

Anderson, J. E. (1979). "A theoretical foundation for the gravity equation". *The American Economic Review*, 69(1), 106-116.

Anderson K. and Masters W. (2009) "Distortions to Agricultural Incentives in Africa", World Bank Publications.

- Anderson, K., and Nelgen, S. (2012). "Trade barrier volatility and agricultural price stabilization". *World Development*, 40(1), 36-48.
- Anderson, J. E., and Van Wincoop, E. (2003). "Gravity with gravitas: a solution to the border puzzle". *American Economic Review*, 93(1), 170-192.
- Antràs, P., and R. W. Staiger (2012). "Offshoring and the Role of Trade Agreements". *American Economic Review*, 102(7): 3140-83.

- Baier, S. L., and Bergstrand, J. H. (2004). "Economic determinants of free trade agreements". Journal of international Economics, 64(1), 29-63.
- Baier, S. L., and Bergstrand, J. H. (2007). "Do free trade agreements actually increase members' international trade?". *Journal of international Economics*, 71(1), 72-95.
- Baier, S. L., and Bergstrand, J. H. (2009). "Bonus vetus OLS: A simple method for approximating international trade-cost effects using the gravity equation". *Journal of International Economics*, 77(1), 77-85.
- Baier, S., Kerr, A. and Yotov, Y. (2017). "Gravity, Distance, and International Trade," School of Economics Working Paper Series 2017-5, LeBow College of Business, Drexel University.
- Bair, J., and Peters, E. D. (2006). "Global commodity chains and endogenous growth: Export dynamism and development in Mexico and Honduras". World Development, 34(2), 203-221.
- Baldwin R. and D. Jaimovich (2012). "Are Free Trade Agreements contagious?," *Journal of International Economics*, Elsevier, vol. 88(1), pages 1-16.
- Baldwin, R., and Taglioni, D. (2014). "Gravity chains: Estimating bilateral trade flows when parts and components trade is important". *Journal of Banking and Financial Economics*, (2 (2)), 61-82.
- Bellemare, M. F. (2012). "As You Sow, So Shall You Reap: The Welfare Impacts of Contract Farming". *World Development* 40(7): 1418-1434.
- Bellemare, M. F., Yu Na L., and L. K. Novak (2017), "Contract Farming as Partial Insurance," Working Paper, University of Minnesota.
- Bergstrand, J. H. (1989). "The generalized gravity equation, monopolistic competition, and the factor-proportions theory in international trade". *The review of economics and statistics*, 143-153.
- Blanchard, E. J., and X., Matschke (2015). "U.S. Multinationals and Preferential Market Access". *Review of Economics and Statistics*, 97(4): 839-854.
- Blanchard, E. J., Bown, C. P., and Johnson, R. C. (2016). "Global supply chains and trade policy". National Bureau of Economic Research (No. w21883).
- Borin, A., and Mancini, M. (2015). "Follow the value added: bilateral gross export accounting." Bank of Italy, Economic Research and International Relations Area.
- Bown, C. P., and Crowley, M. A. (2016). "The empirical landscape of trade policy". World Bank Policy Research Working Paper, (7620).
- Caliendo, L., Feenstra, R. C., Romalis, J., and Taylor, A. M. (2016). "Tariff reductions, entry, and welfare: Theory and evidence for the last two decades". National Bureau of Economic Research. No. w21768.
- Cameron, A. C., and Miller, D. L. (2014). "Robust inference for dyadic data". Unpublished manuscript, University of California-Davis.
- Cappariello, R. and A. Felettigh, 2015. "How does foreign demand activate domestic value added? A comparison among the largest euro-area economies." Temi di Discussione (Working Papers) 1001, Bank of Italy.
- Cattaneo, O., G. Gereffi, S. Miroudot, and D., Taglioni (2013). 'Joining, Upgrading, and Being Competitive in Global Value Chains". Policy Research Working Paper No. 6406. Washington, DC: World Bank. ECA, & AUC. (2013). "Economic Report on Africa 2013: Making the most of Africa's Commodities: Industrializing for Growth, Jobs and Economic Transformation."

- Curran, L., and Nadvi, K. (2015). "Shifting trade preferences and value chain impacts in the Bangladesh textiles and garment industry". *Cambridge Journal of Regions, Economy and Society*, rsv019.
- Deardorff, A. (1998). "Determinants of bilateral trade: does gravity work in a neoclassical world?". In The regionalization of the world economy (pp. 7-32). University of Chicago Press.
- De Backer, K., and Miroudot, S. (2014). "Mapping global value chains". ECB Working Paper No. 1677.
- De Benedictis, L., and Tajoli, L. (2011). The world trade network. The World Economy, 34(8), 1417-1454.
- Del Prete, D., Giovannetti, G., and Marvasi, E. (2017a). "Global value chains participation and productivity gains for North African firms." *Review of World Economics*, DOI 10.1007/s10290-017-0292-2.
- Del Prete, D., Giovannetti, G., and Marvasi, E. (2017b). "Global Value Chains: new evidence for North Africa ." *International Economics*, *https://doi.org/10.1016/j.inteco.2017.03.002*.
- Di Comite, F., Nocco, A., and Orefice, G. (2015). "Trade liberalization and the wage gap: the role of vertical linkages and fixed costs" *Review of World Economics*, forthcoming.
- Eaton, J., and Kortum, S. (2002). "Technology, geography, and trade". Econometrica, 70(5), 1741-1779.
- Egger, Peter H. and Mario Larch (2008), "Interdependent Preferential Trade Agreement Memberships: An Empirical Analysis", *Journal of International Economics* 76(2), 2008, pp. 384-399.
- Elms, D. K., and Low, P. (2013). "Global value chains in a changing world". Geneva: World Trade Organization.
- Foster-McGregor, N., Kaulich, F., and Stehrer, R. (2015). "Global Value Chains in Africa." UNU-MERIT Working Paper Series (024).
- Gawande, K., Hoekman, B., and Cui, Y. (2015). "Global Supply Chains and Trade Policy Responses to the 2008 Crisis". The World Bank Economic Review, 29(1), 102-128.
- Gereffi, G., and Fernandez-Stark, K. (2011). "Global Value Chain Analysis: A Primer". Durham, North Carolina, USA: Center on Globalization, Governance & Competitiveness (CGGC) Duke University.
- Gil-Pareja, S., Llorca-Vivero, R., and Martínez-Serrano, J. A. (2017). The effect of nonreciprocal preferential trade agreements on benefactors' exports. *Empirical Economics*, 52(1), 143-154.
- Grant, J., H. and D., M., Lambert (2008). "Do Regional Trade Agreements Increase Members' Agricultural Trade?" American Journal of Agricultural Economics. Vol. 90, No. 3, pp. 765-782
- Greenville, J., Beaujeu, R., and Kawasaki, K. (2016). "GVC participation in the agriculture and food sectors: draft report". OECD Trade and Agriculture Directorate; TAD/TC/CA/WP(2016)1
- Hanson, G., R. Mataloni, Jr. and M. Slaughter (2005), "Vertical Production Networks in Multinational Firms", *The Review* of *Economics and Statistics*. 87(4), pp. 664-678
- Head, K., and Mayer, T. (2014) Gravity equations: Workhorse, toolkit and cookbook. In: Gopinath G, Helpman E, Rogoff K (Eds) Handbook in International Economics vol. 4, North-Holland, Amsterdam.
- Hoekman, B. (2014). Supply chains, mega-regionals and multilateralism: a road map for the WTO. CEPR Press.
- Hummels, D., J. Ishii, and K.-m. Yi (2001). "The nature and growth of vertical specialization in world trade". *Journal of International Economics* 54, 75-96.
- Humphrey, J., and Memedovic, O. (2006). "Global value chains in the agrifood sector". UNIDO working paper; Wien.

IMF (2015). "Regional economic outlook. Sub-Saharan Africa."

Johnson, R. C., and Noguera, G. (2012). "Accounting for intermediates: Production sharing and trade in value added". Journal

of international Economics, 86(2), 224-236.

- Koopman, R., Z. Wang, and S.-J. Wei (2011). "Give credit where credit is due: Tracing value added in global production chains". NBER Working Paper (16426).
- Koopman, R., Wang, Z., and Wei, S.-J. (2014). "Tracing Value-Added and Double Counting in Gross Exports." American Economic Review, 104(2), 459–494. doi:10.1257/aer.104.2.459
- Kowalski, P.,Gonzalez, J. L., Ragoussis, A., and Ugarte, C. (2015). "Participation of Developing Countries in Global Value Chains: Implications for Trade and Trade-Related Policies". OECD Trade Policy Papers, No. 179, OECD Publishing, Paris. <u>http://dx.doi.org/10.1787/5js33lfw0xxn-en</u>
- Lee, J., G. Gereffi and J. Beauvais (2010) "Global value chains and agrifood standards: challenges and possibilities for smallholders in developing countries". PNAS 2012 109 (31) 12326-12331
- Lenzen, M., K. Kanemoto, D. Moran, and A. Geschke (2012). "Mapping the Structure of the World Economy". *Environmental Science & Technology* 46 (15), 8374-8381.
- Lenzen, M., D. Moran, K. Kanemoto, and A. Geschke (2013). "Building Eora: A Global Multi-regional Input-Output Database at High Country and Sector Resolution". *Economic Systems Research* 25 (1), 20-49.
- Magee, C. S. (2003). "Endogenous preferential trade agreements: An empirical analysis". Contributions in Economic Analysis & Policy, 2(1).
- Magrini, E.; Montalbano, P.; Nenci, S., and Salvatici L. (2017). "Agricultural (dis)incentives and Food Security: Is there a Link?". American Journal of Agricultural Economics, forthcoming. DOI 10.1093/ajae/aaw103.
- Minten, B., Randrianarison, L., and Swinnen, J. F. (2009) "Global retail chains and poor farmers: Evidence from Madagascar". World Development, 37(11), 1728-1741.
- Montalbano, P., and Nenci, S. (2014) "Assessing the trade impact of the European Neighbourhood Policy on the EU-MED Free Trade Area", *Applied Economics*, 46(7). pp. 730-740.
- Montalbano, P., Nenci, S., and Rotili, L. (2015). "Trade and Global Value Chains in the EU: a Dynamic Augmented Gravity Model". Paper presented at the 17th Annual ETSG Conference 10-12 September 2015 Université Paris 1 Panthéon_Sorbonne.
- Montalbano, P., Nenci, S., and Pietrobelli, C. (2016). "International Linkages, Value-added trade, and Firm productivity in Latin america and the Caribbean". In Firm Innovation and Productivity in Latin America and the Caribbean (pp. 285-316). Palgrave Macmillan US.
- Montalbano P., Nenci S. and Pietrobelli C. (2017a) "Opening and Linking up: Firms, GVCs and Productivity in Latin America", *Small Business Economics*, DOI: 10.1007/s11187-017-9902-6, forthcoming (2017)
- Montalbano, P., R. Pietrelli, and L. Salvatici (2017b). "Market chain involvement and food security: The case of the Ugandan maize farmers". Sapienza DiSSE Working Paper, Nr. 2-2017.
- Muradov, K. (2017). "Trade costs and borders in global value chains". Review of World Economics, 1-23.
- OECD and WTO (2012). "Trade in Value-Added: Concepts, Methodologies, and Challenges". Paris: Organisation for Economic Co-operation and Development; and Geneva: World Trade Organization.
- OECD (2013). "Interconnected Economies: Benefiting from Global Value Chains". OECD Publishing, Paris.
- Olper, A. (2016)."The Political economy of trade-related regulatory policy: environment and global value chain". Mimeo, Department of Economics, Management and Quantitative Methods - University of Milano and Centre for Institutions

and Economic Performance - LICOS (KU Leuven)

- Pickles, J., and Smith, A. (2011). "Delocalization and persistence in the European clothing industry: the reconfiguration of trade and production networks". *Regional Studies*, 45(2), 167-185.
- Rahman J. and T. Zhao. 2013. "Export Performance in Europe: What Do We Know from Supply Links?". IMF Working Paper, No. 62.
- Reardon, T., Barrett, C. B., Berdegué, J. A., and Swinnen, J. F. (2009). "Agrifood industry transformation and small farmers in developing countries". *World development*, 37(11), 1717-1727.
- Reardon, T., and Timmer, C. P. (2007). "Transformation of markets for agricultural output in developing countries since 1950: How has thinking changed?". Handbook of agricultural economics, 3, 2807-2855.
- Silva, J. S., and Tenreyro, S. (2006). The log of gravity. The Review of Economics and statistics, 88(4), 641-658.
- Swinnen J.F. (2014) "Global agricultural value chains, standards, and development". Robert Schuman Centre for Advanced Studies Research Paper No. RSCAS, 30.
- Swinnen, J. F., and Vandeplas, A. (2014). "Price transmission and market power in modern agricultural value chains", LICOS Discussion Paper Series, 347/2014.
- Taglioni, D. and Winkler, D. (2016). "Making Global Value Chains Work for Development," Trade and Development series. Washington, DC: World Bank. doi:10.1596/978-1-4648-0157-0.
- Timmer, M. P., E. Dietzenbacher, B. Los, R. Stehrer, and G. J. de Vries (2015). "An Illustrated User Guide to the World Input-Output Database: the Case of Global Automotive Production". *Review of International Economics* 23 (3), 575-605.
- Torres, C., and van Seters, J. (2016). "Overview of trade and barriers to trade in West Africa". European Centre for Development Policy Management Discussion Paper No. 195 July 2016.
- Wang, Z., Wei, S.-J., and Zhu, K. (2013). "Quantifying international production sharing at the bilateral and sector levels."National Bureau of Economic Research
- World Bank (2012). "Africa Can Help Feed Africa". Washington, DC: World Bank
- Yi, K-M. (2003), "Can Vertical Specialisation Explain the Growth of World Trade?". *Journal of Political Economy*, Vol. 111, pp. 52-102.
- Yi, K. M. (2010). "Can multistage production explain the home bias in trade?". *The American Economic Review*, 100(1), 364-393.

Appendix A: Tables and Figures

Figure 1A Gross exports accounting: Domestic value added



Source: WWZ, 2013

Figure 2A Gross exports accounting: Foreign value added and Pure Double counting



Source: WWZ, 2013

Table 1A GVC participation by SSA countries in 2013

	Со	mponents of C	SVC			
	pa	rticipation inc	lex			
	•	•		GVC		
	-			participation	of which	:
Country	DVX	FVA	PDC	index	-	
					Agriculture	Food
Angola	0.26	0.04	0.02	0.32	0%	0%
Benin	0.15	0.09	0.02	0.27	11%	5%
Botswana	0.16	0.22	0.07	0.44	1%	10%
Burkina Faso	0.18	0.18	0.06	0.41	22%	3%
Burundi	0.26	0.13	0.05	0.44	15%	1%
Cameroon	0.33	0.05	0.03	0.41	15%	2%
Cape Verde	0.18	0.20	0.06	0.44	1%	3%
Central African Republic	0.36	0.08	0.04	0.48	11%	1%
Chad	0.24	0.04	0.02	0.30	28%	0%
Congo	0.28	0.06	0.03	0.37	3%	0%
DR Congo	0.46	0.06	0.06	0.58	4%	1%
Diibouti	0.21	0.13	0.05	0.38	5%	3%
Eritrea	0.24	0.08	0.03	0.35	4%	2%
Ethiopia	0.15	0.31	0.12	0.58	31%	5%
Gabon	0.27	0.04	0.02	0.32	15%	0%
Gambia	0.22	0.14	0.05	0.41	6%	9%
Ghana	0.31	0.06	0.03	0.40	34%	14%
Guinea	0.44	0.06	0.05	0.55	3%	1%
lvory Coast	0.25	0.06	0.02	0.33	33%	15%
Kenva	0.19	0.00	0.04	0.39	30%	15%
Lesotho	0.11	0.36	0.10	0.58	0%	1%
Liberia	0.31	0.06	0.03	0.40	15%	0%
Madagascar	0.22	0.00	0.03	0.35	38%	8%
Malawi	0.21	0.10	0.03	0.34	39%	8%
Mali	0.19	0.08	0.02	0.30	23%	2%
Mauritania	0.23	0.13	0.05	0.41	1%	21%
Mauritius	0.13	0.31	0.06	0.50	1%	15%
Mozambique	0.23	0.07	0.03	0.33	22%	7%
Namibia	0.15	0.23	0.05	0.44	3%	28%
Niger	0.24	0.12	0.05	0.40	3%	1%
Nigeria	0.28	0.06	0.02	0.36	4%	1%
Rwanda	0.23	0.00	0.02	0.50	9%	1%
Sao Tome and Principe	0.20	0.21	0.08	0.50	7%	2%
Senegal	0.23	0.09	0.00	0.34	11%	42%
Sevehelles	0.23	0.05	0.05	0.40	1%	36%
Sierra Leone	0.21	0.14	0.05	0.42	5%	5%
Somalia	0.20	0.10	0.00	0.33	10%	۵% ۵%
South Africa	0.21	0.00	0.05	0.33	1%	
Swaziland	0.25	0.12	0.00	0.45		270 16%
Tanzania	0.15	0.20	0.00	0.45	15%	13%
	0.15	0.24	0.00	0.45	15%	7%
llganda	0.10	0.12	0.05	0.31	37%	11%
Zambia	0.15	0.11	0.05	0.37	6%	2%
Lation	0.20	0.10	0.04	0.07	070	2/0

Note: GVC participation index= DVX + FVA + PDC

Table 2A Regions of destination of the agriculture indirect value added DVX (%), by SSA (2013)

exporting country	EU	LAC	NAFTA	AFRICA	EAST ASIA	SOUTH ASIA	OTHERS
Angola	0.61	0.06	0.01	0.13	0.04	0.06	0.09
Benin	0.50	0.03	0.01	0.14	0.03	0.27	0.03
Botswana	0.39	0.10	0.02	0.16	0.08	0.11	0.14
Burkina Faso	0.82	0.02	0.01	0.05	0.02	0.07	0.01
Burundi	0.86	0.02	0.01	0.03	0.01	0.03	0.05
Cameroon	0.78	0.00	0.01	0.03	0.15	0.03	0.00
Cape Verde	0.33	0.16	0.03	0.10	0.09	0.12	0.16
Central African Republic	0.85	0.01	0.01	0.03	0.07	0.02	0.02
Chad	0.76	0.01	0.17	0.02	0.01	0.02	0.01
Congo	0.87	0.00	0.01	0.01	0.08	0.02	0.01
DR Congo	0.95	0.01	0.00	0.02	0.01	0.01	0.01
Djibouti	0.58	0.06	0.03	0.08	0.07	0.09	0.10
Eritrea	0.61	0.06	0.01	0.08	0.05	0.08	0.10
Ethiopia	0.63	0.00	0.03	0.01	0.17	0.02	0.14
Gabon	0.23	0.00	0.00	0.02	0.72	0.02	0.00
Gambia	0.65	0.06	0.01	0.08	0.06	0.08	0.08
Ghana	0.90	0.00	0.02	0.00	0.05	0.02	0.01
Guinea	0.84	0.01	0.00	0.10	0.01	0.02	0.01
Ivory Coast	0.91	0.00	0.03	0.01	0.01	0.03	0.00
Kenya	0.90	0.00	0.01	0.02	0.03	0.02	0.03
Lesotho	0.37	0.10	0.03	0.10	0.11	0.13	0.16
Liberia	0.45	0.00	0.48	0.01	0.01	0.04	0.01
Madagascar	0.73	0.00	0.12	0.02	0.07	0.04	0.00
Malawi	0.72	0.01	0.07	0.07	0.04	0.07	0.02
Mali	0.48	0.01	0.01	0.03	0.02	0.44	0.01
Mauritania	0.49	0.09	0.01	0.14	0.04	0.10	0.11
Mauritius	0.57	0.03	0.07	0.08	0.05	0.05	0.14
Mozambique	0.69	0.00	0.00	0.09	0.15	0.06	0.01
Namibia	0.83	0.01	0.00	0.13	0.01	0.01	0.01
Niger	0.47	0.03	0.01	0.39	0.02	0.04	0.05
Nigeria	0.81	0.00	0.01	0.01	0.07	0.10	0.00
Rwanda	0.87	0.02	0.01	0.03	0.02	0.03	0.03
Sao Tome and Principe	0.71	0.05	0.01	0.07	0.03	0.06	0.07
Senegal	0.88	0.00	0.01	0.03	0.07	0.01	0.00
Seychelles	0.43	0.09	0.03	0.11	0.09	0.12	0.13
Sierra Leone	0.74	0.04	0.03	0.05	0.03	0.05	0.06
Somalia	0.45	0.03	0.01	0.04	0.03	0.13	0.31
South Africa	0.78	0.00	0.02	0.10	0.03	0.04	0.03
Swaziland	0.88	0.01	0.00	0.05	0.01	0.02	0.03
Tanzania	0.62	0.01	0.07	0.04	0.14	0.06	0.05
Тодо	0.79	0.05	0.01	0.04	0.01	0.08	0.01
Uganda	0.82	0.01	0.01	0.09	0.02	0.01	0.03
Zambia	0.75	0.01	0.01	0.19	0.01	0.02	0.02
Average	0.68	0.03	0.03	0.07	0.07	0.07	0.05

Table 3A Regions of destination of the agriculture foreign value added FVA (%), by SSA (2013)

						SOUTH	
exporting country	EU	LAC	NAFTA	AFRICA	EAST ASIA	ASIA	OTHERS
Angola	0.50	0.08	0.01	0.17	0.04	0.07	0.13
Benin	0.41	0.15	0.02	0.18	0.07	0.15	0.03
Botswana	0.28	0.17	0.03	0.26	0.05	0.08	0.14
Burkina Faso	0.56	0.15	0.01	0.09	0.14	0.04	0.01
Burundi	0.61	0.04	0.11	0.07	0.02	0.05	0.10
Cameroon	0.54	0.00	0.03	0.06	0.31	0.05	0.00
Cape Verde	0.24	0.22	0.05	0.15	0.08	0.09	0.18
Central African Republic	0.67	0.02	0.05	0.06	0.15	0.02	0.03
Chad	0.57	0.01	0.32	0.05	0.01	0.02	0.02
Congo	0.56	0.01	0.03	0.04	0.22	0.11	0.02
DR Congo	0.77	0.03	0.01	0.10	0.03	0.02	0.04
Djibouti	0.34	0.06	0.03	0.11	0.12	0.21	0.12
Eritrea	0.53	0.08	0.03	0.12	0.05	0.06	0.13
Ethiopia	0.19	0.00	0.06	0.01	0.56	0.03	0.15
Gabon	0.11	0.00	0.00	0.01	0.85	0.02	0.00
Gambia	0.53	0.07	0.01	0.13	0.09	0.06	0.10
Ghana	0.58	0.00	0.13	0.01	0.15	0.11	0.01
Guinea	0.71	0.02	0.02	0.14	0.02	0.06	0.03
Ivory Coast	0.66	0.01	0.13	0.02	0.04	0.12	0.01
Kenya	0.57	0.01	0.06	0.07	0.14	0.05	0.09
Lesotho	0.26	0.14	0.05	0.16	0.09	0.10	0.18
Liberia	0.21	0.01	0.73	0.02	0.02	0.02	0.01
Madagascar	0.40	0.00	0.30	0.04	0.19	0.06	0.01
Malawi	0.33	0.01	0.32	0.18	0.08	0.06	0.02
Mali	0.45	0.08	0.04	0.08	0.04	0.29	0.02
Mauritania	0.46	0.10	0.02	0.18	0.04	0.07	0.13
Mauritius	0.47	0.03	0.20	0.08	0.09	0.04	0.09
Mozambique	0.35	0.00	0.01	0.17	0.19	0.27	0.01
Namibia	0.38	0.01	0.01	0.57	0.01	0.01	0.02
Niger	0.33	0.03	0.01	0.56	0.02	0.02	0.04
Nigeria	0.46	0.00	0.02	0.02	0.13	0.36	0.01
Rwanda	0.66	0.05	0.06	0.10	0.03	0.04	0.07
Sao Tome and Principe	0.42	0.12	0.02	0.23	0.03	0.06	0.11
Senegal	0.50	0.01	0.05	0.04	0.39	0.01	0.01
Seychelles	0.33	0.12	0.04	0.17	0.09	0.09	0.15
Sierra Leone	0.49	0.07	0.07	0.13	0.04	0.07	0.14
Somalia	0.17	0.02	0.01	0.03	0.03	0.27	0.47
South Africa	0.42	0.01	0.09	0.21	0.14	0.07	0.06
Swaziland	0.43	0.03	0.00	0.29	0.12	0.03	0.09
Tanzania	0.29	0.01	0.10	0.07	0.37	0.09	0.07
Тодо	0.28	0.57	0.02	0.04	0.01	0.07	0.01
Uganda	0.25	0.01	0.07	0.54	0.09	0.01	0.04
Zambia	0.33	0.01	0.03	0.57	0.02	0.02	0.02
Average	0.43	0.06	0.08	0.15	0.12	0.08	0.07

Table 4A Regions of destination of the food indirect value added DVX (%), by SSA (2013)

exporting country	EU	LAC	NAFTA	AFRICA	EAST ASIA	SOUTH ASIA	OTHERS
Angola	0.36	0.06	0.01	0.26	0.08	0.15	0.09
Benin	0.35	0.05	0.01	0.42	0.03	0.05	0.08
Botswana	0.89	0.01	0.00	0.04	0.02	0.02	0.02
Burkina Faso	0.46	0.18	0.01	0.12	0.05	0.08	0.10
Burundi	0.43	0.10	0.02	0.11	0.07	0.12	0.15
Cameroon	0.81	0.01	0.08	0.08	0.00	0.01	0.01
Cape Verde	0.49	0.08	0.02	0.16	0.05	0.09	0.11
Central African Republic	0.49	0.07	0.02	0.11	0.07	0.10	0.13
Chad	0.37	0.10	0.03	0.11	0.10	0.13	0.16
Congo	0.63	0.06	0.01	0.08	0.05	0.07	0.10
DR Congo	0.83	0.02	0.01	0.03	0.02	0.03	0.06
Djibouti	0.47	0.09	0.02	0.12	0.06	0.11	0.13
Eritrea	0.50	0.08	0.02	0.09	0.07	0.10	0.14
Ethiopia	0.21	0.03	0.16	0.04	0.02	0.03	0.50
Gabon	0.55	0.06	0.01	0.16	0.05	0.08	0.10
Gambia	0.73	0.04	0.01	0.11	0.03	0.05	0.05
Ghana	0.93	0.00	0.04	0.01	0.00	0.01	0.00
Guinea	0.46	0.04	0.02	0.18	0.17	0.07	0.06
Ivory Coast	0.85	0.00	0.09	0.02	0.00	0.01	0.02
Kenya	0.89	0.00	0.01	0.04	0.02	0.01	0.03
Lesotho	0.52	0.08	0.02	0.09	0.07	0.10	0.13
Liberia	0.38	0.10	0.06	0.12	0.07	0.12	0.16
Madagascar	0.87	0.01	0.01	0.04	0.02	0.05	0.01
Malawi	0.82	0.01	0.01	0.12	0.01	0.01	0.02
Mali	0.62	0.05	0.01	0.13	0.04	0.06	0.09
Mauritania	0.73	0.01	0.00	0.05	0.15	0.05	0.01
Mauritius	0.89	0.01	0.00	0.02	0.04	0.01	0.02
Mozambique	0.30	0.02	0.03	0.52	0.08	0.02	0.03
Namibia	0.89	0.01	0.00	0.07	0.01	0.01	0.01
Niger	0.44	0.07	0.04	0.19	0.05	0.09	0.12
Nigeria	0.96	0.00	0.00	0.02	0.00	0.00	0.00
Rwanda	0.35	0.11	0.02	0.13	0.09	0.13	0.17
Sao Tome and Principe	0.49	0.08	0.02	0.08	0.07	0.11	0.13
Senegal	0.94	0.00	0.00	0.03	0.01	0.01	0.00
Seychelles	0.92	0.00	0.00	0.02	0.01	0.04	0.01
Sierra Leone	0.71	0.04	0.09	0.04	0.02	0.04	0.05
Somalia	0.43	0.07	0.01	0.09	0.06	0.09	0.26
South Africa	0.55	0.01	0.04	0.23	0.08	0.05	0.04
Swaziland	0.83	0.01	0.04	0.07	0.03	0.01	0.01
Tanzania	0.80	0.00	0.00	0.11	0.02	0.03	0.03
Тодо	0.66	0.03	0.01	0.20	0.02	0.03	0.04
Uganda	0.62	0.04	0.00	0.17	0.05	0.03	0.08
Zambia	0.31	0.05	0.00	0.47	0.03	0.05	0.07
Average	0.62	0.04	0.02	0.12	0.05	0.06	0.08

Table 5A Regions of destination of the food foreign value added FVA (%), by SSA (2013)

exporting country	EU	LAC	NAFTA	AFRICA	EAST ASIA	SOUTH ASIA	OTHERS
Angola	0.25	0.03	0.00	0.19	0.39	0.08	0.05
Benin	0.15	0.02	0.00	0.77	0.01	0.02	0.03
Botswana	0.86	0.01	0.00	0.10	0.01	0.01	0.01
Burkina Faso	0.19	0.55	0.01	0.17	0.01	0.02	0.05
Burundi	0.33	0.14	0.03	0.17	0.06	0.10	0.17
Cameroon	0.44	0.00	0.27	0.27	0.00	0.00	0.01
Cape Verde	0.43	0.10	0.02	0.19	0.05	0.08	0.12
Central African Republic	0.39	0.09	0.04	0.20	0.06	0.08	0.14
Chad	0.25	0.14	0.05	0.20	0.08	0.10	0.18
Congo	0.59	0.06	0.02	0.13	0.06	0.06	0.09
DR Congo	0.60	0.05	0.03	0.12	0.02	0.04	0.14
Djibouti	0.36	0.11	0.03	0.19	0.05	0.10	0.15
Eritrea	0.34	0.13	0.04	0.15	0.07	0.09	0.17
Ethiopia	0.06	0.01	0.22	0.02	0.03	0.01	0.64
Gabon	0.62	0.04	0.00	0.21	0.04	0.03	0.05
Gambia	0.42	0.07	0.02	0.32	0.04	0.05	0.08
Ghana	0.74	0.01	0.14	0.06	0.03	0.01	0.01
Guinea	0.38	0.02	0.01	0.14	0.40	0.02	0.03
Ivory Coast	0.64	0.00	0.20	0.06	0.06	0.01	0.03
Kenya	0.57	0.01	0.08	0.19	0.08	0.01	0.06
Lesotho	0.40	0.11	0.03	0.16	0.06	0.09	0.16
Liberia	0.25	0.13	0.11	0.20	0.05	0.08	0.17
Madagascar	0.72	0.00	0.02	0.10	0.12	0.03	0.01
Malawi	0.60	0.01	0.04	0.32	0.00	0.01	0.02
Mali	0.56	0.05	0.01	0.25	0.02	0.05	0.07
Mauritania	0.63	0.00	0.00	0.09	0.26	0.01	0.00
Mauritius	0.66	0.01	0.03	0.05	0.22	0.02	0.02
Mozambique	0.23	0.01	0.04	0.51	0.19	0.01	0.01
Namibia	0.63	0.01	0.00	0.19	0.09	0.01	0.08
Niger	0.27	0.07	0.04	0.42	0.03	0.08	0.10
Nigeria	0.83	0.00	0.03	0.13	0.00	0.00	0.00
Rwanda	0.28	0.14	0.03	0.21	0.07	0.10	0.18
Sao Tome and Principe	0.46	0.09	0.03	0.12	0.06	0.11	0.13
Senegal	0.88	0.00	0.01	0.06	0.04	0.01	0.00
Seychelles	0.82	0.01	0.00	0.05	0.07	0.04	0.01
Sierra Leone	0.64	0.12	0.13	0.04	0.02	0.02	0.04
Somalia	0.31	0.05	0.01	0.09	0.04	0.04	0.46
South Africa	0.26	0.02	0.07	0.36	0.18	0.04	0.07
Swaziland	0.59	0.01	0.11	0.21	0.04	0.02	0.02
Tanzania	0.41	0.01	0.08	0.23	0.09	0.05	0.13
Тодо	0.27	0.01	0.01	0.66	0.01	0.01	0.02
Uganda	0.13	0.05	0.03	0.46	0.18	0.03	0.13
Zambia	0.05	0.01	0.00	0.90	0.01	0.01	0.02
Average	0.45	0.06	0.05	0.22	0.08	0.04	0.09

Variables	Obs	Mean	Std. Dev.	Min	Max
DirDVA	813,109	3.25	2.48	-5.16	16.33
MVA	810292	-6.26	3.79	-20.61	14.10
DirRDV	811535	-5.00	3.30	-19.38	13.68
FVA	815,689	0.95	2.63	-6.48	14.72
DVX	812,236	1.98	2.50	-7.19	14.99
Simple tariffs	563,408	1.80	1.09	0.00	6.62
RTAs	816,960	0.14	0.35	0.00	1.00

Table 6A Variables applied in the empirical analysis: summary statistics

Figure 3A Average import tariff rates for Agriculture and Food, by area



3a: Agriculture

Source: Authors' elaboration on WITS data



Figure 4A Signed RTAs by area in 1990 and 2013

Source: Authors' elaboration on Egger and Larch (2008, updated to 2015) database